CADILLAC

ADVANCE INFORMATION
to DISTRIBUTORS, DEALERS, SALESMEN

To the Cadillac Sales Organization

In presenting to our sales organization this confidential advance statement of features incorporated in the new Cadillac, it is unnecessary to attempt a detailed mechanical description of the car. Each new Cadillac type is a development. So sound were the principles on which Cadillac cars were originally designed, so correct was our initial V-eight construction, that no reason for departing from them has ever arisen.

This year Cadillac presents a number of advancements in design that simplify service requirements. It introduces an effective method of preventing crankcase dilution. It reveals more striking beauty of coachwork and color than ever before.

The most effective selling points about any new Cadillac are its resemblances to, not its differences from, earlier Cadillac models.

For people do not buy a Cadillac because it has this or that mechanical feature. They buy it, rather, for the sum of its qualities—because they know the Cadillac to be a beautiful, capable, dependable, and enduring car. The long and consistent record of this company, its conservative and sound leadership in technical advancement, the practical value of improvements it has sponsored, and the phenomenal long life and ability of the cars it has built, mean more to the public than minute details of mechanical refinement will ever mean.

You, on the other hand, who are to sell and service Cadillac cars can do your work to advantage only if you know the new type intimately. Questions regarding its construction will inevitably be put to you. Public interest in the car is eager and naturally will turn to you for enlightenment. You must be in position to supply it.

The basis of accurate knowledge you already have in your familiarity with previous Cadillac models. For the new car is essentially the same, refined and improved through two added years of intensive study and development. We need merely to put you in possession of a few facts to enable you to continue to present the Cadillac to your customers intelligently and effectively.

Such is the purpose of this booklet.

DETROIT

CADILLAC MOTOR CAR COMPANY

1925

CADILLAC
ADVANCE INFORMATION
TO
DISTRIBUTORS, DEALERS
SALESMEN

MECHANICAL CHANGES

A CRANKCASE ventilation system prevents contamination of the crankcase oil with water and unburned gasoline vapors which seep past piston rings. In addition an oil filter has been installed.

The platform spring suspension has been replaced by a semi-elliptic spring system with universal suspension at the rear shackles.

The generator and starter are separate units.

The timer-distributer is at the rear of the engine, is driven by an automatically lubricated spiral gear on the camshaft, and is easily removed for service.

Main bearing caps are one-piece aluminum alloy, and are retained by two screws each, which are threaded into steel trunnions solidly anchored into the crankcase webs.

The six camshaft bearings are lubricated by oil under direct pressure from the oil pump.

Camslides, or valve lifters, operate directly upon the cams without the interposition of rocker arms.

Valve stem clearance can be adjusted with one wrench and screw driver.

Valve stems are automatically lubricated.

For better distribution of fuel gas and easier servicing, intake manifolds as well as exhaust manifolds are separate castings bolted to the cylinder blocks.

The air pressure pump for gasoline feed is mounted on the front left side of the crankcase and operated by a cam on the camshaft with spring return action.

Nickeled radiator standard on all cars.

There is one water pump.

Upper hose connections need never be loosened. Instead, outlet elbows are easily unbolted from the cylinder heads.

Automatic shutters, thermostatically controlled, are added in front of the radiator.

The oil pump is in the position formerly occupied by the right hand water pump and, with the present water pump, driven by cross shaft from the crankshaft.

The new oil pressure regulator affords adjustment for pressure at idling speed.

Engine support bolts can be removed by using one wrench on the outside of the frame.

Gear teeth replace lugs on the inside circumference of driven discs of the clutch.

Grease gun connections are added at each end of the propeller shaft, from which lubricant is conducted to the universal joints through internal ducts in the shaft.

A new type of joint connects the front end of the torque arm to the frame.

Axle shafts drive the rear wheels through fourteen teeth on the inside of the hub instead of six lugs on the end of the hub.

A new type of hand brake requires no adjustment during the life of the brake lining.

All wiring, both fore and aft from the dash, is carried in protective metal conduits and terminates in a terminal block on the dash.

Headlamps have two-filament bulbs instead of tilting reflectors.

For use about the car, the inspection lamp can be attached to the 12-foot cord of the cigar lighter. It has a 21 c. p. bulb.

Battery box and tool box are carried in easily accessible positions in the front fenders.

There is an electric gasoline gauge on the instrument panel.

The accelerator pedal is changed in form.

Moulded fenders are standard on all models.

The horn is mounted in front of the radiator on the left hand headlamp bracket.

Watson Stabilators are standard equipment, front and rear.

Custom cars are equipped with spring covers.

Custom cars are equipped with front and rear bumpers.

A moto-meter has also been installed on the Custom cars.

THE MECHANISM

THE new Cadillac is powered with a 90° V-type, eight-cylinder engine because with no other construction can the manifold advantages of this type be approximated. Compactness, sturdiness, smooth flow of power, and simplicity in service attentions are inherent in the V-eight design. In the new Cadillac these advantages are carried to ultimate degrees of perfection.

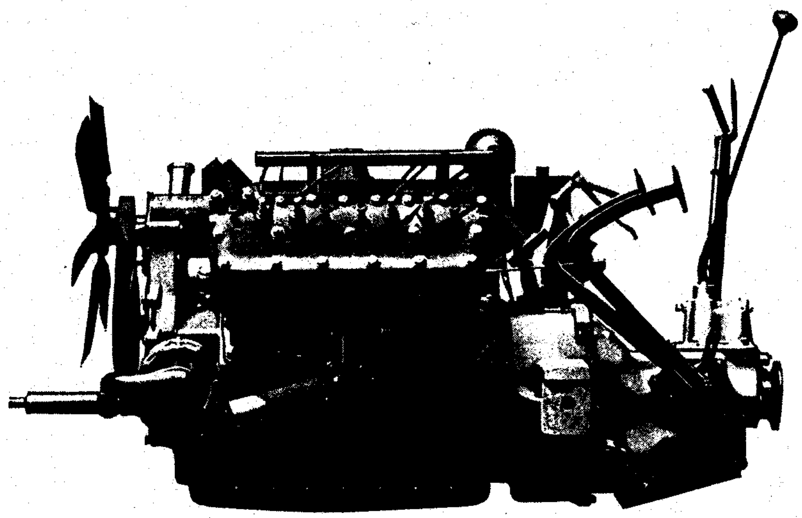
Cadillac developed and introduced the V-type, high-speed, eight-cylinder engine eleven years ago. Every Cadillac car built since that time has been so powered. Two years ago, the V-63 introduced the revolutionary development of a fully-compensated crankshaft, thereby achieving a flow of power so abundant, so pliant, and so docile as to amaze even the most seasoned motorists.

That engine is still the greatest Cadillac power plant. Its performance is not excelled by any other type. Therefore, Cadillac adheres to its essential features. Bore and stroke remain the same —3⅛ by 5⅛—the piston displacement is still 314 cubic inches, and the S. A. E. horsepower rating 31.25. The compensated crankshaft introduced in the V-63 is retained.

Such changes as the new mechanism reveals are developments and refinements calculated to improve the product, and resulting in greater accessibility and in a wider range of power at usual driving speeds. The single notable innovation is the system for crankcase ventilation.

CRANKCASE VENTILATION

EVER since the earliest development of the internal combustion engine, a difficult problem has been presented by the leakage of



SIDE VIEW OF THE ENGINE

Fundamental simplicity prevails throughout the Cadillac engine. Note the single water pump and the inlet pipe of the crankcase ventilating system.

unburned gasoline and water vapors from the combustion chambers into the crankcase oil. The consequent contamination of the lubricant is rendered especially serious by the water vapor which makes up 75 per cent of the exhaust gas. This vapor, if allowed to condense upon the walls of the crankcase, combines with the oil to make an emulsion of sharply lessened lubricating value. This contamination is most noticeable in cold weather, but it goes on to some extent at all times. The finest possible manufacturing practice cannot wholly obviate it. The only solution heretofore has been to change the lubricating oil frequently.

A chief difficulty has been that many fuels contain free sulphur, which combines with water in the crankcase to form sulphuric acid. This acid quickly etches the finely machined working surfaces of the engine and so impairs the efficiency of the power plant.

In bringing about this effect, advantage is taken of the fact

that the rotation of the crankshaft, with its compensating weights, constantly draws air into the crankcase. But instead of permitting air to be drawn in through one breather and idly blown out through the other, the right hand breather is closed. No outlet is provided in the crankcase itself, but in the wall of each cylinder is a port connecting the space below the piston with the valve compartment. This port remains open all the time except when the piston reaches the very bottom of its stroke.

The effect of this arrangement is as follows: In the absence of any direct air outlet from the crankcase, the rotation of the crankshaft builds up in the crankcase a pressure slightly above atmospheric pressure. This pressure opposes the entrance into the crankcase of the air forced down by the descending piston. The leakage vapors that pass the piston rings to some extent in all combustion engines are then forced through slots milled on the circumference of the lowest piston ring and through corresponding holes in the piston into the center of the cylinder below the piston. Caught there between the descending piston and the outward pressure from the crankcase, they are expelled through the port into the valve compartment before they can cool enough to condense.

Such is, in brief, the principle of the new system. Several additional but minor changes have also been made necessary. The left hand breather has been altered in form and extended in a passage along the under side of the rear half of the cylinder block, forming a chamber in which the air admitted to the crankcase is preheated. The valve compartments are made oil tight and each provided with an opening at the rear end to which is connected a flexible pipe which discharges the expelled vapors underneath the car.

So effectively does this system keep contaminating gases out of the crankcase that the oil is maintained at a high lubricating quality and need not be changed within 2000 miles, except in cold weather.

For years Cadillac has sought a remedy for these difficulties, and two measures against them are now taken. An oil filter is connected by tubes to the oil pressure regulator on the crankcase, and whose function it is to remove from the oil all foreign materials that may find their way into it. But these materials are so effectually kept out of the crankcase by the second arrangement that their amount is well-nigh negligible. For Cadillac here introduces the really effective method of prevention—vapors are expelled before they have an opportunity to reach the oil.

CRANKSHAFT

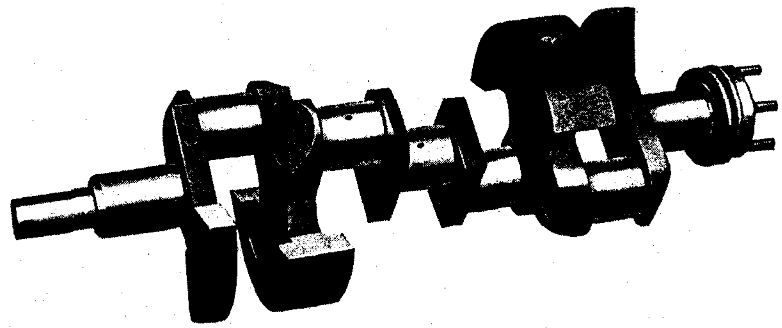
THE crankshaft used in the new Cadillac is the same in design as that of the V-63. So significant are the principles by which this shaft finally conquers vibration that the salesman cannot too often review them.

They involve, first, the arrangement of the cranks, or throws, and secondly, the use of compensators, or counterweights, attached to the shaft and revolving with it. These two factors are so arranged in the Cadillac engine as completely to eliminate vibration.

The light, regular, overlapping power impulses of the 90° V-type engine—the accurate machining and sensitive balancing of reciprocating parts—the use of a short, stiff crankshaft carried in ample bearings—these had already reduced vibration in the Cadillac engine well-nigh to the vanishing point. There remained only the type resulting from the inertia developed by the pistons in traveling at extreme speeds with rapidly alternating motion. This the compensated crankshaft effectually neutralizes.

The first step is the arrangement of crankshaft throws in two planes at right angles to each other. That is, if the forward throw is considered to correspond with the figure XII on a clock-dial, the second, third, and fourth throws stand at III, IX, and VI respectively. This arrangement has the effect of dividing the inertia forces into pairs of forces which are equal and opposite, but are not in the same plane.

The effect of these forces is then completely neutralized by compensators of steel securely bolted to the crankshaft cheeks. The weights of these compensators and the angles at which they



THE CRANKSHAFT

This compensated crankshaft so conquers vibration that the Cadillac engine runs smoothly as a balanced flywheel.

are placed are so calculated that their centrifugal effect causes the entire assembly to operate with the smoothness of a balanced flywheel.

CAMSHAFT AND VALVES

THE single camshaft is supported on six bearings instead of five as formerly, and is driven from the crankshaft by a silent chain 1¾ inches wide. The chain is automatically adjusted by a mechanism contained in the idler sprocket. There are sixteen cams, each of which operates a valve lifter directly.

Valve adjustment screws are locked in the valve lifters by means of a split collar and clamping screw. Adjusting the valve stem clearance has been reduced to its simplest terms, and is effected by loosening the clamping screw with a screw driver, setting the adjustment with a wrench, and retightening the screw.

The camshaft bearings are lubricated under pressure directly from the engine pump through the hollow camshaft, instead of by overflow from the pressure regulator valve as formerly.

Valve stems are lubricated from the cylinders through two ⅛-inch holes drilled in each cylinder wall opposite the two nearest valves, and at such distance from the bottom of the cylinder that when the piston is at the bottom of its stroke these holes register with a groove in the piston between the second and third piston rings. When the piston descends on the power stroke, oil collects in this groove in the piston and as soon as the groove registers with the two small holes in the cylinder wall, the pressure of the gases above the piston forces a fine spray of oil out through each hole upon the adjacent valve stem. Excess oil collects in the bottom of the valve chamber, whence it is returned through ducts into the crankcase.

MANIFOLDS

THE greatest possible uniformity in distribution of fuel gas and simpler servicing attention are assured by the construction of the intake manifold. A very short, exhaust-heated induction pipe conducts fuel from the carburetor to the intake passage. Instead of being cast in the cylinder block itself, as in previous models, this passage is now in a separate casting bolted on the face of the cylinder block. The induction pipe has a single cover on top and is attached to the intake manifolds and the exhaust pipes by four cap screws in each flange.

ELECTRIC SYSTEM

STARTING and ignition are by a two-unit Delco system, with the generator mounted at the front of the engine and driven by the fan belt, and the starter mounted vertically upon the flywheel housing. The starting motor meshes with the flywheel through a spring-loaded pinion gear, which is brought into play upon the initial pressure upon the starter pedal. Farther depressing the pedal operates the starter switch and sets the starter into action.

The timer-distributer is located immediately forward of the starter and driven by a spiral gear from the camshaft. This drive is automatically lubricated by oil from the oil passage in the hollow crankcase and does not require packing in grease.

To insure dependable ignition at high speeds, the timer-distributer has a four-lobe cam and two sets of timer contact points which operate alternately, each one supplying ignition for one-half of the cylinders. Both manual and automatic controls are provided for advancing and retarding ignition.

The entire timer-distributer can be removed for service by taking out one screw. Since it can be put back in only one position, removal and replacement of this unit does not necessitate re-timing.

All wires, both forward and backward from the dash, are carried in protective metal conduits supported inside the frame. To facilitate service attention, each circuit contains wires of distinctive colors, and all are brought together into a single terminal block in a metal case on the dash. All connections between chassis and cowl wiring are made at this one point.

The battery is carried in a locked metal case inset into the left hand front fender. In this position the battery is fully accessible at all times without disturbing passengers in the car, yet is fully protected from the weather.

A similar metal case in the right hand fender carries road tools in a convenient place with special provision for holding certain individual tools separately.

ENGINE LUBRICATION

ENGINE lubrication is by pressure from a gear pump which occupies the position formerly taken by the right hand water pump and is driven by the water pump shaft. It sends oil under pressure to all main, connecting rod, and camshaft bearings.

In the course of its circulation, the engine oil passes through the simple but efficient oil filter, where all foreign materials which may have found their way into it are effectually removed.

The automatic pressure regulator has an adjustable bleeder regulator for controlling the oil pressure at low engine speeds.

The oil level indicator has been removed from the valley between the cylinder blocks to the right hand side of the crankcase, where it is readily visible.

WATER PUMP

A SINGLE water pump larger than the combined capacity of the two earlier ones circulates the cooling medium.

The pump is located at the lower left hand side of the crankcase in front, and driven by a cross shaft from the crankshaft gear. The pump requires but one radiator connection, and discharges water at the middle of the base of the left hand cylinder block. From that point, one channel leads upward into the block, and a second leads directly across the crankcase, through a brass-lined channel cast in the center web to the right hand block.

Each block connects individually to the radiator for return water. An outlet elbow attachment to the cylinder head, with gasket, makes it unnecessary to loosen the hose connection when giving service.

The six-blade fan is now driven by belt from the camshaft instead of by a second silent chain. This eliminates the fan driving clutch and spring necessary with a chain drive.

Efficiency in bringing the engine quickly to operating temperature and maintaining it there is attained by the installation of automatic shutters upon the radiator.

Operated by a thermostatic member in the upper tank of the radiator, these control positively and automatically the volume of air passing through the radiator at all times.

Being completely closed at starting, they restrict the circulation of air to that under the hood, which quickly becomes warmer; then, as the circulating water increases in temperature, the shutters open gradually, increasing the cooling effect as needed.

This system gives very precise control over the operating temperature of the engine without attention from the driver at any time.

The blade pivot pins and pivot bar are made of non-corrosive chrome alloy steel to assure permanent operation of the shutters with a minimum of friction.

The shutters are of the vertical type and as a result contribute to the beauty and bearing of the car.

CLUTCH

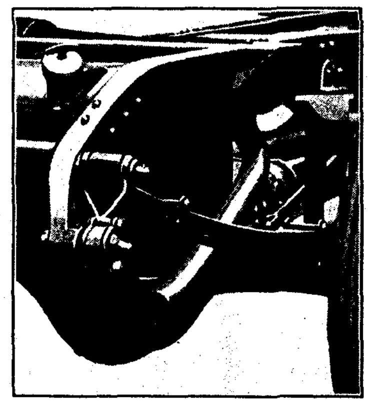
THE clutch is of the multiple disc, dry-plate type composed of seven driving and eight driven members. Instead of working on six lugs as formerly, the driven discs mesh with forty-five teeth on the steel clutch hub, distributing the driving impulse over forty-five keys and as many keyways. Pedal leverages are so compounded that the three-hundred pound pressure of the clutch spring is smoothly and easily operated.

TRANSMISSION

THE transmission cover is of new design and carries the floor board trimplate of pressed aluminum. The shifter shafts are interlocked by a single ball, which also serves as transmission lock operated by a Sargent lock in the transmission cover.

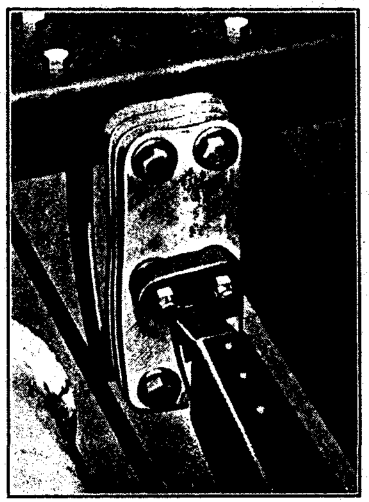
SPRING SUSPENSION

A SIGNAL improvement is incorporated in the rear spring suspension, which now employs a semi-elliptic spring 60 inches long. The advantages of the former platform type are retained through the method of attaching the rear shackle which is universally mounted to the frame through a shackle of tension type with ball and socket connection. This design protects the body from strain because it does not transmit the twists which result from the body riding level while the wheels are aligning themselves with the road.



SPRING SUSPENSION

Through this universal ball and socket rear shackle, Cadillac's semi-elliptic spring suspension preserves all the advantages of the platform type.



TORQUE ARM JOINT

A new-type connection of the torque arm to the frame eliminates wearing surfaces at this point.

TORQUE ARM

THE front end of the torque arm is connected to the frame through three plies of heavy fabric which absorb the braking and torque reactions. This construction completely eliminates wearing surfaces at this point, giving silent operation throughout the life of the car without necessity for lubrication.

REAR AXLE

INSTEAD of slotting the rear wheel hubs for the six lugs on the axle shaft, fourteen teeth are cut into its interior circumference, which engage with fourteen splines on the shaft.

FOUR-WHEEL BRAKES

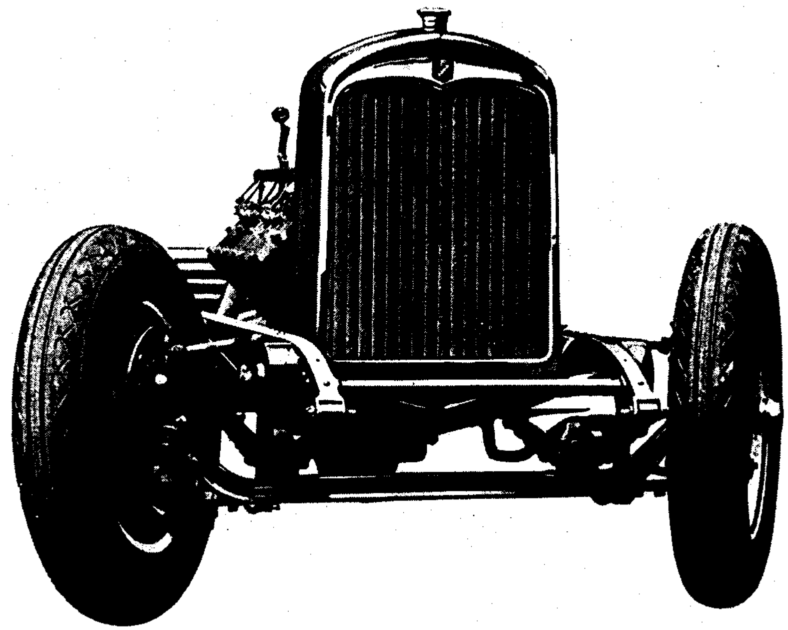
So overwhelming are the proved advantages of four-wheel brakes that this equipment is now acknowledged to be essential in fine-car construction. The Cadillac salesman should, however, keep constantly in mind the fact that his brakes differ decidedly from those found on any other motor car.

Cadillac four-wheel brakes are alone in using external contracting bands on the rear wheels and internal expanding bands on the front wheels. The effect of heat in expanding the brake drums on grades is thereby fully counterbalanced. When the drums are expanded, external contracting brakes necessarily take effect more quickly than normally or, if the original adjustment was close, may seize, whereas internal expanding brakes will be slower than normal in taking effect. Cadillac's design neutralizes these two

tendencies, so that the amount of brake pedal movement necessary does not perceptibly change when the drums expand. Long, steep grades may be taken without question either of having the brakes seize or of losing the braking effect.

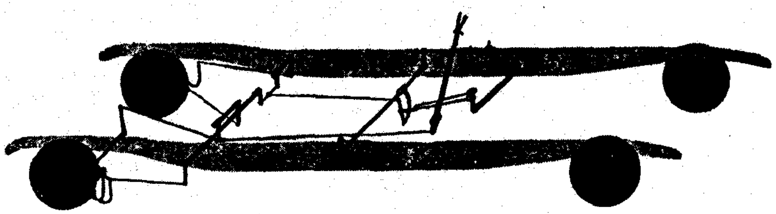
The brake pedal is made self-adjusting for wear of the brake lining by the use of two connections. These are so adjusted that the first operates during normal use, applying the brakes with light foot pressure. When, however, the lining has worn so that the pedal is within a short distance of the toeboard, the other connection comes into play, materially increasing the leverage and retaining the full efficacy of the brakes.

Further advantages built into Cadillac's mechanical four-wheel brakes are the safe distribution of braking effect between front and



COMING HEAD-ON

Handsome vertical radiator shutters. Cellular construction. Note, too, the sturdy front-wheel brake construction.



FOUR-WHEEL BRAKES

Self-equalizing and self-compensating, Cadillac's four-wheel brakes give the maximum of safety and comfort in driving.

rear wheels, and the provision for full freedom of steering even when the brakes are applied with full force.

HEADLAMPS

THE new Cadillac has nickeled drum-type headlamps with tiltable light beam for safety in driving. The lamps are fitted with two-filament bulbs, in which the filaments are so arranged with reference to the focal point of the parabolic reflector that the full intensity of the beam of light can, at will, be thrown straight ahead or inclined upon the road. The filaments are individually controlled from the dash. In this way, the Cadillac gains all the advantages of dimming without incurring the hazards involved in the practice.

Lamps are fitted with fluted lenses that spread the light upon the road. A metal cap over each lamp bulb excludes some of the horizontal rays, thereby adding to the comfort and safety of the driver, because, when driving in fog, the cap excludes the rays which would otherwise be reflected back into the driver's eyes.

Auxiliary bulbs of 3 c.p. in the headlamps serve for parking and for city driving. The familiar combination of tail light, traffic signal, and back-up light is retained; mounted on left rear fender instead of the tire carrier. Only three types of bulbs are required for the entire car.

GASOLINE GAUGE

THE dash carries an electric gasoline gauge, which indicates at all times the amount of fuel available in the tank.

CADILLAC BODIES

SECOND in selling value only to the excellence of the Cadillac chassis is the beauty of Cadillac coachcraft. The new bodies—the most beautiful Cadillac has ever offered—supply you with a wealth of sales ammunition.

Cadillacs have always enjoyed the hearty endorsement of the public, not only for their mechanical supremacy, but also for the substantial dignity of their appearance and the luxurious comfort they accord their passengers. Their sound engineering is matched with a quality of coachcraft that gains the instant and abiding approval of those motorists who insist upon the genuinely fine and beautiful.

In the new car, this traditional leadership in fine coachwork is asserted more emphatically than ever before. The new body types designed by Cadillac engineers and the Fisher Body Corporation working in close harmony mark a genuine achievement in distinctive design. At every point there is evidence of true artistic taste, practical engineering ability, intimate knowledge of the requirements for travel comfort, and sensitive responsiveness to prevailing public preferences.

Bodies are offered in two general classifications—Standard and Custom. The former embody Cadillac's most advanced ideals of travel dignity and comfort. The latter add to this basic excellence an appeal to that limited class of buyers who seek the individualized touch which makes their motor cars faithful expressions of their personal requirements and tastes.

With an abundance of room, Cadillac bodies have a low, graceful outline, in full harmony with the long wheelbase of the car and suggestive at once both of ready power and of restful comfort. They are finished in every detail with an expert attention to correct appointment that fits them to serve the most exacting motorists on every sort of occasion.

Radiator and hood are strikingly simple and dignified, with an impression of fleetness that is accentuated by the vertical lines of the radiator shutters and by the use of only fourteen louvres grouped at the rear of the hood.

A touch of added beauty and of high practical value is supplied by finishing the entire dash behind the engine in Duco in the body color. Not only is this expanse of metal thereby made attractive in appearance, but it is also easier to keep clean.

The instrument board is unusually rich by reason of the panels finished in walnut.

An instance of that tireless attention to minute detail that is characteristic of Cadillac is the relocation of bolts attaching the body to the frame in such a way as to support the body more rigidly than ever before.

All body frames are constructed of first quality, thoroughly seasoned, clear white, kiln-dried ash, and are mortised and tenoned, glued, screwed and braced in accordance with the best body-builder's practice.

Fenders are oval in contour, substantial, sturdy and dignified. Running boards of rigid metal construction carry out the lines of the fenders. The running boards are covered with cork composition and have white metal binding with black facing. In Custom cars, the cork is replaced by special moulded rubber composition.

Standard cars are finished in Duco in three color treatments—Blue, Waverly Gray, and Arizona Gray. This remarkable finish amply merits its wide popularity. Its rich, soft luster, its permanence, the ease with which it may be cared for make it the most practical finish for automobiles ever devised. A car of Cadillac's unquestioned value, resplendent in this beautiful and indestructible finish, is a combination whose sales value can hardly be approached in the automotive industry.

In Custom cars any practical color combination can be supplied on condition that we be allowed sixty days for delivery. These models are regularly produced, however, in six color treatments, in Duco, every one of which is in production each month. Your customer, therefore, has an option for immediate delivery of a variety of color schemes.

All cars have an electric cigar lighter on the instrument panel, fitted with a twelve-foot cord which permits its use in any part of the car. When desired, the lighter can be removed and this cord attached to the inspection lamp to supply light for inspection at any point of body or chassis.

In all models, battery and road tools are carried in locked metal cases inset into each front fender and running board, tools on the right and battery on the left.

OPEN CARS

THE three open models, Touring, Phaeton, and Roadster, are all Custom cars.

All are upholstered in extra heavy, soft, pliable, satin finish, colored, special-grained, hand-buffed leather. The tops are made of heavy leatherized fabric with a plate glass window in the rear, the Touring with five bows, the Phaeton four, and the Roadster three. Tops are neater in contour than in past models and are designed to fold into compact space—10 inches for the Touring as against 14 inches last year; 8 inches for the Phaeton, and 7 inches for the Roadster. Top irons and top covers are provided. Rain-tight curtains of patented construction are provided that open with the doors and have upper panels which open individually for ventilation.

The wheelbase of the Touring Car and Phaeton is 138 inches; that of the Roadster is 132 inches.

The Phaeton is fitted with a Cadillac special trunk rack.

CLOSED BODIES

THE closed models are Standard Brougham, Standard Five-Passenger Sedan, Standard Seven-Passenger Sedan, Standard Seven-Passenger Imperial Sedan, Standard Two-Passenger Coupe, Standard Four-Passenger Victoria, Custom Five-Passenger Coupe, Custom Five-Passenger Sedan, Custom Seven-Passenger Suburban, and Custom Imperial Suburban.

To prevent drumming, the roof of all closed cars is constructed of two-inch slats, covered with padding and leather fabric. Front and sides are fitted with aluminum drip mouldings, fastened with screws.

The windshield is a one-piece panel, operated for ventilation by a regulator handle in the header bar. A slight lift of the panel opens a ventilating aperture across the entire width of the car behind the instrument board; or the full lift admits a stream of air directly into the body of the car across the entire width of the windshield.

The panel is heavy plate glass in mirror finish with ground and polished outer edges, sliding in velvet-covered channels. At the lower edge it engages a soft, flexible rubber seat, forming a waterproof seal.

A universally adjustable rear view mirror is mounted above the windshield, and a windshield cleaner is carried outside the header bar. Control rod of the cleaner is on the dash; in Custom cars, it permits regulation of the speed of the cleaner and automatically holds the blade out of the driver's line of vision when not in operation.

All windows are weather and rattle proof. The glass used is the best crystal plate, from $\frac{5}{32}$ to $\frac{7}{32}$ inch thick, with mirror finish, and ground and polished upon all outer edges. The top or header rail contains a concealed channel, lined with felt, which engages glass on both sides when the window is closed.

All doors and rear quarter windows are operated with mechanical window lifts, by handles of neat design mounted upon substantial base plates. Segment and pinion type lifting mechanism is used in Standard cars, cable type lifters in Custom cars. Glass in rear quarters lowers a little better than half way.

All doors incorporate a dovetail of special construction, encased in metal, which eliminates wear and assures the permanent alignment of the doors. Large rubber door bumpers are used in all models. The decorative walnut panels on the doors have been discontinued and all doors are now trimmed plain. Both doors and

windows in all Custom closed cars are, however, trimmed with garnish walnut mouldings.

In Custom cars, doors swing from the windshield posts, where the body frame supplies the maximum of stiffness.

Door sills are covered with aluminum in Standard cars, with Benedict nickel in Custom cars.

Double safety catches of hard phosphor bronze—with which pull-to handles are combined into one graceful unit—outside doors handles, and locks, are used on all closed models. Outside handles are offset bar type in white nickel in the Standard line, in hard rubber finish with nickel ends in the Custom line. The key lock in the right front door handle is operated by the same key that fits ignition switch, transmission lock, and spare tire lock. Other doors are fitted with inside thumb lock lever.

In the Standard cars, upholstery is in mohair velvets, with the top and head linings in colors to harmonize. Custom cars are upholstered to the buyer's specifications.

The cushions are built up of special springs, covered with the highest quality of curled hair. Standard cars have plaited type upholstery, Custom cars tufted type of the best custom quality.

Arm rests in both Standard and Custom cars are a patented construction made of coiled springs covered with curled hair, and upholstered.

Standard Five-Passenger Sedan, Standard Seven-Passenger Sedan, Standard Seven-Passenger Imperial Sedan, Custom Five-Passenger Sedan, Custom Seven-Passenger Suburban, and Custom Imperial Suburban have robe rails. In Standard cars, a solid hinged rail is used. Custom cars have a solid hinged rail, but with a handle added on each end to assist passengers in entering and alighting. All Custom cars also have a short silk cord hanging from the top of the rear door post for further assistance to passengers.

Standard closed cars have smoker case and ladies' case, detachable type, made of walnut. The smoker case contains ash tray and match box; the ladies' case contains a removable cosmetic case with mirror, memo pad with pencil, and ash tray. In Custom cars, the cases are of inlaid walnut, with cigar lighter, ash tray, and removable cigarette case in one, and sterling silver compact case with cosmetics, mirror, memo pad with silver pencil, and ash container in the other.

FACTS ABOUT CLOSED CARS

STANDARD BROUGHAM

DOORS have been widened 2 inches, or to 37 inches. The two front seats are full bucket type, and both are hinged at the floor to fold forward, allowing twenty inches of clearance for entering the rear seat. The same garnish mouldings are used as in other Standard closed cars, and the grade of upholstery is identical with that of the Standard closed cars. There is an extra large trunk rack.

STANDARD FIVE-PASSENGER SEDAN

Adequate room is afforded for all five passengers, and the same trunk rack is used as on the Custom Five-Passenger Sedan.

STANDARD SEVEN-PASSENGER SEDAN

The auxiliary seats are changed to occupy the full width of the car and will, if necessary, accommodate three passengers.

STANDARD SEVEN-PASSENGER IMPERIAL SEDAN

With the exception of the one-piece glass partition between the compartments, this car is exactly the same as the Seven-Passenger Sedan. This partition may be completely lowered out of sight.

STANDARD TWO-PASSENGER COUPE

A new and singularly graceful rear deck has been supplied. The leather rear quarter now has a D window.

The parcel compartment behind the seat has been enlarged, and the side door into the luggage space is larger to permit more convenient handling of packages, bags, or golf clubs.

Also hinged deck cover—storage space lined and carpeted—dust-proof.

STANDARD FOUR-PASSENGER VICTORIA

There is a substantial increase in the luggage space under the rear deck.

CUSTOM FIVE-PASSENGER COUPE

This model carries the same new rear deck design as the Standard Two-Passenger Coupe. The parcel compartment behind the rear seat is not so large as in the two-passenger model.

CUSTOM FIVE-PASSENGER SEDAN

Without sacrifice of head room, this model is the lowest in the Cadillac line and has a full metal-panel body without rear quarters. Its trunk rack is a special Cadillac type accommodating a large trunk and fitted with aluminum bars, artistic in design, which are an added touch of beauty when no trunk is carried.

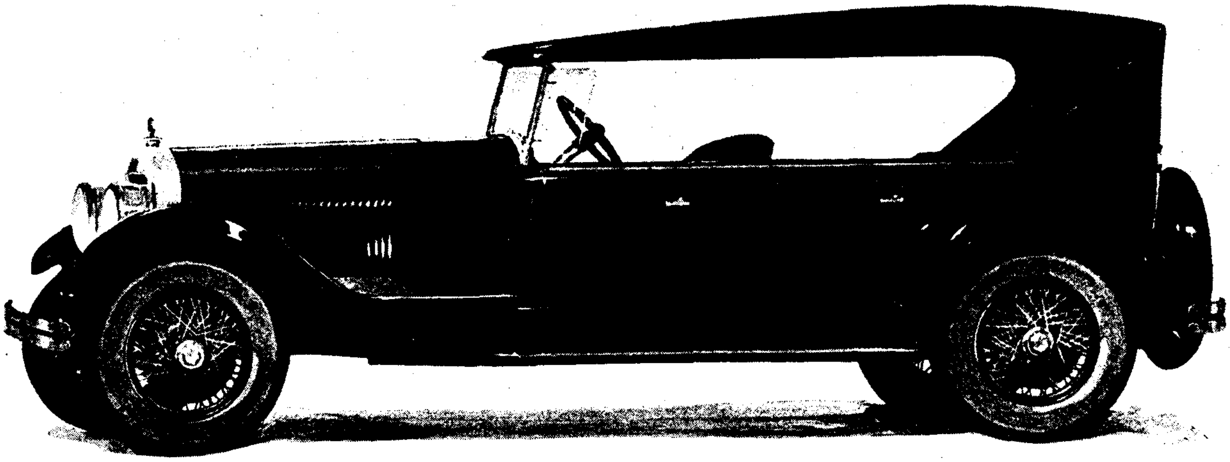
CUSTOM SEVEN-PASSENGER SUBURBAN

Auxiliary seats are the full width of the car and will, on occasion, accommodate three passengers.

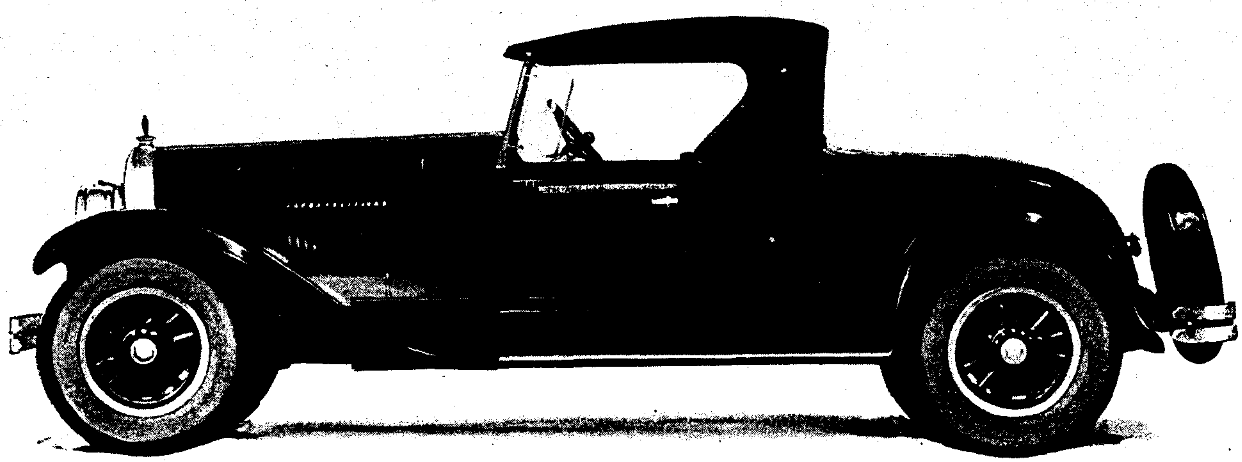
CUSTOM IMPERIAL SUBURBAN

This model is exactly the same as the Custom Suburban except for the one-piece glass partition between the compartments. This partition may, if desired, be lowered completely out of sight behind the front seat.

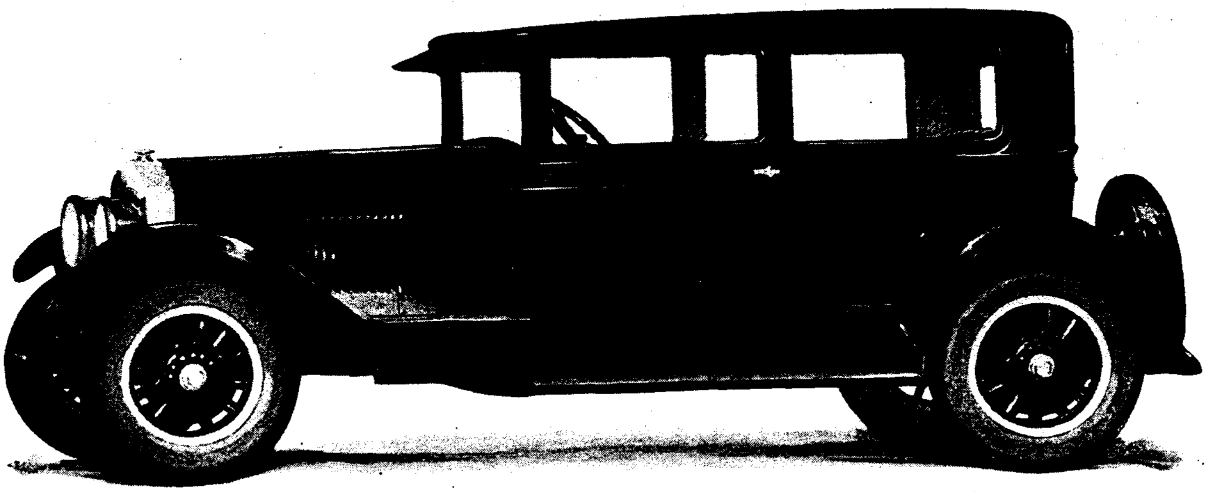
On the following pages eight of the twelve models are illustrated



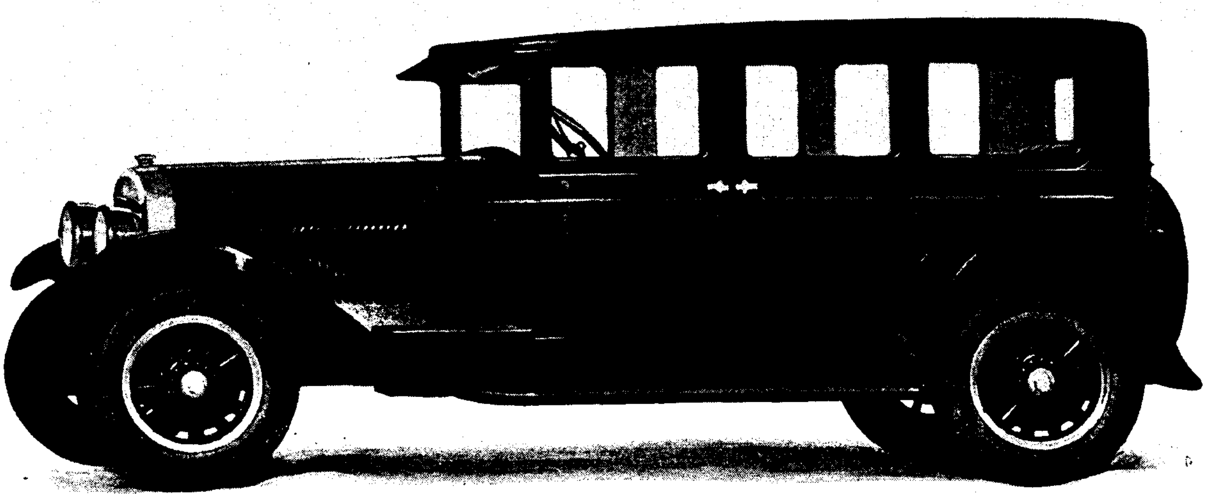
THE CUSTOM SEVEN-PASSENGER TOURING



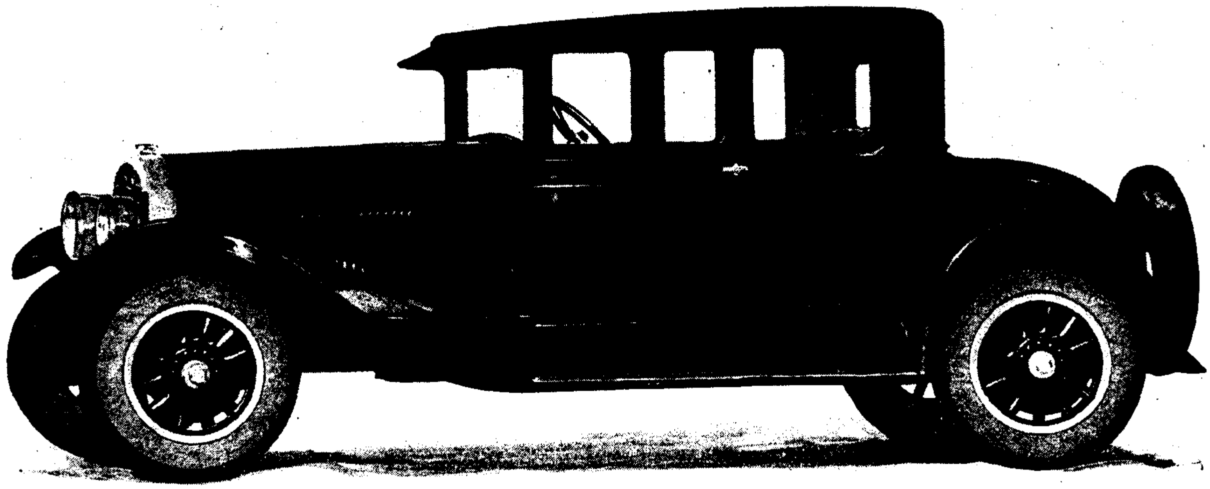
THE CUSTOM ROADSTER



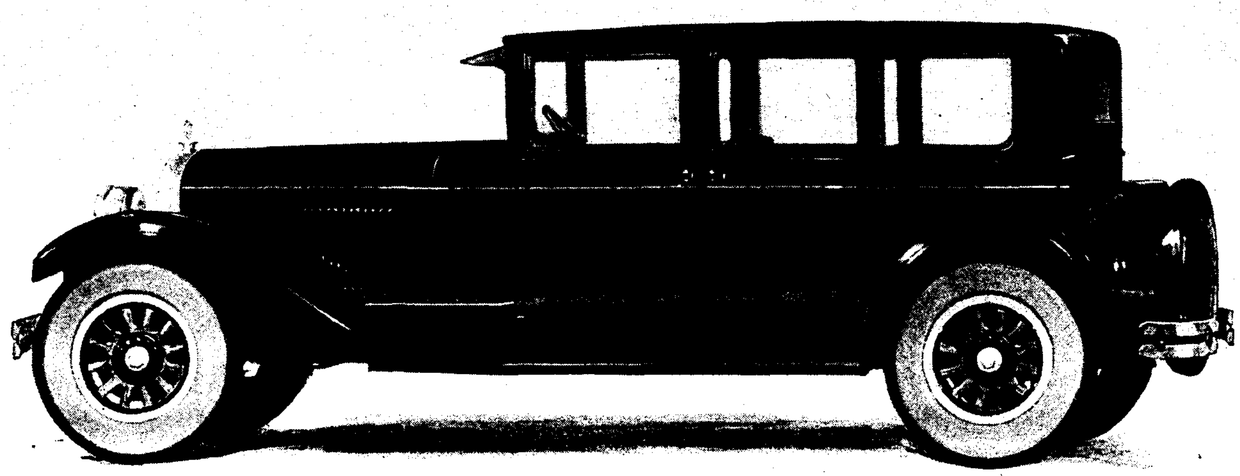
THE STANDARD BROUGHAM



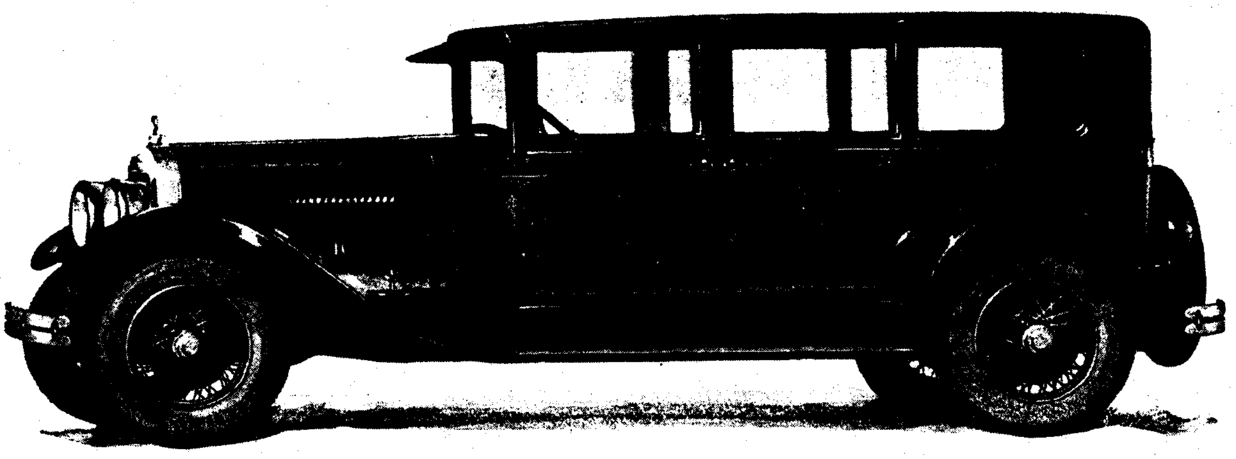
THE STANDARD SEVEN-PASSENGER SEDAN



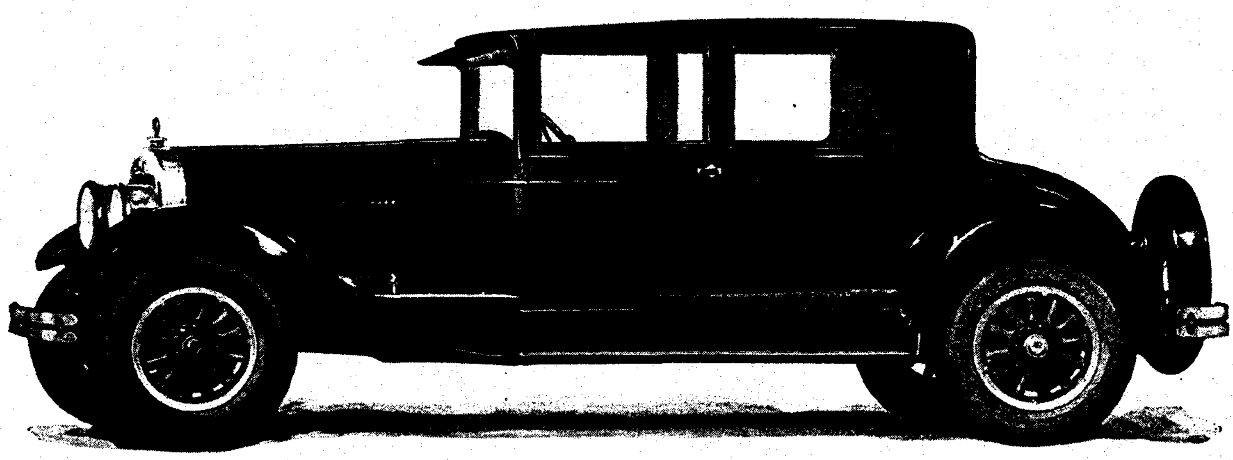
THE STANDARD FOUR-PASSENGER VICTORIA



THE CUSTOM FIVE-PASSENGER SEDAN



THE CUSTOM SEVEN-PASSENGER SUBURBAN



THE CUSTOM FIVE-PASSENGER COUPE

Substantially Lower Prices
on the Great New
CADILLAC

At these new prices, the greatest of all Cadillac cars represents the *greatest of all motor car values*

Standard Line

Five-Passenger Brougham	$2995
Two-Passenger Coupe	3045
Four-Passenger Victoria	3095
Five-Passenger Sedan	3195
Seven-Passenger Sedan	3295
Seven-Passenger Imperial	3435

Custom Line

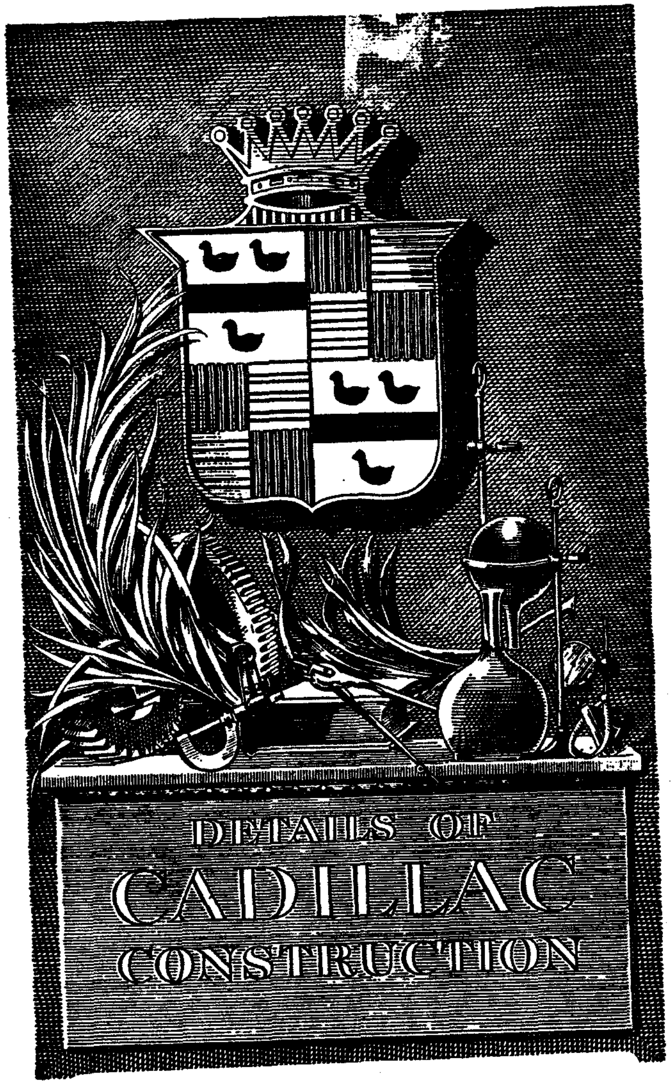
Roadster	3250
Touring Car	3250
Phaeton	3250
Five-Passenger Coupe	4000
Five-Passenger Sedan	4150
Seven-Passenger Suburban	4285
Seven-Passenger Imperial	4485

All prices quoted f.o.b. Detroit. Tax to be added

The privilege of deferred payment over a twelve months' period is gladly given on any Cadillac car. All prices and equipment are subject to change without notice

CADILLAC

Division of General Motors Corporation


DETAILS OF
CADILLAC
CONSTRUCTION

DETAILS
OF
CADILLAC
CONSTRUCTION

Being an illustrated description of the mechanical features of the V-63 chassis

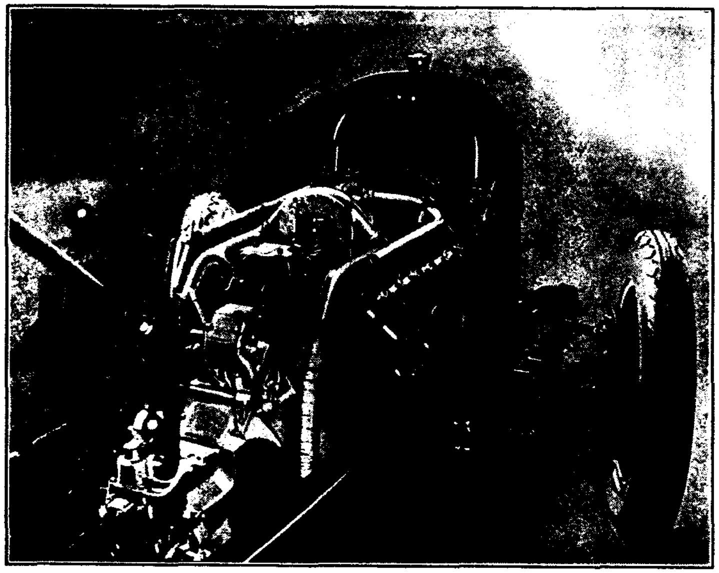
CADILLAC MOTOR CAR COMPANY
Division of General Motors Corporation
DETROIT, MICHIGAN, U. S. A.

THE story of automobile development is interwoven with the story of Cadillac progress and each chapter marks epochal accomplishment in automotive transportation to which Cadillac contributed by the several recognized advancements introduced in Cadillac chassis. In the type V-63, Cadillac comes forth with further signal improvements.

The new V-63 engine possesses perfect inherent balance by virtue of a fully compensated crankshaft and establishes new standards of comparison for engine performance.

More than a year ago Cadillac perfected and introduced mechanical four-wheel brakes as a part of the Cadillac automobile.

It is by advances such as these that Cadillac has achieved its position of leadership. For the benefit of motorists who like to go deeper into construction details and the reasons for the superiority of the Cadillac, this brief analysis of V-63 is presented.



Cadillac V-63 Power Plant

Cadillac presents the V-63 engine, which is inherently balanced at all engine speeds.

Numerous advantages are possessed by the Cadillac V-type 90-degree, eight-cylinder engine, as follows:

Impulses frequent

1. The Cadillac V-63 engine has a smooth, easy turning movement, resulting from the overlapping of the frequent power strokes.

Light reciprocating parts

2. The Cadillac engine has a low rate of wear because of the light power impulses and the reduction of inertia forces, resulting from its light reciprocating parts. The compensated crank-

shaft construction relieves the bearings of all centrifugal and inertia load and only the working pressure exerted by pistons is carried on the bearings.

High engine speed

3. High engine speed is also made possible by the light reciprocating parts, resulting in the development of a great amount of power from small piston displacement.

High compression—high efficiency

4. Great efficiency is made possible by high compression of the gases in the combustion chambers. Amount of compression of the mixture is one of the important factors in securing efficiency, but it is limited in many cases by a tendency to pre-ignition. The easy cooling of the small pistons of the Cadillac V-63 engine permits of high compression of the gases without the rise in temperature from which pre-ignition results.

Short engine—sturdy construction

5. The placing of the cylinders opposite each other, rather than all in line or staggered, makes the Cadillac V-type of engine the shortest of all engines with four or more cylinders and of equal piston displacement.

The bore and stroke of the Cadillac V-63 engine are $3\frac{1}{8}$ inches and $5\frac{1}{8}$ inches, respectively. The piston displacement is 314 cubic inches.

The compensated crankshaft

The Cadillac compensated crankshaft which renders the engine inherently balanced is the most important advancement of recent years in eight-cylinder engine design.

The Cadillac V-63 crankshaft has four throws or cranks in two planes at right angles to each other, rather than all in one plane as in other types of V-eights. As a result of this rearrangement of the crankshaft throws, the V-63 engine has a new firing order, although the firing interval is still evenly spaced, the impulses occurring regularly every quarter revolution of the crankshaft.

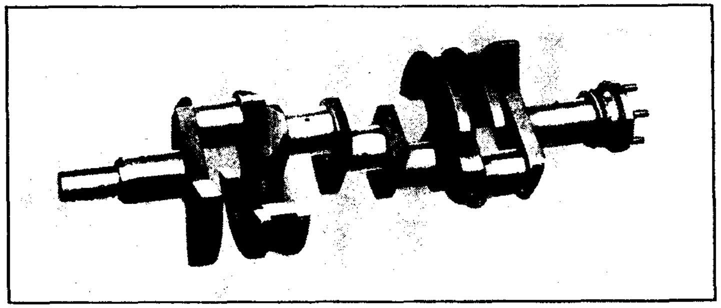
Four compensators of forged steel are secured to the crankshaft. Each crankshaft, with its compensating weights and with supplementary weights to represent the pistons and connecting rods, is dynamically balanced on a special machine so that the entire reciprocating and centrifugal mass is perfectly balanced at all engine speeds.

An understanding of the compensating principle of the V-63 engine, employed by Cadillac for the past year, requires an explanation of the disturbing forces which tend to produce vibration.

Reciprocating inertia forces

INERTIA forces, due to the alternating movement of the pistons, are the principal disturbing forces and their elimination is one of the designer's most difficult problems.

Types of engines in which the inertia forces *completely* cancel each other are designated as "inherently balanced."



Crankshaft

The Cadillac V-63 engine is of this type and is the first V-type eight-cylinder engine to be "inherently balanced."

By placing the crankshaft throws in two planes at right

angles to each other, the component inertia forces are divided into pairs of forces which are equal and opposite although not in the same plane. The effect of these out-of-plane forces is then completely neutralized by the compensators.

The weights of the compensators and the angles at which they are placed are so calculated that their centrifugal effect causes the whole assembly—crankshaft, connecting rods and pistons—to operate with the smoothness of a balanced flywheel.

Rigidity of crankshaft

AMONG other forces acting on the crankshaft of an automobile engine are torsional forces, tending to twist the shaft. This tendency is obviously more marked in a long shaft than in a short one.

It is because of this inherent defect of a long crankshaft that Cadillac engineers have never approved of more than four cylinders in line.

Even with its extreme shortness, the V-63 crankshaft has the large diameter of 2⅜ inches. This gives the crankshaft a great degree of rigidity.

Bearings

THREE main bearings support the crankshaft, a smaller number of long bearings being preferable to a larger number of short ones for two reasons. It is difficult in a short bearing to maintain an oil film between the crankshaft and the bearing metal. It is also difficult to maintain the alignment of a larger number of bearings.

It should be observed that although the compensated crankshaft of the Cadillac V-63 engine relieves the bearings of all duty except loads due to the power impulses, other forces being completely neutralized, the diameter of the bearings is even greater than in former Cadillac eight-cylinder engines.

Connecting rods

THE connecting rods are drop-forged from special formula steel, and finished over their entire surface, reducing weight to a minimum, and insuring uniformity.

The connecting rods from cylinder blocks on each side of the valve channel connect with the four-throw crankshaft, the bearing of each throw taking care of the ends of connecting rods from opposite cylinders.

The connecting rods exemplify Cadillac manufacturing precision. The machining and finishing of one pair of connecting rods and pistons involve three hundred and thirty-six operations. Two dimensions are held within the limits of three ten-thousandths of an inch; four within one-half thousandth of an inch; thirty-nine within one thousandth of an inch; twenty-eight within two thousandths of an inch, and more than fifty within ten thousandths of an inch. More than 200 gauges and micrometers are used to insure that the pistons and connecting rods conform to the dimensions specified on the drawings.

This care is typical of thousands of operations in building the Cadillac car.

Pistons

THE pistons are of unusually light design, the entire eight pistons wighing no more than two pistons of the average four-cylinder engine with equal piston displacement. Gray cast iron alloy of Cadillac special formula is used.

Three concentric piston rings are carried above the wrist-pin. Each of the two upper rings has a small groove cut in its circumference which entraps lubricating oil, rendering the seal against compression leakage most effective. The lowest ring is grooved and slotted, permitting excess oil to drain back through the piston into the crankcase.

Crankcase

THE most striking characteristic of the Cadillac crankcase, or engine base, is its weight efficiency, with ample strength, rigidity and stability.

The material employed is a special copper alloy aluminum, with a strength-to-weight ratio more than twice that of an iron casting.

Seven ribs brace the deep walls of the crankcase and support the crankshaft and camshaft bearings. The center and rear crankshaft bearings are supported by two ribs each.

The crankshaft bearing caps are not simply bolted to the supporting ribs, but are held in place over the bearings by through-bolts, eleven inches long, which pass between the ribs to the very top of the crankcase and share with it the tensile stress imposed by both the dead and live load of the crankshaft.

The Cadillac engine is supported at three points—two points at the rear of the crankcase, and the ball and socket joint on the front coverplate.

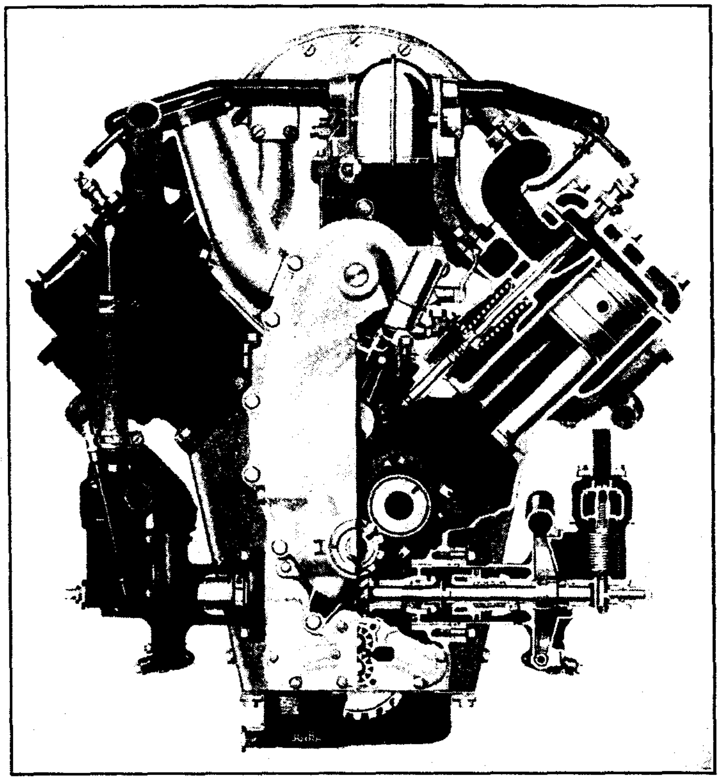
Cylinder blocks

CADILLAC cylinders are cast *en bloc*, in fours, with detachable heads. Both inlet and exhaust valves are on the same side of the combustion chamber.

Detachable heads

THE separately cast head members permit the accurate profiling of the combustion chambers. This results in uniform compression, and the smoothly machined surface reduces the tendency of carbon to adhere.

Casting of the cylinder heads separately renders it possible in manufacturing to have access to both ends of the cylinder bore, permitting use of the plug gauge in both ends of the cylinder.



Sectional view through exhaust valve, showing details of valve system

A gray cast iron alloy of Cadillac special formula used in the cylinder blocks gives them exceptional wearing qualities and facilitates the formation of a glass-like surface on the walls of the bore.

Valve system

THE Cadillac eight-cylinder V-type design permits a simple and unusually quiet valve mechanism. The single camshaft has sixteen cams, each operating one of the sixteen valves. It

is positioned directly above the crankshaft, and driven from it by a silent chain of unusual width and strength.

Its five bearings constitute more than one-third of its over-all length.

The camshaft is a drop forging with integral cams. To convey abundant supply of lubricant to its bearings the shaft is hollowed through its entire length. Each valve is actuated by a rocker arm, carrying a hardened steel roller which rides upon the cam.

The rocker arms are pendant from shafts, supported from the underside of the crankcase top coverplate. They are bushed with replaceable bearings of a special composition.

The motion of the valve rocker arms is transmitted to hardened steel push rods with adjustable tappets, and passed on to the valve stems.

The Cadillac poppet valves are forged from high quality special steel.

The diameter of the valve opening is approximately one and eleven-sixteenths inches. The valve stems have their bearings in guides four and a half inches long pressed into the cylinder blocks. This length prohibits the possibility of wear.

Fuel System

THE 20-gallon tank at the rear of the frame is of Terne plate steel, rectangular in section.

Fuel supply is positive

THE flow of fuel to the carburetor is positively assured by a pressure of air on the contents of the tank, which is automatically maintained between one and two pounds per square inch above atmospheric pressure.

The pressure is furnished by an air compressor supported on the front coverplate of the engine and driven by an eccentric on the camshaft.

Fuel strained

Two settling chambers and two strainers between tank and carburetor purify the engine fuel before it enters the mixing chamber.

Carburetor Cadillac-designed and built

The Cadillac carburetor is designed by Cadillac engineers to meet every requirement of the Cadillac eight-cylinder V-63 engine, and is manufactured in the Cadillac factory.

The carburetor, located between the cylinder blocks, is of the air-valve, single jet type, but with a number of exclusive features.

The auxiliary air supply, by which the correct mixture is automatically maintained at all speeds and throttle openings, is controlled by a leather-seated swing valve, governed by an adjustable spring.

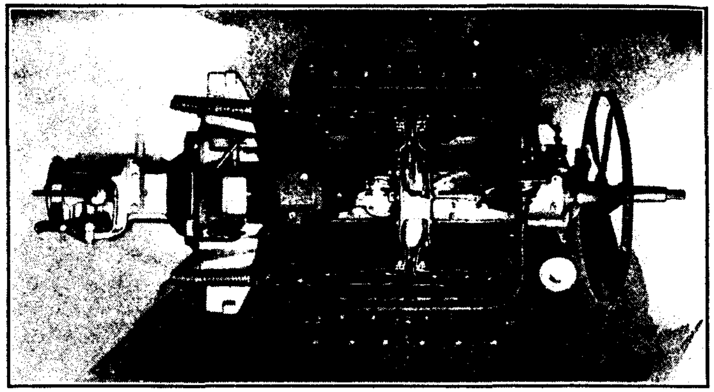
Three thermostatic elements are embodied in the V-63 carburetor. One thermostatic device controls the action of the auxiliary air valve. The second thermostatic element regulates the action of the throttle pump to compensate for changes in temperature. A third thermostat, acting only at unusually high temperatures, opens a vent to permit the escape of pressure which might be generated in very warm weather by "high-test" gasoline.

Throttle pump for quick acceleration

The requirement for a mixture of additional richness at the moment of acceleration is met by a plunger pump, operated from the throttle shaft, forcing the necessary extra fuel through the spraying nozzle.

Exhaust-heated intake

Complete vaporization of the present low grade gasoline is provided for in the Cadillac engine by an exhaust-heated intake manifold.



Intake heater is heated direct from exhaust manifolds

By the application of heat above and beyond the carburetor that part of the mixture which normally would condense and lodge on the walls of the intake manifold remains a part of the explosive mixture which enters the cylinders.

Alternate high and low pressure in the exhaust manifolds sets up a surging action which draws the hot exhaust gases through the passageway as soon as the engine is started.

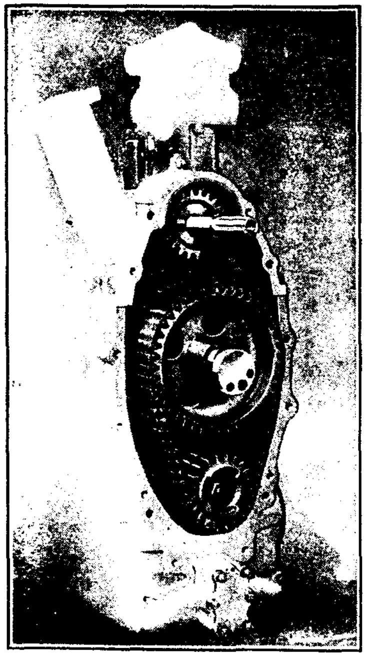
This immediate application of heat at the vital point in the fuel system gives good carburetion in a cold motor almost instantly.

The Exhaust System

Each block of four cylinders has its individual exhaust system, insuring the rapid conduction of the spent gases away from the cylinders.

Timing Chains

Silent timing chains have been used on Cadillac engines since 1911–1912. They have the advantage of being quieter than gears, and they retain this quietness throughout their life.


Timing chains

A large double sprocket is keyed directly to the camshaft and is driven from the crankshaft sprocket by a silent chain, while another silent chain from the double camshaft sprocket drives the fan and generator shaft.

No adjustment of the chains is necessary because of the increased size of the chains employed and the smoothness with which the crankshaft rotates.

The Ignition System

THE Cadillac engine has a single ignition system of the Delco high tension type, a simple, high grade and reliable design embodying the following elements:

A source of current, the generator, or, at low speeds, the storage battery.

An ignition timer, which interrupts the low tension current at the proper instant to produce a spark in the high tension circuit.

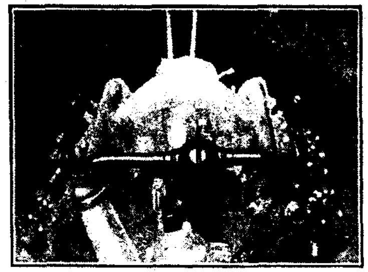
An induction coil, transforming the primary current of six volts into one of sufficient voltage to jump between the points of the spark plugs. This coil is of the transformer type and is completely enclosed in moulded bakelite, making it waterproof.

A condenser, which assists the induction coil to raise the

voltage, and which protects the contact points of the ignition timer against burning.

A high tension distributor, which directs the distribution of the high tension current to the spark plugs.

A resistance unit, which protects the ignition coil and timer contacts from injury.


Timer, distributor, condenser and resistance form one easily accessible unit

Structurally, the ignition timer, the distributor, the condenser and the resistance unit constitute a single assembly, which is bolted to the rear of the fanshaft housing.

Double set of contact points

THE ignition timer, which is driven by a vertical shaft through spiral gears from the fanshaft, has two sets of contact points. These share between them the current which would otherwise pass through one.

The firing order of the cylinders is as follows:

FRONT	8	7	5	2
	1	4	6	3

Automatic spark control

ONE of the many steps taken by the Cadillac to make driving entirely pleasurable, free from constant attention to details, is the automatic spark control which relieves the operator of practically all spark lever manipulation.

The Cooling System

THE temperature of the Cadillac engine is maintained at the point of maximum efficiency and smooth running by forced water circulation, thermostatically controlled.

Two pumps

CIRCULATION of water through the radiator and water jackets is maintained by two centrifugal pumps, one for each block of cylinders.

Thermostatic control

THERMOSTATIC control of engine temperature was developed and first employed by the Cadillac Company.

A balanced valve and a thermostatic member are housed and mounted in each pump.

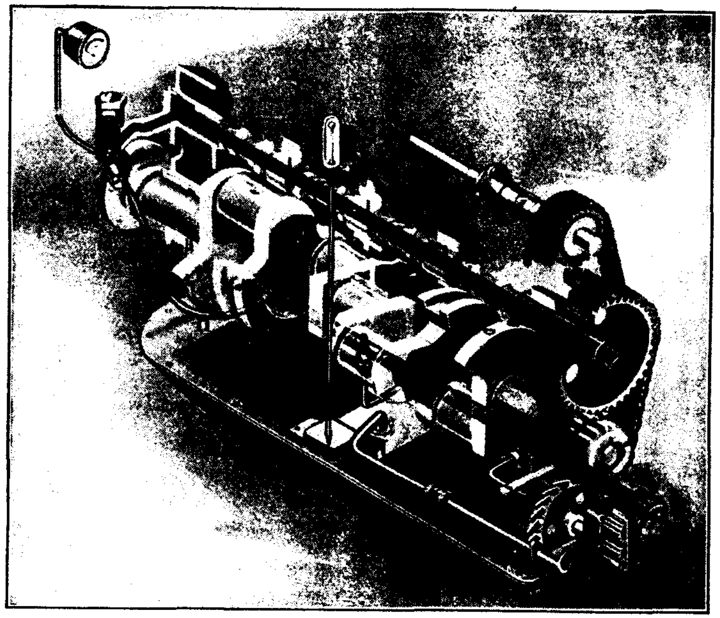
When the engine is cold, the thermostat valves are closed, and the supply from the radiator is cut off. The water then is circulated only through the water jackets of the cylinders and heads.

As soon as the temperature of the water in the water jackets reaches the predetermined point, the thermostats force open the valves and allow only sufficient cooled water from the radiator to enter to keep the temperature down to the predetermined point.

Radiator construction

THE copper tubular and plate radiator embodies but four elements—the upper and lower tanks, the vertical tubes, and the horizontal plates. The construction is such that there is a positive metallic connection between each tube and each plate, insuring the rapid conduction of heat away from the tubes.

A six-bladed fan is driven at engine speed from the camshaft by a silent chain. A friction clutch, under spring tension, allows the fan to slip at high speeds.



Lubricating system in perspective—path of oil indicated by darkened portions. Oil level indicator and pressure gauge shown. Passages, not shown, in the crankshaft conduct the oil from the main bearings to the connecting rod bearings

Condenser holds winter solution

A CONDENSING device, protected by patent rights, renders it possible to use with safety the inexpensive alcohol solution as an anti-freezing cooling medium. A condenser of simple construction is attached to the frame, and is connected by a tube to the overflow which runs from the upper tank of the radiator. It is filled automatically.

The Engine Lubricating System

THE engine is lubricated by the pressure circulation system, employing a gear pump which is driven from the water pump drive shaft through helical gears.

The oil supply is carried in the pressed steel reservoir which closes the under side of the crankcase.

Leads to all bearings

The oil is forced by the pump to a manifold fitting which runs the length of the crankcase above the oil pan, and at the left. Leads to each of the main bearings from this manifold circulate oil to all crankshaft bearings.

Hollow crankshaft

Oil passages in the crankshaft conduct the oil from the main bearings to the connecting rod bearings.

Oil forced from the connecting rod bearings is thrown by centrifugal force onto the cylinder walls and pistons, lubricating the cylinders and wrist-pins.

Pressure regulated

The pressure under which the oil is forced to the main and connecting rod bearings is controlled by a ball valve pressure regulator. Overflow oil from the regulating valve, forced into the hollow camshaft, is a source of supply for the camshaft bearings, the engine chains and the gasoline system air pump.

Valve lubrication

The valve rocker arms are lubricated by oil entrained in cup-like depressions at their upper ends. All oil drains back into the reservoir through a fine wire gauze.

An oil level gauge is fastened to the top coverplate of the crankcase, at the right of the carburetor.

The Starting and Lighting System

The Cadillac-Delco starting and lighting system is the result of many years of effective coöperation between the Dayton Engineering Laboratories Company and Cadillac.

Starting, lighting and ignition Cadillac-Delco

The units of the starting system include a source of current supply—a generator; a means of storing the current generated —a storage battery; and a method of applying the current to crank the engine—a motor.

The motor and generator functions are combined in one unit, a motor-generator.

Single unit, single wire system

A single wire system connects the different units, the circuit being completed through the frame.

Motor-generator

As a generator, the armature is driven at engine speed by an extension of the fanshaft, which in turn is driven through a silent chain from the camshaft.

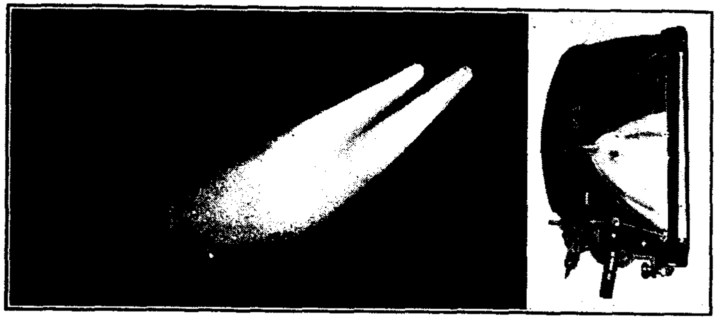
When acting as a motor, the sole function of the motor-generator is to crank the engine. The armature is then geared to the flywheel by idler gears, which are meshed upon pressing the starter button.

The storage battery

The specially built Cadillac-Exide storage battery gives uninterrupted service and long life.

Cadillac Headlamps

Cadillac headlamps are provided with highly efficient diffusing lenses which deflect and spread out the rays. To provide for deflecting the rays still further on special occasions when more illumination is desired nearer the car, as in rounding sharp corners and going over the crests of steep grades, and when headlights may be wanted in city driving, the reflectors in the headlamps are pivoted so that they can be tilted. They are controlled by a button on the instrument board.



Cadillac headlights may be tilted at will

The lamps and horn

A single wire system supplies current to the lamps, one side of each lamp socket being grounded.

The headlamps, side lamps, tail lamp and speedometer lamp are controlled by a single lever from the ignition and lighting switch on the instrument board.

The tail lamp has been included in a "triple utility" lamp. Besides the customary red light for ordinary use, there is a bright green light for stop signaling, and a bright white light for use when backing up. The stop signal switch is operated by the brake pedal. The back-up lamp switch is operated by the transmission control lever, and is turned on whenever the transmission is in reverse.

An inspection lamp with fourteen feet of cord and reel is located under hood.

Protection is afforded to the various circuits by circuit breakers.

The Power Transmission System

The clutch has fifteen steel plates; eight plain driven discs and seven driving discs faced on both sides with an asbestos friction fabric.

The periphery of each driving disc is serrated in the form of gear teeth, of ten pitch, which mesh with similar teeth on the inner surface of the clutch driving ring, bolted to the flywheel. The effect produced by this method of driving the clutch is that of eighty-one driving keys and as many keyways, greatly reducing the load on each key.

The thrust of a three-hundred-pound coil clutch spring, which forces driving and driven discs tightly together, is taken by a ball-thrust bearing.

Careful compounding of leverage has made the clutch release pedal astonishingly smooth and easy.

Gearset

The Cadillac selective gearset provides for three speeds forward and one reverse. The gears and shafts are chrome nickel steel forgings, heat-treated. The faces of the gear teeth are accurately ground and the ends of the teeth are backed off, facilitating easy and quiet gear-shifting. Wide gear faces distribute tooth pressure over an ample area to minimize frictional wear.

The clutch shaft and main transmission shaft revolve on ball bearings. To allow differential motion between the clutch shaft and the transmission shaft, when other than direct drive is in use, the front end of the transmission shaft revolves on a Hyatt flexible roller bearing, housed in the rear end of the clutch shaft. The countershaft revolves on two roller bearings on a stationary tubular shaft.

Propeller shaft

The propeller shaft between the transmission and the rear axle is of seamless drawn steel tubing.

The rear axle

The rear axle carries the weight of the car independently of its transmission of power to the rear wheels, a construction usually designated as full-floating. The load is taken by the pressed steel, tube-shaped housing. Into the ends of this pressing, chrome nickel steel sleeves are riveted and welded. The wheel bearings are mounted upon these sleeves.

The transmission of power and the gear reduction are accomplished by the helical bevel gear and pinion, and the two live axle shafts of chrome nickel steel. The pinion gear is a nickel steel forging.

Helical bevel gears insure a degree of quietness impossible with straight-tooth gears. The pinion shaft and ring gear mount are both supported on large ball bearings. In each case the thrust is taken by a double-row ball bearing. The differential is the bevel gear type.

Frame and Running Gear

CADILLAC engineers have not been content to allow only an ample factor of safety in the frame. They have designed a foundation on the basis of rigidity. Body and chassis, as a result, have an increased length of life.

The side bars have a long, deep channel section through the center, where the stress is most severe, and a wide top flange. There is a gradual reduction in the section toward each end with a moderate kickup at the rear.

Six cross members

THE side bars are rigidly tied together by six cross members; a central cross member of channel section; the cross member for the front engine support; a channel cross member opposite the front ends of the rear springs; a channel cross member in front of and supporting the gasoline tank, and two additional cross members of steel tubing.

The wheels

SAFETY will impress the purchaser or prospective purchaser as the primary consideration in the design and construction of Cadillac wheels.

They are of the artillery type, with twelve spokes in each wheel. The best selected hickory, thoroughly seasoned, composes the spokes which are of especially large elliptical section.

The felloe is of steel, hollow in section, and the spokes are anchored in the felloe by hydraulic pressure, forming a practically indestructible unit.

The wheels revolve upon adjustable roller bearings.

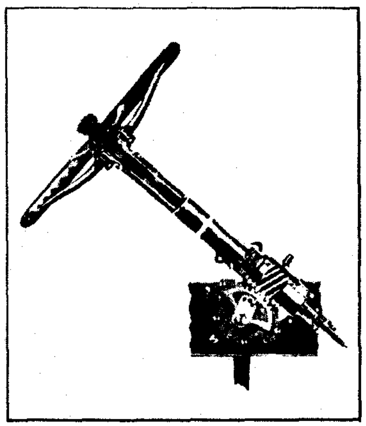
The consideration of safety has been given unusual attention in the device used for locking-on the front wheels.

The front axle

THE front axle has been entirely redesigned and strengthened to resist the additional stresses imposed by the front wheel brakes. It is of the reverse Elliott type with forked spindles, and straight axle ends.

Adjustable tapered roller bearings are used in the steering spindles.

Further facilitating easy turning of the front wheels, the steering spindle bolts are inclined at an angle which brings the point of contact between the tire and the road nearer the pivot axis.



Steering wheel and steering gear housing sectioned to show worm and sector

The Steering System

THE steering gear is of the worm and sector type. The worm is machined from a solid bar of steel and is keyed to the steering column, which is a length of seamless steel tubing. The worm is supported in the steering gear housing by bearings, which take the radial load, and adjustable ball bearings, which take the thrust.

The sector is machined from a single drop forging of nickel steel. Adjustment of the position of the sector relative to the worm is easily made.

The tubular steering connecting rod has a ball and socket joint at each end. The spindle arms, of generous dimensions, are forged of chrome nickel steel.

The turning diameter of the 132-inch chassis is forty-four feet and of the 138-inch, forty-six and one-half feet.

The Spring System

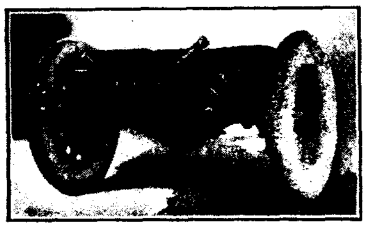
THE front springs are semi-elliptical and three semi-elliptical units, arranged on the platform principle, comprise the rear suspension system.

The combined length of all five units is more than nineteen feet.

Rear axle torque reactions are transmitted by a substantial torque arm to the chassis frame.

Unusual precautions have been taken against spring breakage.

The spring leaves are silico-manganese steel, heat-treated to give maximum life in service. The length of the springs and the width and thickness of the plates composing the spring leaves have been accurately determined.



Semi-elliptic spring construction in front and three-quarter platform suspension at rear

The spring eyes are lined with phosphor bronze bushings, bearing on shackle bolts with the unusually large diameter of three-fourths of an inch. The forged steel shackles, in

which these bolts are journaled, have uncommonly large bearing surfaces.

Four-Wheel Brakes

THE addition of front wheel brakes to the already efficient Cadillac system brings to the owner of the V-63 not only greatly increased braking ability, but also safer, smoother, and more durable brakes.

The complete braking system of the V-63 consists of three pairs of brakes—external brakes acting on the rear wheels; internal brakes acting on the rear wheels; and internal brakes acting on the front wheels. All of the brake drums have the same diameter—17 inches.

The rear wheel external brakes and the front wheel internal brakes are operated simultaneously by the brake pedal.

The rear wheel internal brakes are operated by a hand lever which has the customary provision for locking the rear wheels when the car is standing. The hand brakes are independent of the foot brakes in every detail of their mechanism, thus providing a complete reserve braking system.

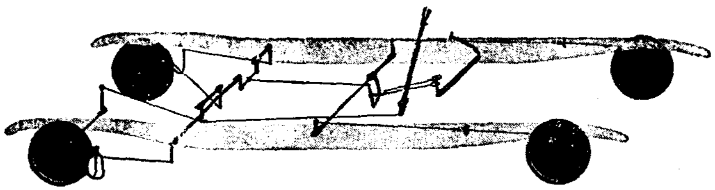
Safety

CADILLAC V-63 brakes are designed with the greatest consideration for safety. In the case of front wheel brakes, safety in control is more important than maximum ability to stop quickly.

This is accomplished in the Cadillac V-63 by a construction which provides that when the brakes are applied with the steering wheel turned to the right or left, only the brake on the inner wheel will take effect, leaving the outer wheel free to rotate. Similarly, if the car is sliding straight ahead on a slippery surface with both front wheels locked, and if the steering wheel is then turned, the outside front brake will automatically release. The outer wheel will, therefore, start to rotate, giving it power to change the direction of the car. It is, accordingly, impossible for both front wheel brakes to be locked on a turn.

Provision for safety is further made by properly proportioning the braking effect between the front and rear wheels. In order that the front wheels will not lock until more than enough pressure has been applied to lock the rear wheels, the braking effect of the front wheel brakes is purposely made less than that of the rear wheel brakes.

Finally, safety is enhanced by the provision made to counterbalance the effect of heat in expanding the brake drums.



The simple mechanism of Cadillac four-wheel brakes

On the Cadillac V-63, internal brakes on the front wheels are combined with external brakes on the rear wheels. Through the division bar, to which the brake pedal is connected, the effect of expansion of the front wheel brake drums is neutralized by the opposite effect of expansion of the drums on the rear wheels. The applied position of the brake pedal therefore hardly changes as the drums expand, minimizing the possibility on long steep grades either of the brakes seizing or of being unable to apply the brakes because of heated drums.

Adjustment infrequent

A SECOND consideration in the design and construction of brakes should be freedom from attention.

One feature contributing toward this is a two-stage pedal construction which increases the effective travel of the brake

pedal. The rod from the brake pedal to the division bar is connected to the pedal at two points, one of which is nearer the pedal shaft and, naturally, has a greater leverage than the other. The connections are so adjusted that, during the first part of the pedal travel—corresponding to normal use—the brakes are applied through the connection nearest the pedal shaft, and the leverage permits application of the brakes with light foot pressure.

When the brake lining has worn so that the pedal is within a short distance of the toeboard, the upper connection takes effect and the rate of pedal travel is reduced.

In addition to making every inch of pedal travel count, the brakes have been freed from the need of frequent attention by increasing the life of the brake lining. The distribution of braking duty among four instead of two wheels lessens of itself the load on each brake. Lining wear is proportionately less than with two brakes alone.

Details of brake construction

ALL three sets of brakes are of the flexible-band type, which permits the lining to conform to any slight distortion of the brake drums resulting from heat.

The rear wheel external brakes are essentially the same as the corresponding brakes on former Cadillac cars.

The front internal brakes are of the expanding toggle type similar in principle to previous rear wheel internal brakes but differing in method of application.

Careful provision has been made for protecting the front wheel brakes from the weather. The brake drum overlaps the edge of the dust shield in an angle-shaped projection which automatically catches and throws off any water or dirt which may pass the dust shield. Connections which are outside the brake drums and which are exposed to splash from the front wheels are enclosed.

The rear wheel internal brakes are of the expanding toggle type. The hole for the inspection and adjustment of the brakes has been enlarged and a new type of cover, easily removed and attached, is employed.

Each set of brakes is mechanically operated through positive connections. Connections at the front axle are made through universal joints which allow play of the springs and movement of the steering spindles.

The brake control mechanism is designed so that either set of brakes is as effective to retard or prevent reverse motion of the car as forward motion.

The rear wheel external brake equalizer is suspended from the frame cross member opposite the front ends of the rear springs. The location of the equalizer is such that the rods between it and the rear axle pivot about approximately the same axis as the rear springs. Movement of the rear springs accordingly has no effect on the brake action, the pedal remaining stationary on the roughest roads. A rocker shaft for the rear wheel internal brakes is provided on the same cross member to which the rear wheel external brake equalizer is attached.

All lever and rocker shaft bearings are provided with lubricating connections for use with the pressure gun in the tool equipment.

The last analysis

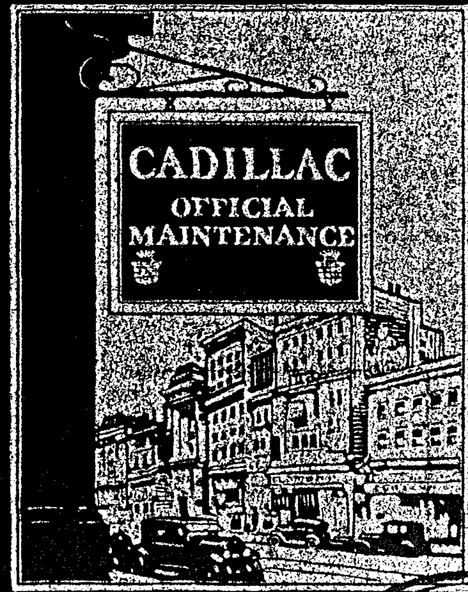
THESE fine points of engineering and these precise manufacturing practices converge to a common focus, which is the behavior of the car in the owner's hands. They insure, as nothing else can do, great excellence in two phases of performance, *viz.:* (1) spirited, flexible, quiet action of the new Cadillac and (2) rare longevity of all parts, which guarantees the Cadillac standard of performance during a long period of use.

You may test the first very readily, as any Cadillac dealer

will be glad to place a car at your command. The second will be confirmed by a large and very notable list of Cadillac owners whom Cadillac has served long and faithfully, and whose recognition of Cadillac excellence has made it the leader in an exacting field.

A separate booklet is devoted to describing and picturing Cadillac body styles and will be mailed on request

Where craftsmanship is a creed and accuracy is a law



V-63
CADILLAC
OPERATOR'S MANUAL

CADILLAC

OPERATOR'S MANUAL

V-63

PRICE 35 CENTS

CADILLAC MOTOR CAR COMPANY
DETROIT

SIXTH EDITION

Printed in U. S. A.
by
Friesema Bros. Printing Co.
Detroit

OPERATION

Part I

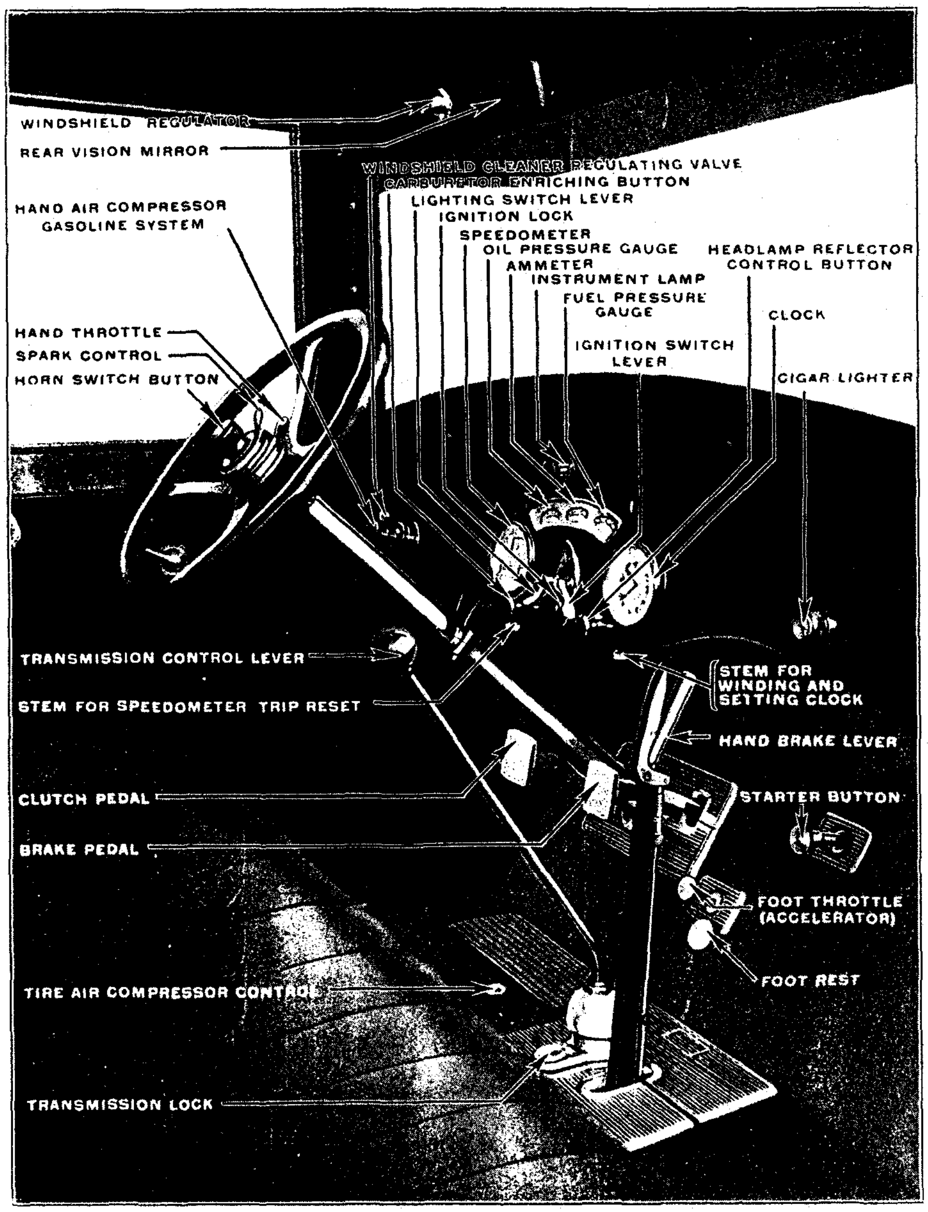


Fig 1. Instruments, Control Levers and Pedals.

LICENSE DATA

The following information may be found useful in making license application:

Number of cylinders	8
Cylinder bore	$3\frac{1}{8}$ in.
Piston displacement	314 cubic in.
Stroke	$5\frac{1}{8}$ in.
Horsepower (N. A. C. C. rating)	31.25

Engine number:

The engine number is stamped on the crank case just back of the right-hand block of cylinders, and on the name plate attached to the forward face of the dash.

The number of each "V-63" engine begins with the figures "63."

Wheelbase:	132 and 138 in.
Tread	56 in.

THE THREE MOST IMPORTANT THINGS IN CONNECTION WITH THE CARE OF THE ENGINE

1. *Use of Suitable Oil*

The use of Cadillac Engine Oil is recommended (see under "Lubricants" page 33.)

2. *Replacement of Oil*

Replace the engine oil at the end of each 500 miles of travel during warm weather and at the end of each 350 miles of travel or once a week during cold weather. (See under "Replace Engine Oil" page 35 and "Replace Engine Oil Frequently During Cold Weather," page 36.)

3. *Manipulation of Carburetor Enriching Button*

After starting the engine, do not run it with the carburetor enriching button pulled back any longer than is absolutely necessary. (See under "Starting the Engine," page 9.)

THE USER'S RESPONSIBILITY

The information, advice and instruction contained in this Manual are furnished because the user of a motor car needs them. But if the user fails to heed the advice, the loss is not wholly his but partly ours as well.

A Cadillac car in the hands of an operator who will give it the reasonable consideration to which it is entitled, and which every car requires, will run as smoothly and as quietly as is possible for any motor car to run. No car will give greater satisfaction nor will any car stand more abuse. But no car can be expected to stand continued abuse without showing the results of it sooner or later.

We are interested that Cadillac cars render unfailing service and satisfaction. They are built for that purpose but the user must do his part after the car comes into his possession. The Cadillac is capable of rendering the best of service and directions are furnished which will guide the user toward obtaining that service. But if he persists in ignoring these directions, there is no one but himself upon whom he can rightfully place the responsibility for difficulties which may result.

DRIVING AND CARING FOR A MOTOR CAR

Driving an automobile means more than simply starting, steering and stopping. To drive an automobile properly requires an understanding of the principles involved and the exercise of intelligence and judgment.

With well designed and correctly built automobiles, probably 95 per cent of the so-called "troubles" are directly traceable to lack of lubrication, abuse, carelessness, and a lack of an understanding of the principles involved.

To begin with, the driver should study the construction of his car and thoroughly acquaint himself with its mechanism, the functions of its various parts and the "why" of everything connected with it. If he understands these he is better able to realize why certain things must be done and why certain other things must not be done, if he is to obtain the most satisfactory results, the greatest efficiency and the greatest economy, together with durability and long life of the engine and car. Remember that the difference between a comprehensive understanding of your car and the superficial knowledge possessed by many drivers is the difference between having "troubles" and not having them.

On the other hand is frequently found the user who is constantly tinkering with his car when there is no necessity for it. Avoid both extremes. If, after seeing that all parts are lubricated properly and that all bolts, nuts and screws are tight, the car is running well, let it alone. Many users drive their Cadillacs for months without finding an adjustment necessary. If adjustment seems necessary and you are not sufficiently acquainted with the construction of the car to know what adjustment is necessary or how to make it, *don't experiment* but take the car to a Cadillac maintenance station. Maintenance stations operated by Cadillac distributors and dealers display the official sign illustrated on the cover of this Manual.

The most important thing in the care of an automobile is proper lubrication. Part Two of this Manual gives detailed directions regarding lubrication.

PLACING A NEW CAR IN RUNNING CONDITION

Before the cars are shipped, the fuel and cooling systems are drained. When the car is received and before it is placed in use, the supply of gasoline and water must be replenished. During freezing weather an anti-freezing solution should be used instead of water. (See under "Anti-Freezing Solutions," page 24.)

The car should be lubricated thoroughly in accordance with directions contained in this Manual. (See under "Lubrication," Part II.)

Filling the Cooling System

Fill the cooling system with water during warm weather and with a suitable anti-freezing solution during freezing weather (see under "Anti-Freezing Solutions," page 24.) To fill the cooling system proceed as follows:

Make sure that the cylinder drain plugs "E", Fig. 22, are tightly in place. Close the water pump drain valves "G". Turn the thermostat control shaft "B" on each water pump so that the triangular indicator on the end of the shaft points up. The shaft may be turned in either direction.

There is a drain plug "E" in each cylinder block and a drain valve "G" and a thermostat control shaft "B" at each water pump. A special wrench for the drain valves "G" and the thermostat control shafts "B" is included in the tool equipment of the car.

Remove the radiator filler cap "A" and fill the cooling system to within one inch of the top of the filler. Then add three quarts additional to fill the condenser which is connected to the radiator overflow pipe. This may be done by pouring the liquid slowly into the radiator filler or by removing the filler strainer and pouring the liquid directly into the overflow pipe through a small funnel. The second method is the shorter.

Screw the radiator filler cap down tightly after replacing it. This is important because the operation of the radiator condenser depends upon a tight joint at the radiator cap.

After filling the cooling system turn the thermostat control shafts "B" so that the triangular indicators point down. These indicators should point up when filling the cooling system and down at all other times.

Caution:—Do not use water in the cooling system during freezing weather. Use a good anti-freezing solution. Water will freeze even though the engine be run continuously.

Filling the Gasoline Tank

The gasoline tank is at the rear of the car. (See Figure 21.) The filler cap can be removed after loosening the thumb screw.

Filtered gasoline should be used to prevent dirt or water entering the gasoline system. Only high-grade, reliable filling stations, which supply filtered gasoline should be patronized.

After filling the tank and screwing on the filler cap, tighten the thumb screw. This is necessary to prevent leakage of the air pressure by which gasoline is forced to the carburetor.

Operating a New Car

It is recommended that the operator of a new car refrain from driving it at its maximum capacity and speed until the car has been driven at least five hundred miles.

Although the parts of a Cadillac car are machined and ground with the greatest possible accuracy and fineness of finish, manufacturing processes cannot give to bearing surfaces the fine polish which results from actual operation at moderate speed and under light loads.

For this reason, it is advised that a car be driven no faster than twenty miles per hour for the first two hundred and fifty miles, and no faster than twenty-five miles per hour for the second two hundred and fifty miles.

TOOL BOX LOCK

A compartment for tools is provided in the right hand dust shield. The hinged door of the compartment forms a part of the dust shield and is locked with the switch key. To open the tool box door insert the switch key and turn the nickel plated handle to the right. Do not attempt to *turn* the key in the lock. *Insertion* of the key unlocks the handle.

STARTING THE ENGINE

1. First make certain that the transmission control lever is in the neutral position and that the hand brake is applied, (see Figure 1.)

2. If the fuel pressure gauge on the instrument board indicates a pressure of less than one pound, increase the pressure by means of the hand air compressor. The handle of the compressor is screwed into place. Loosen it by unscrewing it a few turns in the counter-clockwise direction. After the pressure has been increased to at least one pound, lock the plunger in place by holding it in and turning it in the clockwise direction.

3. Place the spark lever about one-third the way down from the "Advance" position, except in cold winter weather, when it should be at the "Advance" position. If the engine should be cranked by hand, always place the spark lever at the "Retard" position. If this precaution is not observed, a back kick will occur, resulting in personal injury.

4. In extremely cold winter weather, prime the carburetor by placing the throttle lever at the "Close" position, then pushing the accelerator button down to the floor and permitting it to return. Twice repeat this operation. Do not prime the carburetor except in extremely cold weather.

5. Place the throttle lever approximately one-fourth the way down from the "Close" position.

6. In cold weather, or in warm weather, if the engine has been standing for some time, pull back the carburetor enriching button.

7. Switch on ignition by moving the ignition switch lever up.

8. Push down on the starter button. This will bring the starter into operation and will cause the engine to "turn over." (See under "Caution.") In extremely cold weather, when the car has been standing long enough to have become thoroughly chilled, it is a good plan to release the clutch before pressing down on the starter button, and to hold the clutch pedal down during the cranking operation. If the habit is formed of doing this regularly one will not be so likely to neglect to do it during cold weather.

9. Immediately the engine commences to run under its own power, which should be in a few seconds, permit the starter button to return to the normal position. If the carburetor enriching button is back, push it as far forward as possible without causing the engine to stop or slow down materially. Push it in as far forward as it goes as soon as the engine is warm enough to permit it. *It is important that the button be left back no longer than is absolutely necessary.*

If the engine does not start within thirty seconds, do not continue to operate the starter, but permit the starter pedal to return to the normal position and determine the cause. Be certain that the ignition is on, that there is gasoline in the tank, and sufficient air pressure to force it to the carburetor. The starter will crank the engine only; ignition and gasoline must be present before it will run.

Caution:—The action which causes the engine to "turn over" is produced by a gear of the electric starting motor sliding into mesh with teeth on the fly wheel of the engine. When pushing down on the starter button to throw these gears into mesh, if it should so happen that they are in just such positions that the ends of the teeth of the starter gear come against the ends of the teeth of the fly wheel, instead of the teeth of one sliding between the teeth of the other, do not use force. Simply permit the starter button to return to the normal position and then push it down again. In the meantime, the gears will probably have changed their relative positions sufficiently to permit the teeth to mesh.

Oil Pressure

Lubricating oil is fed under pressure to the main and connecting rod bearings of the engine (see under "Engine Lubrication," page 34.) The pressure of the oil is indicated by the pressure gauge on the instrument board. (See Fig. 1.)

When the engine is not running, the hand of the oil pressure gauge should remain at zero, but immediately the engine is started and while it is in operation, pressure should be indicated. The pressure indicated depends upon the speed of the engine and the viscosity of the oil.

If at any time while the engine is in operation, the hand of the oil pressure gauge remains at zero, stop the engine at once and determine the cause. Serious engine trouble is a result of continuing to run the engine without oil pressure.

GEAR SHIFTING

Caution: Do not attempt to shift from neutral to any gear, or from one gear to any other without first disengaging the main engine clutch by pushing and holding down the clutch pedal (see Figure 1.)

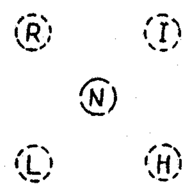


Fig. 2.

Control Lever Positions.

As the transmission is of the selective type, the operator may shift from any gear to any other gear without shifting through a third gear.

Referring to Fig. 2, the ball at the top of the transmission control or gear shifting lever is shown at "N" in the neutral position, at "L" in the low gear position, at "I" in the intermediate gear position, at "H" in the high gear position, and at "R" in the reverse gear position.

Starting the Car

To start the car, after starting the engine and unlocking the transmission lock, push down on the left pedal, which is the clutch pedal, thereby releasing the main engine clutch. Be sure the clutch pedal is pushed down far enough to release the clutch completely. Then disengage the hand brake by means of the hand lever—still holding the clutch pedal down. (If the car is standing on a grade it will be necessary to hold it with the foot brake until ready to start.) Next shift into low gear.

To do so, move the control lever as far to the left as possible and then pull it back as far as it will go (Fig. 3.) Open the throttle slightly by means of the accelerator pedal or throttle lever and permit the main clutch to engage gradually, by allowing the pedal to come towards you slowly.

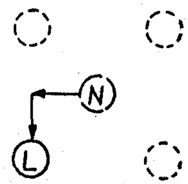


Fig. 3.

Neutral to Low Gear.

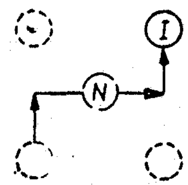


Fig. 4.

Low Gear to Intermediate Gear.

If it should so happen that the gears which mesh to make low gear are in positions such that the ends of the teeth of one gear come against the ends of the teeth of the other gear instead of the teeth of one sliding between the teeth of the other, do not force them but return the transmission control lever to the neutral position, engage the clutch by allowing the clutch pedal to come towards you, again release the clutch, then shift into low gear as directed above.

After the car is under way in low gear, release the clutch and shift into intermediate gear. To do this move the control lever back to the neutral position, then to the right and push it forward as far as it will go (Fig. 4.) Then permit the clutch to engage. In shifting from low to intermediate gear, it is advisable to pause for a moment in the neutral position if there is a tendency of the gears to clash.

After the car is under way in intermediate gear, shift into high gear. To do this, simply release the clutch and then pull the control lever straight back (Fig. 5.) Then permit the clutch to engage.

It is possible when starting the car on level ground to shift from low gear to intermediate gear and from intermediate to high gear at low speeds, and shifting can be done more quietly than at higher speeds. In starting on an incline a higher rate of speed must be attained before shifting gears.

Reversing

To start the car backwards, with the control lever in the neutral position, release the clutch, move the control lever to the left and push it forward as far as it will go. Open the throttle slightly by means of the accelerator pedal or throttle lever and engage the main clutch gradually.

If it should so happen that the transmission gears which mesh to make reverse are in just such positions that the ends of the teeth of one gear come against the ends of the teeth of the other gear, do not force them, but return the transmission control lever to the neutral position, engage the clutch, again release the clutch and shift into reverse gear as directed.

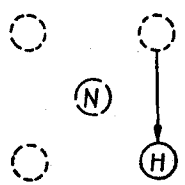


Fig. 5.

Intermediate Gear to High Gear.

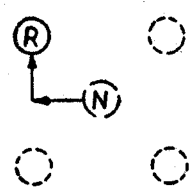


Fig. 6.

Neutral to Reverse Gear.

Shifting into Lower Gear

If, when ascending steep grades or pulling through soft mud roads or deep sand in high gear, the speed of the car is reduced until the engine labors, shift into intermediate gear. To do this, release the clutch, then push the control lever forward as far as it will go. Then engage the clutch. It is best to allow the car to slow down before making the shift and then, after releasing the clutch, to shift quickly. An experienced driver may find it more satisfactory to shift from high into intermediate gear in the following manner:

Release the clutch, return the control lever to the neutral position, engage the clutch, at the same time slightly accelerating the engine; then release the clutch again, and *instantly* shift into intermediate gear. Engage the clutch.

This entire change may be made in less time than it takes to read these directions by one who becomes familiar with this method. Shifting in this manner may be accomplished satisfactorily at higher speeds than is possible

when shifting in the usual manner. It is not recommended, however, that the operator attempt to shift from high to intermediate gear in this manner until he has considerable experience in shifting in the ordinary way.

Stopping the Car

First close the throttle and then release the engine clutch. Next return the transmission control lever to the neutral position. The clutch may then be re-engaged. Stop the car by pushing forward on the brake pedal. After the car has been brought to a stop, apply the hand brake by means of the hand brake lever.

Stopping the Engine

After stopping the car and applying the hand brake, move the ignition switch lever down.

TILTING HEAD LAMP REFLECTORS

Cadillac headlamps are provided with highly efficient diffusing lenses which deflect and spread out the rays. To provide for deflecting the rays still further on special occasions when more illumination is desired nearer the car, as in rounding sharp corners and going over the crests of steep grades, the reflectors in the headlamps are pivoted so that they can be tilted. They are controlled by a button on the instrument board (see Fig. 1) and are tilted down when the button is pushed forward. To raise the reflectors for illumination of the distant road pull the button out from the instrument board.

DRIVING SUGGESTIONS

Rules of the Road

Road and traffic laws vary greatly in different localities. It is, therefore, impossible to set down a complete list of rules which may be followed in all parts of the country. The following are some of the rules which are universal in practically all parts of the United States.

In meeting a vehicle going in the opposite direction *pass to the right.*

In passing a vehicle going in the same direction *pass to the left.*

Always stop with the right hand side of the car next to the curb. If it is necessary to turn the car around to do this, it should be done.

Never turn around or turn off onto another road without making absolutely certain that there is no other vehicle directly behind you.

Never enter upon street car tracks without making sure that there is no car directly behind you—*no matter how sure you feel, look and see.*

Do not cross street car or steam railroad tracks without making certain that it is absolutely safe to do so. At any railroad crossing which is on an up grade or which for any reason must be approached very slowly, it is a wise precaution to shift to intermediate gear before crossing as the car can thereby be accelerated more quickly, if necessary.

In crowded traffic do not apply the brakes suddenly unless it is absolutely necessary. It may be that a following vehicle cannot stop as quickly as you can.

On wet asphalt streets or slippery roads do not apply the brakes suddenly unless it is absolutely necessary. Cadillac four wheel brakes minimize the possibility of skidding under these conditions but their effectiveness should not induce anyone to drive less carefully.

Always signal vehicles at the rear, before turning. The law requires this in most cities.

Slow down in passing vehicles going in the opposite direction.

One of the most essential things to remember is that you should *never "take a chance."*

Coasting

To coast on the level, close the throttle and then release the main engine clutch by pushing forward on the left pedal.

When descending grades a good method is to close the throttle and, with the clutch engaged, allow the engine to do the holding back as much as possible. This saves much wear on the brake band linings. The resistance offered by causing the car to drive the engine when "high gear" or "direct drive" is engaged is usually sufficient to control the speed. When the engine does not offer sufficient resistance the speed may be checked further by applying the foot brakes.

When it is necessary to descend a very steep grade it is best to engage the intermediate or possibly the low speed gear *before commencing the descent*, and if the resistance thus obtained is not sufficient, to supplement it by the foot brakes. Bear in mind that the more the resistance of the engine is used in coasting the longer the brake band linings will last and the longer the brakes will retain their adjustment.

Do not switch off the ignition when coasting with the car driving the engine. This does not appreciably increase the resistance and is liable to injure the engine. Even with the throttle closed some fuel is admitted to the cylinders and if this is not burned it condenses on the cylinder walls and washes off the oil by which the pistons are lubricated. In time a sufficient quantity of this unburned fuel would find its way into the crankcase to dilute the oil supply and destroy its lubricating qualities.

DON'TS FOR GENERAL OPERATION

Don't fail to change the engine oil frequently.

Don't fail to push forward the carburetor enriching button as soon after starting as possible.

Don't fill the lubricating system of the engine alone and neglect to lubricate all other parts of the car.

Don't neglect the lubrication of any part of the car.

Don't run the car at sustained high speed when it is new.

Don't permit filling station attendants to remove the strainer in the oil filler before adding oil. This strainer, which is of fine mesh, is necessary to insure against dirt or other foreign matter entering with the oil.

Don't allow the clutch to engage suddenly.

Don't prime the carburetor too much.

Don't attempt to shift from neutral to any gear, or from one gear to another gear without first releasing the clutch.

Don't attempt to shift from the reverse gear to any other gear when the car is moving.

Don't attempt to shift from any forward gear to the reverse gear when the car is moving.

Don't attempt to shift from the high gear to the low gear when the car is moving.

Don't attempt to shift from the intermediate gear to the low gear when the car is moving, unless it is moving very slowly. Ordinarily it is best to stop the car altogether.

Don't switch off the ignition when coasting with the car driving the engine.

Don't push the starter button when the engine is running.

Don't turn the steering gear when the car is standing. This is not only unnecessary but is also bad practice. The front wheels pivot more easily if they are rotating.

Don't fail to investigate any unusual sound which may develop in the car. The car should be inspected at the maintenance station of a Cadillac distributor or dealer.

Don't neglect to inspect the level of the acid in the storage battery every 500 miles and add distilled water if necessary. (See page 62.)

Don't turn corners at high speed.

Don't neglect to keep the cooling system filled.

Don't drive fast or attempt to stop suddenly on wet pavements.

Don't attempt to start the engine with the switch turned off, without air pressure or without gasoline in the tank.

Don't neglect to keep the tires inflated properly.

Don't race the engine when it is not driving the car. There is no worse abuse.

OPEN CAR CURTAINS

Installing Curtains

The side curtains with which the open cars are equipped are carried in an envelope provided with cloth partitions to prevent rubbing and chafing. The Touring Car curtains are stowed under the front seat; the Phaeton, in a compartment back of the front seat, with a door opening in the tonneau; the Roadster, in the package compartment just back of the seat.

The Touring Car and Phaeton curtains are in six sections, each of which is marked to indicate its position, as "Left Front", "Right Center", etc. The front and center sections on both sides are each provided with a rod, the lower end of which fits a socket in the top of the door. When a curtain is folded

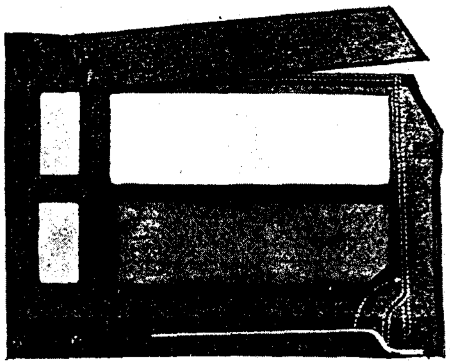


Fig. 7. Center Section of Side Curtains Showing Position of Rod.

for stowing, this rod is parallel with the bottom of the curtain as shown in Fig. 7. Before the curtain can be attached to the door, the rod must be moved to the position shown by the dotted line. The upper end of the rod is slotted to engage with the stiffener which runs along the upper edge of the curtain.

The rear sections should be applied first, followed by the center and front sections in the order named. The rear sections should be fastened to the rear bows *under* the side flaps of the permanent rear curtains.

Curtain Fasteners

Most of the curtain fasteners used are of the type illustrated in Fig. 7a. When this type of fastener is snapped together, it becomes locked on three sides. To release the fastener, it must be lifted on the side which is not locked. This side is indicated by a small projection on the fastener as shown in Fig. 7a. This type of fastener cannot be released by lifting it at

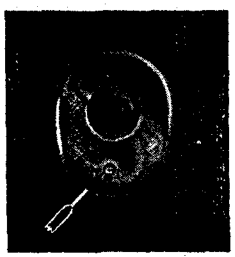


Fig. 7a
Curtain Fastener

any other side. The remainder of the fasteners used are of the usual glove type.

Before the curtains are stowed, they should be dry and clean.

SPEEDOMETER

The speedometer registers the speed at which the car is traveling, the total number of miles traveled, and the trip mileage. The total mileage cannot be reset but the trip mileage can be reset to zero.

An automobile repairman should never be permitted to attempt to adjust or repair the speedometer head or to replace the glass. This work can be done only by men experienced in speedometer work and only with special machinery and tools.

If the speedometer head is removed, handle it with the same care that you would a fine watch. The speedometer head may easily be damaged by rough handling.

CLOCK

The clock is at the right of the ignition and lighting switch. It has an eight day movement and is wound and set in the same manner as any stem winding watch. The winding and setting stem is on the under side of the clock just back of the instrument board.

TIRE AIR PRESSURES

For normal driving the following air pressures are recommended for the 33" x 5" tires which are standard on V-63 Cadillac cars.

Body Style	With Driver Only		With Full Load	
	Front	Rear	Front	Rear
Touring	45 lbs.	50 lbs.	45 lbs.	65 lbs.
Phaeton	"	45 "	"	60 "
Roadster	"	45 "	"	50 "
Coach	"	50 "	"	60 "
5-passenger Sedans	"	50 "	"	65 "
7-passenger Sedans	"	55 "	"	70 "
2-passenger Coupe	"	45 "	"	50 "
Victoria	"	50 "	"	60 "
5-passenger Coupe	"	50 "	"	60 "
Limousine	"	55 "	"	70 "
Town Brougham	"	50 "	"	65 "

Note—Front tires on cars driven at high speeds must be inflated to more than the pressure recommended above. This is important.

TIRE VALVE CAPS

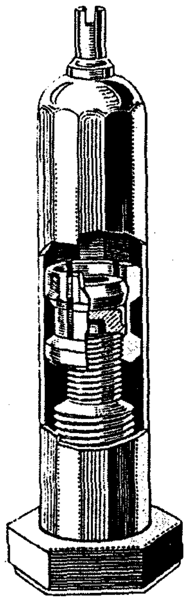


Fig. 8

Tire Valve Cap

The caps which fit over the tire valve stems on some makes of tires are combination dust and valve caps. They can be removed or replaced without screwing the cap the entire length of the thread on the stem.

To install one of these tire valve caps, place the cap over the valve stem and turn it a few turns to the right to engage the thread in the sliding nut inside the cap. (See Fig. 8.) If the sliding nut is too far inside the cap to be reached by the valve stem, shake it down by tapping the bottom of the cap on some solid object. When the valve stem has been started in the sliding nut push the cap down as far as it will go. Turn the cap to the right until it locks tightly.

To remove a tire valve cap turn it two or three turns to the left. This loosens the sliding nut inside the cap. Next pull the cap up as far as it will go. Then remove the cap by unscrewing it the rest of the way.

DEMOUNTABLE RIMS

Demounting Rim with Tire

Jack up the axle until the wheel is free from the ground. Then remove the valve cap and the valve stem clamping nut. Loosen the eight rim clamping nuts with the brace wrench furnished with the tool kit. Turn each clamp so that the lug is away from the rim and hold it in this position by tightening the nut slightly with your fingers. Turn the wheel so that the valve is at the top and pull the bottom of the rim towards you until it clears the wheel. The rim with tire can then be removed by lifting it straight up.

Mounting Rim with Tire

If the rim you are mounting has no split clamping ring, take the one from the rim removed. Turn the wheel so that the hole for the valve stem is at the top. Hold the rim so that the valve stem is at the top and so that the rim latch and the clamping ring are towards you. Insert the valve stem and then push the bottom of the rim into place.

Turn each clamp to its original position and turn the clamping ring so that the split in the ring comes directly under one of the clamps. Tighten each clamping nut slightly. Then continue around the wheel, tightening each nut firmly. Screw on the valve stem clamping nut and tighten it firmly against the rim. *This is important.* Install the valve cap. (See page 18.)

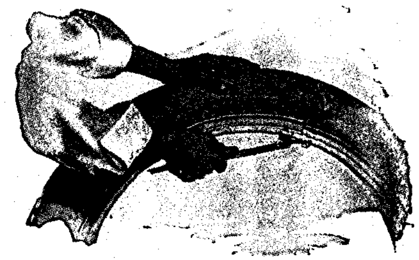


Fig. 9.

Removing Tire from Rim First Position.

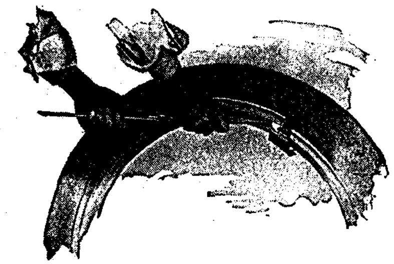


Fig. 10.

Removing Tire from Rim, Second Position.

If the rim does not run true, mark the part that runs "out" from the face of the wheel. Then slightly loosen the nuts diametrically opposite this part and tighten the nuts at the marked part. Proceed in this manner until the rim does run true.

Removing Tire from Rim

Caution—Do not attempt to remove a tire from a demountable rim without first completely deflating the tire. Serious personal injury may result if this is attempted.

The tire may be removed without removing the rim from the wheel.

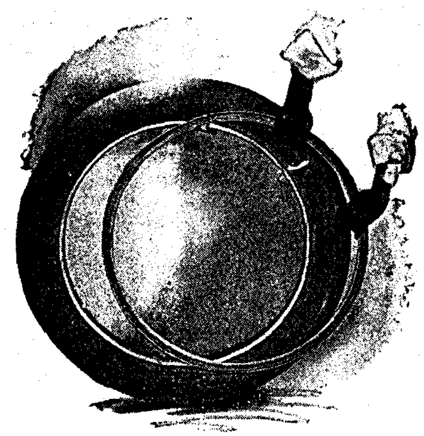


Fig. 11.

Removing Tire from Rim, Third Position.

Deflate the tire. Then open the lock with the pointed end of the tire tool or with a screw-driver.

Raise one end of the ring with the tool as shown (Figure 9) until the lug is clear of the slot in the rim.

Raise the end of the ring further and force the lug out over the edge of the rim. (Figure 10.)

Start at the end of the ring, which is out of the groove, and remove the entire ring from the rim. (Figure 11.) (See note.)

Turn the wheel until the valve stem is at the top, and pull the lower part of the tire towards you until it is clear of the rim. The tire may then be removed from the rim by lifting it straight up.

Note—In removing the ring from the rim, care should be taken to avoid opening the ring beyond its elastic limit. When the ring is free from the rim, the ends should overlap from ½ to 1½ inches which they will do if the ring has not been stretched in removal.

If the ends of the ring do not overlap they should be closed together before replacing. If this is not done there is a possibility of the lock failing to engage the lugs on the ends of the ring. This might later be the cause of an accident.

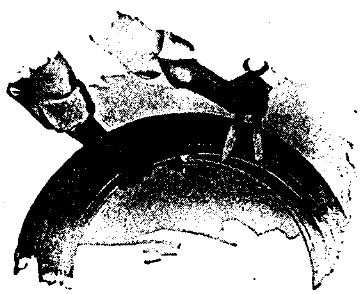


Fig. 12.

Placing Tire on Rim, First Position.

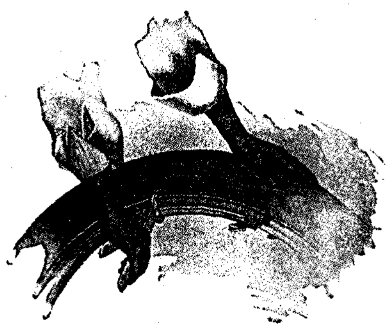


Fig. 13.

Placing Tire on Rim, Second Position.

Placing Tire on Rim

If the demountable rim is on the wheel, jack up the axle and turn the wheel until the hole for the valve is at the top.

Hold the tire so that the valve stem is at the top and insert the valve stem in the valve stem hole in the rim and wheel. Then push the bottom of the tire into place.

Fig. 14.

Placing Tire on Rim. Third Position.

Insert one end of the locking ring in the slot in the rim. Then with the tool as a lever, force the tire back far enough to allow the ring to go on easily. (Figure 12.)

Starting at the end of the ring which is inserted in the slot in the rim, force the remainder of the ring into place by using the tire tool as pliers. (Figure 13.)

Insert the flat end of the tool between the rim and the ring and turn the tool up edgewise. (Figure 14.) This will lift the loose end of the ring and force it into place.

Draw the ends of the locking ring together with the tool. (Figure 15.) Then swing the lock into place.

Then inflate the tire. (See under "Tire Air Compressor," page 21 and "Tire Air Pressures," page 17.)

If the demountable rim is not attached to a wheel, lay the rim with the tire flat on the ground when removing or replacing a tire.

Fig. 15.

Placing Tire on Rim, Fourth Position.

TIRE HOLDER

The tire holder is designed to carry two standard size tires inflated on rims.

To remove the tire with rim, remove the cap from the lock at the center of the clamp and unlock it. Then unscrew the clamp as far as it will go. The tire then may be removed.

To put a tire on the holder proceed in the reverse manner.

When mounting two tires on the tire holder, the clamping or locking rings should face each other to prevent theft of the tires by removing them from the rims. If mounting one tire on the tire holder, the clamping or locking ring should face to the front or toward the body.

Care should be exercised not to permit the inner tire to strike the body of the car when removing or replacing it.

TIRE AIR COMPRESSOR

Using the Compressor

To inflate a tire, first attach the air hose to the connection projecting from the left hand dust shield just back of the battery box cover, then connect the other end to the tire valve. Do not connect the hose to the tire first, if there is air pressure in the tire.

If the engine is running, release the clutch by pushing the left pedal down. Hold the pedal down until you are certain the transmission gears have ceased to revolve, and then turn the slotted head of the compressor control shaft in the clockwise direction (see Figure 1). If the engine is not running, it is unnecessary to disengage the clutch before bringing the compressor into operation.

Run the engine at a speed of approximately 1,000 revolutions per minute. With all lights turned off, the ammeter on the instrument board should indicate approximately thirteen at 1,000 revolutions per minute of the engine. With the side, tail and speedometer lights turned on, the ammeter should indicate approximately eleven at this speed. If the portable lamp is also in use, the ammeter should read approximately ten. The compressor operates at its most efficient speed at 1,000 revolutions per minute of the engine. Do not race the engine in operating the compressor, or at any other time, when it is not driving the car.

To stop the compressor, turn the slotted head of the control shaft in the counter-clockwise direction.

Caution:—Do not turn the compressor control shaft to bring the compressor into operation when the engine is running and the clutch is engaged.

COLD WEATHER SUGGESTIONS

STARTING THE ENGINE

Manipulation of Carburetor Enriching Button

Pull back the carburetor enriching button before attempting to start the engine in cold weather, but immediately the engine commences to run under its own power push the button as far forward as possible without causing the engine to stop or slow down materially and as far forward as it goes as soon as the engine is warm enough to permit it.

Priming the Carburetor

In *extremely* cold weather, if the engine is not started in 30 seconds with the carburetor enriching button pulled back, remove the foot from the starter button. This will stop the cranking operation. Now open and close the throttle once or twice with the hand throttle or the foot accelerator. *Do not* open and close the throttle more than twice. Opening and closing the throttle operates the throttle pump of the carburetor. This raises the level of the gasoline in the carburetor, thereby priming it. If the throttle is opened and closed more than twice, gasoline is forced out of the carburetor.

Position for Spark Lever

Except in extremely cold weather the spark lever should be placed about one-third the way down from the "Advance" position when starting. In extremely cold weather, it should be in the "Advance" position when starting. (If the engine is to be cranked by hand, the spark lever should be placed at the "Retard" position.)

It is the practice of some drivers to place the spark lever at the "Retard" position when starting the engine. While this is the proper position for the spark lever if the engine is to be hand cranked, there is no reason for retarding the spark when the engine is electrically cranked and starting is facilitated if the spark lever is advanced. In extremely cold weather there is no reason why the spark lever cannot be placed in the "Advance" position if the engine be electrically cranked and a quicker start is assured if this is done. The following will explain why it is possible to fully advance the spark lever at such times:

The mixture in a cold engine does not burn as rapidly, nor is there so much energy in it, as when the engine is warmer and the fuel is better vaporized. When the engine is cold a large percentage of the heat of each explosion is instantly dissipated by reason of the cold combustion chambers and cylinder walls, the result being that an explosion which in a hot engine would occur early enough and have energy enough to produce a "spark knock" or "back kick," occurs so much later and is so much less intense, that neither of these results is produced.

It is best to have the spark lever in the fully advanced position for cold weather starting for the following reasons:

As explained before, a cold mixture ignites much more slowly than a hot mixture. A cold, slow-burning mixture, if ignited on top dead center on account of the spark being in the retarded position, may burn through the power stroke, through the exhaust stroke and may be still burning in the combustion chamber when the inlet valve is opened to draw in another charge. When this happens, the flame sets fire to the incoming charge, igniting the mixture in the intake pipe and carburetor, producing a "pop back" in the carburetor. The possibility of this happening is very much less if ignition is started earlier by placing the spark lever in the fully advanced position.

Position for Throttle Lever

In winter weather the throttle lever should be opened only slightly for starting. Many drivers make a practice of opening the throttle wide or nearly so immediately the engine is started and after shifting the transmission into gear. The full suction of each piston through the carburetor under these conditions causes the auxiliary air valve in the carburetor to open wide, allowing a large volume of cold air to rush into the carburetor.

The proportion of air to gasoline drawn in under these conditions is practically the same as when the engine is hotter, but as only a portion of the gasoline drawn in is vaporized, and as only the vaporized portion burns, the proportion of air to gasoline burned is greater than when the engine is warmer, thus producing a "lean" mixture. A "lean" mixture is slow burning, whether it is warm or hot, and a cold "lean" mixture is particularly slow burning. Thus if the throttle is opened suddenly before the engine is thoroughly warm, the cold "lean" mixture resulting, burns so slowly that a "pop back" in the carburetor is almost sure to occur.

Use of Starter Button

Do not press the starter button while the engine is running.

In extremely cold weather, when the car has been standing long enough to become thoroughly chilled, it is a good plan to release the clutch before pressing down the starter button and to hold the clutch pedal down during the cranking operation. If this is not done, the starter is called upon to turn the jackshaft in the transmission in addition to cranking the engine. While at ordinary temperatures the additional energy required is almost negligible, in extremely cold weather the lubricant in the transmission may offer enough resistance to the transmission gears to increase considerably the demand upon the battery. If the habit is formed of regularly holding the clutch pedal down during the cranking operation one will not be so likely to neglect to do so during cold weather.

ANTI-FREEZING SOLUTIONS

In cold weather a good anti-freezing solution should be used. A solution of commercial glycerine and water is recommended of the correct proportion for the temperature experienced. The following are the freezing temperatures of glycerine and water solutions:

Glycerine (Parts by volume)	Water (Parts by volume)	Freezing Temperature (degrees Fahr.)
1	3	20°
1	2	12°
1	1	0°
3	2	—4°

Do not use a solution containing calcium chloride, as it is injurious to the metal parts of the cooling system.

The radiator condenser also makes it possible to use with safety an anti-freezing solution of denatured or wood alcohol and water. The following are the freezing temperatures of denatured alcohol and water solutions.

Denatured Alcohol (Parts by volume)	Water (Parts by volume)	Freezing Temperature (degrees Fahr.)
1	4	10°
1	3	0°
1	2	—10°
1	1	—25°

Before filling the cooling system with anti-freezing solution, the condenser should be drained by removing the plug "R", Fig. 22. If water is left in the condenser at this time, it may freeze before enough alcohol passes over from the radiator to lower its freezing temperature.

Caution—Strong solutions of alcohol have a harmful effect on the finish. In adding pure alcohol or solutions containing 50 per cent or more alcohol, extreme care must be used not to let the liquid spatter or spill. A funnel and a pouring vessel with a suitable spout should always be used. Especially avoid pouring cold alcohol into extremely hot water. The effect of this is to make the mixture foam up and possibly bubble over on the finish.

The capacity of the cooling system exclusive of the condenser, is 5¼ gallons. The condenser should contain an additional three quarts, making a total of six gallons.

Caution—Do not use water alone in the cooling system during freezing weather. Use a good anti-freezing solution. Water will freeze even though the engine be run continuously.

ADDITIONAL COLD WEATHER SUGGESTIONS

Starting in Intermediate or High Gear

Starting in intermediate or high gear should not be done at any time, but this is particularly unfair to a cold engine, as it necessitates a further opening of the throttle than is necessary when starting on low gear, with the probability of a "pop back" in the carburetor.

Cold Test of Engine Oil

Use oil having a low cold test. In other words, use oil which flows freely at low temperature. (See under "Lubricants," page 33.)

Frequent Changing of Oil

Water and gasoline may accumulate in the crank case of the engine during cold weather. It is necessary, therefore, to drain the oil frequently and replace it. (See under "Replace Engine Oil Frequently During Cold Weather," page 36.) If water and gasoline are permitted to accumulate in the crank case, serious damage to the engine may result.

Strainers in Gasoline System

It may be found necessary to remove the strainers in the gasoline line more frequently during cold weather in order to prevent an accumulation of water at these points which would freeze and prevent the gasoline from flowing to the carburetor. (See under "Settling Chambers and Strainers," page 53.)

OPERATION OF ENGINE

General Principle

The production of power by the engine may be described briefly as follows:

Gasoline is forced by air pressure from the tank to the carburetor. At the carburetor the gasoline is mixed with air in the proper proportion, forming an explosive vapor or gas. The gas is drawn through the intake manifold and inlet valves into the cylinders of the engine, where it is compressed and ignited by electric sparks, the pressure of the resulting explosions producing the power.

The quantity of gas supplied to the engine is regulated by a throttle valve at the carburetor which is operated by means of the throttle lever at the steering wheel or by the accelerator button at the right of the brake pedal.

Four-Cycle Engine

The engine is of the four-cycle type, that is, there are four movements or strokes of each piston and two revolutions of the flywheel to complete each power producing stroke. The four strokes of the cycle each have a different function and follow one another in the same order as follows:

Suction Stroke. The suction stroke commences with the piston at its highest point in the cylinder and with the inlet and exhaust valves closed. Immediately the piston starts to descend the inlet valve opens and through this valve a charge of gas from the carburetor is drawn into the space above the piston.

Compression Stroke. As the piston starts upward again after completing the suction stroke, the inlet valve closes. As there is then no escape for the gas in the cylinder, it is compressed, the maximum compression being reached when the piston is at the top of its stroke.

Power Stroke. At the completion of the compression stroke, the spark takes place at the spark plug, igniting the compressed charge of gas. The heat resulting from the rapid combustion causes the pressure of the confined gas to rise almost instantaneously to several times its pressure before the explosion. This pressure exerted on the piston forces down the piston and produces the impulse which is transmitted by the connecting rod to the crankshaft, causing it to rotate.

Exhaust Stroke. Just before the piston reaches the end of the power stroke, the exhaust valve opens. It remains open as the piston travels upward again on the exhaust stroke, driving the burned gas out from the cylinders. By the time the piston has reached its highest point it has forced out the burned gas and the exhaust valve closes. Having completed the four strokes, the piston is now ready to draw in a new charge and to repeat the cycle.

The same cycle of events takes place in all of the cylinders but no two pistons are at the same point in the cycle at the same time. In the Cadillac eight cylinder V-type engine, the impulses in the eight cylinders are so timed that a power stroke is begun every quarter turn of the crankshaft. In other words, the crankshaft receives four overlapping impulses every revolution. The order in which the impulses take place is shown in Figure 16.

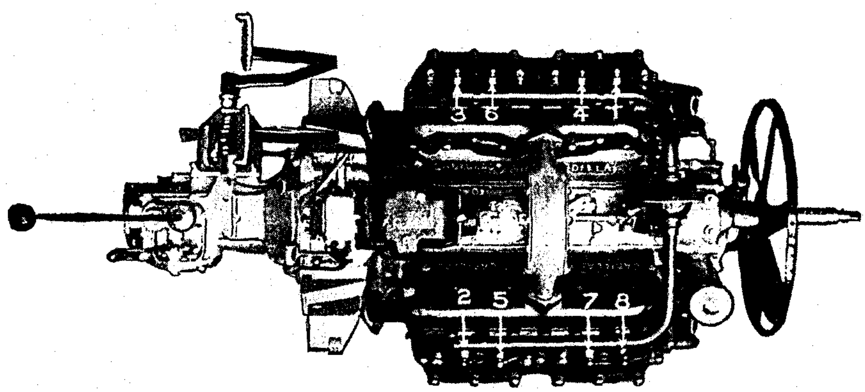


Fig. 16. Firing Order

Automatic Spark Control

When each piston is at its highest position in the cylinder is, of course, the time when the charge is at its greatest compression, or, in other words, when the gas is "jammed in the tightest." Ignition occurring exactly at this instant produces a much more forceful explosion than if it occurred at a time when the charge was not so tightly compressed.

If the charge were ignited the instant the contact is made in the ignition timer, regardless of the speed of the engine, the spark could be set permanently in one position and would not require changing. But a certain amount of time elapses from the instant the circuit is closed at the ignition timer until the charge is ignited in the cylinder. While this time is but the merest fraction of a second, in fact, almost infinitesimal, yet it is time just the same and must be taken into account when dealing with such a rapidly acting mechanism as an automobile engine.

The lapse of time required to ignite the charge is always the same regardless of the speed of the engine and pistons. You will realize that when the engine is running, say 3000 R. P. M., the pistons are traveling many times as fast as they do when it is running only 300 R. P. M. When the engine is running 3000 R. P. M., it is necessary therefore to start the ignition process earlier.

In the Cadillac this is accomplished by means of a ring governor located directly under the ignition timer. As the speed of the engine increases, the ring in the governor assumes a position more nearly horizontal, forcing the timer cam slightly ahead on the shaft by which it is driven. This causes the timer contact points to break earlier, thereby starting the ignition process earlier in relation to the positions of the pistons. When the engine slows down, the ring in the governor assumes a position more nearly vertical, forcing the cam back on the shaft by which it is driven, causing the contact points to break later and thereby starting the ignition process later in the strokes of the pistons.

Manual Spark Control

The automatic control takes care of the spark position for all ordinary driving. A spark lever is provided, however, by which the ignition timing may be still further advanced or retarded.

Ordinarily the spark lever should be carried about one-third the way down from the "Advance" position. To get the best results, however, it should be retarded further for extremely low speeds and advanced further for extremely high speeds. The car should be driven at all times with the greatest possible spark advance permitted by the speed of the engine.

Advancing the spark too far for given engine speeds will usually cause a slight pounding noise, which is sometimes not noticed by the beginner, as it is usually but slight owing to the substantial character of the crankshaft and bearings.

When starting the engine, place the spark about one-third the way down from the "Advance" position, except during extremely cold weather when it should be placed at the "Advance" position. If the engine should be cranked by hand, the lever should be placed at the "Retard" position. If this caution is not observed a "back kick" may occur, probably resulting in personal injury.

WINDSHIELD POSITIONS

Open Cars

Under ordinary conditions, sufficient ventilation in the front compartment of the open cars is provided for by the cowl ventilator which is operated by a lever just in front of the instrument board and at the right of the steering column. Additional ventilation for warmer weather is provided for by the adjustable upper and lower sections of the windshield.

To secure greater ventilation by means of the windshield, the lower section of the windshield should be tilted inward. The thumb screws half way up the windshield standards must be loosened before the lower section can be moved and should be tightened afterward. If still greater ventilation is desired, the upper section may be tilted toward the driver. The rubber strip between the windshield glasses must be removed before either the upper or lower section of the shield is tilted inward.

The normal position of the windshield for inclement weather is with the upper and lower sections closed, and with the removable rubber strip between the glasses. If rain or snow should freeze on the glass, making it impossible to clean it with the windshield wiper, the upper section may be tilted out at a slight angle. This is known as the "rain vision" position.

Closed Cars

Ventilation in the front compartment of some of the closed cars is provided for by raising the windshield glass which is in one piece. The glass slides up and down and is operated by a knob above the windshield. (See Fig. 1). The knob should be turned counter-clockwise to raise the glass and clockwise to lower it.

If only moderate ventilation is desired, the windshield glass should be raised only a slight amount, so that the lower edge of the glass is still below the ledge over the instrument board. In this position air is deflected down behind the instrument board through an opening extending the entire width of the windshield. If additional ventilation is desired, the windshield glass should be raised above the level of the ledge over the instrument board. In this position air enters the compartment direct.

On closed cars which have the windshield in two sections, ordinary ventilation is provided by the cowl ventilator as on the open cars. To secure greater ventilation in these cars the upper edge of the lower section of the windshield should be tilted outward, leaving the upper section closed. To do this, loosen the thumb screws at the sides, lift the handles until the lower edge clears the weather strip on the cowl, and then push outward. Tighten the thumb screws when the windshield is in the open position. If still greater ventilation is desired the lower section of the windshield should be closed and the upper section tilted outward.

LUBRICATION

Part II

IMPORTANCE OF LUBRICATION

There is no one thing which is the primary cause of more trouble and the cause of more expense in maintenance to the mechanism of an automobile than insufficient lubrication.

All moving parts of the Cadillac car are manufactured with an unusual degree of accuracy. In order to maintain the splendid running qualities of the car, it becomes necessary systematically to introduce suitable lubricants between surfaces which move in contact with one another.

It should be borne in mind constantly that where one part moves upon or in contact with another friction is created. Friction means wear, and the wear will be of the metal itself unless there is oil. The use of too much oil is better than too little, but just enough is best.

Proper lubrication not only largely prevents the wearing of the parts, but it makes the car run more easily, consequently with less expense for fuel and makes its operation easier in every way.

The oiling diagram shown on page 38 indicates the more important points which require attention. But do not stop at these. Notice the numerous little places where there are moving parts, such as the yokes on the ends of various brake rod connections, etc. A few drops of oil on these occasionally will make them work more smoothly.

Judicious lubrication is one of the greatest essentials to the satisfactory running and the long life of the motor car. Therefore, lubricate, and lubricate judiciously.

LUBRICANTS

There are many grades of oils. There are none too good. Naturally, we have experimented a great deal with numerous lubricants to determine which are best adapted for the various parts of the Cadillac car. It is not always an easy matter for users to obtain suitable lubricants. The constant demand made upon us by Cadillac users has induced us to provide suitable lubricants which may be obtained from Cadillac distributors or dealers.

Engine Oil

Cadillac Engine Oil is recommended and is supplied in three grades: light, medium and heavy. If some other oil is preferred our Technical Department will mail a complete up-to-date list of tested and approved oils on request.

The oil used should be a filtered one and not an acid or alkali treated oil.

We cannot hold ourselves responsible for damage resulting from the use of oil not suited to the Cadillac engine.

Rear Axle and Transmission Lubricant

Cadillac Rear Axle and Transmission Lubricant is recommended for the rear axle and transmission. This lubricant is made in two grades: heavy and light, for summer and winter use respectfully. It is important that the light grade be used when low temperatures prevail.

Gun Grease

Cadillac Roller Bearing and Cup Grease is recommended for use in the grease gun or, in its absence, number three cup grease.

Distributor Grease

Cadillac Distributor Grease is recommended for the distributor.

Universal Joint Grease

Cadillac Universal Joint Grease is recommended for the universal joints on the drive shaft or, in its absence, number three fibre grease.

Steering Gear Lubricant

Cadillac Steering Gear Lubricant is recommended for the steering gear. In its absence a mixture consisting of seventy-five per cent of Cadillac Rear Axle and Transmission Lubricant and twenty-five per cent Cadillac Roller Bearing and Cup Grease or number one cup grease can be used.

ENGINE LUBRICATION

Lubricating System

The lubrication of the engine is by oil under pressure. A supply of oil is carried in the oil pan. Oil is drawn from the oil pan by an oil pump and forced to the main engine bearings.

The connecting rod bearings on the crank shaft are lubricated by oil from the main bearings forced through holes drilled in the crank shaft. A hole drilled in the forward end of the crankshaft communicates with a hole drilled in the crankshaft sprocket through which oil is supplied to the camshaft driving chain. The cylinders are lubricated by oil thrown from the lower ends of the connecting rods.

The pressure of the oil is regulated by pressure regulator (Figure 17), containing a valve under spring tension. When the pressure is reached for which the valve is set, the valve is forced open and the oil overflows past the valve. A small hole drilled in the regulator housing allows oil to by-pass the valve when the valve is seated. Oil flowing through the by-pass and oil forced past the valve is carried to the camshaft bearings, power pressure pump in the gasoline system and the camshaft sprockets and chains through a hole drilled in the camshaft.

There is one gauge and one indicator in the lubricating system. The pressure gauge is located on the instrument board and indicates the pressure of the oil. The indicator is attached to the upper cover of the crank case near the carburetor and indicates the level of the oil in the engine.

Filling Lubricating System

An oil level indicator on the engine is for the purpose of indicating when the supply of engine oil is low and when a sufficient amount has been added. The indicator is between the cylinder blocks and is under the intake manifold, on the right hand side.

Oil should be added whenever the red ball of the indicator is down to the line marked "Fill." Do not risk running the engine after the red ball has reached the line marked "Fill." If, through oversight, the red ball should reach the line marked "Empty" the engine should be stopped immediately and supplied with oil. The oil filler is just back of the fan on the right side. (See Figure 17.)

Use only oil which is suitable (see under "Lubricants," page 33), and be certain that the oil is free from dirt or lint before pouring it into the engine.

When the red ball of the indicator is at "Full" the engine should contain seven quarts of oil.

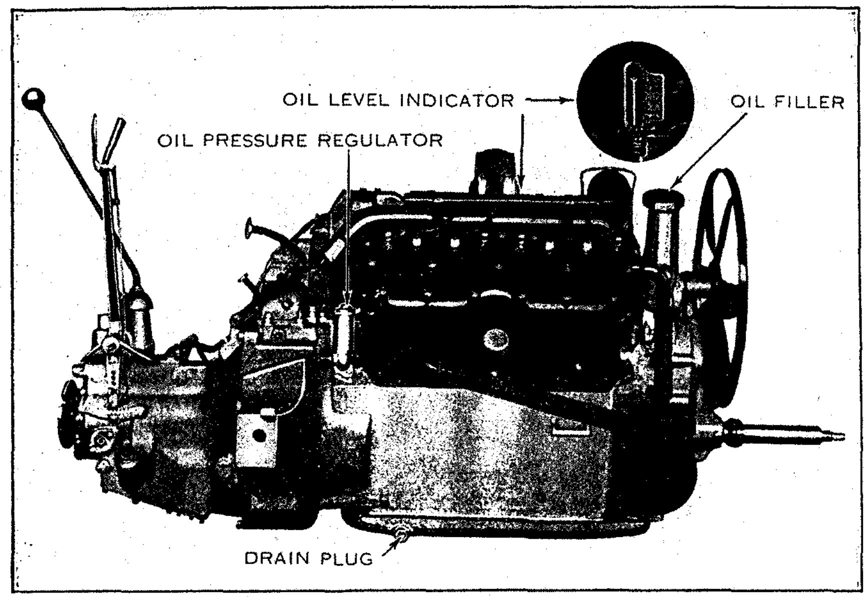


Fig. 17.
Oil Filler, Pressure Regulator, Level Indicator and Drain Plug.

Replace Engine Oil

At the end of each 500 miles of travel remove the drain plug from the engine oil pan (see Figure 17). After the oil has drained out replace the plug and through the oil filler on the housing just back of the fan, add seven quarts of fresh engine oil (see under "Replace Engine Oil Frequently During Cold Weather," page 36). A socket wrench with a long handle is supplied with the tool equipment to facilitate the removal and replacement of the drain plug.

At the end of the first 1,000 miles of travel, at the end of the next 3,000 miles of travel and at the end of every 4,000 miles of travel thereafter, drain the oil pan as directed in the preceding paragraph, replace the plug and through the filler add a mixture consisting of three quarts of kerosene oil and one quart of engine oil. The mixture must be free from dirt and lint. Run the engine at a speed of between 600 and 1,000 revolutions per minute for the period of one minute. Then drain the oil pan, remove it and the screen from the engine and thoroughly clean the oil pan and screen. Do not fail to add seven quarts of fresh engine oil after replacing the oil pan.

After cleaning the lubricating system with a mixture of kerosene and engine oil it is a good plan to clean the valve and seat of the pressure regulator. The regulator is located just back of the right hand block of cylinders. The valve can be removed after removing the regulator cover by unscrewing it. It is important also to make certain that the small by-pass hole by which oil is permitted to escape when the regulator valve is closed, is clean and free from any obstruction. Do not use waste in cleaning the regulator valve or its seat. Use cloth free from lint.

Caution:—Do not fail to replace the engine oil as frequently as suggested.

Replace Engine Oil Frequently During Cold Weather

The mileages given under "Replace Engine Oil" at which engine oil should be replaced and the oil pan and screen cleaned are those at which this work should be done during warm weather.

During cold weather water and gasoline may accumulate in the crankcase of the engine. It is necessary, therefore, to drain the oil pan and clean the oil pan and screen much more frequently than during warm weather.

The frequency with which it is necessary to do this depends very largely upon the manner in which the car is driven. In cases where the car is driven short distances only and frequent stops are made so that the engine base and the oil remain cold it will be necessary to drain the oil pan and to clean the oil pan and screen much more frequently than in cases where the car is driven for longer distances with fewer stops, so that the engine base becomes thoroughly warmed.

If the car is constantly making short trips in cold weather the oil should be drained every 350 miles of travel or once a week and the oil pan and screen cleaned once a month.

Unless the oil is drained out and the oil pan and screen are cleaned frequently in cold weather, serious damage to the engine may result, particularly on cars in short trip service.

Oil Pressure

The pressure indicated by the oil gauge on the instrument board varies with the speed and temperature of the engine and the viscosity of the oil. When the engine is warm and supplied with fresh Cadillac Engine Oil or oil of approximately the same viscosity, the pressure as indicated by the gauge should be from five to seven pounds when the engine is idling. (When idling the engine should run at approximately 300 revolutions per minute, if the

throttle stop-screw at the carburetor is properly adjusted.) At higher speeds a higher pressure should be indicated and at lower speeds, a lower pressure. Before the engine has become warm, higher pressures will be indicated at given speeds. In other words, maximum pressures will be indicated at given speeds when the engine is cold and the oil is fresh; minimum pressures, when the engine is hot and the oil becomes thin from use.

Practically all engine lubricating oils become less viscous from use even under normal conditions. Running the engine too long with the carburetor enriching button pulled back will cause the oil to be thinned more rapidly due to the condensation of gasoline from the rich mixture.

Caution

If when starting the engine after replacing the oil it is found that the pressure gauge does not register pressure, stop the engine immediately and prime the oil pump. This may be done by disconnecting, at its upper end, the oil pipe running from the engine around the right hand side of the dash, and forcing clean engine oil into the pipe. Connect the pipe and tighten the union before starting the engine.

Do not continue to run the engine if, as a result of low viscosity of the oil, or other cause, pressure is not indicated on the gauge when the engine is running. (See under "Replace Engine Oil," page 35.)

GENERAL LUBRICATION

It is manifestly impossible to give exact directions in every instance as to just how frequently each individual point should be oiled or exactly how much lubricant should be applied. In the following directions this is given approximately, based on average use. The numbers refer to Fig. 18.

With the tool equipment of each car is packed a lubrication chart, with a schedule for the lubrication of the car. This is intended to be hung in the garage to serve as a reminder.

EVERY 125 MILES

Engine: 28

At every 125 miles, or oftener, determine the quantity of oil in the engine and add oil if required (see under "Filling Lubricating System," page 34, and under "Replace Engine Oil," page 35).

EVERY 500 MILES

Grease Gun Connections: G

Points "G" should be lubricated with the grease gun at every 500 miles of travel. Cadillac Roller Bearing and Cup Grease or No. 3 cup grease is recommended.

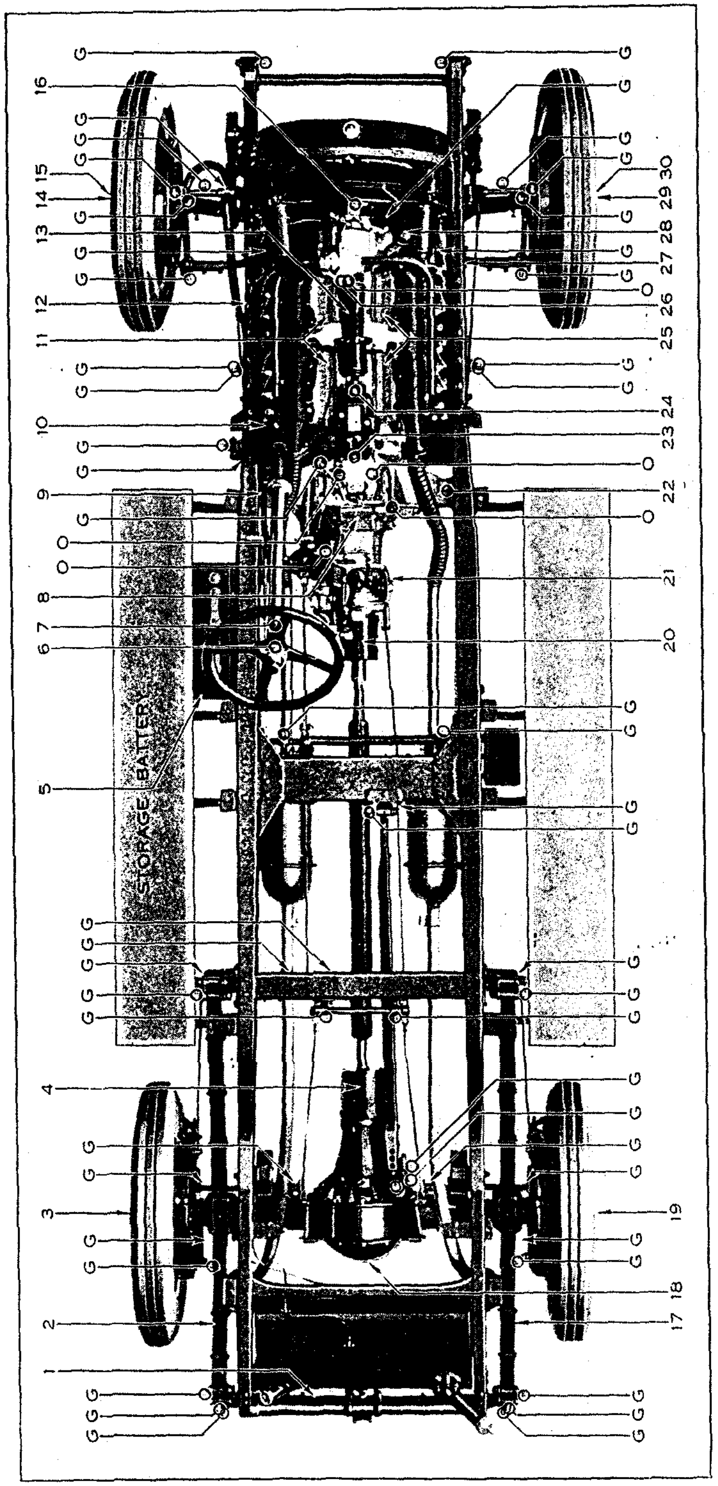


Fig. 18. General Lubrication Diagram

Each "G" Indicates a Grease Gun Connection. Each "O" Indicates An Oiling Point at Which Engine Oil Should Be Applied.
Each Number Indicates a Lubricating Point for Which Instructions Are Given Under "General Lubrication."
Lubricating points which are visible in the diagram are surrounded by circles. Others are indicated by arrows.

Springs: 1, 2, 12, 17, 27

It is recommended that the springs be lubricated every 500 miles by painting the edges and ends of the leaves with engine oil. A small, stiff brush should be used. After applying the oil, the car should not be washed until it has been driven far enough to allow the lubricant to work in between the leaves. Do not open the leaves and insert lubricant.

Replace Engine Oil

Replace the engine oil at the end of every 500 miles of travel. (See under "Replace Engine Oil", page 35, and "Replace Engine Oil Frequently During Cold Weather," page 36.)

Water in Storage Battery: 5

Every five hundred miles inspect the level of the acid in the storage battery and add *distilled* water if the level is low. (See under "Adding Water to Storage Battery," page 63.)

EVERY 1000 MILES

Oil Cups: O

A few drops of engine oil should be applied at points "O" every 1,000 miles.

Universal Joints: 4, 20

Fill the forward and rear universal joints on the drive shaft between the transmission and rear axle with Cadillac Universal Joint Grease every 1,000 miles. A connection is furnished with the grease gun which fits the filling holes.

The forward joint on some cars is surrounded by a cylindrical shield shown at 20, Fig. 18, to prevent grease from being thrown upon the under side of the floor. To fill the joint it is necessary first to detach this shield from the transmission case and to slide it back over the drive shaft. This may be done after loosening the two screws which hold the shield and turning the shield through a small arc in a counter-clockwise direction. On other cars the shield covers only the upper half of the joint and grease can be injected from underneath without removing the shield.

Fan Driving Clutch: 16

There is a lubricating point in the hub of the rear fan disc just forward of the shield which encloses the fan spring. This point is fitted with a slotted screw plug. Every 1,000 miles, the screw plug should be removed and the grease gun connection furnished with the tool equipment should be temporarily fitted in its place. A small amount of Cadillac Roller Bearing and Cup Grease should then be injected with the grease gun. Be sure afterward to remove the connection and replace the screw plug. This is important. A grease gun connection should not be installed permanently in place of the screw plug as the fan will be thrown out of balance.

Generator Oil Cups: 23, 24

These oil cups conduct lubricant to the forward and rear bearings on the armature shaft of the motor generator. A few drops of engine oil should be applied every 1,000 miles.

Oil Holes at Steering Wheel: 6, 7

A few drops of engine oil should be applied at "6" and "7" every 1,000 miles. The hole at "6" is in the collar directly above the steering wheel. The oil hole at "7" is at the upper end of the steering column and is closed by a screw plug, which must be removed before the oil can be applied. Do not mistake the hole in the collar just below the steering wheel for an oil hole. This hole is for tightening the collar in assembly and is not drilled through.

Engine Rear Supports: 9, 22

There are felt wicks in the frame brackets to which the engine supports are bolted. Engine oil should be applied at these points every 1,000 miles of travel or oftener if necessary.

Clean Engine Lubricating System

At the end of the first 1,000 miles of travel, at the end of the next 3,000 miles of travel, and at the end of every 4,000 miles of travel thereafter, clean the lubricating system and the oil pan and screen. (See under "Replace Engine Oil", page 35, and "Replace Engine Oil Frequently During Cold Weather," page 36.)

EVERY 2000 MILES

Transmission: 21

The transmission should contain sufficient lubricant to bring it up to the level of the filling hole at the right hand side. The level should be inspected every 2,000 miles and lubricant added if necessary. Cadillac Rear Axle and Transmission Lubricant is recommended. It is important that, with the beginning of freezing weather, the heavy lubricant be drained and replaced with the light or winter grade.

Rear Axle: 18

The rear axle should contain enough lubricant to bring it up to the level of the filling hole in the rear cover plate. The level should be inspected every 2,000 miles and lubricant added if necessary. Cadillac Rear Axle and Transmission Lubricant is recommended. It is important that, with the beginning of freezing weather, the heavy lubricant be drained and replaced with the light or winter grade.

Timer and Distributor: 26

Every 2,000 miles remove the small breather at the rear of the timer-distributor housing by unscrewing it and pack Cadillac Distributor Grease around the gears by which the timer and distributor are driven.

Valve Stems: 11, 25

Apply engine oil to the valve stems and cam slides every 2,000 miles. This may be done by lifting the valve compartment covers and inserting the spout of the oil can.

Steering Gear: 10

The steering gear should be lubricated every 2,000 miles by applying the grease gun to the connection at "A", Fig. 26. Cadillac Steering Gear Lubricant is recommended. In order to determine when sufficient grease has been injected, remove the screw plug from the hole in the steering column just below the steering wheel and inject grease with the gun until it flows from this hole.

Speedometer Flexible Drive Shaft

The flexible shaft by which the speedometer is driven is carried in a flexible casing. The shaft should be removed from the casing and lubricated at the end of every 2,000 miles of travel. Cadillac Roller Bearing and Cup Grease is recommended.

Do not under any circumstances attempt to lubricate the speedometer head. Any parts in the head which require lubrication are amply supplied when the head is assembled.

EVERY 4000 MILES

Clutch Thrust Bearing: 8

Every 4,000 miles remove the cover plate shown at "8." With the engine not running reach in and turn the clutch thrust bearing so that the small filler screw is at the top. Remove the screw with a screw driver. Care must be exercised not to drop the screw into the clutch case.

A small connection for the grease gun is furnished with the tool kit. Screw this into the threaded hole from which the filler screw was removed and attach the grease gun.

Cadillac Roller Bearing and Cup Grease is recommended.

Wheels: 3, 14, 19, 29

Front Brake Trunnions 15, 30

Every 4,000 miles, or every six months if the car is driven but little, all the wheels should be removed (see under "Wheels", page 67) and the bearings thoroughly cleaned in either gasoline or kerosene and examined. The bearings should be lubricated with a thin grease. Cadillac Roller Bearing and Cup Grease is recommended. Do not use heavy grease, as it will roll away from the path of the rollers and will not return.

Every 4,000 miles, while the front wheels are removed for lubricating, the brake operating trunnions inside the front wheel brake drums should also be lubricated by attaching the grease gun to the connection at "A," Fig. 19, and injecting grease just until it begins to appear around the trunnion bearing. *Do not inject too much grease.* Before replacing the wheel be sure and wipe off any grease appearing around the trunnion bearing.

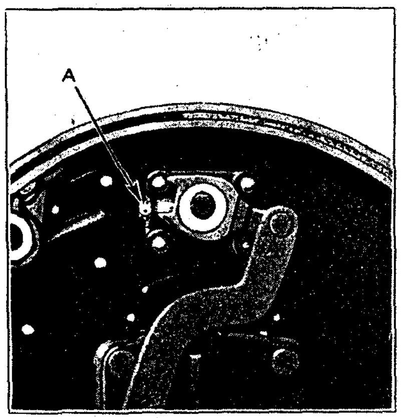


Fig. 19. Front Wheel Brake Lubricating Connection. (Front Wheel Removed.)

Clean Engine Lubricating System

At the end of every 4,000 miles of travel clean the engine lubricating system and the oil pan and screen. (See under "Replace Engine Oil", page 35 and "Replace Engine Oil Frequently During Cold Weather," page 36.)

Horn: 13

The horn is lubricated when assembled and does not require further lubrication but the commutator of the horn should be inspected every 4,000 miles and cleaned if necessary. To do this remove the motor shell from the horn. If the commutator appears to be dirty clean it with a dry cloth. This should be done with the horn motor running so that the commutator will be cleaned on all sides. Do not attempt to polish the commutator or brushes with oil or vaseline. These parts are designed to run dry.

Replace Transmission Lubricant: 21

At the end of every 4,000 miles of travel remove the drain plug from the under side of the transmission case and drain out all of the lubricant. Refill with two quarts of suitable lubricant. Cadillac Rear Axle and Transmission lubricant is recommended. It is important that the light grade be used in winter. The filler is shown at "21," Fig. 18.

Replace Rear Axle Lubricant: 18

At the end of every 4,000 miles of travel remove the drain plug from the axle and drain out all of the lubricant. Refill with 5 quarts of suitable lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended. It is important that the light grade be used in winter. The filler is shown at "18," Fig. 18.

ADDITIONAL

In addition to the places specially mentioned, note carefully and oil all of the small connections and joints throughout the car, such as the various brake rod connections and joints in the brake mechanism.

Also lubricate the door lock strikers and striker plates, the dovetail bumpers, the door hinge pins and the door checks as directed under "Care of Body," page 50.

Remember that wherever one part moves in contact with another wear will be reduced to the minimum by lubrication.

GENERAL CARE

Part III

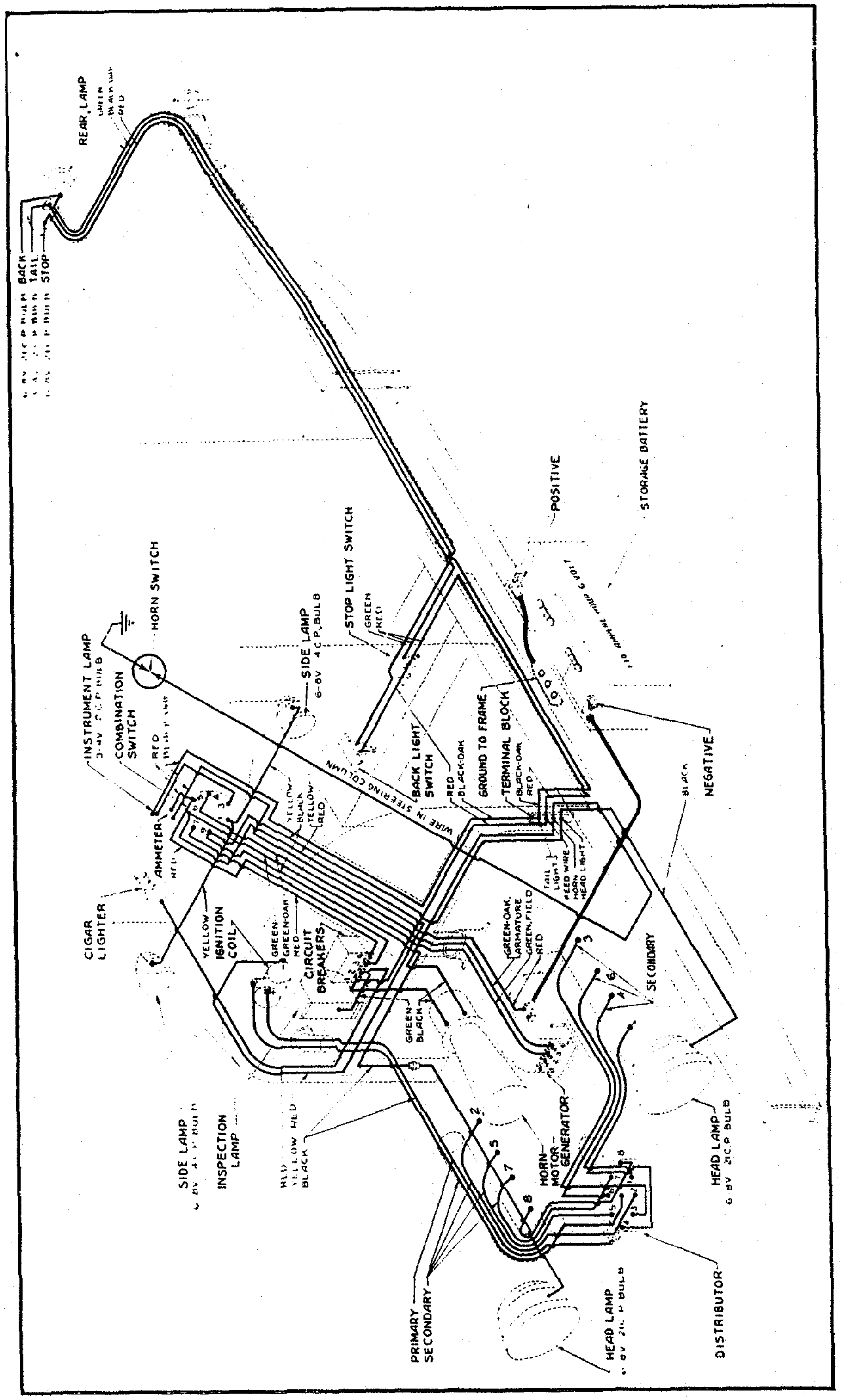


Fig. 20. Wiring Diagram

TIRES

Each tire maker publishes a booklet with instructions for care and repair of tires. Every motorist should provide himself with one of these and thoroughly familiarize himself with the contents. We give here suggestions that apply to pneumatic tires in general.

Probably 75% of so-called "tire trouble" is the result of misuse. We give here some suggestions regarding the more important points of the care of tires.

Result of Under-Inflation

Under-inflation causes a tire to flatten out under load. This causes the side walls to bend sharply as the tire revolves. The result is the breaking of the side walls. An under-inflated tire is susceptible to bruise, broken cords and blow-out.

Result of Improperly Aligned Front Wheels

Running a car with the front wheels out of alignment causes rapid tread wear. This usually affects both tires similarly, although sometimes only one tire is affected. An incorrect adjustment of the front axle parallel rod or a bent steering arm is responsible for the condition. Unless the wheels are in proper alignment the treads of the front tires will wear away in a remarkably short time.

Neglect of Small Cuts

If cuts extending to the cords are neglected deterioration and blistering of the tire tread is the result. It is unnecessary to remove a tire to treat small cuts of this nature. Tire companies furnish a plastic compound for filling cuts. This prevents moisture and dirt from getting in. If a cut is large, it should be vulcanized at once.

Result of Improperly Adjusted Tire Chains

Tires are sometimes badly damaged through the use of tire chains which are incorrectly adjusted or which are fastened to the spokes of the wheel holding the chains tightly in place.

The least injury results when chains are applied loosely leaving play enough to permit them to work around. The wear on the tire is thus distributed evenly. Probably the greatest amount of injury comes from using chains unnecessarily on paved streets.

Result of Sudden Application of the Brakes

The sudden application of the brakes resulting in sliding the wheels causes the treads to wear away in spots. A tire will give away very rapidly under this severe treatment.

Additional Suggestions

The tires are constructed for the purpose of carrying up to certain maximum loads and no more. It should be realized that overloading a car beyond the intended carrying capacity is sure to materially shorten the life of the tires.

Do not turn corners or run over sharp obstructions, like car tracks, at a high rate of speed. Such practice is sure to strain or possibly break the cords, with the result that the further life of the tires will be limited. Remember that most tire troubles are the result of abuse.

Avoid scraping the tires against the curb and running in ruts. This kind of wear scrapes off the rubber side wall and exposes the layers of cords to dirt and moisture, which soon starts to rot the cords.

In turning in a narrow street, avoid striking the curb.

If a tire goes flat without any indication of injury to the tire, see that the valve is not leaking. A little moisture on the tip will show bubbles if the air is escaping.

In case of puncture, the car should be stopped at once and the tube repaired or replaced, or the tire replaced by the extra one. The tire should also be examined carefully and the cause of the puncture ascertained and the nail, glass or whatever it may be, should be extracted. Before replacing the tire on the rim, examine the inside of the casing to see that the cause of the puncture is not still protruding. It is also advisable to look over the outside of the tires frequently and take out any pieces of glass or other particles which may have become imbedded in the casing.

Don't run in ruts or car tracks; the sides of a tire will soon wear out under such treatment. Avoid large stones or other obstructions in the road. To hit one of these may break the carcass even though no external injury be visible.

The garage floor should be kept free from oil or gasoline. The tires on a car left standing on a grease-covered floor deteriorate quickly, the natural enemies of rubber being oil and gasoline. These destroy the nature of the rubber, rendering it soft, so that it cuts and wears away quickly.

If the car is not used during the winter, it is better to remove the tires from the rims, keeping casings and tubes in a fairly warm atmosphere away from the light. It will be better to slightly inflate the tubes, as that keeps them very nearly in the position in which they will be used later on. If the tires are not removed and the car is stored in a light place, it will be well to cover the tires to protect them from the strong light, which has a deteriorating effect on rubber.

The greatest injury that can be done to tires on a car stored for the winter is to allow the weight of the car to rest on the tires. The car should be blocked up, so that no weight is borne by the tires, and the tires should then be deflated partially. This will relieve the tires of all strain, so that in the spring they should be practically no worse for the winter's storage.

STORAGE

Engine

To prepare the engine for storage proceed as follows: Start the engine, cover the radiator and run the engine until it is hot. (See under "Personal Danger in Running Engine in Closed Garage," page 54.) The engine should be run at a speed which will show an ammeter reading of about 10 with all lights switched off. It usually requires from two to ten minutes to heat up the engine.

After the engine is hot, stop the flow of gasoline to the carburetor by removing the gasoline tank filler cap, thus relieving the air pressure. Immediately the engine starts to slow down from a "lean mixture" inject from three to four tablespoonfuls of clean fresh engine oil into the carburetor. This may be done easily after lifting the large polished aluminum cap on the carburetor directly over the air valve. This will stop the engine. Be certain there is no fire near when the filler cap is removed. Replace and tighten the cap after the engine stops.

Open the compression relief cocks by turning them counter-clockwise. Put from two to three tablespoonfuls of clean fresh engine oil into each cylinder and before closing the cocks crank the engine three or four revolutions with the ignition switched off. This will tend to distribute the oil over the cylinder walls.

If the engine is started again repeat the series of operations given in Paragraphs 1, 2 and 3.

Drain the cooling system. You will find complete directions in this book under "Draining the Cooling System," page 57.

Storage Battery

(See under "Preparing Battery for Winter Storage," page 63).

Tires

During winter storage it is best to remove the tires from the rims and keep the casings and tubes in a fairly warm atmosphere away from the light. It is best to inflate the tubes slightly after the tires have been removed to keep the tires in the position in which they are when inflated on the rim.

If the tires are not removed from the car, and the car is stored in a light place, it is best to cover the tires to protect them from strong light, which has a deteriorating effect on rubber.

The greatest injury that can be done to tires when the car is stored is to allow the weight of the car to rest on them. If the tires are not removed the car should be blocked up so that no weight is borne by the tires and the tires partly deflated.

Body and Top

It is best to put the top up and cover the entire car to protect it from dust.

Taking the Car Out of Storage

When the car is taken out of storage and before the engine is started, drain the oil from the oil pan, remove and clean the oil pan and baffle plate and replace the oil with fresh oil. (See under "Replace Engine Oil," page 35.)

The following instructions should be followed carefully in starting the engine:

Open the compression relief cocks by turning them counter-clockwise and put from two to three tablespoonfuls of clean fresh engine oil into each cylinder.

Close the cocks and with the ignition turned off turn the engine over a few revolutions by hand. This will tend to distribute the oil over the cylinder walls.

Start the engine in the usual manner.

Immediately the engine starts push the carburetor enriching button as far forward as possible without causing the engine to stop or slow down materially and open the throttle to a point which causes an ammeter reading of approximately 10 with all lights switched off. With the engine running inject from two to three tablespoonfuls of clean fresh engine oil into the carburetor. This may be done after lifting the large polished aluminum cap on the carburetor directly over the air valve.

Push the carburetor enriching button forward as far as it will go as soon as the engine is warm enough to permit it.

CARE OF BODY

Finish

The finish of an automobile requires more careful and frequent attention when the car is new than when it is older and the varnish is harder. Particular care should be taken to keep mud from the body and hood of the car while new.

Never permit mud to remain on the finish over night or long enough to dry. If it is not possible to wash the car thoroughly before putting it away for the night, flush it off and then thoroughly wash the car the next morning. Mud permitted to remain on the car until it has dried, is not only difficult to remove but stains and dulls the finish.

Washing the Car

Use clean water and plenty of it. Do not use water containing alkali. In parts of the country where the regular water supply contains alkali use rain water. Do not use hot water, as it destroys the lustre. The temperature of the water should be between 40 and 60 degrees Fahrenheit. Do not wash the hood while it is hot. The effect on the finish is the same as washing it with hot water. Unless the hood is allowed to cool before washing, the lustre will soon disappear.

If a hose is used in washing, do not have water pressure greater than will carry the water 6" beyond the end of the hose. Water under higher pressure drives the grit and dirt into the varnish. It is best not to use a nozzle.

Start at one of the front wheels, first going over the underside of the fender, the wheel and the chassis nearby, with water flowing gently from the hose. This will flush off most of the mud and dirt.

If it is necessary to use soap to remove road oil from the underside of the fenders or machine oil or grease from the chassis, use a little good automobile soap dissolved in a pail of water and apply the soapy solution with a sponge. Do not let this soapy solution remain on the finish more than two or three minutes but immediately wash it off thoroughly with a good soft carriage sponge. Then proceed to wash the under surfaces of the remaining fenders, the wheels and the remainder of the chassis in a similiar manner.

When the washing of the chassis is completed begin at the front of the car and with the water running gently from the hose, flow on the body, hood and upper surfaces of the fenders. This will soften the accumulation of road dirt and remove most of it. Then go over the car again and remove all dirt by rubbing lightly with a soft wool sponge, which should be kept exclusively for the body, hood and upper surfaces of the fenders. At the same time, apply gently from a hose an abundance of water. Rinse the sponge frequently in clean water to remove any grit. After the washing is completed squeeze the sponge as dry as possible and pick up all water from crevices.

Then thoroughly wet a clean soft chamois, wring it as dry as possible, and dry the finish. Rinse the chamois and wring it out frequently. Do not rub the finish or apply more pressure than is necessary to dry off the water. Water evaporates quickly and leaves the finish in good condition.

If it is desired to chamois the wheels and chassis, wet the parts with clean water if they have become dry, and then wipe them. Use a separate ıamois for the chassis. Do not use on the body a chamois that has been sed on the chassis or wheels.

Do not use soap, gasoline, kerosene or anything of this nature on the nish. Such ingredients attack the varnish.

Do not clean the glass with preparations which may contain harmful ıgredients. Use only cleaning compounds which are known to have no estructive effects on highly polished glass.

'pholstery

To keep the upholstery in closed cars in the best condition it should be leaned thoroughly at least once a month with a whisk broom and vacuum leaner. Dirt and grit accumulating in the fabric wear it out faster than use.

Spots on the upholstery may be cleaned with any good dry cleaner. When he cleaner has thoroughly evaporated, apply a hot flat iron wrapped in a wet loth. Steaming the fabric and rubbing lightly against the nap will raise the ap to its normal position.

Body Bolts

An automobile body is attached to the chassis by hold-down bolts. Between he sills of the body and the chassis frame is placed a closely woven fabric, alled "anti-squeak," which may compress to some extent under the weight f the body. Since this may permit the body bolts to loosen somewhat, it is vell to have the bolts inspected occasionally and tightened if necessary. ,oose body bolts result in noises which are frequently attributed to other auses.

Door Hardware

Whenever the chassis is being lubricated it is important to lubricate the oor locks and other door hardware as follows:

Place a few drops of oil on each door lock plunger or striker, turning the andle back and forth so that the oil will work into the lock. Also place a rop of oil on each of the striker plates against which the strikers engage vhen the doors are closed. The hinge pins should also be oiled sparingly, so s not to get oil on the finish.

Each door has a wedge-shaped tongue which dove-tails into a receptacle n the body when the door is closed. These tongues should receive a small mount of grease or oil.

A check which limits the outward movement of the door is fitted at the op of each door. Apply a small amount of hard grease to the pin which lides in the slot at the top of the door.

Vindow Regulators

The window regulators should not be forced after the window has been aised or lowered as far as it will go. In order to provide easy operation of he windows, the regulator handle has a leverage of about fifteen to one and o apply excessive force is liable to result in damage.

GASOLINE SYSTEM

General Description

The supply of gasoline is carried in a tank at the rear of the car and is forced to the carburetor by air under a pressure of one to two pounds. A float controlled needle valve in the carburetor maintains the gasoline at the correct level in the carburetor bowl.

The gasoline pressure is indicated by a gauge on the instrument board (see Figure 1). A hand air compressor on the instrument board is provided, by which pressure for starting may be obtained when the car has been standing long enough to make this necessary. When the engine is running, pressure is automatically maintained by an air compressor on the engine, driven by an eccentric on the front end of the cam shaft. An air pressure relief valve connected in the air line prevents the pressure rising above that for which the valve is set.

The pipe extending almost to the bottom of the gasoline tank is a continuation of the gasoline line. The air line simply enters the tank at the top and does not extend into the gasoline.

Filling the Gasoline Tank

The gasoline tank is at the rear of the car. (See Fig. 21.) The filler cap may be removed after loosening the thumb screw.

Gasoline should be strained through a wire cloth of very fine mesh before it is poured into the tank. If dirt or water is allowed to enter the gasoline system it may cause great annoyance by getting under the carburetor inlet needle and causing the carburetor to flood.

After filling the tank, screw on the filler cap and tighten the thumb screw. This is necessary to prevent leakage of the air pressure by which the gasoline is forced to the carburetor.

Settling Chambers and Strainers

There are two settling chambers in the gasoline system, one at the under side of the gasoline tank and the other attached to the left hand side of the frame of the car just under the front floor boards.

There is a drain plug at the bottom of each of these settling chambers. Every one thousand miles or oftener the plug in the settling chamber under the floor boards and the plug in the settling chamber underneath the gasoline tank should be removed to drain the settling chambers of any dirt or water which has accumulated. Before unscrewing either of the plugs, the car should be driven out of the garage into the open and the gasoline system relieved of all air pressure by removing the gasoline filler cap on the tank. Be sure there is no fire near the car when these plugs are removed.

There are two strainers in the gasoline system which require cleaning ›riodically—one at the point where the gasoline feed pipe is attached to ıe carburetor, and the other attached to the drain plug in the settling ıamber under the front floor boards. (See Fig. 21.)

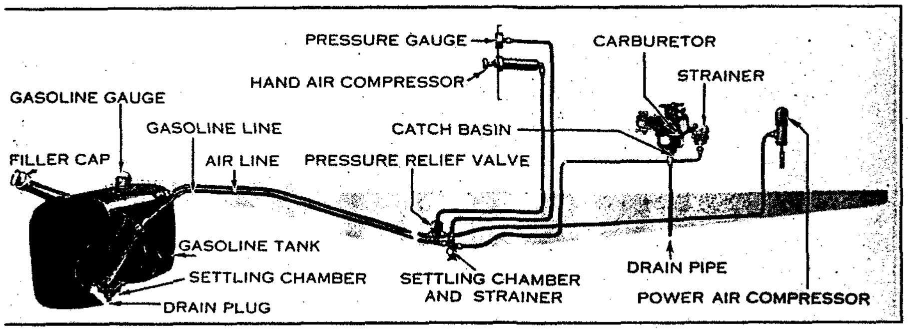


Fig. 21. Gasoline System.

The strainers should be removed and cleaned every one thousand miles · oftener. Remove the filler cap to relieve the air pressure before removing ther strainer. In cold weather it may be found necessary to remove the ;rainers more frequently, to prevent an accumulation of water at these oints which would freeze and prevent gasoline from flowing to the car- uretor.

CARBURETOR

The carburetor is correctly adjusted when the car is assembled and unless ımpered with should not require readjustment. It is unnecessary to change ıe adjustment for changes in season and weather.

Good carburetor action cannot be expected until the engine is thoroughly ·armed up. Imperfect carburetor action while the engine is cold does not ıdicate that the carburetor requires adjustment.

If adjustment of the carburetor seems to be necessary have it made by Cadillac distributor or dealer. The adjustment should not be attempted y one unfamiliar with it.

ersonal Danger of Running Engine in Closed Garage

Carbon monoxide, a deadly poisonous gas, is present in the exhaust of ısoline engines. Increasing the proportion of gasoline to air in the mixture ›d to the engine, in other words, enriching it, increases the amount of ırbon monoxide given off.

The presence of carbon monoxide makes it very dangerous to run the ıgine while the car is in a small, closed garage. If the doors and windows

are open the danger is lessened, but it is far safer, particularly if an adjustment of the carburetor is being made, to run the car into the open.

Serious personal injury may be caused by the presence of carbon monoxide in a garage if the percentage of it in the air is greater than a very small fraction of one per cent. Unconsciousness may result without warning. It is reported that no indication of danger is given by personal discomfort until too late. Deaths resulting from the presence of carbon monoxide in garages have been reported.

COOLING SYSTEM

General Description

The cooling system is of the forced circulation type. Circulation through each cylinder block is independent of that through the other, two pumps being provided.

The temperature of the liquid circulated by the pumps is under thermostatic control, the purpose of which is to permit liquid circulated through the water jackets of the cylinders to warm up to the temperature at which the engine operates best, very soon after the engine is started and to prevent the temperature dropping below this point while the engine is running.

Condenser

A condenser, the purpose of which is to prevent the loss of the cooling medium by evaporation, is attached to the right hand side of the car frame and connected by a pipe to the radiator overflow pipe.

The operation of the condenser requires an air tight seal at the radiator filler cap. To make it possible to screw down and tighten the cap without injury to the rubber gasket, two metal washers are interposed between the head of the cap and the gasket. If anything is installed on the radiator cap which makes necessary cutting a hole through the gasket, care must be taken that no air leak results.

Refilling the Cooling System

Fill the cooling system with water during warm weather and with a suitable anti-freezing solution during freezing weather. (See under "Anti-Freezing Solutions", page 24.) To fill the cooling system proceed as follows:

Make sure that the cylinder drain plugs "E", Fig. 22, are tightly in place. Close the water pump drain valves "G". Turn the thermostat control shaft "B" on each water pump so that the triangular indicator on the end of the shaft points up. The shaft may be turned in either direction.

There is a drain plug "E" in each cylinder block and a drain valve "G" ıd a thermostat control shaft "B" at each water pump. A special wrench ır the drain valves "G" and the thermostat control shafts "B" is included in ıe tool equipment of the car.

Remove the radiator filler cap "A" and fill the cooling system to within ıe inch of the top of the filler. Then add three quarts additional to fill the ɔndenser which is connected to the radiator overflow pipe. This may be one by pouring the liquid slowly into the radiator filler or by removing the ller strainer and pouring the liquid directly into the overflow pipe through small funnel. The second method is the shorter.

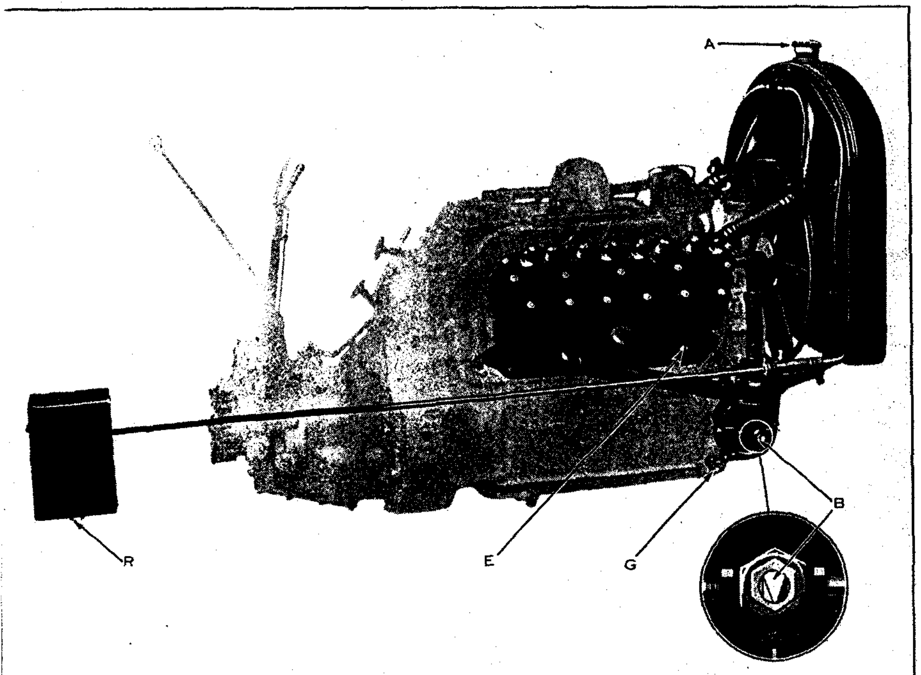


Fig. 22. Cooling System

Screw the radiator filler cap down tightly after replacing it. This is imɔortant because the operation of the radiator condenser depends upon a tight joint at the radiator cap.

After filling the cooling system turn the thermostat control shafts "B" so that the triangular indicators point down. These indicators should point *up* when filling the cooling system and *down* at all other times.

Adding Cooling Solution

If only a small amount of cooling solution is necessary to fill the system, it is necessary only to remove the radiator filler cap and pour in the required amount.

Screw down the radiator filler cap firmly after replacing it. This is necessary to insure operation of the condenser.

Draining the Cooling System

To drain the cooling system turn the thermostat control shaft "B," Fig. 22, on each water pump so that the triangular indicator on the end of the shaft points up. The shaft may be turned in either direction. Then open the drain cock "G" on each water pump and remove the drain plug "E" on each cylinder block.

To drain the condenser remove the drain plug "R."

Cleaning the Cooling System

The cooling system should be drained and flushed out every two or three months. This can be done in the following manner:

Run the engine with the radiator covered until the liquid in the cooling system is boiling hot.

Shut off the engine and immediately drain the cooling system.

If an alcohol anti-freezing solution is drawn off part of it may be used again if the sediment is allowed to settle. In case it is used the specific gravity should be tested with a hydrometer, after it has cooled thoroughly.

After the liquid is drained off, refill the cooling system with hot water and repeat the operations outlined above.

In cleaning the cooling system do not turn the water pump shafts "B" (Fig. 22) each time the cooling system is drained and refilled. After draining it the first time, leave the shafts with the indicators pointing up until the cleaning has been completed and the cooling system has been refilled with fresh liquid. Then turn the shafts so that the indicators point down.

If, in draining the second time, the water is very dirty, it may be desirable to repeat the flushing operation a third time, using a solution of salsoda. If the sal-soda solution is used, be sure that it is drained out and the system flushed again with clear water.

The sal-soda solution should not be permitted to get onto the finish of the hood or radiator.

CADILLAC-DELCO ELECTRICAL SYSTEM

eneral Description

The Cadillac-Delco system is the single wire, single unit system. One de of the motor, generator, storage battery, lamps, horn and ignition pparatus is connected to some part of the frame of the car or the engine. he other connections are made with copper wires or cables.

The motor generator serves both as a generator of current and as an ectric motor for cranking the engine when starting. The principal eleents of the motor generator are an armature and a field. There are two indings on the armature and two in the field—one on the armature and ne in the field are used when the motor generator is used as a generator nd the other windings when it is used as a motor.

GENERATION OF CURRENT

When the engine is not running and the lights are turned on, the ammeter ocated on the instrument board (see Figure 1) indicates on the "discharge" ide of the dial, the amount of current drawn from the storage battery or the lights. When the ignition switch is turned on the ammeter indicates n addition the current used in slowly rotating the armature of the motor enerator. When the starter button is pushed down, the current is no onger required for slowly rotating the armature of the motor generator. The ammeter then indicates only the current used for ignition and lights turned on. The ammeter does not indicate the amount of current used n the cranking operation.

Before the engine is running fast enough to generate sufficient current o equal the current demand, the ammeter indicates on the "Discharge" ide the amount of current being drawn from the storage battery. When he engine has attained a speed sufficient to generate current to more than qual demand, the ammeter indicates on the "Charge" side the excess urrent. This passes to the storage battery and recharges it.

Ordinarily, with all lights switched off, sufficient current is generated to tart recharging the battery when the car is operated in high gear at speeds rom ten to twelve miles per hour and, of course, at much lower speeds when the car is operated in low or intermediate gear. With all lights turned on sufficient current is generated to take care of the requirements at speeds rom ten to fifteen miles per hour. At speeds greater than this the surplus urrent passes through the storage battery and recharges it. In other words, the ammeter indicates the rate at which the storage battery is being charged or discharged.

To determine the total output of the generator turn off all the lights and add the amount of current used for ignition, i. e., two to three amperes, to the ammeter reading.

MOTOR GENERATOR COMMUTATORS

Do not put oil on the commutators of the motor generator.

IGNITION SYSTEM

The ignition system embodies the following elements: A source of current, the generator, or at low speeds, the storage battery; an ignition timer, which interrupts the low tension current at the proper instant to produce a spark in the high tension circuit; an induction coil, transforming the primary current of six volts into one of sufficient voltage to jump between the points of the spark plugs; a condenser, which assists the induction coil to raise the voltage, and which protects the contact points of the ignition timer from burning; and a high tension distributor which directs the distribution of the high tension current to the spark plugs in the respective cylinders.

Spark Plugs

Spark plugs should be clean. When carbon or soot is permitted to collect on them short circuiting of the current results and prevents the proper ignition of the charge in the cylinder. A good method of cleaning plugs is to wash them in alcohol. Use gasoline in the absence of alcohol.

In order to get the best results the points of the spark plugs should be .023 of an inch apart.

Cleaning Lamp Reflectors

The reflectors of the head and side lamps are plated with pure silver. In polishing, extreme care must be exercised in selecting materials which will not scratch it.

Powdered dry rouge and a chamois skin are recommended. If the reflectors are tarnished, moisten the rouge with alcohol, and apply with the chamois. Then polish with a dry chamois and rouge.

The chamois should be soft and must be free from dust. Do not use a chamois used for any other purpose.

Lamp Bulbs

It is recommended that bulbs for the lamps be purchased from a Cadillac distributor or dealer. In any event bulbs should have the correct voltage and candle power rating. The following is a table of correct voltages and candle powers:

Lamps	Voltage	Candle Power
Head	8	21
Side	8	4
Instrument	4	2
Tail	4	2
Stop light	8	21
Back-up light	8	21
Portable	8	4
Dome, enclosed cars	8	4
Quarter, enclosed cars	8	2

Cigar Lighter

The cord which supplies current to the cigar lighter (Fig. 1) is carried on a reel which is fastened to the front face of the instrument board and which operates in a manner similar to a curtain roller. The cord may be pulled out to any desired length and will lock when slowly released. To return the lighter to its receptacle, pull the cord out slightly and then let it rewind rapidly. To turn on the current, press the button in the rim of the lighter. The current can be turned on only when the reel is locked, that is, when the cord is slack.

Some cars are equipped with a different type of cigar lighter which does not have the locking feature and the cord must be held taut while the lighter is in use. On these cars the current is automatically turned on when the lighter is taken out and turned off when the lighter is returned to its receptacle.

Portable Lamp

The portable lamp is attached to the right hand side of the front face of the dash. The wire to the lamp is wound upon a reel. The current for the lamp is controlled by a small switch button near the lamp socket. To use the lamp lift the right hand side of the engine hood and pull the lamp straight out from its socket. To release the reel and return the lamp to its socket, press in on the switch button, holding it in while the cord is rewound.

STORAGE BATTERY

General Description

The storage battery consists of three cells. It is carried in a compartment in the left hand dust shield. The cover of this compartment forms a part of the dust shield and may be removed after turning the nickel-plated handle to the right. On some cars this handle is fitted with a lock which must be unlocked by inserting the switch key before the handle can be turned. Do not attempt to turn the key. Insertion of the key unlocks the handle.

Caution:—Never run the engine with the storage battery disconnected. Serious damage to the motor generator may result. Do not remove the motor generator or attempt any adjustment of the circuit breakers or remove any of the wires to the circuit breakers, without first disconnecting the storage battery.

The battery is designed especially for the Cadillac-Delco electrical cranking, lighting and ignition system and is unusually rugged and long lived. It is made by the Electric Storage Battery Co., Philadelphia, Pa., whose batteries are known as "Exide" batteries.

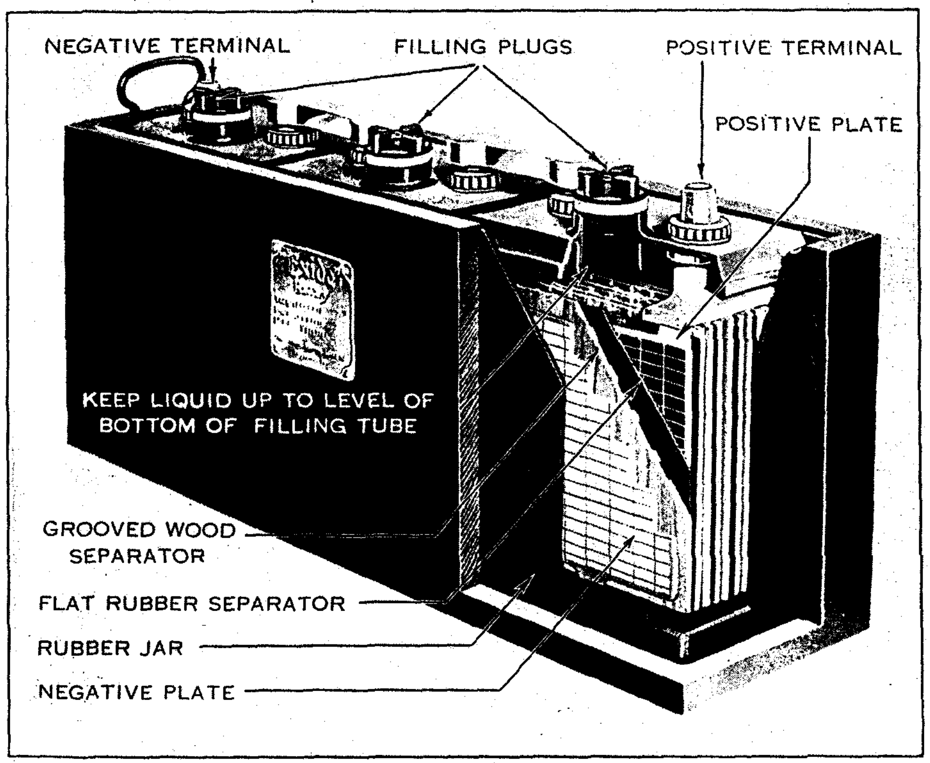


Fig. 23. Storage Battery, Sectional View.

The specific gravity of the acid solution in the battery is an indication of the state of charge. (See under "Hydrometer Syringe," page 62.) In a fully charged battery the specific gravity should be from 1.270 to 1.290. If the specific gravity registers from 1.150 to 1.170 it indicates that the battery is practically discharged. A battery discharged below a specific gravity of 1.150 will not crank the engine nor will it burn the lights to full candlepower when the engine is not running.

Adding Water to Storage Battery

The acid solution in the battery must always cover the plates and the level of the acid solution should be kept even with the bottom of the filling tubes. Water should be added every 500 miles or frequently enough to keep the level up to this point. *Do not add acid.* Usually it will require only a teaspoonful or so; in hot weather it may require more. Be sure to replace and tighten the filling plugs after adding water.

To remove a filling plug, turn it as far as possible in the counter-clockwise direction, then lift it straight up. To replace it, set the plug in place and turn it in the clockwise direction until tight.

If a plug is left out or is loose, acid solution will escape from the cell, especially when the battery is being charged. If a plug is lost or broken obtain a new one and install it as soon as possible.

If one cell regularly requires more water than the others, thus lowering the specific gravity of the acid solution in that cell, a leaky jar is indicated. Even a very slow leak will in time result in the loss of all the acid solution in the cell. A leaky jar should be replaced immediately by a new one.

Water for filling the battery must be pure. Distilled water, melted artificial ice or fresh rain water are suitable for this purpose. If rain water is used, it should not be allowed to come in contact with any metal. It should not be caught from a metal roof or in a metal receptacle.

Never keep the water in a metal container, such as a metal bucket or can. It is best to get a bottle of distilled water from a druggist or from an ice plant. A quart will last a long time. The whole point is to keep metal particles out of the battery. Spring water, well water or hydrant water from iron pipes generally contains iron and other metals in solution, which will ultimately cause trouble if used.

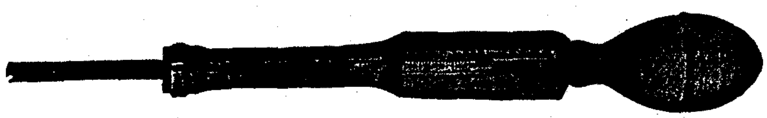


Fig. 24. Hydrometer Syringe

Hydrometer Syringe

A hydrometer (Fig. 24) is an instrument for testing the specific gravity of a liquid. A hydrometer syringe is a hydrometer specially designed for convenience in testing the specific gravity of the acid solution in storage batteries. Hydrometer syringes are not a part of the electrical system but can be purchased from any "Exide" representative

To test the solution in the storage battery with a hydrometer syringe, proceed as follows:

Remove the filling plug from the cell to be tested, compress the rubber bulb of the syringe, and insert the pipette into the solution of the cell. *Hold the syringe as nearly vertical as possible, and gradually lessen the pressure on the bulb until enough of the acid solution is drawn into the syringe to float the hydrometer.* The specific gravity reading is taken on the hydrometer at the surface of the acid solution in the glass barrel.

If the acid solution is below the top of the battery plate, or so low that it is not possible to draw enough of the solution into the barrel to float the hydrometer, fill the cell to the proper level (see Fig. 23), by adding pure water, run the engine until the water has become thoroughly mixed with the acid solution, and then take the reading as above described. The engine should run for several hours after water is added before an hydrometer reading is taken.

Preparing Battery for Winter Storage

When the car is stored for the winter the level of the acid solution should be even with the bottom of the filling tubes. (See under "Adding Water to Storage Battery," page 62.) If water is added it should be added just before the last time the car is used so that it will be thoroughly mixed with the acid solution. When the car is stored, the specific gravity of the acid should register from 1.270 to 1.290. In this condition there is no danger of the acid solution freezing. The specific gravity of water is 1.000 and water freezes at 32 degrees F. above zero.

Unless the battery is fully charged or nearly so it is probable that the acid solution in the battery will freeze and cause extensive damage.

The following is a table of the freezing temperatures of sulphuric acid and water solutions of specific gravities from 1.050 to 1.300.

Specific Gravity (Hydrometer Reading)	Freezing Temperature (Degrees Fahr.)
1.050	+27°
1.100	+18°
1.150	+ 5°
1.164	0°
1.200	—17°
1.250	—61°
1.275 to 1.300	—90°

The battery should be charged every two months during the "out of service" period, by running the engine. If the above is impossible and there is no garage equipped for charging batteries to which it may be conveniently sent, the battery may be allowed to stand without charging during the winter, provided the specific gravity of the acid solution registers from 1.270

to 1.290 at the time the car is laid up. Much better results and longer life from the battery will be obtained by giving the periodic charges.

The wires of the battery should be disconnected during the "out of service" period, as a slight leak in the wiring will discharge the battery.

Placing Battery in Service Again

If the battery has received periodic charges it will be unnecessary to give it any special attention, other than to fill it to the proper height with distilled water and connect the wires which were disconnected when the car was stored. After the car has been driven for a number of hours, the specific gravity of the acid solution should be taken with a hydrometer syringe. The solution should register from 1.270 to 1.290 if the battery is fully charged.

A greenish deposit sometimes exists on the terminals of a storage battery which has been stored. This deposit may be removed with a solution of bicarbonate of soda (common cooking soda) in water. Do not allow any of this solution to get into the cells of the battery.

If the battery has not been kept charged during the winter, it is advisable to remove it from the car and give it a fifty-hour charge at a 4-ampere rate, before putting it into service again. This should be done at a plant equipped to take care of the work.

Sediment

The sediment which gradually accumulates in the bottom of the jars, should be removed before it reaches the bottom of the plates. The need of cleaning may be determined by inspection. Its necessity is indicated by lack of capacity, excessive evaporation of the acid solution and excessive heating when charging. If a battery is in need of cleaning or repairs, it is best to communicate with a Cadillac distributor or dealer or with the nearest Exide depot, who will advise you where to ship the battery. *Do not ship batteries without receiving instructions.*

Exide Depots and Sales Offices

The Electric Storage Battery Company, whose general offices and works are at Alleghany Avenue and 19th Street, Philadelphia, Pa., has representative stations in towns of any considerable size where battery repair work is done, as well as sales offices and Exide battery depots in a number of the larger cities of the country, where complete assembled batteries and repair parts are carried in stock. For the location of the nearest Exide representative, write the local Cadillac distributor or dealer, or, if preferred, the Electric Storage Battery Company, at Philadelphia.

TRANSMISSION AND CLUTCH

TRANSMISSION

General Description

The transmission is in unit with the engine, and is of the selective type of sliding gear. The gear changes are accomplished by the movement of a hand lever at the driver's right (see Figure 1, also under "Gear Shifting," page 10).

When traveling in high gear, power from the engine is transmitted through the transmission without passing through any of the transmission gears. Power is transmitted through transmission gears when the car is operated in intermediate, low, or reverse gear.

Changes of gear must never be attempted without first disengaging the clutch by holding down on the clutch pedal.

Lubrication

The transmission case should always contain lubricant enough to bring the level up to the filler plug in the right-hand side of the case. The level should be inspected at least every 2,000 miles, and lubricant added if necessary.

At the end of every 4,000 miles the transmission case should be thoroughly drained and refilled with fresh lubricant.

Cadillac Rear Axle and Transmission Lubricant is recommended for the transmission. It is important that, with the beginning of freezing weather, the heavy lubricant be drained and replaced with the light or winter grade.

CLUTCH

General Description

The main clutch is of the multiple disc dry plate type. The driving discs are covered on both sides with a friction material composed largely of asbestos, and are driven by gear teeth in a clutch ring bolted to the fly wheel of the engine.

The driven discs are not covered. These discs are carried on a clutch hub and drive the clutch hub through keys. The clutch hub in turn drives the transmission shaft.

When the clutch is engaged by allowing the clutch pedal to come toward you, the clutch spring forces all of the discs together.

Fig. 25. Clutch Control.

The resulting friction between the driving and driven discs drives the transmission shaft and the car when the transmission control lever is in other than neutral position.

The clutch pedal should be adjusted occasionally to compensate for wear on the facings of the clutch discs. This adjustment is explained below under "Adjustment of Clutch Pedal Clearance."

Adjustment of Clutch Pedal Clearance

After the car has been run for some time it may be found that the facings on the clutch discs have become compressed or worn to some extent and that consequently the clutch pedal strikes the stop screw before the clutch is fully engaged. When this condition exists a readjustment may be made as follows:

Remove the pin "T," Fig. 25, and unscrew the yoke "S," which is threaded on the rod "O," so that when the pin "T" is replaced the clutch pedal has a movement back and forth of one and one-quarter inches without starting to release the clutch. Secure the pin "T" with a cotter pin and tighten the lock nut "R."

STEERING GEAR

General Description

The steering gear is of the worm and sector type. Adjustments are provided in the steering gear for taking up play, which may result after long use.

The worm and sector are contained in a housing, which is bolted to the web of the side bar, and serves as a container for lubricant.

Lubrication

The steering gear should be lubricated every 2,000 miles by applying the grease gun to the connection at "A", Fig. 26. Cadillac Steering Gear Lubricant is recommended. In its absence, lubricant made by mixing 75 percent of Cadillac Rear Axle and Transmission Lubricant with 25 percent of Cadillac Roller Bearing and Cup Grease or No. 1 cup grease can be used. In order to determine when sufficient grease has been injected, remove the screw plug from the hole in the steering column just below the steering wheel and inject grease with the gun until it flows from this hole.

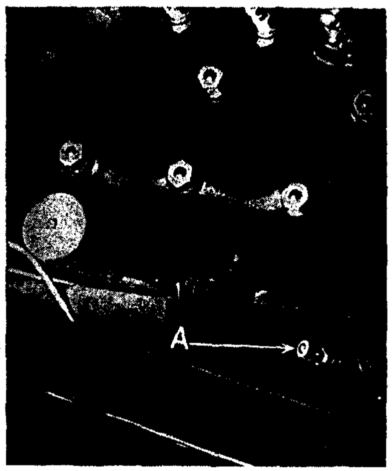


Fig. 26. Steering Gear Lubrication Connection

WHEELS

The adjustment of wheel bearings or the removal of wheels should not be attempted by one unfamiliar with work of this nature. It is recommended that the car be taken to a Cadillac distributor or dealer for this work.

Removing a Front Wheel

Jack up the axle until the wheel is free from the ground. Remove the hub cap by unscrewing it. Remove the cotter pin. Remove the lock nut "A," Fig. 27. Remove the washer "B." Remove the adjusting nut "C." The wheel may now be removed.

Before replacing the wheel, see that the bearings are clean and that they are filled with a thin grease. Be sure that the grease is free from dirt and grit.

Replacing a Front Wheel and Adjusting Bearings

In replacing the wheel, adjust the nut "C" very carefully. (See under "Caution in Adjusting Wheel Bearings," page 68.) Replace washer "B," being sure that one of the notches in the washer fits over the stud "D." Replace the lock nut "A" and tighten carefully. Replace the cotter pin.

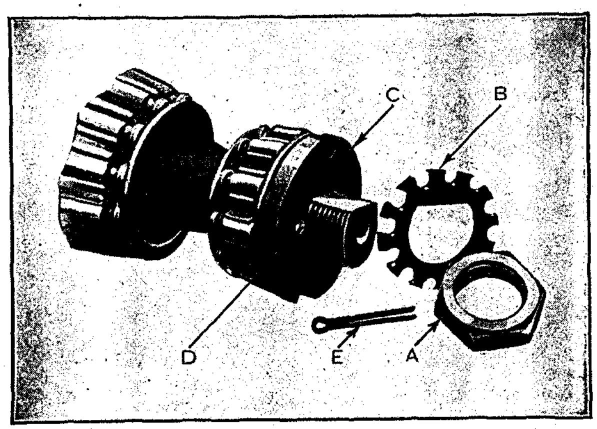


Fig. 27. Front Wheel Bearings and Adjusting Nuts.

It is better to adjust the wheel bearings a little too loose than tight. If, after the adjustment is apparently correct, a notch in the washer "B" is not directly over the stud "D," it is best to loosen the adjustment rather than to tighten it.

Removing a Rear Wheel

Remove the hub cap "B", Fig. 28, by unscrewing it.

Remove the spring locking ring "I."

Withdraw the axle shaft "K."

Jack up the axle so that the wheel will clear the floor.

With a screw driver or blunt tool straighten the lug of the outer lock washer "E" which has been bent over the lock nut "D."

Remove the lock nut "D," both washers "E" and the adjusting nut "F." The wheel can then be taken off.

Replacing a Rear Wheel and Adjusting Bearings

Before replacing the wheel see that the bearings "A" and "G" are clean and filled with light grease which is free from dirt and grit.

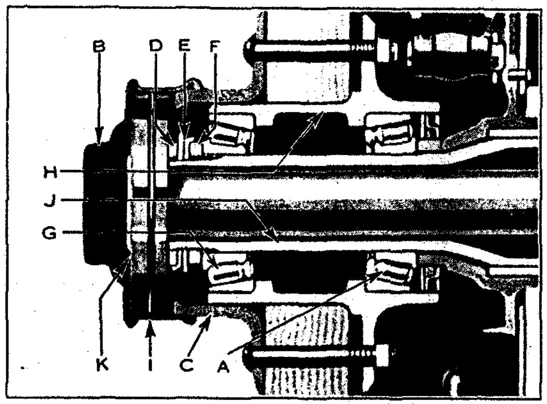


Fig. 28. Sectional View of Rear Hub, Showing Bearings.

In replacing the wheel, set the adjusting nut "F" very carefully. (See under "Caution in Adjusting Wheel Bearings.") Before replacing the lock washers "E," straighten them or use new ones. Place both washers in position, reversing the outer one with respect to the inner so that the lugs on one washer are opposite the spaces between the lugs on the other washer, that is, so that the lugs on the two washers are staggered. Install and tighten the lock nut "D." Next select that lug on the inner washer which falls nearest to the center of one of the flat sides of the adjusting nut and with a screw driver or other suitable tool bend this lug over the nut. In the same way bend one of the lugs of the outer washer over one of the flat sides of the locking nut. In bending the lugs of the locking washers, take care not to alter the adjustment of the inner nut nor loosen the outer nut.

CAUTION IN ADJUSTING WHEEL BEARINGS

When adjusting the wheel bearings, with which the wheels are equipped, great care must be exercised not to get them tight. These bearings will revolve even when adjusted very tightly, but that condition is sure to prove disastrous. They should be adjusted so that a very slight amount of play or looseness may be discerned.

If, after a bearing has been adjusted to a point that is apparently correct, the locking device cannot be placed in position without changing the adjustment, it is far better to *loosen* the adjustment until it can be secured with the locking device than to *tighten* the bearing adjustment.

BRAKES

General Description

There are three pairs of brakes: the rear wheel external brakes, the rear wheel internal brakes, and the front wheel internal brakes. The rear wheel

external brakes and the front wheel brakes are operated by the brake pedal and are used for regular service. The rear wheel internal brakes are operated by a hand lever and are used principally for locking the rear wheels when the car is standing.

The purpose of the front wheel brakes is to add to the braking ability as much as is consistent with safety. It is not desirable to attempt to secure the maximum possible braking effect on the front wheels for the reason that when a front wheel slides without rotating it has no power to change the direction of the car. The driver of a car with both front wheels locked has therefore no control over its direction, particularly in rounding slippery corners.

The Cadillac front wheel brakes are accordingly designed so that when the foot brakes are applied while the steering wheel is turned to right or left, only

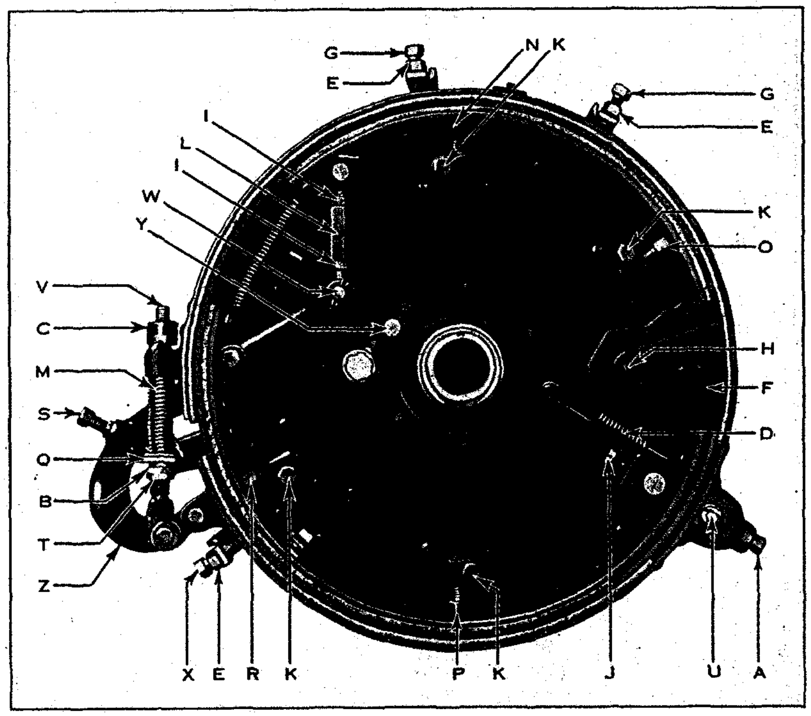


Fig. 29. Rear Wheel Brakes (Wheel Removed)

the brake on the inner wheel is effective, and the outer wheel is left free to rotate. This feature also provides that if the brakes are applied with sufficient pressure to lock both front wheels while moving straight ahead on a slippery road and the steering wheel is then turned to right or left, the brake on the outer wheel will automatically release and the wheel will turn freely, giving it ability to steer the car.

Adjustment

Provision is made at each brake for its adjustment to compensate for wear on the brake lining. It is recommended that the car be taken to a Cadillac distributor or dealer for all brake adjustments. If this is done before the pedal pad is less than one inch from the toe board when the brakes are fully applied, no emergency adjustment will be required. In the event, however, that the adjustment is neglected and as a result the pedal pad touches the toe board before the brakes are fully applied, an emergency adjustment may be made by screwing down the adjusting nuts "C", Fig. 29, one or more half-turns. The nuts "C" lock every half-turn and must be turned a half-turn at a time.

If adjustment of nuts "C" is not sufficient, a more complete adjustment should be made as follows:

Loosen the three locking nuts "E", Fig. 29, and screw the two stop screws "G" and the stop screw "X" away from the brake band. Observe the clearance between those parts of the brake lining nearest the hexagonal headed screw "A" and the brake drum. This clearance should be .030-.035 of an inch. If the clearance is not correct adjust the screw "A" until it is. The screw "A" is kept from turning of its own accord by a lock washer which turns with the screw and locks every half-turn. It must accordingly be turned a half-turn at a time.

Loosen the locking nut "T" and adjust the nut "B" and the screw "X" so that there is a uniform clearance of .030-.035 of an inch between the *lower* part of the brake lining and the brake drum. To decrease the clearance between the brake lining and the drum the nut "B" should be turned counter-clockwise (looking up).

Adjust the nut "C" and the two stop screws "G" so that there is a uniform clearance of .030-.035 of an inch between the *upper* part of the brake lining and the drum.

After making the foregoing adjustments so that there is a uniform clearance of .030-.035 inch between the drum and the lining, check the result by applying the brake and measuring the travel of the upper end of the lever "Z." This travel should not be less than ⅞ inch.

If the end of the lever "Z" travels less than ⅞ inch in moving from the released position to the applied position, readjust one or all of the nuts "C" and "B" and the screws "A" "G" and "X" to increase the clearance slightly, keeping the clearance uniform at all points around the drum. Do not fail to tighten the locking nut "T" and the locking nuts "E" when the adjustment has been made.

Do not change the adjustment of the screw "S." This screw is properly set when the car is assembled and does not require readjustment in taking up wear on the lining.

Since the brakes are designed so that the greater proportion of the braking load is taken by the rear wheel brakes, the rear wheel foot brakes can be adjusted several times before it is necessary to make any adjustment of the front wheel brakes. In any event the car should be taken to a Cadillac distributor or dealer and the front wheel brakes adjusted before the limit of adjustment for the rear wheel foot brakes has been reached.

All joints in the brake connections should be oiled at regular intervals. The brakes should also be tested occasionally to be sure that they are in serviceable condition. When the brake band linings have worn so that further adjustment is impossible they can be renewed.

SNUBBERS

The spring rebound snubbers, of which there are four, one for each of the front and rear side springs, should be readjusted at the end of the first 1000 miles of travel. This is necessary on account of a slight settling of the springs and firmer seating of the coils of the snubber belts. The snubbers should also be lubricated every 4000 miles. Refer to a Cadillac distributor or dealer regarding adjustment or lubrication of snubbers.

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REPAIR PARTS

Genuine Cadillac Parts

Cadillac owners are cautioned against permitting the use of other than genuine Cadillac parts in the repair of their cars. The quality of the Cadillac car is identical with the quality of its component parts, the production of which is based upon more than twenty years of experience in designing, manufacturing, and inspecting. No other individual or organization has access to the data resulting from this experience nor could they possibly have the same interest in protecting the owners of Cadillac cars.

Uniform Parts Prices

Cadillac parts are sold at uniform prices throughout the United States and are not subject to the addition of transportation, excise or other supplementary charges. Printed price lists published by the Cadillac Motor Car Company are open to inspection by owners at any authorized Cadillac distributor's or dealer's establishment.

Ordering New Parts

With many thousands of Cadillac automobiles in use, it is obviously impractical to deal directly with each Cadillac owner. We cannot open accounts with any except regular distributors with whom annual contracts are made.

To avoid unnecessary delay and correspondence new parts should, where possible, be ordered from the distributor or dealer from whom the car was purchased or from the nearest Cadillac distributor or dealer, who carries a large stock and is generally in a position to supply a part immediately. If he cannot do so, he can order it for you.

Where, however, conditions are such as in our judgment to warrant it, we will fill orders for parts at current list prices, f. o. b. factory, provided the order is accompanied by cash. In ordering, send the engine number and type of the car with an accurate description of the part desired, preferably accompanied by a sketch with dimensions. If this cannot be done, return the part tagged properly and with transportation charges prepaid. (See below under "Returning Parts"). Otherwise, we cannot promise prompt service or to fill the order intelligently.

Our responsibility ceases in all cases, with delivery to the transportation company.

Returning Parts

In the event parts are returned, transportation charges must be prepaid or the parts cannot be accepted. They should be tagged properly with the name of the owner and the engine number of the car. A letter should be sent, giving complete instructions regarding the disposition of the parts.

Tires, Speedometer and Clock

In cases of repairs to tires, speedometer, or clocks, correspondence should be opened with the manufacturers or one of their branches. If necessary the parts should be sent to them. Transportation charges should be prepaid.

5-25—6000

CADILLAC
OPERATOR'S MANUAL

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Foreword

THE experienced motorist whose new Cadillac succeeds other cars, some of which may also have been Cadillacs, requires less elementary operating instructions than the beginner, learning for the first time to drive. Likewise, the owner who takes advantage of the facilities offered by the maintenance station has less need for detailed information in regard to care of the car than the owner who provides for all necessary attention in his private garage.

In preparing this Manual, it has been taken for granted that the typical Cadillac purchaser is no longer a novice in motor car operation and that the greatest number of Cadillac owners will be best served by omitting that which is extremely elementary in character. It has also been assumed that, although he should at least know what care his car must regularly receive in order to render the best possible performance with the fewest possible interruptions, the typical Cadillac owner prefers to depend upon the maintenance station for occasional adjustments and repairs.

By thus omitting both that which is very elementary and that which is too technical, the first two divisions of the Manual have been made to include only information that is vital to every Cadillac owner regardless of his previous motoring experience. Part I, "Operation," is important because, no matter what car the owner may have driven before, his new car will differ in some feature, even from an earlier Cadillac. Part II, "Lubrication and Care," contains information that every owner should have regardless of the extent to which he expects to delegate the care of the car to others. Especially should he be familiar with lubrication, for correct lubrication is an essential without which it is impossible for the car to render unfaltering performance.

Part III, "General Information," may be considered as a supplement to the Manual. It contains information that may never be required by some owners, but that is included for use should occasion arise. In other words, it is a reference section.

All written instructions are subject to limitations. The owner is asked to remember that the Manual is only one means by which the Cadillac organization desires to assist the Cadillac owner to realize the most from his car. Cadillac distributors and dealers everywhere invite the Cadillac owner to consult them on any matters pertaining to the operation and care of his car. If preferred, a request for information may be made direct to the factory, where it will receive the attention of the Technical Department.

Contents

Part I—Operation

Part II—Lubrication and Care

Part III—General Information

PART I

OPERATION

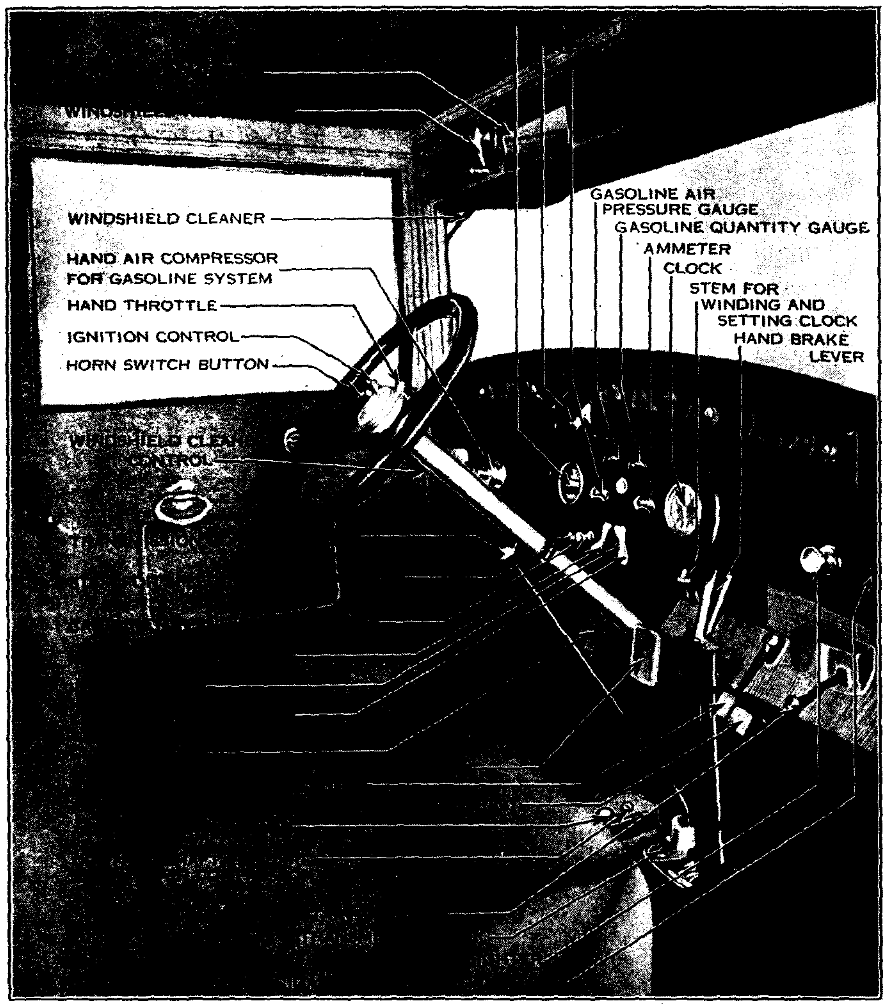

FIGURE 1. ***Instruments and controls***

CHAPTER I

Controls and Instruments

One of the first things the driver of a new car has to do is to familiarize himself with the various controls. In the following chapter are described the levers, pedals, instruments, and other devices used in the operation of the car. The experienced motorist, as well as the beginner, should read this chapter to avoid overlooking any detail of operation in which the car may differ from cars he has previously driven.

Locks

The Cadillac car is provided with the following cylinder locks, all of which on any one car are operated by the same key: ignition switch, transmission control lever, tool compartment, battery compartment, tire holder, and, on closed cars, the doors and various package compartments.

The lock on the switch acts only on the ignition or left-hand lever, which must be *down* in order to be locked. The transmission control lever can be locked in neutral or in any one of the four other positions of the lever.

Gasoline Gauges and Air Compressor

The two upper dials on the instrument panel (Fig. 1) are gauges for the gasoline system. The gauge at the right marked "Gas" indicates in gallons the quantity of fuel in the tank at the rear of the car, and is operated electrically.

The gauge at the left marked "Air" is a pressure gauge and indicates in pounds per square inch the air pressure in the gasoline system. This pressure is necessary to force the fuel from the tank to the carburetor.

Initial pressure is secured by operating the hand air compressor at the left-hand end of the instrument board. While the engine is running, pressure is automatically maintained by a compressor driven by the engine camshaft.

The normal pressure maintained by the automatic compressor is from one to two pounds. There is sufficient pressure for starting the engine when the car is on level ground, if the gauge pointer is even one division away from the pin at zero. On a steep upgrade an initial pressure of one pound may be necessary.

In order to prevent leakage of the air pressure in the gasoline system it is important that the gasoline tank filler cap be air-tight. After screwing on the filler cap be sure to tighten the thumb screw in the center of the cap.

Before operating the hand compressor, the plunger must be released by turning the handle counter-clockwise. When the necessary pressure has been

obtained, push the compressor handle all the way in and lock it, turning it clockwise as far as it will go.

Throttle Control

The power and speed of the engine are controlled by opening and closing a throttle valve in the carburetor. This throttle is operated both by a hand lever and a foot pedal.

The foot pedal, or accelerator, is at the right of the brake pedal (Fig. 1). The hand control is the right-hand lever of the two levers above the steering wheel. Both controls operate the same throttle; the hand lever, however, remains in the position to which it is moved, whereas the accelerator must be held down to keep the throttle open.

The normal position of the throttle hand lever for driving the car is all the way up. In this position the throttle of the carburetor is open just enough to permit the engine to run at idling speed after it is warm. For starting, however, the lever should be moved approximately one-fourth the way down, and should be left in this position until the engine is warm enough to permit the lever to be returned to the idling position without stalling the engine.

The throttle should normally be controlled by the accelerator. In starting the car on a hill, however, the hand lever should be used rather than the accelerator. This permits the brake pedal to be released with the right foot at the same time that the clutch is engaged with the left.

In cold weather, the accelerator should not be pushed down suddenly before the engine is warm. Sudden opening of the throttle before the engine is warm causes "popping-back" in the carburetor. This should be avoided as much as possible by judicious opening of the throttle during the warming-up period. (See page 32 under "Use of Accelerator Before Engine is Warm.")

The accelerator can be used in cold weather to prime the carburetor by pushing the accelerator to the floor once or twice. This is not necessary except in very cold weather and should never be done more than twice; otherwise gasoline may overflow from the carburetor. (See page 31 under "Priming the Carburetor.")

Ignition Control Lever

Correct timing of the ignition in relation to the positions of the pistons is accomplished automatically by a governor which is a part of the timer-distributor and which provides for all ordinary advancing and retarding of the spark. (See page 66 under "Timer-Distributor.") A hand control is also provided for still farther advancing or retarding the spark on certain occasions as hereafter described.

The hand control is the left-hand lever of the two levers above the steering wheel. For average driving, the correct position of this lever is about one-

third down from the extreme top or advanced position. The lever should be left in this position except on the following occasions:

1. If the engine is being cranked by hand, the lever should be moved all the way down. If this is not done, a "kick-back" may occur resulting in personal injury.
2. In pulling at low speeds with the throttle well open, the lever should be moved farther down.
3. In driving at high speeds, the lever should be moved all the way up.
4. In starting the engine in extremely cold weather, the lever should be moved all the way up unless the engine is being cranked by hand.

Carburetor Enriching Button

The button at the left of the ignition switch lever (Fig. 1) controls a device on the carburetor for temporarily enriching the fuel mixture supplied to the engine. In starting the engine it is necessary to have the proportion of liquid gasoline in the fuel mixture greater than at other times because in a cold mixture only a part of the gasoline is vaporized. Pulling out the enriching button increases the proportion of liquid gasoline to air, the normal proportions being restored when the button is released and permitted to return to its original position.

Correct use of the enriching control not only is essential to quick starting of the engine, but also has an important bearing on the life of the engine. The enriching button must be pulled out far enough in starting to provide an explosive mixture quickly so that the battery is not unnecessarily discharged by useless cranking. The button must also be held out far enough during the warming-up period so that the engine will run without missing and "popping back." On the other hand, it should not be pulled out any farther or held out any longer than is necessary to accomplish these results, because some of the excess liquid gasoline in the enriched mixture does not burn.

If the engine still retains heat from previous running, the enriching control should not be used without first attempting to start the engine on the normal mixture. If the enriching button is pulled out for starting a hot engine the mixture may be made so rich that starting will be impossible.

The enriching button is not a priming device. It has no effect whatever on the fuel or the fuel mixture unless the engine is being cranked or is running under its own power. The button must be pulled out and held partly out during the cranking operation.

Ignition and Lighting Switch

The ignition and lighting switch (Fig. 1) controls the current for the ignition and for the following lamps: headlamps, instrument lamp, and rear

lamp. The ignition lever is the left-hand lever and has two positions: "off," when down, and "on," when up. The lighting lever is the right-hand lever and has four positions. Starting with the lowest position, these are:

First Position—All lights off.

Second Position—Parking lights, instrument lamp and rear lamp.

Third Position—Headlamp lower beams, instrument lamp and rear lamp.

Fourth Position—Headlamp upper beams, instrument lamp and rear lamp.

Cadillac headlamp bulbs have two filaments, one above the other, instead of the customary single filament. Both filaments are of the same candle-power (21), but because they are located in different positions with respect to the focus of the parabolic reflector, the beam of light from one filament is projected at a different angle from the other. When the switch lever is in the fourth position, the lower filaments are lighted and the beams are projected straight ahead, illuminating the road at a distance. When the lever is in the third position, the upper filaments are lighted and the beams are projected down at an angle, illuminating more brightly the road directly in front of the car.

The practice to be followed by the driver in using this double-beam feature of the headlamps will depend upon the regulations imposed by local authorities. In general, it is expected that the upper beams will be used except on the following occasions: when passing a vehicle approaching from the opposite direction, when rounding a sharp curve and when topping the crest of a hill. On these occasions and at other times when illumination is desired directly in front of the car, the lower beams should be used. For a further description of the headlamps, see page 68.

Starter Pedal

The starter pedal is at the right of the accelerator (Fig. 1). Pushing this pedal forward brings into action the electric motor that cranks the engine for starting. *Do not push the starter pedal when the engine is running.*

The starter pedal is only one of the controls that must be manipulated to start the engine. Unless there is an explosive mixture in the cylinders and a spark to ignite it, it is useless to crank the engine. The starter pedal should not be operated, therefore, until the necessary preliminary steps have been taken. The following, in their proper order, are the various steps that must be performed to start the engine. As each control is mentioned, reference is made to the page on which that control is explained in detail.

1. Unlock the transmission. (Page 9.)
2. Unlock the ignition switch. (Page 11.)
3. Make sure that the transmission control lever is in neutral. (Page 15.)

4. Note whether pressure is indicated on the gasoline pressure gauge; if not, operate the hand compressor. (Page 9.)
5. Place the ignition control lever at the steering wheel about one-third* the way down. (Page 10.)
6. Place the throttle lever about one-fourth the way down from the idling position. (Page 10.)
7. *Cold Weather Only*—In extremely cold weather, prime the carburetor by pushing the accelerator to the floor once or twice, but not more than twice. (Page 10.)
8. Pull back the carburetor enriching button unless the engine is still warm. If the engine is still warm, do not pull back the enriching button unless the engine fails to start on the normal mixture. (Page 11.)
9. Switch on the ignition. (Page 11.)
10. Push the starter pedal forward and hold it until the engine starts under its own power. Release it immediately as soon as the engine starts. (See below for probable causes for the engine failing to start.)
11. Let the carburetor enriching button partly in as soon as the engine starts, and all the way in as soon as the engine is warm enough to permit it. (Page 11.)
12. Note whether pressure is indicated on the oil pressure gauge and stop the engine at once if no pressure is indicated. (Page 14.)
13. Move the throttle lever up to the idling position as soon as the engine is warm enough to permit it.

In cold weather, disengage the clutch before pressing down the starter pedal, and hold it down during the cranking operation. This relieves the starter of the necessity of turning the transmission gears, which are immersed in lubricant. The additional load is small in warm weather when the lubricant is thin, but in cold weather the power required to turn the gears through the thickened lubricant adds unnecessarily to the demand upon the battery.

If the Engine Fails to Start—If the engine fails to start after being cranked for a few seconds, do not continue to operate the starter. To do so is a useless expenditure of battery energy. Release the starter pedal and investigate the cause, which may be one of the following:

No fuel in the tank.

No air pressure in the gasoline system.

Ignition not switched on.

Carburetor flooded by unnecessary use of enriching device when engine is warm.

---

*In extremely cold weather move the ignition control lever all the way up unless the engine should be cranked by hand. If the engine is cranked by hand, be sure to move the ignition control lever all the way down.

Oil Pressure Gauge

The lower left-hand dial on the instrument panel (Fig. 1) is the oil pressure gauge. This gauge indicates, not the *quantity* of oil in the engine, but the *pressure* under which the oil is forced to the engine bearings.

When the engine is not running, the pointer on the oil pressure gauge should remain at zero, but as soon as the engine is started and as long as it runs the gauge should show pressure. If the gauge does not show pressure when the engine is running, stop the engine at once and determine the cause. Serious damage may be done if the engine is run without oil pressure. (See page 41 under "Oil Pressure.")

The amount of the pressure indicated by the gauge depends upon the speed of the engine, the viscosity of the oil, and the adjustment of the oil pressure regulator. At idling speed with fresh oil of the correct viscosity, the pressure after the engine is warm should be 5 to 7 lbs. Before the engine is warm, higher pressures than those specified will be indicated. After the oil has become thin from use, lower pressures than those specified will be indicated. These are normal variations from the standard and do not indicate need for readjustment of the oil pressure regulator.

Clutch Pedal

The clutch pedal is the left-hand pedal. When this pedal is in its normal or released position, the clutch is engaged. The flywheel of the engine is then coupled to the transmission by a series of discs, every other one of which is faced on both sides with friction material, and which are pressed together by a powerful spring. When the clutch pedal is pushed down, the spring is compressed and the clutch discs are allowed to separate. The clutch is then disengaged and the flywheel, if the engine is running, revolves independently of the transmission.

The clutch has two uses: First, to enable the car to be started gradually and without jerk or jar; second, to permit shifting of the transmission gears. The operation of the clutch pedal is discussed in connection with the transmission control on page 15. Further comment is unnecessary at this point except the following suggestions to the driver:

Do not drive with the foot resting on the clutch pedal. The Cadillac clutch operates so easily that even the weight of the driver's foot may unintentionally cause the clutch to slip.

Do not form the practice of disengaging the clutch whenever the brakes are applied. Most occasions for use of the brakes require only slowing down without stopping or even shifting of gears. A skilled driver will not touch the clutch pedal until the car is just about to stop or until he is about to shift to a lower gear. It is a mistaken idea that applying the brakes with the clutch engaged is more severe on the brake lining. The opposite is actually

the case, proof of which is in the fact that in coasting down grades the resistance of the engine is used to assist the brakes in controlling the car speed.

It will be observed in operating the clutch pedal that the pedal offers almost no resistance until it has been moved about one inch. It is at this point that it actually begins to disengage the clutch. It is important that the pedal have this "lost motion." If the full pressure of the clutch spring is felt just as soon as the pedal is moved from its released position, necessity for readjustment of the pedal connections is indicated. Failure to make this adjustment will result in the clutch slipping. (See page 72.)

Transmission Control

The Cadillac transmission has three forward speeds and reverse. It is controlled by a lever, the handle of which describes the letter "H" as it is moved from one position to another. It should be observed by those who have driven other makes of cars that, although most cars have this conventional H-type of transmission control, all these cars do not have the same positions of the lever. The driver should study Fig. 2 carefully, and if the various positions of the lever are different from those to which he has been accustomed, he should master the new arrangement before attempting to drive.

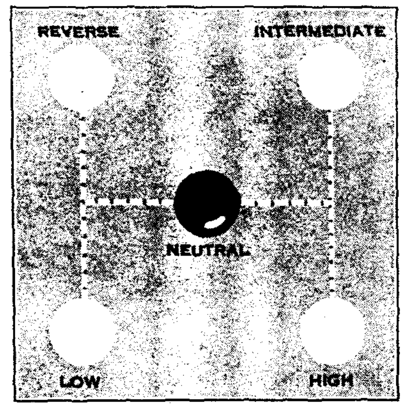

FIGURE 2. ***Positions of transmission control lever***

No attempt can be made here to teach the beginner the technique of gear shifting. It is recommended that the beginner secure individual instruction from the Cadillac distributor or dealer from whom the car was purchased and who will be glad to give this instruction. There are, however, certain rules and suggestions for the operation of the transmission control that it will be to the advantage of every driver to learn or to recall if he already knows them.

Always disengage the clutch before moving the control lever and hold the pedal down until the shift is completed.

Do not attempt to start the car with the transmission control in high gear.

Do not start with the transmission control in intermediate except when the car is on a smooth level road or on a down grade; even under these conditions do not start the car in intermediate unless the engine is thoroughly warm.

Do not make any of the following shifts when the car is moving:

From reverse to any forward gear.

From any forward gear to reverse.

From high gear to low gear.

From intermediate to low gear (except when the car is moving very slowly.)

In shifting from high to intermediate, the car should not be traveling faster than fifteen miles per hour and the control lever should be moved very quickly and with no hesitation in neutral.

There are times when it is desirable to be able to shift from high to intermediate at higher car speeds. It is possible to do this by the following method, which is called "double de-clutching":

Disengage the clutch and shift the transmission control lever at once to neutral. Re-engage the clutch at the same time accelerating the engine; then disengage the clutch again and instantly shift to intermediate, after which re-engage the clutch. The speed to which the engine should be accelerated while the transmission control is in neutral depends upon the speed at which the car is traveling when the shift is made.

It is not recommended that the driver attempt the double de-clutching method until he has become expert in shifting from high to intermediate in the usual manner at lower speeds.

Make a practice of shifting the transmission control to intermediate or even to low before commencing the descent of steep grades. The reason for this is explained on page 19, where will also be found further suggestions for coasting.

Brakes

The foot brakes, which consist of external brake bands on the rear wheels and internal bands on the front wheels, are operated by the right-hand pedal. This pedal differs from the conventional brake pedal in a construction that provides automatically for notifying the driver when re-adjustment of the brakes is necessary. Every driver is familiar with the fact that, as the brake lining wears, the brake pedal must be pushed farther toward the floorboard to apply the brakes. On most cars this proceeds until an occasion arises for an emergency stop and then it is found that the pedal goes all the way to the floorboard before the brakes are fully applied.

The Cadillac brake pedal has two stages in its travel. The first stage, which consists of the first four or five inches of the pedal travel, is sufficient for all ordinary stops when the brake band clearance is properly adjusted. When, as the result of wear on the lining, the pedal must be pushed farther toward the floorboard, an inch or inch and a half from the floorboard the second stage of pedal travel is reached. In the second stage, the pedal has somewhat less leverage than in the first stage and the point of division is marked by increased resistance to movement of the pedal. This serves as a notice to the driver that the brakes require readjustment. If it is not convenient to have the adjustment made at once, the brakes can still be operated for some time. The adjustment should be made, however, as soon thereafter as possible.

The hand brakes, which are internal brakes on the rear wheels, are operated by the hand lever at the right of the transmission control lever.

Speedometer

The speedometer has three dials. The upper dial indicates the speed of the car. The center dial indicates the total mileage traveled. The lower dial also indicates mileage, but it can be reset to zero by pushing up and turning the knurled stem back of the instrument board. The right-hand figure on the lower dial indicates tenths of a mile.

An automobile repairman should never be permitted to attempt to adjust or repair the speedometer head or to replace the glass. This work can be done only by men experienced in speedometer work and only with special machinery and tools. If the speedometer head is removed, handle it as carefully as a fine watch. The speedometer head may easily be damaged by rough handling.

Ammeter

The lower right-hand dial on the instrument panel (Fig. 1) is the ammeter, which measures the electric current flowing to the battery and the current flowing from the battery at all times except when the starter is cranking the engine. When current is flowing from the battery, the ammeter shows a reading on the side marked "Discharge"; when current is flowing to the battery, the ammeter reading is on the "Charge" side.

The ammeter should indicate on the "Charge" side most of the time. Otherwise, more current will be taken out of the battery than is put into it and the battery will eventually become fully discharged. The exact amount of current that should be indicated by the ammeter at any time depends upon various conditions, which are explained on page 62.

Ordinarily, when no lights are in use, the ammeter should show "Charge" as soon as the car is running ten or twelve miles per hour in high gear. If the ammeter indicates "Discharge" with all lights off, either when the engine is not running or when the car is running more than twelve miles per hour in high gear, need for readjustment of the generator is indicated.

CHAPTER II

Driving

THE preceding chapter of the Manual has aimed to familiarize the driver with the controls and instruments used in operating the car. Actual skill in driving is, of course, more than knowledge of and familiarity with these individual devices. It is not the purpose of this Manual to discuss all phases of driving, but there are a few matters of sufficient importance to Cadillac owners to warrant devoting a chapter to them.

Driving Speed When Car is New

The parts of the Cadillac car are machined and ground to secure the most accurate fit and the finest finish. Proper functioning of the assembled mechanism is further assured by testing the engine and chassis both on shop dynamometers and on the road. Nevertheless, it is not possible by manufacturing processes and tests to give to bearing surfaces the fine polish that results from continued operation at moderate speeds and loads.

Until a new car has been driven far enough to produce this effect on the bearing surfaces, the car should not be driven at high speeds. It is recommended that the car be driven no faster than twenty miles per hour for the first two hundred and fifty miles, and no faster than twenty-five miles per hour for the second two hundred and fifty miles. Moderate driving during the first five hundred miles will increase the life of the car more than enough to repay any inconvenience. Manufacturers of locomotives and stationary steam engines have always recognized the necessity for an initial "running-in" period.

Danger of Running Engine in Closed Garage

Every person having to do with the operation or care of a motor car should be warned of the danger that attends running the engine while the car is in a small closed garage.

Carbon monoxide, a deadly poisonous gas, is present in the exhaust of all internal combustion engines. Most people are already familiar with carbon monoxide in the form of illuminating gas, or in the gas produced by furnaces and stoves when insufficient air is supplied to give complete combustion. But illuminating gas and coal gas have an unpleasant odor, which serves as a warning, whereas carbon monoxide, as produced in the internal-combustion engine, is colorless, tasteless, and almost odorless, so that the victim may be overcome before he is aware of the danger.

When the engine exhausts into the open air, the carbon monoxide is so

diluted that it has no effect. It is when the engine is run for a time in a closed room that the proportion of carbon monoxide in the air may increase to the point at which continued breathing of it would be fatal. The United States Public Health Service advises that the average automobile engine warming up in a single-car garage will give off enough carbon monoxide in three minutes to endanger life.

Unusual precaution must be taken in cold weather when the natural tendency is to keep the garage doors and windows closed. The practice of letting the engine warm up before running the car out of the garage is unsafe. The risk is made greater by the fact that the enriching of the mixture by manipulation of the carburetor enriching device increases the amount of carbon monoxide formed.

Coasting

To coast *on the level*, simply release the accelerator pedal and disengage the clutch. If coasting to a stop, the transmission control may also be shifted to neutral and the clutch re-engaged.

In coasting *down grades*, however, it is recommended that the transmission be left in gear and the clutch engaged. With the throttle in the idling position, the car is thus made to drive the engine, the resistance of which assists the brakes and saves wear on the brake lining. It must be remembered that the brakes are subjected to much more severe use on grades than on the level because gravity acts continuously, whereas on the level the brakes need absorb only the momentum of the car. Even on slight grades, coasting with the transmission in neutral or the clutch disengaged is not advisable. On any grade steep enough to warrant coasting, it is worth while to save the brakes as much as possible by utilizing the braking effect of the engine.

Ordinarily, the resistance offered by the engine when the transmission is in high is sufficient to control the speed of the car, supplemented by moderate use of the brakes. On steep grades, however, the transmission control should be shifted to intermediate or even to low if the grade is very steep. Shifting should always be done before commencing the descent of the grade, because, after the car has once gained speed, considerable braking may be necessary to slow down to the speed at which the shift can be made easily.

Do not switch off the ignition when coasting with the car driving the engine. Contrary to a common impression, this does not appreciably increase the resistance and is likely to cause damage to the engine. Even with the throttle closed, some fuel is admitted to the cylinders and if this is not burned it condenses on the cylinder walls and washes off the oil by which the pistons are lubricated.

General Driving Suggestions

Road and traffic laws vary greatly in different localities. It is unfortunately impossible to set down a complete list of rules that may be followed in all parts of the country. The following are some of the rules that are universal in practically all parts of the United States:

In meeting a vehicle going in the opposite direction pass to the right.

In overtaking a vehicle going in the same direction pass to the left.

Always stop with the right-hand side of the car next to the curb. If it is necessary to turn the car around to do this, it should be done.

Never turn around or turn off on another road without making absolutely certain that there is no other vehicle directly behind.

Never start to cross street car tracks without making sure that there is no car directly behind. No matter how sure you feel, look and see.

Do not cross street car or steam railroad tracks without making certain that it is absolutely safe to do so. At any railroad crossing that is on an up grade or which for any reason must be approached very slowly, it is a wise precaution to shift to intermediate gear before crossing because the car can thereby be accelerated more quickly, if necessary.

In crowded traffic do not apply the brakes suddenly unless it is absolutely necessary. A vehicle following may not have brakes as efficient as Cadillac four-wheel brakes.

On wet asphalt streets or slippery roads do not apply the brakes suddenly unless it is absolutely necessary. Cadillac four-wheel brakes minimize the possibility of skidding under these conditions, but their effectiveness should not induce anyone to drive less carefully.

Slow down in passing vehicles going in the opposite direction.

Never take a chance.

Don'ts for General Operation

Don't fail to change the engine oil as frequently as recommended.

Don't fail to release the carburetor enriching button as soon after starting as possible.

Don't fill the lubricating system of the engine alone and neglect to lubricate all other parts of the car.

Don't neglect the lubrication of any part of the car.

Don't run the car at sustained high speed when it is new.

Don't allow the clutch to engage suddenly.

Don't prime the carburetor too much.

Don't attempt to shift from neutral to any gear, or from one gear to another gear, without first disengaging the clutch.

Don't attempt to shift from the reverse gear to any other gear when the car is moving.

Don't attempt to shift from any forward gear to the reverse gear when the car is moving.

Don't attempt to shift from the high gear to the low gear when the car is moving.

Don't attempt to shift from the intermediate gear to the low gear when the car is moving, unless it is moving very slowly. Ordinarily it is best to stop the car altogether.

Don't switch off the ignition when coasting with the car driving the engine.

Don't push the starter pedal when the engine is running.

Don't turn the steering gear when the car is standing. This is not only unnecessary but is also bad practice. The front wheels pivot more easily if they are rotating.

Don't fail to investigate any unusual sound which may develop in the car. The car should be inspected at a Cadillac maintenance station.

Don't neglect to inspect the level of the acid in the storage battery every 500 miles and add distilled water if necessary.

Don't turn corners at high speed.

Don't neglect to keep the cooling system filled.

Don't drive fast or attempt to stop suddenly on wet pavements.

Don't attempt to start the engine with the switch turned off, without air pressure or without gasoline in the tank.

Don't neglect to keep the tires inflated properly.

Don't race the engine when it is not driving the car. There is no worse abuse.

CHAPTER III

Equipment

THE controls and instruments used in driving have already been described. In addition to these the car is equipped with various devices which are for the convenience and comfort of the occupants, and are used only as occasion demands. It is suggested that the driver anticipate his use of such equipment by becoming familiar at once with the directions contained in this chapter.

Windshield and Ventilation

Closed Cars—Cadillac closed cars are equipped with a one-piece windshield, which can be moved up and down. Movement of the glass is controlled by a handle above the windshield. To raise the glass, the handle should be turned clockwise, and to lower the glass the handle should be turned counter-clockwise.

For moderate ventilation, the windshield should be raised not more than one inch so that the lower edge of the glass is still below the ledge over the instrument board. With the windshield in this position, air is deflected into the driving compartment through an opening in the cowl just forward of the instrument board. For additional ventilation, the windshield can be raised above the level of the ledge over the instrument board, and air then enters directly into the car.

Open Cars—Cadillac open cars are equipped with a cowl ventilator which is operated by a lever just in front of the instrument board and at the right of the steering column. Additional ventilation for warmer weather can be secured by manipulating the windshield.

The open-car windshield is in one section, which is pivoted at the upper corners. To secure more ventilation than can be obtained through the cowl ventilator, the windshield should be tilted in toward the driver. A fixed stop prevents the windshield from striking the steering wheel. If still greater ventilation is desired, the windshield can be tilted out.

The thumb screws on the windshield supports must be loosened before adjusting the position of the windshield and must be tightened to hold it in the desired position.

Windshield Cleaner

The windshield cleaner is attached to the car outside and above the windshield. It is operated by the suction or vacuum in the passages between the carburetor and the engine, and is controlled by a lever on the instrument board. (Fig. 1.) The lever has three positions: in the extreme right-hand position, the cleaner is shut off; in the center position, the cleaner operates slowly; and in the left-hand position, the cleaner operates at its full speed.

Rear Vision Mirror

The rear vision mirror may be adjusted by the driver to suit his preference, after loosening the clamp screws that hold the mirror to its supporting bracket.

Cigar Lighter and Inspection Lamp

The car is equipped with a combination cigar lighter and inspection lamp that makes use of a single reel with twelve feet of flexible cord attached to the back of the instrument board. The flexible cord ends in a bayonet type socket to which may be attached either the inspection lamp or the heating element of the cigar lighter. The method of attachment is identical with that of an ordinary lamp bulb. Ordinarily the cigar lighter is carried in place in the socket on the cord and the inspection lamp in a stationary socket provided on the front of the dash, where it is useful to illuminate the engine.

To use the cigar lighter pull it out from the instrument board at least a foot, wait a few seconds for the heating element to heat and apply it to the cigar or cigarette. The current is automatically switched on as soon as ten or twelve inches of the cord has been unreeled. To light a pipe, remove the nickel plated shield by turning it slightly counter-clockwise and pulling it straight off.

To lock the cord in any desired position, pull out the button on the instrument board at the right of the cigar lighter (Fig. 1). This engages a ratchet which prevents the reel from rewinding. To rewind the cord, press the button back to its original position.

The inspection lamp socket on the dash has a double bayonet lock with two sets of slots. Normally, the pins on the lamp engage the first or outer set of slots and in this position the current is not switched on. To switch the current on, turn the lamp slightly counter-clockwise, press in, and turn it clockwise again, engaging the pins in the second or inner set of slots. To switch off the light, turn the lamp counter-clockwise and pull it out of the socket far enough to engage the first set of slots.

Clock

The clock has an eight-day movement and is wound in the same manner as a watch. The stem is under the clock back of the instrument board.

Side Curtains

The side curtains, with which the open cars are equipped, are carried in an envelope provided with cloth partitions to prevent rubbing and chafing. The Touring car curtains are stowed under the front seat; the Phaeton curtains in a compartment back of the front seat, with a door opening in the tonneau; the Roadster curtains in the package compartment just back of the seat.

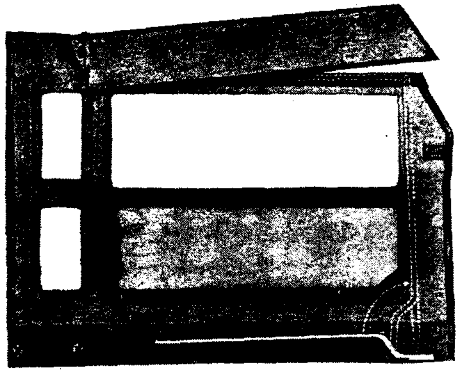

FIGURE 3. ***Side curtains***

The Touring car and Phaeton curtains are in six sections, each of which is marked to indicate its position, as "Left Front," "Right Center." The front and center sections on both sides are each provided with a rod, the lower end of which fits a socket in the top of the door. When a curtain is folded for stowing, this rod is parallel with the bottom of the curtain as shown in Fig. 3. Before the curtain can be attached to the door, the rod must be moved to the position shown by the dotted lines. The upper end of the rod is slotted to engage with the stiffener that runs along the upper edge of the curtain.

The rear sections should be applied first, followed by the center and front sections. The rear sections should be fastened to the rear bows *under* the side flaps of the permanent rear curtains.

Before stowing the curtains, they should be dry and clean.

Curtain Fasteners

Most of the curtain fasteners used on the top and side curtains are of the type illustrated in Fig. 4. When this type of fastener is snapped on its stud, it becomes locked on three sides. To release the fastener it must be lifted on the side that is not locked. This side is indicated by the small projection to which the arrow points in Fig. 4. This type of fastener cannot be released by lifting it at any other side. The remainder of the fasteners used on the top and curtains are of the usual glove type.

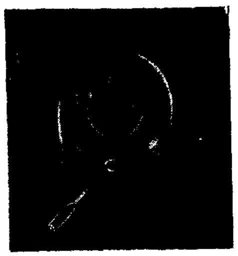

FIGURE 4.
Curtain fastener

Tools

The compartment for carrying the tool equipment is just forward of the right-hand running board. The lock on this compartment is operated by the switch key. The following are the tools comprising the standard equipment. The numbers refer to the numbers by which the tools are designated in Fig. 5.

1. Open end wrenches (two) for adjusting rear foot brakes
2. Small screw driver
3. Socket wrench for oil pan drain plug
4. Large screw driver
5. Center punch
6. Cold chisel
7. Hammer
8. File
9. Pliers
10. Distributor wrench (with gauge for adjusting timer contact points and spark plugs)
11. Distributor wrench (plain)
12. Bicycle wrench
13. Monkey wrench
14. Wrench for rim clamping nuts
15. Rim assembling tool
16. Wrench for spark plugs and compression relief cocks
17. Adapter for grease gun for lubricating clutch thrust bearing
18. Grease gun
19. Hand starting crank
20. Hub cap wrench
21. Oil can
22. Jack handle
23. Jack
24. Hose for tire air compressor
25. Small tool bag
26. Large tool bag
27. Lubrication chart
28. Operator's Manual

Tires

Tire Valve Caps

The valve caps used with some makes of tires are a combination dust and valve cap. This type of cap can be removed and installed without screwing the cap the entire length of the threads on the valve stem.

To remove one of these valve caps, turn it two or three turns counterclockwise. This loosens the sliding nut inside the cap. (Fig. 6). Next, pull the cap up as far as it will go. Then remove the cap by unscrewing it the rest of the way.

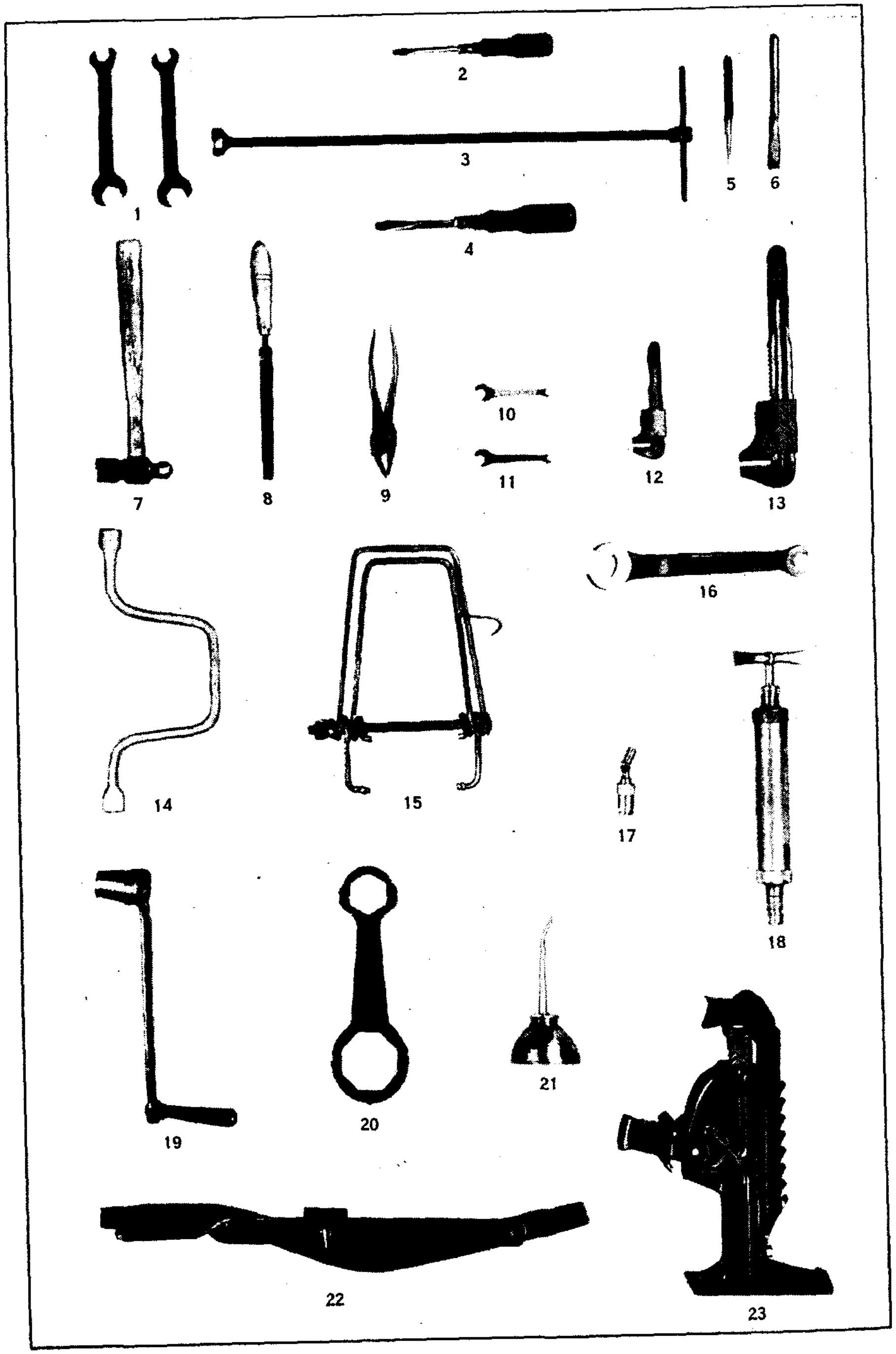

FIGURE 5. ***Standard tool equipment***

To install a valve cap, place the cap over the valve stem and turn it a few turns clockwise to engage the threads in the sliding nut. If the sliding nut is too far inside the cap to be reached by the valve stem, shake the nut down by tapping the bottom of the cap on some solid object. When the valve stem has been started in the sliding nut, push the cap down over the stem as far as it will go. Then turn the cap until it locks tightly.

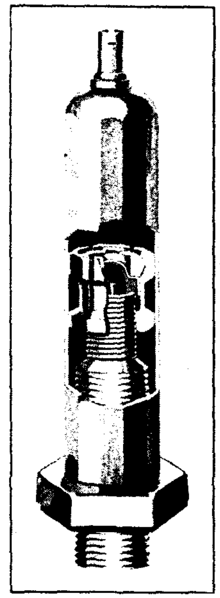

FIGURE 6
Tire valve cap

Inflation Pressure

For normal driving, the 33 by 6.75 low pressure tires, which are standard equipment on Cadillac cars, should be inflated to a pressure of 40 lbs. per square inch. The inflation pressure should be checked at least weekly and should not be permitted to drop more than 5 lbs.

On cars driven at high speeds, the front tires should be inflated to 45 lbs. or higher if necessary. *This is important.*

Tire Air Compressor

To use the tire air compressor with which the car is equipped, proceed as follows:

Turn back the left-hand side of the front carpet and lift the small oval-shaped cover which is in the floor just to the left of the transmission control lever. Reach through the hole in the floor and remove the knurled cap from the connection on top of the compressor. Connect one end of the air hose (in the tool equipment) to this connection and the other end of the hose to the valve of the tire to be inflated. *Do not connect the hose to the tire first if there is pressure in the tire.*

The control shaft by which the compressor driving gear is placed in mesh with the transmission gears projects through a small hole in the floor just in front of the large hole over the compressor. To start the compressor, if the engine is running, disengage the clutch and hold the pedal down until the transmission gears have ceased to revolve. Then, with a screw driver, turn the slotted head of the compressor control shaft clockwise. If the engine is not running, simply turn the control shaft clockwise without disengaging the clutch and then start the engine.

The compressor gives best results when the engine runs at a speed of approximately 1,000 r.p.m., which is about three times the normal speed of the engine when idling. Do not race the engine in operating the compressor, or, for that matter, at any other time when it is not driving the car. Racing the engine beyond the recommended speed not only decreases the efficiency

(Continued on page 30)

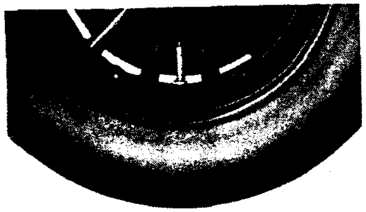

Figure 7a

Jack up the axle until the tire clears the ground. Unscrew the dust cap and the clamping nut from the tire valve stem.

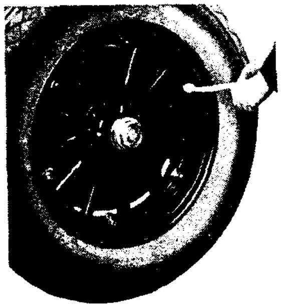

Figure 7b

With the brace wrench, supplied in the tool kit, loosen the six rim clamping nuts. Turn each clamp so that the lug is away from the rim and tighten the nut enough to hold the clamp in this position.

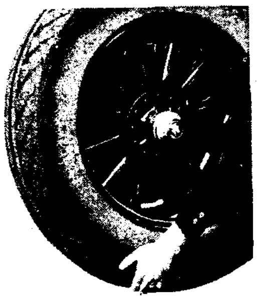

Figure 7c

Rotate the wheel so that the valve stem is at the top, and pull the bottom of the rim away from the wheel.

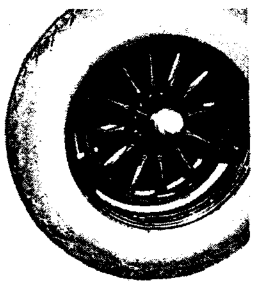

Figure 7d

Rotate the wheel until the valve stem approaches the bottom. At the point shown in the illustration, the rim and tire will roll free from the wheel and can be removed without lifting.

FIGURE 7. ***Removing rim with tire from wheel***

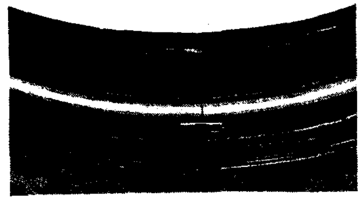

Figure 8a

If the rim has no split clamping ring, take the one from the rim removed. The correct position for the ring is just inside the three lugs and with the split opposite one of the lugs. If the ends of the ring overlap, they can be sprung into place with a screw driver.

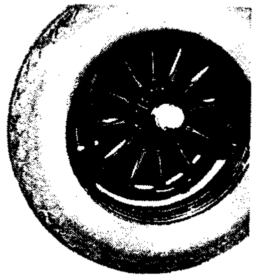

Figure 8b

Rotate the wheel so that the hole for the valve stem is in the position shown. Hold the rim so that the three lugs are on the side away from the car and insert the valve stem into the hole in the wheel.

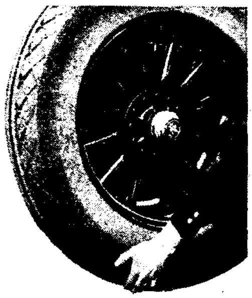

Figure 8c

Rotate the wheel, which will carry the rim with it, until the valve stem is at the top. Then push the lower part of the rim into place.

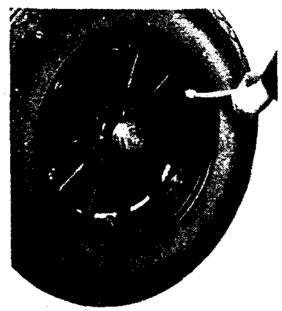

Figure 8d

Turn each rim clamp so that the lug is over the clamping ring, drawing the nut down until the end of the bolt is flush, or nearly so, with the outer surface of the nut. Then go over the six nuts again, tightening them firmly. (See page 30 in regard to truing up the rim on the wheel.) Install the valve stem clamping nut and the dust cap. It is important that the clamping nut be firmly tightened.

FIGURE 8. ***Installing rim with tire on wheel***

of the compressor, but is one of the worst forms of abuse. To stop the compressor, turn the control shaft counter-clockwise.

Do not turn the compressor control shaft to start the compressor when the engine is running and the clutch is engaged.

Tire Holder

The tire holder is designed to carry either one or two standard size tires mounted on rims and inflated. Each rim has on it three lugs which are located so as to engage with notches on the support arms and on the adjustable clamp. There are two sets of these notches.

When two rims are carried, the rim nearest the car should be placed so that the side with the lugs is away from the car and the lugs should be inserted in the inner set of notches. The outer rim should then be placed so that the side with the lugs faces toward the car and the lugs of this rim should be inserted in the outer set of notches.

When only one rim is carried, the side of the rim with the lugs should face away from the car and the lugs should be inserted in the outer set of notches.

The tire holder lock is in the upper end of the clamp screw and is protected by a dust cap which must be unscrewed to insert the key. Turning the key clockwise disengages the lock, permitting the clamp screw to be turned.

To lock the tire holder, screw the clamp down firmly against the rim or rims. Adjust the clamp screw handle so that it points squarely across the car. Then turn the key counter-clockwise. Care should be exercised in removing or replacing a spare tire not to strike the body of the car.

Changing Tires

If a spare rim with inflated tire is always carried on the tire holder, the driver will seldom or never have occasion to disassemble a tire from the rim. In case of tire trouble it is then merely necessary to remove the rim with tire from the wheel and to install on the wheel the spare rim and tire. Illustrated directions for making this change are on pages 28 and 29. Disassembly of the tire from the rim is necessary only if the tire is to be repaired or a new one installed. Directions for this work, which is usually left to the repair shop, will be found on pages 78 and 79. Never attempt to remove a tire from its rim without first deflating the tire.

Truing Up Rim

If a rim does not run true, it may be trued up in the following manner: Rotate the wheel slowly and mark the part that runs farthest out from the face of the wheel. Loosen slightly the nuts diametrically opposite the mark and then tighten the nuts on the marked side. Test the wheel again and if it still does not run true repeat the operation.

CHAPTER IV

Cold Weather Operation

THE Cadillac car is an all-season car and no owner need hesitate to make full use of his car in severe winter weather as well as at other times. It is necessary in freezing weather, however, to observe certain precautions and to follow a somewhat different procedure, particularly in starting the engine. In this chapter has been grouped all the information relating to operation of the car during cold weather. It should be reviewed just prior to the beginning of the winter season.

Starting the Engine

Carburetor Enriching Button

The first difference between starting the engine in cold weather and starting the engine in warm weather is in the greater use of the carburetor enriching device necessary in cold weather. Gasoline does not vaporize as readily at low temperatures, and in order to supply the cylinders with a gaseous mixture rich enough to be ignited, the proportion of liquid gasoline to air must be increased.

At the same time it is important not to apply the enriching device more than is necessary. The unvaporized gasoline collects on the cylinder walls and works down past the pistons, washing off the lubricant as it goes. Although dilution of the oil supply with this unburned gasoline is minimized in the Cadillac engine by an exclusive system for ventilating the crankcase (see page 42), it is best to avoid an excess of liquid gasoline in the combustion chambers by careful and judicious use of the enriching device.

The following rule should govern the use of the enriching button in winter weather: Pull the enriching button back just as far as it is necessary to start the engine, but as soon as the engine starts, let the button return as far as possible without causing the engine to stop or slow down. Then release the button entirely as soon as the engine is warm enough to permit doing so.

Priming the Carburetor

In extremely cold weather, if the engine does not start after cranking for a few seconds with the enriching device fully applied, release the starter pedal. Then prime the carburetor by opening and closing the throttle once or twice rather rapidly with the accelerator. Opening and closing the throttle operates

a throttle pump on the carburetor and raises the level of gasoline in the carburetor bowl. Do not open and close the throttle more than twice or gasoline will overflow from the carburetor.

Position of Throttle Hand Lever

The correct position of the throttle hand lever for starting in cold weather is the same as for starting under other conditions, that is, about one-fourth the way down from the idling position. In warm weather, however, the lever may be returned to the idling position almost as soon as the engine is started. In cold weather, the throttle must be left slightly open until the engine becomes warm.

Position of Ignition Control Lever

Unless the weather is extremely cold, the correct position of the ignition control lever for starting is the same as that recommended on page 10, that is, about one-third the way down. In extremely cold weather, however, the lever should be moved all the way up for starting, unless the engine should be cranked by hand, in which case the lever should be moved all the way down.

It is the practice of some drivers to move the ignition control lever all the way down whenever starting the engine. This is the correct position if the engine is to be cranked by hand, but if the engine is to be cranked with the starter, there is no reason for retarding the spark, and in extremely cold weather "popping back" in the carburetor is less likely to occur if the spark is fully advanced.

Use of Starter

In extremely cold weather, when the car has been standing long enough to become thoroughly chilled, it is a good plan to disengage the clutch during the cranking operation. If this is not done, the starter is called upon to turn the jackshaft gears in the transmission in addition to cranking the engine. At ordinary temperatures, the additional energy required is negligible, but in extremely cold weather, the lubricant in the transmission offers sufficient resistance to rotation of the transmission gears to increase considerably the demand upon the battery and to retard the cranking speed.

Use of Accelerator Before Engine is Warm

In cold weather, after the engine has been started and before it has run long enough to become warm, the engine cannot deliver its normal power and it should not be called upon to do so. In accelerating the engine to start the car and in accelerating the car after the transmission is in gear, do not open the throttle suddenly or too far. To do so is not only to invite "popping back" in the carburetor, but to increase the amount of excess unvaporized gasoline in the combustion chambers, both of which results are undesirable. For this reason also, starting in intermediate should never be attempted in cold weather.

Additional Cold Weather Suggestions

Engine Oil for Cold Weather

All engine lubricating oil is more viscous at lower temperatures than at higher temperatures. An engine oil of the proper viscosity for summer weather will not flow freely at freezing temperatures, and will not lubricate the cylinders and bearings properly until the engine is warm. If the oil congeals it also offers considerable resistance to cranking of the engine, causing a severe drain on the battery, and retarding the cranking speed.

In cold weather, therefore, it is essential that an oil be used that has a sufficiently low cold test. The light grade of the Cadillac Motor Oil is recommended generally for winter use. If in doubt as to a suitable oil for cold weather, consult an authorized Cadillac maintenance station.

Strainers in Gasoline System

During cold weather, it may be found necessary to remove and clean the strainers in the gasoline line (see page 58) more frequently. An accumulation of water at these points that would have no bad effect in warm weather might freeze in cold weather and prevent the gasoline from flowing to the carburetor.

Anti-Freezing Solutions

In freezing weather, the water in the cooling system must be replaced with some solution that has a lower freezing temperature than that of water. A solution of alcohol and water or of glycerin and water is recommended. Solutions containing calcium chloride or other ingredients injurious to the metal parts of the cooling system should never be used.

Alcohol and Water

The following table gives the freezing temperatures of solutions of denatured alcohol and water:

Denatured Alcohol (Parts by volume)	Water (Parts by volume)	Freezing Temperature (Degrees Fahr.)
1	4	10°
1	3	0°
1	2	−10°
1	1	−25°

Alcohol is more volatile than water and an alcohol solution tends to decrease in strength. It is a good plan, if an alcohol anti-freezing solution is used, to test a sample occasionally with a hydrometer. Hydrometers graduated to indicate the freezing temperature of the solution can be obtained.

Glycerin and Water

The following table gives the freezing temperatures of solutions of commercial glycerin and water:

Glycerin (Parts by volume)	Water (Parts by volume)	Freezing Temperature (Degrees Fahr.)
1	3	20°
1	2	12°
1	1	0°
3	2	−4°

Capacity of Cooling System

The capacity of the cooling system is five and one-half gallons.

Effect of Alcohol on Finish

Strong solutions of alcohol have a harmful effect on the finish. In adding pure alcohol or solutions containing 50 per cent or more alcohol, extreme care must be used not to let the liquid spatter or spill. A funnel and a pouring vessel with a suitable spout are necessary. Especially avoid pouring cold alcohol into very hot water. The effect of this is to make the mixture foam up and possibly bubble over on the finish.

PART II

LUBRICATION AND CARE

Cadillac 4000-Mile Lubrication Schedule

Note: Engine oil must be added whenever the oil level indicator ball drops to "Fill," regardless of the changing of oil specified every 2000 miles on the schedule. The oil level should be checked every 100 to 150 miles.

	Explanation: The figures and letters following the items in this column refer to the chassis lubrication diagram, Fig. 11	Refer to page	Lubrication No. and Mileage at which due							
			1	2	3	4	5	6	7	8
			500	1000	1500	2000	2500	3000	3500	4000
1, 3, 5, and 7	Grease gun connections: G	45	O	O	O	O	O	O	O	O
1, 3, 5, and 7	Spring leaves: 2, 10, 13, 23	48	O	O	O	O	O	O	O	O
1, 3, 5, and 7	Add water to storage battery	63	O	O	O	O	O	O	O	O
LUBRICATION Nos. 2 and 6	Universal joints: 16, 17	46		O		O		O		O
LUBRICATION Nos. 2 and 6	Generator and distributor oil cups: 20, 21, 22	45		O		O		O		O
LUBRICATION Nos. 2 and 6	Engine rear supports: 7, 19	45		O		O		O		O
LUBRICATION Nos. 2 and 6	Steering column oil holes: 4	47		O		O		O		O
LUBRICATION Nos. 2 and 6	Brake pins and connections	77		O		O		O		O
LUBRICATION Nos. 2 and 6	Door hardware	48		O		O		O		O
LUBRICATION Nos. 2 and 6	Gasoline strainers and settling chambers*: 1, 5, 9	58		O		O		O		O
LUBRICATION NUMBER 4	Drain and replace engine oil: 24	43				O				O
LUBRICATION NUMBER 4	Transmission‡—add lubricant: 18	46				O				O
LUBRICATION NUMBER 4	Rear axle‡—add lubricant: 14	46				O				O
LUBRICATION NUMBER 4	Steering gear—add lubricant: 8	47				O				O
LUBRICATION NUMBER 4	Speedometer drive shaft	47				O				O
LUBRICATION NUMBER 8	Clutch thrust bearing: 6	45								O
LUBRICATION NUMBER 8	Transmission‡—drain and replace lubricant: 18	46								O
LUBRICATION NUMBER 8	Rear axle‡—drain and replace lubricant: 14	46								O
LUBRICATION NUMBER 8	Wheel bearings—clean and repack: 3, 11, 15, 25	46								O
LUBRICATION NUMBER 8	Front brake trunnions: 12, 26	47								O
LUBRICATION NUMBER 8	Clean horn commutator	48								O
RECORD	Speedometer Reading									
RECORD	Date									

*More frequently in cold weather.
‡Change to light grade of lubricant at beginning of cold weather and to heavy grade of lubricant at beginning of warm weather, regardless of mileage.

FIGURE 9
Lubrication schedule

CHAPTER I

Systematic Lubrication

Necessity for Lubrication

Lubrication has made machinery possible. Without it the destructive effects of friction would render the most ingeniously designed mechanism useless. Especially is this so of the gasoline engine, in which heat of combustion is added to that of friction. Absence of lubrication for even a brief instant while the engine is running would heat the surfaces in contact to the melting point.

But it is not enough to know that friction, unrestrained by lubrication, is capable of ruining an engine in less time than it takes to tell it. No motorist expects to run out of oil. What is frequently not fully appreciated is that, if improper lubricants are used and are infrequently applied, friction is still a powerful destructive agent capable of shortening the useful life of the car from years to months.

The quiet, dependable operation of a new car is primarily the result of the accurate finishing of surfaces separated from each other by a few thousandths of an inch. In the Cadillac, there are hundreds of such surfaces. If the clearances between these surfaces are to be maintained, so that the car will continue to operate quietly and dependably, friction must be prevented from taking its toll in wear.

Cadillac engineers have provided for the lubrication of all surfaces where friction is a factor. The most that a manufacturer can do, however, is to provide a place for the lubricant and means for it to reach the surfaces to be lubricated. The car cannot be equipped with an inexhaustible supply of lubricant. Upon the car owner devolves the responsibility of replenishing the supply at the proper time with lubricant of the prescribed specifications.

Because of the importance to the car owner of proper lubrication of his car, every effort has been made in this Manual to give explicit information for his guidance. Lubricants are prescribed for each point requiring lubrication, directions are given for applying the lubricant, and recommendations are made as to the frequency with which the lubricant should be applied. All this information is based upon actual operation of Cadillac cars over hundreds of thousands of miles.

Lubrication Schedule

Lubrication is effective only insofar as it is regular and systematic. To be systematic, lubrication must be performed at regular mileage intervals. The

Cadillac technical staff has accordingly developed for the Cadillac car a complete lubrication schedule which, if faithfully followed, will insure for each bearing surface ample, but not superfluous, lubrication. This schedule is shown in Fig. 9.

The unit of the Cadillac lubrication schedule is 4,000 miles, which is divided into eight 500-mile intervals. Corresponding to these is a series of eight consecutive groups of lubricating operations. When the car has traveled 500 miles, the points enumerated under Lubrication No. 1 should receive attention. At 1,000 miles, Lubrication No. 2 is due, and so on until at 4,000 miles Lubrication No. 8 should be performed. At 4,500 miles the schedule begins again with Lubrication No. 1.

In order that the driver may be continually reminded of the mileage at which the next lubrication is due, it is recommended that a lubrication notice be used. Cadillac distributors and dealers can supply a gummed notice to be affixed to the speedometer just below the total mileage dial. This notice has two blank spaces upon which are to be written the number of the lubrication next due and the mileage at which it is due. If this notice is used, the driver need only glance occasionally at the speedometer and compare the mileage on the dial with the figures on the notice in order to plan for the necessary attention.

Cadillac distributors and dealers are prepared to sell lubrication based on this schedule. A car that is being lubricated on the schedule can be taken to any authorized Cadillac maintenance station, and without further ordering than to specify "Schedule Lubrication," the car will receive the necessary attention.

The schedule in Fig. 9 is in outline form. Detailed information as to the location of the points to which lubricant is to be applied, the method of lubricating, and the kind and amount of lubricant will be found in Chapters VI and VII. For each point on the schedule, two reference numbers are given: the number of the page on which detailed directions will be found and the number designating the point on the chassis lubrication diagram, Fig. 11.

The schedule is the most effective aid to systematic lubrication that has been devised. Used in conjunction with a notice on the speedometer cover glass, it reduces lubrication to the simplest possible terms. Whether the car is lubricated in the owner's private garage or in a Cadillac authorized maintenance station, it is strongly urged that this schedule be followed from the first mile of operation.

Lubricants

The selection of proper lubricants for the Cadillac car is one of the first concerns of the owner in his attention to the lubrication of his car.

The lubricants must not only be of high quality, but their viscosity and other characteristics must be suited to the Cadillac car. The difficulty of securing suitable lubricants on the open market has induced us to provide lubricants under the Cadillac trade mark. These lubricants are prepared according to specifications prescribed by the Cadillac technical staff and are based upon hundreds of actual tests. Cadillac lubricants include the following and can be obtained from Cadillac distributors or dealers:

Cadillac Engine Oil—Light, Medium and Heavy
Cadillac Rear Axle and Transmission Lubricant—Light and Heavy
Cadillac Roller Bearing and Cup Grease
Cadillac Universal Joint Grease
Cadillac Steering Gear Lubricant

Engine Oil

Except in extremely hot or extremely cold weather, the medium grade of Cadillac Engine Oil is recommended. In extremely hot weather, the heavy grade should be used and in freezing weather, the light grade.

The names of other engine oils approved for use in the Cadillac engine will be supplied by our Technical Department on request.

Rear Axle and Transmission Lubricant

The heavy grade of Cadillac Rear Axle and Transmission Lubricant should be used except in cold weather. The light grade should then be used. If the heavy grade is used in cold weather the transmission gears will be difficult to shift.

The names of other lubricants suitable for use in the Cadillac rear axle and transmission will be supplied upon request.

Roller Bearing and Cup Grease

Cadillac Roller Bearing and Cup Grease is recommended for the wheel bearings and for all points for which grease gun connections are provided, with the exception of the steering gear and the universal joints. In the absence of Cadillac Roller Bearing and Cup Grease, No. 3 cup grease may be used for the grease gun connections and No. 1½ cup grease for the wheel bearings.

Universal Joint Grease

Cadillac Universal Joint Grease is recommended for the universal joints on the drive shaft. In its absence a No. 3 fibre grease may be used.

Steering Gear Lubricant

Cadillac Steering Gear Lubricant is recommended for lubricating the steering gear worm and sector. In its absence, use a mixture consisting of 75 per cent rear axle and transmission lubricant and 25 per cent cup grease.

CHAPTER II

Engine Lubrication

Oil Circulating System

The supply of engine oil is carried in the pressed steel reservoir that covers the bottom of the crankcase. The oil is forced to the bearings by a gear pump attached to the right-hand side of the engine toward the front and driven by a spiral gear on the crankshaft.

The pump draws the oil from the bottom of the oil pan and delivers it under pressure to a supply pipe running the length of the engine parallel with the crankshaft. From this supply pipe, three leads branch off to feed the three main bearings. A fourth lead connects the supply pipe to the oil pressure regulator which is attached to the crankcase just back of the right-hand cylinder block. A fifth lead at the front end of the supply pipe directs a stream of oil upon the spiral gears. A separate passage drilled through the crankcase conducts oil direct from the pump to the camshaft front bearing from which the oil enters the hollow camshaft and is carried to the other camshaft bearings and to the distributor driving gear.

At the oil pressure regulator there are four paths for the oil to follow:

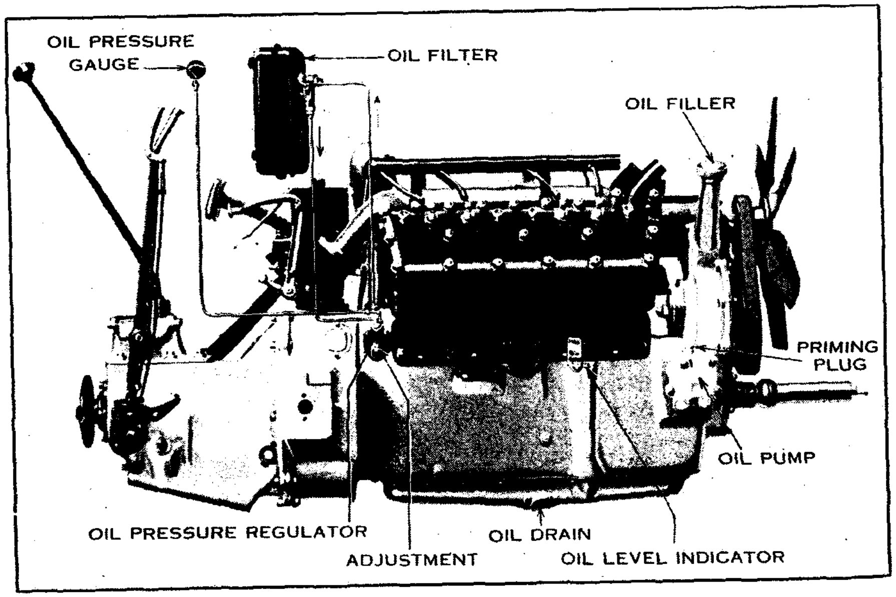

FIGURE 10. *Engine lubrication features*

two through passages within the regulator and two through outside connections. The first passage is a small by-pass which leads back to the crankcase and which has an adjustable metering screw. Oil flows through this by-pass whenever the engine is running. The second passage leads to a valve which is under spring tension and which does not open until the pressure in the supply pipe reaches approximately 30 lbs. Oil passing this valve also flows back to the crankcase.

The T-connection on the outside of the oil pressure regulator leads to the pressure gauge on the instrument panel and to the oil filter on the dash. Oil flows through the filter whenever the engine is running, the filtered oil being returned to the oil pressure regulator and thence to the crankcase.

The crankpin bearings are fed from the main bearings through ducts in the crankshaft. Oil thrown from the crankpins as the crankshaft revolves becomes a fine mist or spray which pervades the interior of the crankcase and cylinders and lubricates the pistons, piston pins, cams, camslides, and rollers.

The valve stems are automatically lubricated by oil sprayed from two small holes drilled in the wall of each cylinder at such a distance from the bottom of the cylinder that, when the piston is at the bottom of its stroke, these holes register with a groove in the piston between the second and third piston rings. As the piston descends on the power stroke, oil collects in this groove and as soon as the groove registers with the holes, the pressure of the gases above the piston forces oil out upon the valve stems. Surplus oil collecting in the valve compartments is returned to the crankcase through drain passages.

All oil returns to the oil pan through a fine mesh screen placed above the oil pan and separating it from the crankcase.

Oil Level

The normal capacity of the oil pan is two gallons which fills it to the level of the screen above the pan. When the oil pan contains this amount, the oil level indicator on the right-hand side of the engine (Fig. 10) indicates "Full." As the oil level descends, the indicator indicates "Fill" and then "Empty." Oil should be added as soon as the indicator ball has dropped to "Fill." If the indicator indicates "Empty," under no circumstances should the engine be run until oil has been added.

The mileage interval at which oil must be added depends upon individual circumstances. *It is recommended that the oil level indicator be checked* every one hundred to one hundred and fifty miles, although it is improbable that oil will be required as frequently as this.

Oil Pressure

The pressure of the oil in the supply pipe is indicated by the oil pressure gauge on the instrument panel (Fig. 1). The purpose of the oil pressure gauge

is, first, to enable the driver to make sure that there is pressure whenever the engine is running, and second, to verify the adjustment of the oil pressure regulator.

It is absolutely necessary that there should be oil pressure just as soon as the engine starts and as long as the engine is running. If the oil pressure gauge does not indicate pressure as soon as the engine starts, stop the engine at once and investigate the cause. First, check the level of oil in the oil pan. If the level is above "Fill," prime the oil pump by removing the plug shown in Fig. 10 and pouring oil in through a funnel. Be sure to replace the plug before starting the engine. If, after priming the oil pump and starting the engine, the oil pressure gauge does not indicate pressure, stop the engine immediately and consult the nearest Cadillac maintenance station.

Before the adjustment of the oil pressure regulator can be verified, the factors affecting the viscosity of the oil must be standardized. The oil pressure changes with the viscosity, which in turn depends upon the kind of oil, the extent to which it has been thinned by use, and the temperature. It is therefore necessary that the oil be fresh and of the viscosity specified for the Cadillac engine. The engine must also be run long enough to become thoroughly warm. Under these conditions the pressure at idling speed (300 r.p.m.) should be from 5 to 7 lbs.

Adjustment of the pressure at idling speeds is made by the screw shown in Fig. 10. To increase the pressure, turn the screw clockwise; to decrease the pressure turn the screw counter-clockwise. This adjustment should be made while the engine is running.

Crankcase Ventilating System

In every internal combustion engine, seepage of vapors by the pistons takes place to some extent, permitting water vapor and other products resulting from combustion, as well as unburned gasoline, to enter the crankcase. Contamination of the lubricating oil from this source makes it necessary in most engines to replace the oil supply at frequent intervals.

Cadillac engines are equipped with an exclusive system to prevent the seepage vapors from entering the crankcase. To bring about this result, advantage is taken of the fact that the Cadillac crankshaft with its compensating weights acts naturally to draw air through an inlet in the left-hand side of the engine, building up within the crankcase a pressure slightly above atmospheric pressure. No outlet is provided in the crankcase itself but in the wall of each cylinder is a port connecting the space below the piston with the valve compartment. This port is open except when the piston is at the extreme bottom of its stroke.

The effect of this arrangement is as follows: The seepage vapors that pass the two upper piston rings are forced through slots milled in the circumference of the lower piston ring and through corresponding holes in the piston into the space inside the piston, where they are carried down as the piston descends. The vapors cannot enter the crankcase, however, because they are prevented from doing so by the pressure built up in the crankcase by the revolving crankshaft. Instead, the vapors are expelled through the port into the valve compartment. From the valve compartments the expelled vapors are conducted through flexible pipes underneath the car where they are discharged.

Oil Filter

Another source of contamination of the oil supply is dirt. In the Cadillac engine all solid matter in the oil is removed by means of a filter (Fig. 10) which is attached to the dash and which is connected to the oil circulating system.

The filter consists of a metal container in which is a series of eight envelopes made of special fabric. As the oil is forced through these fabric envelopes, the total area of which is over five square feet, it leaves all solid matter behind, returning to the engine as clean oil.

The filter is connected to the oil pressure regulator at the same point as the oil pressure gauge. Oil is thus forced to the filter whenever the engine is running and there is pressure in the oil lines. The normal flow when the filter is new is approximately one quart per minute so that an amount of oil equal to the entire capacity of the lubricating system passes through the filter every eight to ten minutes.

The filtered oil, which is returned to the oil pressure regulator and thence to the crankcase, leaves the filter through a sight-feed glass. When the filter is new, the stream of filtered oil visible through the glass should be about ⅛ inch in diameter. As dirt accumulates in the filter, the flow of oil gradually decreases. When the stream has diminished to the size of a pencil lead, the filter unit should be replaced. When checking the flow of oil through the sight-feed the engine should be warm and the throttle should be opened until the oil pressure gauge indicates approximately 15 lbs.

Under average driving conditions the filter unit should not require replacement for 12,000 to 15,000 miles. Filter units for replacement can be obtained from Cadillac distributors and dealers.

Replacing Engine Oil

Although the crankcase ventilating system and the oil filter described in the preceding sections greatly prolong the useful life of the oil, it is recommended that the oil be drained and replaced with fresh oil every 2,000 miles.

To drain the oil, simply remove the drain plug (Fig. 10). A special socket wrench for the oil pan drain plug is supplied as part of the tool equipment.

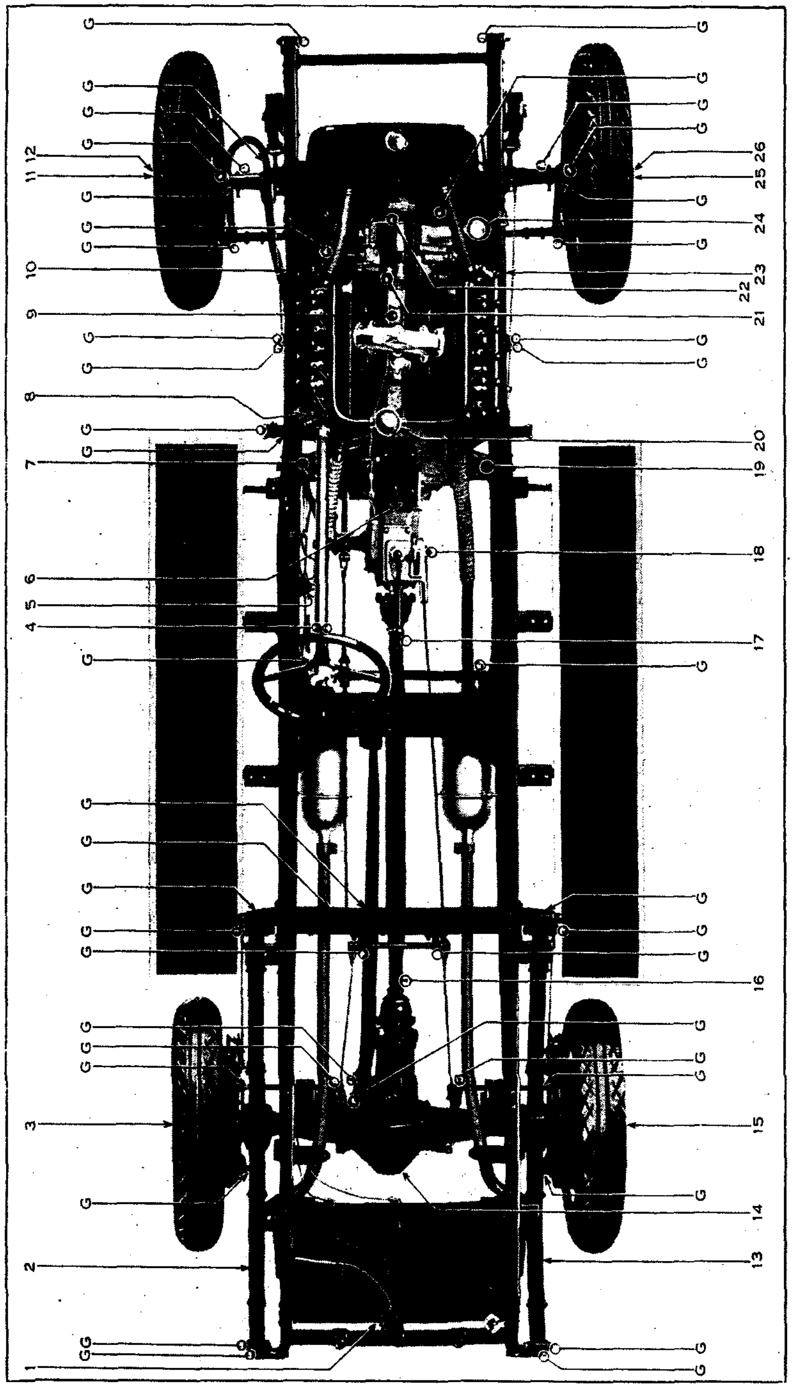

FIGURE 11. *Chassis lubrication diagram*

Each "G" indicates a grease gun connection. Each number indicates a lubricating point for which instructions are given in Chapters II and III. Lubricating points that are visible in the diagram are surrounded by circles, others are indicated by arrows.

Be sure to reinstall the drain plug before adding the fresh oil. Two gallons of fresh oil should be added, or enough to bring the oil level indicator ball to "Full."

At the end of the first 1,000 miles, it is recommended that the car be taken to a Cadillac maintenance station to have the oil pan and screen removed and cleaned with gasoline or kerosene. This should be repeated once a year or whenever the filter unit is replaced.

*Generator Oil Cups: 21, 22**

Two oil cups on the generator conduct lubricant to the forward and rear bearings on the armature shaft. A few drops of engine oil should be applied to each cup every 1,000 miles.

Timer-Distributor Oil Cup: 20

The oil cup at "20" is for lubricating the ball bearing at the upper end of the timer-distributor shaft. A few drops of engine oil should be applied every 1,000 miles.

Engine Rear Supports: 7, 19

The brackets on the frame to which the engine rear supports are bolted are provided with felt wicks. Engine oil should be applied at these points every 1,000 miles.

CHAPTER III

General Lubrication

Grease Gun Connections: G

Spring bolts, steering connections, brake rocker shafts and other points are provided with connections to fit the grease gun supplied with the tool equipment. These points are indicated by "G" in Fig. 11. Cadillac Roller Bearing and Cup Grease should be applied to these points with the grease gun every 500 miles.

Clutch Thrust Bearing: 6

The clutch thrust bearing is provided with a grease gun connection, which is accessible after removing the floor boards and the cover plate shown at

*The numbers following the headings in this chapter and in Chapter III refer to Fig.11.

"6." Before the grease gun can be applied to the connection, it is necessary to attach to the connection the adapter furnished with the tool equipment.

If the connection does not point upward so that the adapter can be applied, turn the bearing until it does. This must be done with the engine not running.

The clutch thrust bearing should be lubricated every 4,000 miles with Cadillac Roller Bearing and Cup Grease.

Caution: Do not inject too much grease into the clutch thrust bearing. One or two turns of the grease gun handle are sufficient.

Transmission: 18

The transmission case should contain sufficient lubricant to bring the level up to the filling hole at the right-hand side. The level should be inspected every 2,000 miles and lubricant added if necessary. Cadillac Rear Axle and Transmission Lubricant is recommended. The heavy grade should be used except in cold weather. The light grade should then be used. If the heavy grade is used in cold weather, the transmission gears will be difficult to shift.

Every 4,000 miles the drain plug should be removed from the bottom of the transmission case and the lubricant should be drained and replaced with fresh lubricant. Three quarts of lubricant are required to fill the transmission case to the proper level.

Universal Joints: 16, 17

The forward and rear universal joints on the drive shaft are provided with grease gun connections as indicated at "16" and "17." It may be necessary to roll the car forward or backward a few inches to bring the connections underneath where they can be reached with the grease gun. Cadillac Universal Joint Grease should be applied every 1,000 miles.

Rear Axle: 14

The rear axle housing should contain enough lubricant to bring the level up to the filling hole in the rear cover plate. The level should be inspected every 2,000 miles and lubricant added if necessary. Cadillac Rear Axle and Transmission Lubricant is recommended. The heavy grade should be used except in cold weather. The light grade should then be used.

Every 4,000 miles the drain plug should be removed from the bottom of the axle housing and the lubricant should be drained and replaced with fresh lubricant. Three and one-half quarts of lubricant are necessary to fill the rear axle housing to the proper level.

Wheels: 3, 11, 15, 25

The front and rear wheel bearings are packed in grease when the car is assembled. Every 4,000 miles all the wheels should be removed and the bearings should be thoroughly cleaned in gasoline or kerosene. They should then be repacked and the bearings adjusted in accordance with the directions on pages 80, 81 and 82.

Cadillac Roller Bearing and Cup Grease is recommended for the wheel bearings. Do not use heavy grease as it will roll away from the path of the rollers and will not return.

Front Brake Trunnions: 12, 26

Every 4,000 miles, at the same time that the wheels are removed for lubrication of the wheel bearings, the brake operating trunnions inside the front wheel brake drums should be lubricated by applying the grease gun to the connection at "A" (Fig. 12). Cadillac Roller Bearing and Cup Grease should be used. It should be injected only until it begins to appear around the trunnion bearings. Do not inject too much grease. Before replacing the wheels, wipe off any grease appearing around the trunnion bearings. Do not inject any grease at "A" except when the wheel is off and the application of too much grease can be definitely avoided.

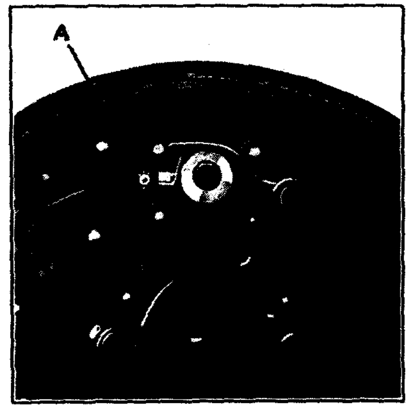

FIGURE 12
Lubrication of front brake trunnions

Steering Gear: 8

A grease gun connection is provided on the steering gear housing for injecting lubricant for the steering gear worm and sector. Cadillac Steering Gear Lubricant is recommended for the steering gear and it should be applied every 2,000 miles.

Oil Holes in Steering Column: 4

There are two oil holes in the steering column just below the steering wheel. A few drops of engine oil should be applied to these every 1,000 miles. The holes are closed by screw plugs which must be removed before the oil can be applied.

Speedometer Flexible Drive Shaft

The flexible shaft by which the speedometer is driven is housed in a flexible casing. To lubricate the speedometer drive shaft, the shaft should be removed from its casing and lubricant applied to it for its entire length. Cadillac Roller Bearing and Cup Grease is recommended for this lubrication, which should be performed every 2,000 miles.

Do not under any circumstances attempt to lubricate the speedometer itself. Any parts in the speedometer requiring lubrication are amply supplied when it is assembled.

Horn

The horn is lubricated when assembled and does not require further lubrication, but the commutator of the horn motor should be inspected every 4,000 miles and cleaned, if necessary. To do this, remove the motor shell from the horn. If the commutator appears to be dirty, clean it with a dry cloth. This should be done with the horn motor running so that the commutator will be cleaned on all sides. Do not attempt to polish the commutator or brushes with oil or vaseline. These parts are designed to run without lubricant.

Springs: 2, 10, 13, 23

To lubricate the spring leaves, it is recommended that the edges and ends of the leaves be painted with engine oil every 500 miles. A small stiff brush should be used. After applying the oil, the car should not be washed until it has been driven far enough to allow the lubricant to work in between the leaves. Do not separate the leaves and insert lubricant. A certain amount of friction between the spring leaves is necessary in order to give the springs the desired characteristics.

If spring covers are used, it is not necessary to lubricate the spring leaves as directed in the preceding paragraph.

Stabilators

The stabilators, with which the car is equipped and which are for the purpose of controlling the recoil of the springs, not only need no lubrication—they *must not* be lubricated. To lubricate the stabilators would defeat their purpose just as oil or grease on the brakes would prevent them from holding.

Door Hardware

Whenever the chassis is being lubricated, the door locks and other door hardware should also be lubricated as follows:

Place a few drops of oil on each door lock plunger or striker, turning the handle back and forth so that the oil will work into the lock. Also place a drop of oil on each of the striker plates against which the strikers engage when the doors are closed. The hinge pins should also be oiled sparingly so as not to get oil on the finish.

Each door has a wedge-shaped tongue that dovetails into a receptacle on the body when the door is closed. These tongues should receive a small amount of grease or oil.

Each closed car door is also fitted with a check at the top which limits the outward movement of the door. A small amount of grease should be applied to the pin that slides in the slot at the top of the door.

CHAPTER IV

Care of Body

Care of Finish When New

On cars finished with varnish, more careful and more frequent attention is necessary when the car is new than after the varnish has hardened. Particular care should be taken to keep mud from the body and hood for the first few weeks. Even after the varnish has hardened, mud should not be permitted to remain on the finish over night or long enough to dry. If it is not possible to wash the car thoroughly before putting it away for the night, flush it off and then thoroughly wash the car the next morning. Mud permitted to remain on the car until it has dried is not only difficult to remove, but stains and dulls the finish.

The same degree of caution, although commendable, is not as necessary on cars finished with Duco, because Duco hardens much more quickly than paint or varnish.

Washing Varnished Cars

Use clean water and plenty of it. Do not use water containing alkali. In parts of the country where the regular water supply contains alkali, use rain water.

Do not use hot water as it destroys the lustre. The temperature of the water should be between 40 and 60 degrees Fahrenheit. Do not wash the hood while it is hot, because the effect on the finish is the same as washing it with hot water. Unless the hood is allowed to cool before washing, the lustre will soon disappear.

If a hose is used in washing, do not have pressure greater than will carry the water six inches beyond the end of the hose. Water under higher pressure drives the grit and dirt into the varnish. It is best not to use a nozzle.

Wash the chassis first, going over the under sides of the fenders, the wheels, and the running gear with water flowing gently from the hose. This will flush off most of the mud and dirt.

If it is necessary to use soap to remove road oil from the under side of the fenders, or machine oil or grease from the chassis, use a good automobile soap dissolved in a pail of water and apply the soapy solution with a sponge.

Do not let this soapy solution remain on the finish more than two or three minutes, but immediately wash it off thoroughly with a soft carriage sponge.

After washing the chassis, begin at the front of the car, and flow water from the hose upon the body, hood, and upper surfaces of the fenders. This will soften the accumulation of road dirt, removing most of it. Then go over the car again and remove all dirt by rubbing lightly with a soft wool sponge, at the same time applying an abundance of water from the hose. The sponge, which should be kept exclusively for the body, hood, and upper surfaces of the fenders, should be rinsed frequently in clean water to remove any grit.

After the washing is completed, squeeze the sponge as dry as possible and pick up all water from crevices. Then thoroughly wet a clean soft chamois, wring it as dry as possible, and dry the finish. Be sure and use a chamois that has not been used on the chassis. Rinse the chamois and wring it out frequently. Do not rub the finish or apply more pressure than is necessary to dry off the surplus water. The remaining water will evaporate quickly, leaving the finish in good condition.

If it is desired to chamois the wheels and chassis, and they have become dry, wet these parts with clean water and then wipe them. Be sure to use a separate chamois for the chassis. The chamois that has been used on the body should be saved for the body exclusively.

Do not use soap, gasoline, kerosene, or anything of similar nature on the finish. Such materials attack the finish.

Washing Duco

Although it is not necessary in washing cars finished in Duco to use the same degree of care as in washing varnished cars, nevertheless the same general directions should be followed.

Cleaning Windows

Do not clean the window glass with preparations that may contain harmful ingredients. Use only cleaning compounds that are known to have no destructive effects on highly polished glass.

Cleaning Upholstery

To keep the upholstery in closed cars in the best condition, it should be cleaned thoroughly at least once a month with a whisk broom and vacuum cleaner. Dirt and grit accumulating in the fabric wear it out faster than use.

Spots on the upholstery may be cleaned with any good dry cleaner. When the cleaner has thoroughly evaporated, apply a hot flat iron wrapped in a wet cloth. Steaming the fabric and rubbing lightly against the nap will raise the nap to its normal position.

CHAPTER V

Care of Tires

EACH tire maker publishes a booklet with instructions for care and repair of tires. Every motorist should provide himself with one of these and thoroughly familiarize himself with the contents. The suggestions here apply to pneumatic tires in general.

Three-fourths of so-called "tire trouble" is the result of misuse. We give here some suggestions regarding the more important points of the care of tires.

Result of Under-Inflation

Under-inflation causes a tire to flatten out under load. This causes the side walls to bend sharply as the tire revolves. The result is the breaking of the side walls. An under-inflated tire is susceptible to bruise, broken cords and blow-out.

Result of Improperly Aligned Front Wheels

Running a car with the front wheels out of alignment causes rapid tread wear. This usually affects both tires similarly, although sometimes only one tire is affected. An incorrect adjustment of the front axle parallel rod or a bent steering arm is responsible for the condition. Unless the wheels are in proper alignment the treads of the front tires will wear away in a remarkably short time.

Neglect of Small Cuts

If cuts extending to the cords are neglected deterioration and blistering of the tire tread is the result. It is unnecessary to remove a tire to treat small cuts of this nature. Tire companies furnish a plastic compound for filling cuts. This prevents moisture and dirt from getting in. If a cut is large, it should be vulcanized at once.

Result of Improperly Adjusted Tire Chains

Tires are sometimes badly damaged through the use of tire chains which are incorrectly adjusted or which are fastened to the spokes of the wheel holding the chains tightly in place.

The least injury results when chains are applied loosely leaving play enough to permit them to work around. The wear on the tire is thus distributed evenly. Probably the greatest amount of injury comes from using chains unnecessarily on paved streets.

Result of Sudden Application of the Brakes

The sudden application of the brakes resulting in sliding the wheels causes the treads to wear away in spots. A tire will give away very rapidly under this severe treatment.

Additional Suggestions

The tires are constructed for the purpose of carrying up to certain maximum loads and no more. It should be realized that overloading a car beyond the intended carrying capacity is sure to materially shorten the life of the tires. Do not turn corners or run over sharp obstructions, like car tracks, at a high rate of speed. Such practice is sure to strain or possibly break the cords, with the result that the further life of the tires will be limited. Remember that most tire troubles are the result of abuse.

Avoid scraping the tires against the curb and running in ruts. This kind of wear scrapes off the rubber side wall and exposes the layers of cords to dirt and moisture, which soon starts to rot the cords.

In turning in a narrow street, avoid striking the curb.

If a tire goes flat without any indication of injury to the tire, see that the valve is not leaking. A little moisture on the tip will show bubbles if the air is escaping.

In case of puncture, the car should be stopped at once and the tube repaired or replaced, or the tire replaced by the extra one. The tire should also be examined carefully and the cause of the puncture ascertained and the nail, glass or whatever it may be, should be extracted. Before replacing the tire on the rim, examine the inside of the casing to see that the cause of the puncture is not still protruding. It is also advisable to look over the outside of the tires frequently and take out any pieces of glass or other particles which may have become imbedded in the casing.

Don't run in ruts or car tracks; the sides of a tire will soon wear out under such treatment. Avoid large stones or other obstructions in the road. To hit one of these may break the carcass even though no external injury be visible.

The garage floor should be kept free from oil or gasoline. The tires on a car left standing on a grease-covered floor deteriorate quickly, the natural enemies of rubber being oil and gasoline. These destroy the nature of the rubber, rendering it soft, so that it cuts and wears away quickly.

If the car is not used during the winter, it is better to remove the tires from the rims, keeping casings and tubes in a fairly warm atmosphere away from the light. It will be better to slightly inflate the tubes, as that keeps them very nearly in the position in which they will be used later on. If the tires are not removed and the car is stored in a light place, it will be well to cover the tires to protect them from the strong light, which has a deteriorating effect on rubber.

CHAPTER VI

Storing Car

IF THE car is not to be used for a period of several months, it should be protected from deterioration during the period when it is not in use by carefully preparing it for storage.

Engine

To prepare the engine for storage, proceed as follows: Run the engine until opening of the radiator shutters indicates that the engine is warm. This may be done by driving on the road or by running the engine idle. In the latter case, care should be taken that there is sufficient ventilation to avoid injury from carbon monoxide poisoning. (See page 18.)

After the engine is warm, place the car where it is to be stored and stop the flow of gasoline to the carburetor by removing the gasoline tank filler cap, thus relieving the air pressure. As soon as the engine starts to slow down, raise the polished aluminum cap on top of the carburetor and inject three or four tablespoonfuls of clean fresh engine oil into the carburetor. Injection of the oil will stop the engine.

Open the compression relief cocks by turning them counter-clockwise. Inject two or three tablespoonfuls of engine oil into each compression relief cock, and before closing the cocks crank the engine three or four revolutions with the ignition switched off. This will tend to distribute the oil over the cylinder walls. The engine should not be started again after injecting the oil. If it is started, it will be necessary to repeat the treatment.

Drain the cooling system by opening the drain valve in the water pump.

Storage Battery

If the car is to be stored during the winter, the storage battery should have special treatment in order to protect it against freezing.

Shortly before the car is used for the last time, distilled water should be added to bring the level of the solution up to the bottom of the fillers. (See page 63.) After the water added has had an opportunity to mix thoroughly with the acid solution, the specific gravity should be taken with a hydrometer. If the specific gravity of the solution is above 1.270 there will be no danger of the acid solution freezing. If, however, the specific gravity is below 1.270, the battery should be removed and charged. *Unless the battery is fully charged or nearly so it is probable that the acid solution in the battery will freeze and cause extensive damage.*

It is important that one of the battery leads should in all cases be disconnected during storage as a slight leak in the wiring will discharge the battery

and lower the specific gravity to the point where the solution may freeze.

If possible, the storage battery should be removed and charged from an outside source every two months during the storage period.

Tires

During storage of the car, it is best to remove the tires *from the rims* and to keep the casings and tubes in a fairly warm atmosphere away from the light. The tubes should be inflated slightly after the tires have been removed.

If it is not convenient to remove the tires from the car and the car is stored in a light place, cover the tires to protect them from strong light, which has a deteriorating effect on rubber.

The weight of the car should not be allowed to rest on the tires during the storage period. If tires are not removed, the car should be blocked up so that no weight is borne by the tires. The tires should also be partly deflated.

Body and Top

A cover should be placed over the entire car to protect it from dust. In storing an open car, the top should be up.

Taking Car Out of Storage

In putting into service again a car that has been stored, it is advisable, unless the storage battery has been removed and charged at periodic intervals, to remove the battery from the car and give it a fifty-hour charge at a four-ampere rate. If the battery has received periodic charges, or if the specific gravity is above 1.200, simply add distilled water to the proper level and connect the leads. If there is a greenish deposit on the terminals of the battery, remove this with a solution of bicarbonate of soda (common cooking soda) and water. Do not allow any of this solution to get into the battery.

Before starting the engine, drain the oil from the oil pan and remove and clean the oil pan and screen. After reinstalling the oil pan, add eight quarts of fresh engine oil. Fill the cooling system, being sure to use anti-freezing solution in freezing weather. Open the compression release cocks and inject two or three tablespoonfuls of engine oil into each cylinder. Close the compression release cocks, and, with the ignition switched off, crank the engine a few seconds with the starter to distribute the oil over the cylinder walls.

Start the engine in the usual manner. As soon as the engine starts, immediately let the carburetor enriching button go as far forward as possible without causing the engine to stop or slow down materially and then open the throttle until the ammeter reads approximately 10 with all lights switched off. While the engine is running lift the aluminum cap on top of the carburetor and inject from two to three tablespoonfuls of engine oil into the carburetor. It is a good plan to run the car outdoors as soon as this has been done. Release the carburetor enriching button entirely as soon as the engine is warm enough to permit it.

PART III

GENERAL INFORMATION

CHAPTER I

Engine

Important Features of Construction

The Cadillac engine is of the water-cooled, four-cycle type with two L-head cylinder blocks of four cylinders each, placed at an angle of ninety degrees between the blocks. The cylinders of one block are directly opposite those of the other block, the lower end of each connecting rod on the left-hand side working in the forked end of the connecting rod opposite. This construction makes the engine shorter and more compact than any other type, the smooth running being largely the result of the short, rigid crankshaft.

The crankshaft has four throws or cranks, three main bearings, and carries on its front end the sprocket by which the camshaft is driven. The camshaft has six bearings, and is driven by the crankshaft through a silent chain in which the proper tension is maintained by an automatically adjusted idler gear. The camshaft has sixteen cams, each operating one valve through a camslide in which is carried a roller.

The fan is mounted on the front end of the generator shaft, which is driven by the camshaft through a special V-shaped belt.

The water pump and oil pump are driven by a cross shaft, which in turn is driven by a spiral gear on the crankshaft. The water pump is at the left-hand end of the cross shaft and the oil pump at the right-hand end.

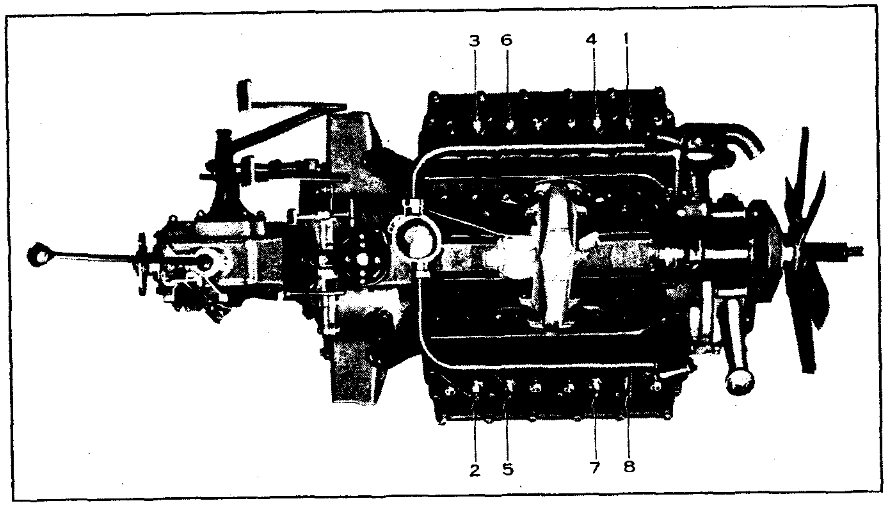

FIGURE 13. ***Firing order***

The engine base is the aluminum crankcase that supports the cylinder blocks and carries the crankshaft and camshaft bearings. The crankcase is supported at the rear end by two arms which are cast integrally with the crankcase and which are bolted to brackets on the frame. The front end of the engine is supported on a cross member of the frame below the radiator.

General Principle of Gasoline Engine

The production of power by the engine may be described briefly as follows:

Gasoline is fed by air pressure from the tank to the carburetor where it is mixed with air in the proper proportions to form an explosive vapor or gas. This gas is then drawn through the intake manifold and inlet valves into the cylinders of the engine where it is compressed by the pistons and then ignited by electric sparks. The pressure of the resulting explosions acting on the pistons produces the power.

The series of operations through which the pistons and valves of each cylinder must go to produce one power stroke is called a "cycle" and for such a cycle four strokes of each piston and two revolutions of the flywheel are required. The four strokes, each of which has a different function, take place in the following order:

Suction Stroke—The suction stroke commences with the piston at its highest point in the cylinder and with the inlet and exhaust valves closed. As soon as the piston starts to descend, the inlet valve immediately opens and a charge of gas is drawn from the carburetor through the valve opening into the space above the piston.

Compression Stroke—When the piston starts upward again after completing the suction stroke, the inlet valve closes. The gas, which has no means of escape, is compressed, the maximum compression being reached when the piston is at the top of its stroke.

Power Stroke—At the completion of the compression stroke, a spark, timed to occur at exactly the right instant, jumps between the electrodes of the spark plug and ignites the compressed charge of gas. The heat that results from the rapid combustion causes the pressure of the confined gas to rise almost instantaneously to several times its pressure before the explosion. This pressure, exerted on the piston, forces the piston down and produces the impulse which is transmitted by the connecting rod to the crankshaft, causing the crankshaft to revolve.

Exhaust Stroke—Just before the piston reaches the end of the power stroke, the exhaust valve opens. It remains open while the piston travels upward on the fourth, or exhaust stroke, driving the burned gas from the cylinders. By

the time the piston has reached its highest point it has forced out the burned gas and the exhaust valve closes. This completes the four strokes of the cycle and the piston is ready to draw in a new charge and to repeat the cycle.

Firing Order

Such a cycle as has been described takes place in each of the eight cylinders but no two pistons are at the same point in the cycle at the same time. In the Cadillac eight-cylinder V-type engine the impulses of the eight pistons are so timed that a power stroke is begun every quarter-turn of the crankshaft. The crankshaft thus receives four overlapping power impulses every revolution.

The order in which the eight cylinders fire is indicated by the numbers in Fig. 13. These numbers are the numbers used in marking the flywheel for valve and ignition adjustments.

CHAPTER II

Gasoline System

THE general arrangement of the gasoline system is illustrated in Fig. 14. There are two sets of tubes, one for air and one for gasoline.

The air tubes connect the automatic compressor at the left-hand front end of the engine, the hand compressor on the instrument board, and the air pressure relief valve, to the top of the gasoline tank. As described on page 9, the automatic and hand compressors are for the purpose of furnishing the necessary pressure to force the gasoline to the carburetor. The air pressure relief valve, which is fastened to the left-hand side of the frame under the front floor boards, prevents excessive pressure that might accompany the use of high-test or casing-head gasoline.

The gasoline line starts at the bottom of the gasoline tank and runs to a combination settling chamber and strainer from which tubes lead to the pressure gauge on the instrument panel and to the carburetor.

Settling Chambers and Strainers

The combination settling chamber and strainer in the gasoline line is attached to the left-hand side of the frame under the front floor boards. There is also a settling chamber at the bottom of the gasoline tank and a strainer at the point where the gasoline pipe enters the carburetor.

It is recommended that both settling chambers be drained and both strainers be cleaned regularly every one thousand miles. In freezing

weather it is advisable to do this more frequently as an accumulation of water at these points might freeze and prevent gasoline from flowing to the carburetor.

Before removing either settling chamber drain plug, or the strainer at the carburetor, first relieve the air pressure by removing the gasoline tank filler cap. Be sure there is no fire near.

To drain the settling chamber at the gasoline tank, remove the drain plug at the rear of the chamber as shown in Fig. 14. It is necessary to drain out only enough gasoline to flush the chamber.

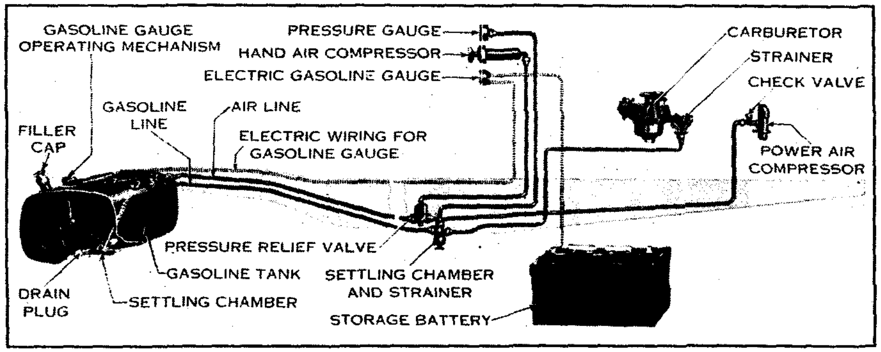

FIGURE 14. ***Gasoline system***

To drain the settling chamber in the gasoline line, remove the drain plug in the bottom of the chamber. While the plug is removed, the strainer, which is attached to the plug, should be carefully cleaned of any accumulated matter.

To clean the strainer at the carburetor, remove the six screws that fasten the cap on the strainer. Remove and clean the three gauze discs. In reinstalling the discs, be sure to place them in their original positions. The two discs with fine mesh gauze should be installed first.

Carburetor

The carburetor is correctly adjusted when the engine is assembled and, unless tampered with, should not require readjustment. It is unnecessary to change the adjustment for changes in season, weather or altitude.

Good carburetor action cannot be expected until the engine is thoroughly warmed. Imperfect carburetor action while the engine is cold does not indicate that the carburetor requires adjustment.

If adjustment of the carburetor seems to be necessary, it should, if possible, be made by an authorized Cadillac maintenance station. The adjustment should not be attempted by one unfamiliar with it.

CHAPTER III

Cooling System

Water Circulation

The Cadillac engine is cooled with water circulated through the jackets of the cylinder blocks by a centrifugal pump. This pump is mounted on the left-hand side of the engine near the front and is driven by a cross-shaft, which in turn is driven by a spiral gear on the crankshaft. The pump draws cold water from the bottom of the radiator and delivers it to a connection on the left-hand side of the engine where the stream divides, half going to the left-hand cylinder block and half through a passage in the crankcase to the right-hand cylinder block. From the front end of each cylinder head an outlet pipe with hose connection carries the heated water to the top of the radiator.

Radiator and Shutters

The radiator consists of an upper tank and a lower tank connected by water passages around the outside of which air is circulated by the fan. The water passages are so constructed that they expose a large amount of surface to the air, which cools the water as it passes from the upper to the lower tank.

Until the water in the cylinder blocks and radiator is warm, the cooling effect of the radiator is not only unnecessary, but is undesirable. The radiator is accordingly provided with shutters that prevent air from circulating around the water passages until the engine becomes warm. The shutters are pivoted vertically and are controlled automatically by a powerful thermostat contained in the upper tank of the radiator.

When the engine is cold, the shutters are held tightly closed and circulation of air is prevented. The water from the cylinders consequently undergoes little change in temperature as it flows through the radiator and the engine quickly becomes warm. As soon as the water entering the upper tank of the radiator reaches the temperature at which the engine operates best, the shutters are forced open by the thermostat and air begins to circulate. The resulting cooling effect checks the rising temperature of the water, which is thereafter maintained uniformly at the temperature of most efficient operation as long as the engine is running.

Filling and Draining the Cooling System

Except during freezing weather, water should be used in the cooling system. In freezing weather, a suitable anti-freezing solution such as those described on page 34 must be used.

To add liquid to the cooling system or to refill the cooling system after it has been drained, remove the radiator filler cap and pour the liquid in through the filler.

To drain the cooling system, open the drain valve at the bottom of the water pump by turning the hexagonal end of the valve counter-clockwise.

Cleaning the Cooling System

The cooling system should be drained and flushed every two or three months. This can be done in the following manner:

Run the engine until the opening of the radiator shutters indicates that the engine is warm. Stop the engine and immediately open the water pump drain valve.

If an alcohol anti-freezing solution is drawn off, part of it may be used again if the sediment is allowed to settle. If it is used, the specific gravity should be tested with a hydrometer after it has cooled thoroughly.

After the liquid has drained off, refill the cooling system with hot water and repeat the operation described above. If in draining the second time the water is very dirty it may be advisable to repeat the flushing operation a third time, placing one or two handfuls of sal-soda in through the radiator filler. The sal-soda must not be permitted to get on the finish of the hood or radiator. If sal-soda is used, the cooling system must be drained and flushed again before refilling for use.

CHAPTER IV

Electrical System

THE electrical system comprises the following units: The generator or source of electrical energy; the storage battery, which stores the current generated; the starting motor, which cranks the engine for starting; the ignition system; the lamps and other devices using electrical current; the ammeter; the ignition and lighting switch; and the circuit breakers, which protect the system. The wiring system connecting these units is the single wire or grounded type, the engine and frame forming one side of the electrical circuit.

Generation of Current

Generator

The generator is attached to the crankcase at the front of the engine and is driven by a specially made V-shaped belt from a pulley on the front end of the camshaft.

At very low engine speeds the voltage of the current generated is not sufficient to provide current for lighting or ignition and the battery is then the source of current. To prevent the battery at such times from discharging through the generator, a cut-out relay on the generator automatically opens the circuit whenever the generated voltage drops below the battery voltage. At approximately eight miles per hour the generated voltage is sufficient to operate the cut-out, which then closes the circuit between the generator and the battery and lighting circuits. If no lights are switched on, the entire output of the generator, less the current required for ignition, flows to the battery for recharging it. If all the lights are on, the generator will not generate sufficient current to start charging the battery until a speed of twelve to fifteen miles per hour is reached.

The amount of current generated by the generator at any instant is the ammeter reading (with all lights off) plus the current for ignition, which is two to three amperes. The generator output reaches its maximum at speeds between twenty and twenty-five miles per hour. This maximum should not exceed eighteen amperes, which is equivalent to an ammeter reading of sixteen when all lights are off.

Do not put oil on the commutator of either the generator or the starting motor.

Ammeter

The ammeter on the instrument board indicates the amount of current flowing to or from the battery except when the starter pedal is down and the starting motor is cranking the engine. When the engine is not running, the ammeter will indicate a current on the discharge side depending in amount upon the number of lights in use. The rate of charge or discharge when the engine is running depends upon the speed of the engine and the number of lights in use, and is equal in amount to the difference between the current generated and the current used by the lights, horn, ignition, and other electrical devices. The ammeter does not indicate the current used in cranking the engine.

If the ammeter should indicate "discharge" with the engine running at normal driving speed and with no lights in use, it is an indication of abnormal conditions and the electrical system should then be checked by a Cadillac maintenance station.

Storage Battery

The storage battery is a three-cell, six-volt Exide battery made especially for the Cadillac electrical system by the Electric Storage Battery Company, of Philadelphia, Pennsylvania. The battery compartment is just forward

of the left-hand running board. The hinged cover of the compartment is provided with a lock that is operated by the switch key.

Adding Water to Storage Battery

The battery is filled with a solution from which the water slowly evaporates and fresh distilled water must be added at intervals to maintain the correct level. The level should be inspected every 500 miles and distilled water should be added to bring the level up to the bottom of the fillers.

The battery compartment has been purposely made convenient of access to facilitate the adding of water. It is important in touring that nothing be placed on top of the compartment that would interfere with this regular attention.

Each cell is provided with a filler and filler plug. To remove a filler plug, turn it as far as possible counter-clockwise and then lift it straight up. To install it, set the plug in place and turn it clockwise until tight. If a plug is lost or broken, obtain a new one and install it as soon as possible.

Nothing but pure distilled water should be added to the battery solution. In the absence of distilled water, melted artificial ice or rain water caught in

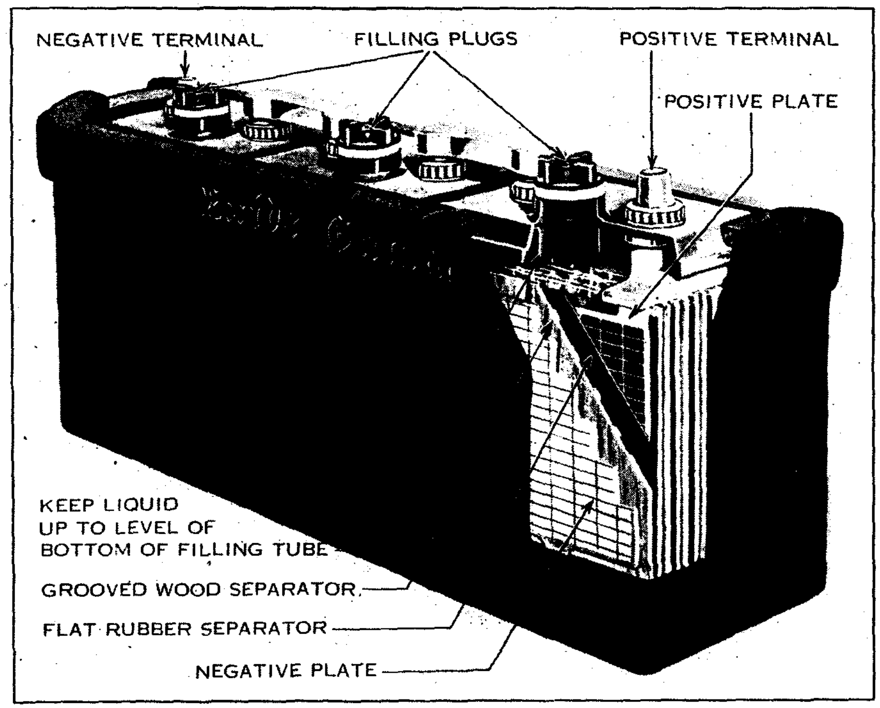

FIGURE 15. *Storage battery*

an earthenware receptacle may be used. Hydrant water or water that has been in contact with metallic surfaces will cause trouble if used. *Acid must never be added to the battery.*

After adding water to the storage battery in freezing weather, the car should immediately be run far enough to mix the water and acid solution thoroughly. If the car is parked immediately after adding water, the water is likely to stay on top of the acid solution and may freeze, causing extensive damage.

If one cell regularly requires more water than the other, a leaky jar is indicated. A leaky jar should be replaced immediately by a new one as even a very slow leak will in time result in the loss of all the solution in the cell.

Specific Gravity of Battery Solution

As the storage battery is charged and discharged, the solution reacts chemically with the plates of the battery, the specific gravity of the solution changing as the reaction proceeds. The state of charge of the battery is thus indicated by the specific gravity of the solution. As the battery is charged, the specific gravity of the solution increases, reaching 1.270 to 1.290 when the battery is fully charged. The specific gravity of the solution decreases as the battery is discharged. A fully discharged battery has a specific gravity of 1.150 to 1.170.

A hydrometer is the instrument used to measure the specific gravity of a solution. A hydrometer syringe is a hydrometer especially designed for convenience in testing the specific gravity of the acid solution in the storage battery. A hydrometer syringe can be obtained at any battery service station.

The specific gravity of the acid solution should never be tested immediately after adding distilled water. If the solution is below the plates so that it cannot be reached with the syringe, add the necessary amount of distilled water and then drive the car for a few hours before taking the hydrometer reading.

Disconnecting Battery

Do not remove the generator or attempt any adjustment of the circuit breakers or remove any of the wires to the circuit breakers without first disconnecting the storage battery.

Never run the engine with the storage battery disconnected. Serious damage to the generator may result.

Exide Depots and Sales Offices

The Electric Storage Battery Company, whose general offices and works are at Alleghany Avenue and Nineteenth Street, Philadelphia, Pennsylvania, has representative stations in towns of any considerable size as well as sales offices and Exide battery depots in a number of the larger cities. If a storage battery is in need of attention other than recharging, it is advisable to communicate either with a Cadillac maintenance station or with the nearest Exide station or depot. Do not ship a storage battery without receiving instructions.

Starting Motor

Operation of Starter

The starting motor is a series-wound motor mounted vertically at the rear end of the crankcase directly over the flywheel. When cranking the engine, the starting motor drives the flywheel through a pinion which meshes with teeth machined on the rear face of the flywheel. The pinion is normally held out of engagement with the teeth on the flywheel. It is moved down into mesh with the teeth on the flywheel by pushing forward on the starter pedal. Further movement of the pedal operates a switch that closes the battery circuit and starts the armature revolving.

If, in pushing down the starter pedal, the ends of the teeth on the pinion strike against the ends of the teeth on the flywheel preventing further movement of the pinion, continued movement of the pedal compresses a spring. As soon as the pedal has been pushed down far enough to close the starting switch, the armature starts to revolve. The pressure of the spring then forces the pinion the rest of the way, completing the meshing operation.

An over-running clutch on the armature shaft prevents the flywheel from driving the starting motor after the engine is running under its own power and before the starter pedal is released.

Ignition

General Description

The function of the ignition system is, first, to multiply the low voltage (six to eight volts) of the storage battery and generator into voltage of sufficient intensity to cause a spark to jump between the electrodes of the spark plugs; and second, to time this spark so that ignition will take place in the proper cylinder at the proper instant.

The Delco single-spark system is used, consisting of a combination timer-distributor unit in connection with a transformer or induction coil. The primary circuit, through which flows the current from the storage battery or generator, includes the primary winding of the ignition coil; the resistance unit, which is attached to the ignition coil; the timer contact arms and points; and the condenser, which is enclosed in the timer. The secondary or

high-voltage circuit includes the secondary winding on the ignition coil, the distributor and the spark plugs.

Current flows through the primary circuit whenever and as long as either of the two sets of timer contact points is closed. Current flows through the secondary circuit for an instant only when either set of contact points is opened; but the voltage of this current is several thousand times that of the primary circuit and is sufficient to cause a spark at the spark plug.

Timer-Distributor

The timer-distributor is mounted on the top of the crankcase at the rear end and is driven by a spiral gear on the rear end of the camshaft. The shaft of the timer-distributor, which revolves at one-half crankshaft speed, carries a four-lobed cam. As this cam revolves, it actuates the two contact arms alternately, opening and closing first one set of contact points and then the the other. The circuit is thus made and broken eight times during each revolution of the cam and eight corresponding sparks are produced at the spark plugs.

In order to procure the maximum power from each explosion, ignition must occur at the right instant in relation to the position of the piston. But the ignition process, although apparently a matter of an instant, consumes a measurable amount of time. It is therefore necessary to break the circuit at the contact points far enough in advance so that actual ignition will take place in the cylinder at the correct time. The lapse of time is always the same, regardless of the speed of the engine, but because the pistons move faster when the engine is running at higher speeds than when it is running at lower speeds, the degree of advance in relation to the positions of the pistons must be increased as the engine speed increases.

This advancing of the relative timing of the spark for higher engine speeds is automatically accomplished by a centrifugal ring governor on the timer shaft below the cam. As the speed of the engine increases, the governor ring assumes a position more nearly horizontal, forcing the cam ahead of the shaft by which it is driven. This causes the contact points to open earlier, starting the ignition process earlier in relation to the positions of the pistons in the cylinders.

In addition to the automatic advance, the timer has a manual control by which the opening of the contact points may be still further advanced or still further delayed. This is operated by the left-hand lever at the steering wheel, as described on page 10.

The distributor is the mechanism that insures that the high voltage current in the secondary circuit is switched to the proper spark plug at the proper time. It consists of a rotor which is carried on the upper end of the timer shaft and which has a metal contact button electrically connected at

all times with the secondary current from the coil. As the rotor revolves, the button makes contact successively with eight metal contacts which are set in the distributor head, and which are connected to the spark plugs. The relation between the rotor and the timer shaft is such that when the cam causes one set of timer contact points to open, the rotor will be in correct position for conducting the resulting high voltage in the secondary circuit to the proper spark plug.

Spark Plugs

For best results the electrodes of the spark plugs should be .023 inch apart. If the spark plugs should be removed, it is recommended that the electrodes be inspected and adjusted to this clearance if necessary.

Lighting System

Lamp Bulbs

It is recommended that bulbs for the lamps, particularly the two-filament bulbs for the headlamps, be purchased from a Cadillac distributor or dealer. In any event bulbs should have the correct voltage and candle-power ratings. Only three different types of lamp bulbs are used in the entire lighting system. The bulbs and the lamps in which they are used are as follows:

Lamp	Voltage	Candle-power
Headlamp	8	21 (two-filament) (Mazda No. 1110)
Back-up light	8	21 (single filament)
Stop light	8	
Inspection lamp	8	
Parking lights	8	3
Instrument lamp	8	
Rear lamp	8	
Closed car dome and quarter lamps	8	

Cadillac two-filament bulbs are equipped with fog caps or metal screens placed over the upper part of the bulb for the purpose of stopping direct unreflected light from the filament. It is this direct unreflected light from the filament that causes the dazzling reflection from fog or smoke. Headlamps equipped with fog caps have the appearance of being dimmed when seen from the front, but they do not perceptibly affect the useful light from the headlamps.

In replacing a headlamp bulb, transfer the fog cap from the old bulb to the new, adjusting the cap to the position shown in Fig. 18. Then adjust the lamp as directed on page 69.

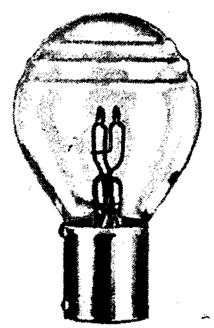

FIGURE 16.
Double-filament headlamp bulb

Cleaning Headlamp Reflectors

The headlamp reflectors are plated with pure silver. Although the reflectors ordinarily require no attention, if they should require polishing extreme care must be exercised to select materials that will not scratch the silver.

Powdered dry rouge and a chamois skin are recommended. If the reflectors are tarnished, the rouge may be moistened with alcohol. Afterward, polish with a dry chamois and rouge.

The chamois used for the headlamp reflectors must not be used for any other purpose. It must be soft and free from dust.

Official Approval of Headlamps

Cadillac headlamps have been approved by practically every state in the country. For purposes of official identification, the following description of the headlamps is given:

A complete headlamp containing a parabolic reflector with axis inclined two and one-half degrees; screw adjustment on shell of headlamp to adjust the bulb filament with relation to the reflector in both axial and vertical planes to compensate for filament variation in bulbs; a cover glass containing cylindrical flutes vertically grouped in three distinct zones, the outer zone having greater refractory power and the flutes being more pronounced than

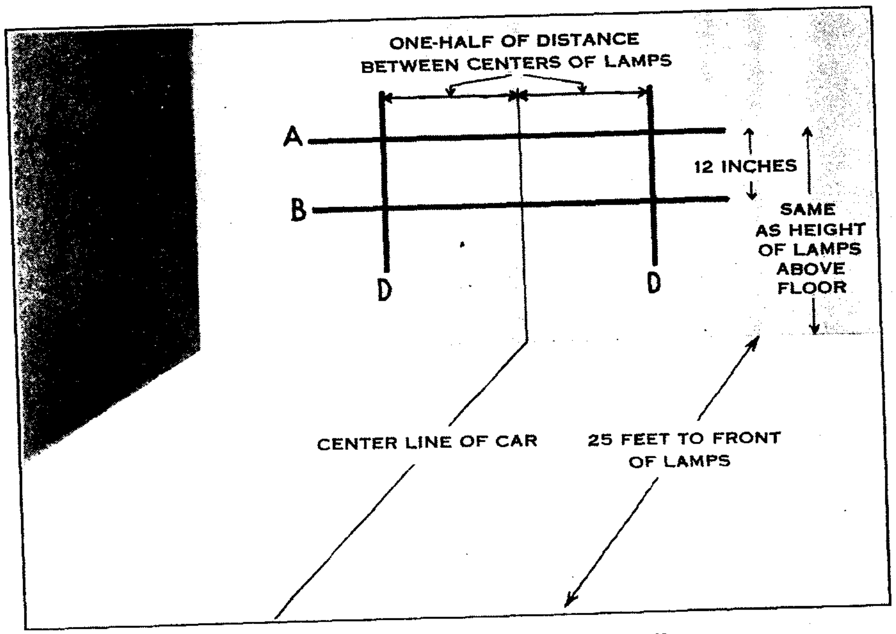

FIGURE 17. *Marks for adjustment of headlamps*

in the center; and a cap over the upper front portion of the bulb to intercept the direct unreflected light above the horizontal.

Approval by the state authorities is conditioned upon the headlamps being adjusted to a definite standard. The directions which follow are for this standard adjustment.

Adjustment of Headlamps

Select a level spot where the car with an average load can be placed facing toward and twenty-five feet distant from a wall upon which the lines shown in Fig. 17 can be drawn. The adjustment should be made when it is dark enough so that the outlines of the projected beams are plainly visible.

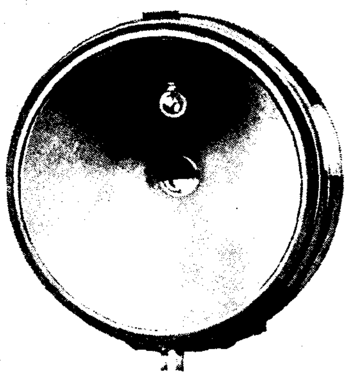

FIGURE 18. *Headlamp fog cap*

Locate a point on the wall directly opposite the front of the car by sighting through the center of the rear curtain toward the radiator cap. Draw a vertical line on the wall through this point: Measure the distance between the centers of the headlamps, and draw two vertical lines "D" parallel to the center line and distant from it by an amount equal to one-half of the distance between the headlamps. Measure the distance of the headlamp centers above the ground or floor and draw the horizontal line "A" at the same elevation. Draw the line "B" twelve inches below the line "A."

Upper Adjusting Screw—The first adjustment should be made with the lower beam on, that is, with the lighting switch lever in the third position. Cover the headlamp that is not being adjusted, or disconnect the plug connector that supplies current to the lamp. Remove the headlamp door. Make sure that the fog cap is properly placed on the bulb as shown in Fig. 18.

The adjusting screws, of which there are two, are in the back of the headlamp shell. Turn the upper or large adjusting screw until the light spot on the screen is the smallest that can be obtained.

Loosen the nut on the headlamp support and aim the headlamp so that the top center of the spot of light is at the intersection of lines "B" and "D" as shown in Fig. 20a. When the lamp has been properly aimed, tighten the nut securely.

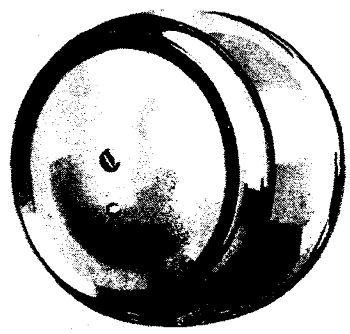

FIGURE 19
Headlamp adjusting screws

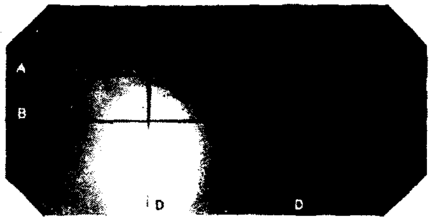

Figure 20a
Left-hand lower beam without lens.

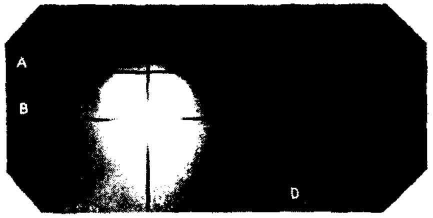

Figure 20b
Left-hand upper beam without lens.

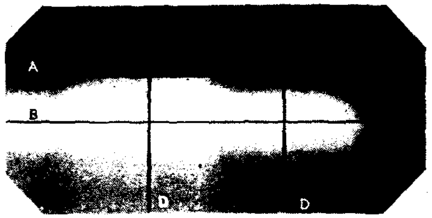

Figure 20c
Left-hand upper beam with lens.

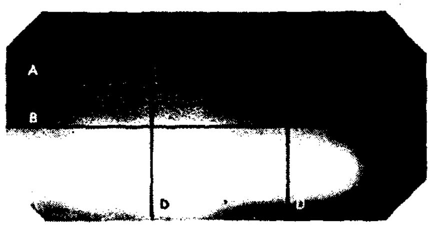

Figure 20d
Left-hand lower beam with lens.

Figure 20e
Both upper beams with lenses.

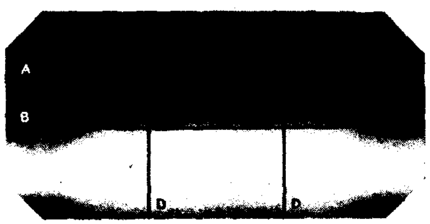

Figure 20f
Both lower beams with lenses.

FIGURE 20. ***Beams from headlamps***

Lower Adjusting Screw—Turn the lighting switch to the fourth position so that the upper beam is on. Adjust the lower or small screw until the top of the beam is at the intersection of lines "A" and "D" as shown in Fig. 20b. The beam should be of approximately the same proportionate size as shown, and the greatest intensity of the beam should be near the top of the spot and at its center. If the lower beam is now switched on, it should appear as in Fig. 20a and should be of the same proportionate size with the greatest intensity near the bottom, rather than at the center of the spot.

Install the door with the lens. If the lens is for any reason removed from the headlamp door, it should be replaced with the cylindrical flutes vertical and the smooth side facing out.

With the lens in place, the upper beam from the left-hand headlamp should appear as in Fig. 20c. The pattern of the lower beam from the left-hand headlamp should appear as in Fig. 20d.

After adjusting the one headlamp, repeat the adjustment on the other. When both headlamps have been adjusted and both headlamp doors are in place, the combined light from both headlamps should appear as in Fig. 20e when the upper beams are on, and as in Fig.20f when the lower beams are on.

CHAPTER V

Clutch and Transmission

Clutch

The Cadillac clutch is a dry multiple-disc clutch with eight smooth driven discs and seven driving discs faced with friction material composed largely of asbestos. The driving discs have gear teeth machined on their outer circumference to engage with teeth machined internally in the flywheel. The driven discs have gear teeth machined on their inner circumference to mesh with teeth machined on the outside of the clutch hub, which in turn drives the transmission. Except when the clutch pedal is pushed down, the clutch discs are pressed together by a spring having a pressure of 300 lbs. The driven discs then revolve with the driving discs and the engine, if running, drives the transmission.

When the clutch pedal is pushed down to disengage the clutch a forked lever presses against the clutch spring through a ball thrust bearing, releasing the discs from the pressure of the spring. The discs then separate and the driven discs rotate independently of the driving discs.

The clutch itself requires no adjustment or attention other than lubrication of the clutch thrust bearing as directed on page 45. Adjustment of the clutch release rod, however, may be necessary after the car has been driven some distance.

Adjustment of Clutch Release Rod

As described on page 15, the clutch pedal is purposely given about one inch of "lost motion." That is, the clutch does not begin to disengage until the pedal has been moved down about an inch from its released position. This lost motion is necessary in order to allow the clutch discs to come closer together as the facings are reduced in thickness. The lost motion gradually decreases as the clutch is used and eventually will be all taken up. Before this happens, the clutch release rod must be readjusted to restore the lost motion; otherwise, the clutch discs will slip and the engine will not drive the car.

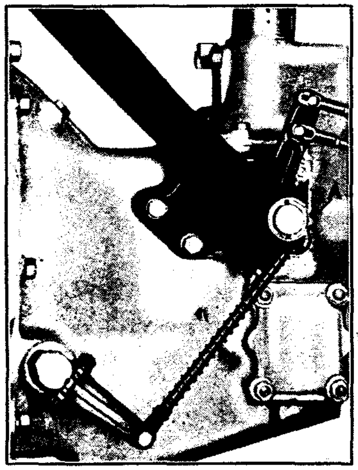

FIGURE 21
Adjustment of clutch release rod

To make the adjustment unscrew the nut "A" (Fig. 21) until the clutch pedal has a movement of one inch without starting to disengage the clutch.

The nut "A" must be turned a half-turn at a time.

Transmission

The purpose of the transmission is to provide a means for varying the ratio and direction of the rear axle speed in relation to the engine speed. Three things are accomplished by doing this: First, the engine is enabled to drive the car backwards. Second, the engine is permitted to revolve fast enough to develop the power necessary for starting and for driving the car at extremely low speeds. Third, the turning effort of the engine is multiplied so that it may be sufficient for climbing steep hills and pulling through deep sand and mud.

The Cadillac transmission is known as the selective, sliding gear type. It has three speeds forward, of which one is direct drive, and one speed in reverse. Selection of the various speeds is accomplished by movement of two shifter gears, "A" and "D," (Fig. 22) which are controlled by the transmission control lever. The positions of the gears corresponding to the five positions of the control lever as illustrated in Fig. 2 are as follows:

Neutral—When the control lever is in neutral position, the shifter gears "A" and "D" are in the positions shown in Fig. 22; that is, they are not in mesh with any of the other gears.

Low—When the control lever is moved from neutral to low, the gear "A" is moved forward into mesh with gear "R." Power is then transmitted from

the clutch shaft "Z" to the transmission main shaft "C" through gears "E," "U," "R" and "A." The ratio of engine speed to propeller shaft speed in low is approximately 3 to 1.

Intermediate—When the control lever is moved from low to intermediate the gear "A" is first returned to its neutral position and gear "D" is then moved back into mesh with gear "S." Power is then transmitted through gears "E," "U," "S" and "D." The ratio of engine speed to propeller shaft speed in intermediate is approximately 1.7 to 1.

High—When the control lever is moved from intermediate to high, the gear "D" is first moved forward out of mesh with gear "S" and then farther forward until teeth cut internally in a recess in gear "D" engage teeth on the

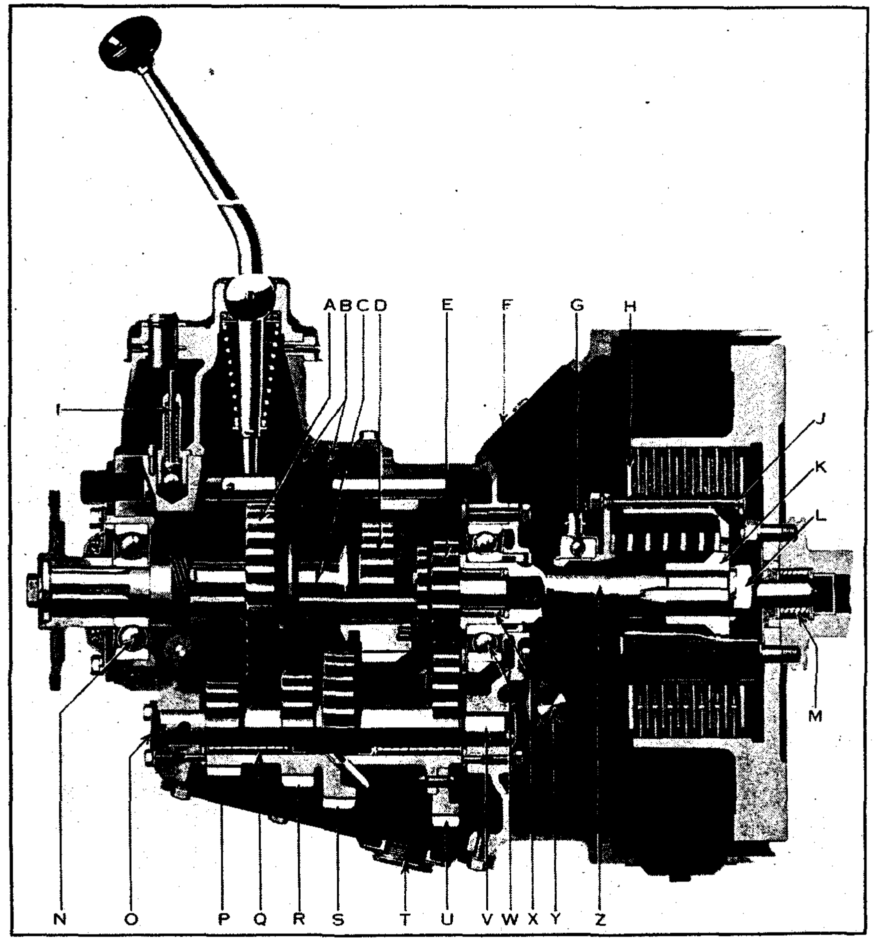

FIGURE 22. ***Sectional view of transmission***

extreme end of gear "E." The drive is then direct from the clutch shaft to the transmission main shaft without reduction.

Reverse—When the control lever is moved from neutral to low, the gear "A" is moved back into mesh with an idler gear, not shown in Fig. 22, which is at all times in mesh with gear "P." Power is then transmitted through gears "E," "U," "P," the reverse idler gear, and gear "A." The interposition of the idler gear reverses the direction of rotation. The ratio of engine speed to propeller shaft speed in reverse is approximately 3.8 to 1.

CHAPTER VI

Brakes

General Description

There are three pairs of brakes: the rear wheel external brakes, the rear wheel internal brakes, and the front wheel brakes, which are also internal. The rear wheel external brakes and the front wheel brakes are operated by the brake pedal and comprise the foot brakes. The rear wheel internal brakes are operated by the hand lever and are used principally for locking the rear wheels when the car is standing.

The purpose of the front wheel brakes is to add to the braking ability as much as is consistent with safety. It is not desirable to attempt to secure the maximum possible braking effect on the front wheels for the reason that, when a front wheel slides without rotating, it has no power to change the direction of the car.

Cadillac front wheel brakes are accordingly designed so that when the foot brakes are applied while the steering wheel is turned to the right or left, *only the brake on the inside wheel is effective and the brake on the outer wheel is released*, leaving the outer wheel free to rotate. It is thus impossible to lock both front wheels even on slippery pavement unless the car is moving straight ahead. If, while the car is moving straight ahead on slippery pavement, the brakes should be applied with sufficient pressure to lock both front wheels and it then becomes necessary to make a turn, the car will instantly respond because the brake on the outer wheel is automatically released as soon as the steering wheel is turned.

Adjustment

Each foot brake has provision to compensate for wear on the brake lining. The adjustment by which this compensation is effected is at the brake itself

rather than in the connections. Cadillac brakes must *not* be adjusted to compensate for wear by adjusting the pull rods or stop screws.

As described on page 16, the Cadillac two-stage brake pedal automatically notifies the driver when the foot brakes require adjustment. It is recommended that the car be taken to a Cadillac maintenance station for attention when necessity for adjustment is thus indicated.

If, however, the adjustment is neglected and as a result the pedal touches the floor boards before the brakes are fully applied, an emergency adjustment can be made by screwing down the adjusting nuts "F" (Fig. 23) one or more half-turns. The nuts "F" lock every half-turn and must be turned a half-turn at a time. The nuts "F" must not be turned down far enough to cause the brakes to heat and they must be turned down the same amount on both sides.

If adjustment of the nuts "F" is not sufficient, or if the occasion gives opportunity for a complete adjustment, this adjustment should be made as follows:

Loosen the three locking nuts "B," "D" and "N" (Fig. 23) and screw the three stop screws "A", "C" and "M" away from the brake band. Observe the clearance between those parts of the brake lining nearest the hexagonal

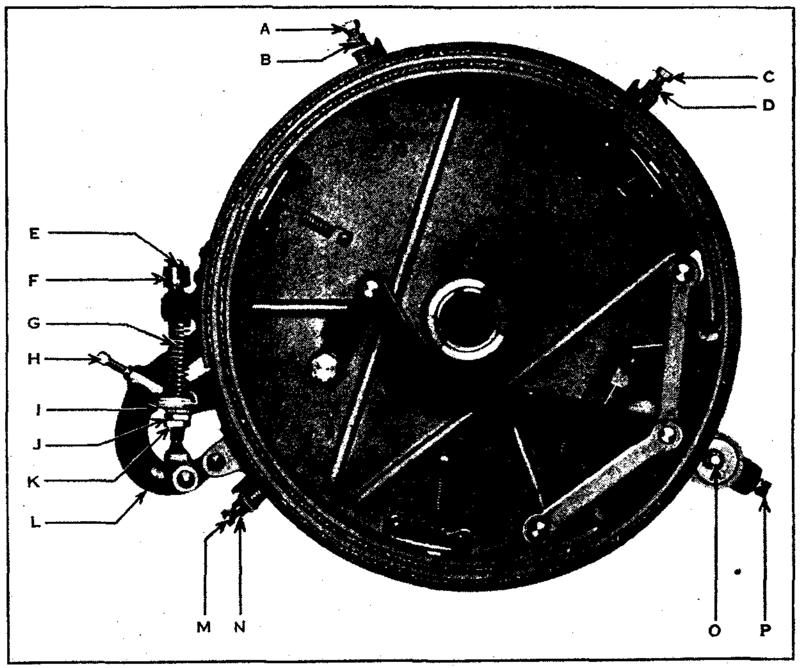

FIGURE 23. *Rear wheel brakes*

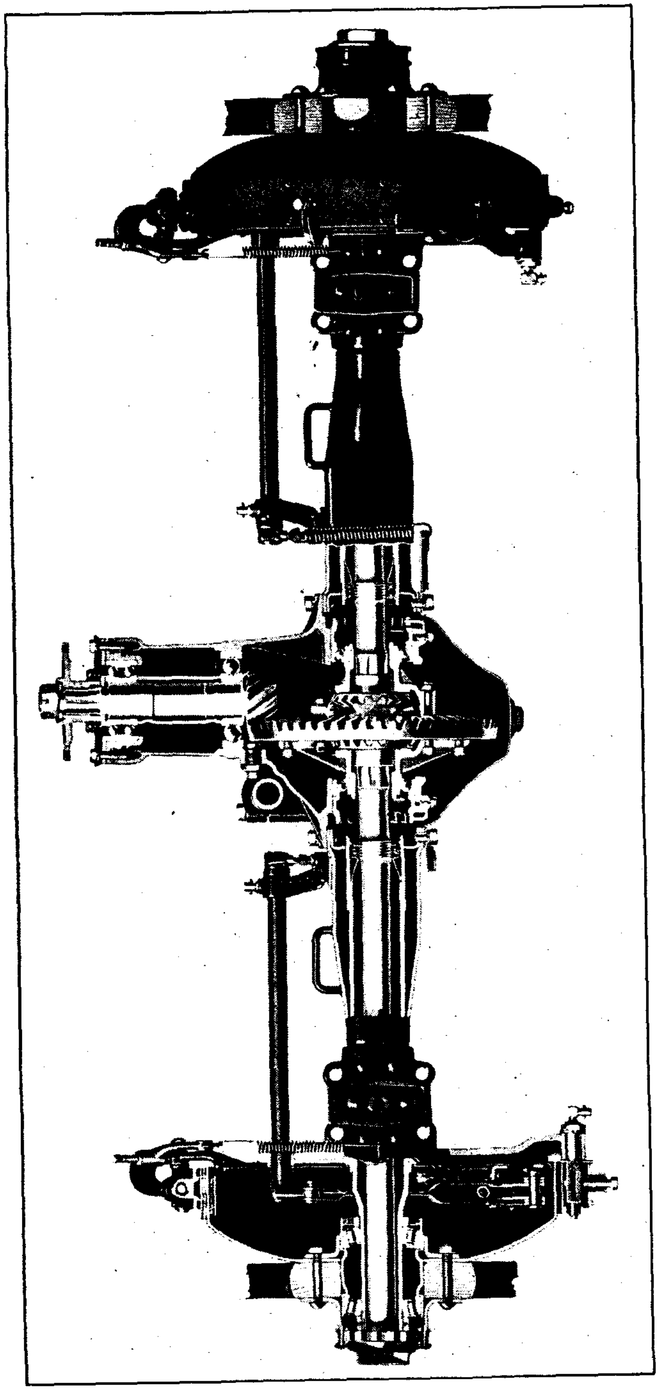

FIGURE 24. *Sectional view of rear axle*

head screw "P" and the brake drum. This clearance should be .030 to .035 inch. If the clearance is not correct, adjust the screw "P" until it is. The screw "P" is kept from turning of its own accord by a lock washer which turns with the screw and locks every half-turn. It must accordingly be turned a half-turn at a time.

Loosen the locking nuts "K" and adjust the nuts "J" and the screws "M" so that there is a uniform clearance of .030 to .035 inch between the *lower* part of the brake lining and the brake drum. To decrease the clearance between the brake lining and the drum, screw the nut "J" farther down on the yoke bolt "E."

Adjust the nuts "F" and the two stop screws "A" and "C" so that there is a uniform clearance of .030 to .035 inch between the *upper* part of the brake lining and the drum.

After making the foregoing adjustments so that there is a uniform clearance of .030 to .035 inch between the drum and the lining, check the results by applying the brakes, and measuring the travel of the upper end of the lever "L." This travel should not be less than 7/8 inch. If the end of the lever "L" travels less than 7/8 inch in moving from the released position to the applied position, readjust one or all of the nuts "F" and "J" and the screws "P," "A," "C" and "M" to increase the clearance slightly, keeping the clearance uniform at all points around the drum. Do not fail to tighten the locking nuts "B," "D," "N" and "K" when the adjustment has been made.

Do not change the adjustment of the screw "H." This screw is properly set when the car is assembled and does not require readjustment in taking up wear on the lining.

Inasmuch as the brakes are designed so that the greater proportion of the braking load is taken by the rear wheel brakes, adjustment of the front wheel brakes is usually not necessary until the rear wheel foot brakes have been adjusted several times. Before the limit of adjustment for the rear wheel foot brakes has been reached, the car should be taken to a Cadillac maintenance station for adjustment of the front wheel brakes.

Adjustment of the hand brakes is unnecessary. The hand brakes retain their effectiveness without adjustment throughout the life of the lining.

All joints in the brake connections should be oiled at regular intervals. The brakes should also be tested occasionally to be sure that they are in serviceable condition. When the brake band linings have worn so that further adjustment is impossible, they can be renewed.

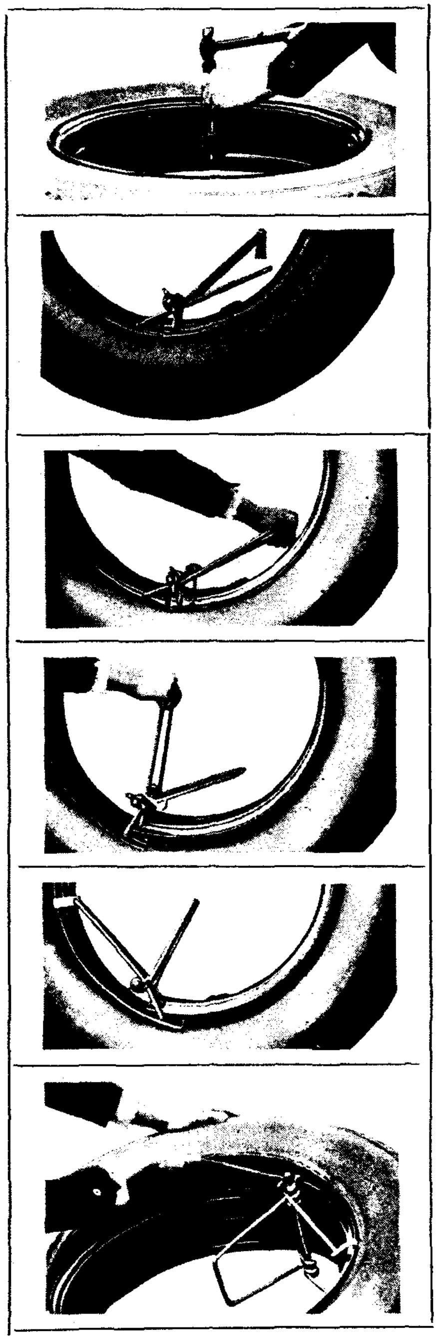

FIGURE 25. ***Removing tire from rim***

Figure 25a

Lay the tire and rim flat on the ground and drive out the locking pin, using the hammer and punch in the tool kit.

Figure 25b

Apply the rim tool, which is furnished in the tool kit, as shown in the illustration. Note that there are two pairs of holes in the rim near the split and that one pair is nearer the split than the other. The short end of the tool must be inserted in the holes nearer the split and the long end in the holes farther from the split. Clamp the tool firmly in position by tightening the wing nut.

Figure 25c

Grasp the two handles and bring them together, spreading the ends of the rim farther apart at the split. Then pull both handles together toward the other side of the rim until one end of the rim is forced up and over the other end.

Figure 25d

Release the short handle of the tool but continue pulling the long handle until it is against the rim.

Figure 25e

Engage the hook that is attached to the long handle over the edge of the rim to hold the rim in the collapsed position.

Figure 25f

Lay the rim and tire on the ground and remove the tire from the rim by working it off first on the side where the rim is split. The handle of the large wrench is flat to serve as a prying tool.

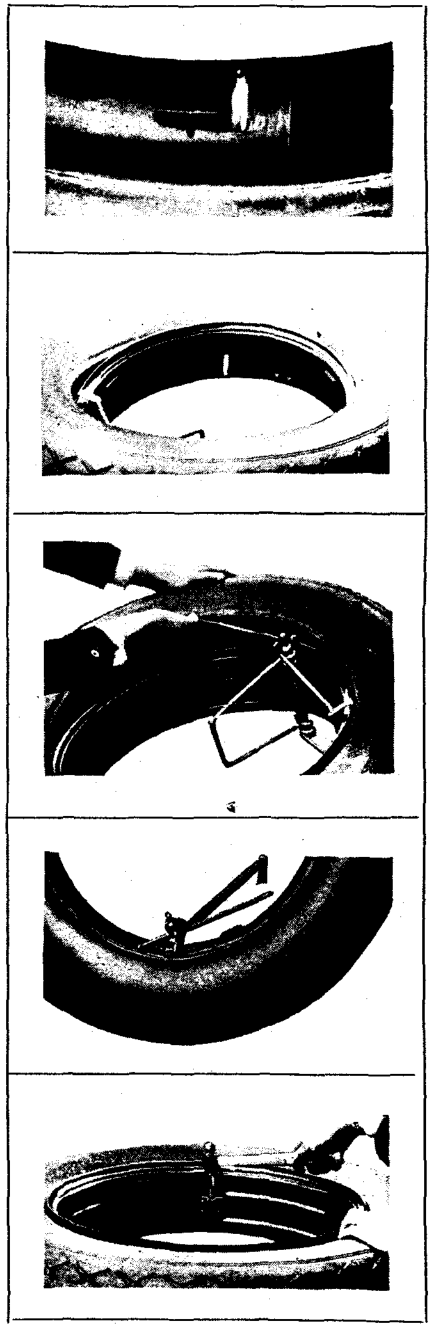

FIGURE 26. ***Installing tire on rim***

Figure 26a

Make sure that the tube flap is in place and that the valve stem passes through the holes in both ends of the flap.

Figure 26b

Insert the valve stem in the hole in the rim and work the tire well into place on each side of the valve stem.

Figure 26c

Pry the tire over the projecting end of the rim where it is split. The rest of the tire can then be pushed down into place.

Figure 26d

Release the hook on the tool and push the handles of the tool back to their original position. Then remove the tool.

Figure 26e

Replace the pin which locks the two ends of the rim together. This is important.

CHAPTER VII

Wheels

Tires and Rims

Illustrated directions for removing a rim with tire from a wheel and installing a rim with tire on a wheel are given in Figs. 7 and 8. Directions for removing a tire from a rim and installing a tire on a rim are given in Figs. 25 and 26.

Do not under any circumstances attempt to remove a tire from a rim without deflating the tire.

Caution in Adjusting Wheel Bearings

The adjustment of wheel bearings or the removal of the wheels should not be attempted by one unfamiliar with work of this nature. It is recommended that the car be taken to a Cadillac maintenance station if possible. In any event great care must be exercised in adjusting wheel bearings not to get them tight. These bearings will revolve even when adjusted very tightly, but that condition is sure to prove disastrous. They should be adjusted so that a very slight amount of play or looseness may be discerned.

If, after a bearing has been adjusted to a point that is apparently correct, the locking device cannot be placed in position without changing the adjustment, it is far better to loosen the adjustment until it can be secured with the locking device than to tighten the bearing adjustment.

Removing Front Wheel

To remove a front wheel, first jack up the axle until the wheel is free from the ground and then proceed as follows:

Remove the hub cap by unscrewing it. Remove the cotter pin "E" (Fig. 27). Remove the lock nut "A." Remove the serrated washer "B." Remove the adjusting nut "C." The wheel may then be removed by pulling it straight off.

Installing Front Wheel and Adjusting Bearings

Before installing the wheel, make sure the bearings are clean and that they are packed in a light grease that is free from dirt and grit.

Set the wheel in place on the spindle and adjust the nut "C" (Fig. 27) very carefully, following the caution above. Install the serrated washer "B," making sure that one of the notches in the washer fits over the stud "D" on

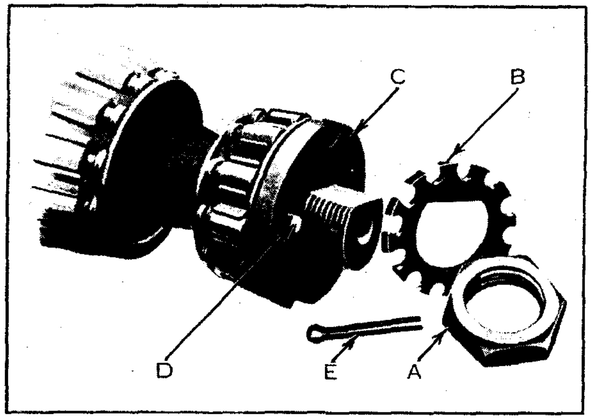

FIGURE 27. *Front wheel bearings*

the adjusting nut. Replace the lock nut "A" and tighten it firmly, locking it with the cotter pin "E."

It is always better to adjust wheel bearings too loosely than too tightly. If after the adjustment is apparently correct, the notch in the washer "B" is not directly over the stud "D," loosen the adjustment rather than tighten it.

Removing Rear Wheel

To remove a rear wheel, first jack up the axle until the wheel is free from the ground and then proceed as follows:

Remove the hub cap "D" (Fig. 28) by unscrewing it. Remove the spring locking ring "F." Withdraw the axle shaft "E." With a screw driver or blunt

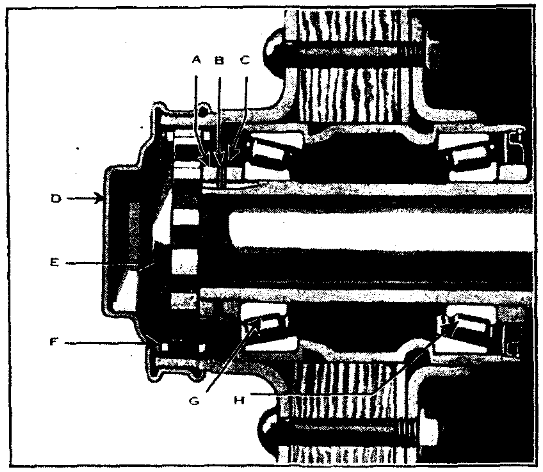

FIGURE 28. *Sectional view of rear wheel hub, showing bearings*

tool straighten the lug of the outer lock washer "B" where it has been bent over the lock nut "A." Unscrew the lock nut "A." Remove the washers "B" and the adjusting nut "C." The wheel can then be removed by pulling it straight off.

Installing Rear Wheel and Adjusting Bearings

Before installing the wheel, make sure that the bearings are clean and packed in a light grease that is free from dirt and grit.

Set the wheel in place upon the axle and adjust the nut "C" (Fig. 28) very carefully. Install the lock washers "B," using new washers or straightening the ones removed if new ones are not available. In placing the washers in position, reverse the outer one with respect to the inner so that the lugs on one washer are opposite the spaces between the lugs on the other washer; that is, so that the lugs on the two washers are staggered. Install and tighten the lock nut "A." Next, select that lug on the inner washer that falls nearest to the center of one of the flat sides of the adjusting or inner nut, and with a screw driver or other suitable tool bend this lug over the nut. In the same way bend one of the lugs of the outer washer over one of the flat sides of the locking or outer nut. In bending the lugs of the locking washers, take care not to alter the adjustment of the inner nut or loosen the outer nut.

CHAPTER VIII

Repair Parts

Genuine Cadillac Parts

Cadillac owners are cautioned against permitting the use of other than genuine Cadillac parts in the repair of their cars. The quality of the Cadillac car is identical with the quality of its component parts, the production of which is based upon more than twenty years of experience in designing, manufacturing, and inspecting. No other individual or organization has access to the data resulting from this experience nor could they possibly have the same interest in protecting the owners of Cadillac cars.

Uniform Parts Prices

Cadillac parts are sold at uniform prices throughout the United States, and are not subject to the addition of transportation, excise or other supplementary charges. Printed price lists published by the Cadillac Motor Car Company are open to inspection by owners at any authorized Cadillac distributor's or dealer's establishment.

Ordering New Parts

With many thousands of Cadillac automobiles in use, it is obviously impractical to deal directly with each Cadillac owner. We cannot open accounts with any except regular distributors with whom annual contracts are made.

To avoid unnecessary delay and correspondence new parts should, where possible, be ordered from the distributor or dealer from whom the car was purchased or from the nearest Cadillac distributor or dealer, who carries a large stock and is generally in a position to supply a part immediately. If he cannot do so, he can order it.

Where, however, conditions are such as in our judgment to warrant it, we will fill orders for parts at current list prices, f. o. b. factory, provided the order is accompanied by cash. In ordering, send the engine number and type of the car with an accurate description of the part desired, preferably accompanied by a sketch with dimensions. If this cannot be done, return the part tagged properly and with transportation charges prepaid. (See below under "Returning Parts.") Otherwise, we cannot promise prompt service or to fill the order intelligently.

Our responsibility ceases in all cases, with delivery to the transportation company.

Returning Parts

In the event parts are returned, transportation charges must be prepaid or the parts cannot be accepted. They should be tagged properly with the name of the owner and the engine number of the car. A letter should be sent, giving complete instructions regarding the disposition of the parts.

Tires, Speedometer and Clock

In cases of repairs to tires, speedometers, or clocks, correspondence should be opened with the manufacturers or their representatives. If necessary the parts should be sent to them. Transportation charges should be prepaid.

CHAPTER IX

Specifications and License Data

Type of engine	8 cyl. V-type
Diameter of cylinder bore	3 1/8 in.
Length of stroke	5 1/8 in.
Piston displacement	314 cu. in.
Horsepower (N. A. C. C. rating)	31.25
Engine number: stamped on crankcase at base of oil filler; also on name plate on front face of dash	
Diameter of crankshaft main bearings	2 3/8 in.
Length of crankshaft between inner ends of front and rear bearings	18 5/8 in.
Exhaust valves	1 9/16 in.
Inlet valves	1 11/16 in.
Capacity of gasoline tank	20 gals.
Capacity of engine lubricating system	2 gals.
Capacity of cooling system	5 1/2 gals.
Capacity of transmission	3 qts.
Capacity of rear axle	3 1/2 qts.
Tires	33x6.75 (low pressure)
Wheelbase	132 in. and 138 in.
Tread	56 in.

CADILLAC

Operator's Manual

142

Price Thirty-Five Cents

CADILLAC MOTOR CAR COMPANY
DETROIT

EDITION NO. 314-110

In ordering a duplicate of this Manual specify the above number or the engine number of the car

Foreword

THE experienced motorist whose new Cadillac succeeds other cars, some of which may also have been Cadillacs, requires less elementary operating instructions than the beginner, learning for the first time to drive. Likewise, the owner who takes advantage of the facilities offered by the maintenance station has less need for detailed information in regard to care of the car than the owner who provides for all necessary attention in his private garage.

In preparing this Manual, it has been taken for granted that the typical Cadillac purchaser is no longer a novice in motor car operation and that the greatest number of Cadillac owners will be best served by omitting that which is extremely elementary in character. It has also been assumed that, although he should at least know what care his car must regularly receive in order to render the best possible performance with the fewest possible interruptions, the typical Cadillac owner prefers to depend upon the maintenance station for occasional adjustments and repairs.

By thus omitting both that which is very elementary and that which is too technical, the first two divisions of the Manual have been made to include only information that is vital to every Cadillac owner regardless of his previous motoring experience. Part I, "Operation," is important because, no matter what car the owner may have driven before, his new car will differ in some feature, even from an earlier Cadillac. Part II, "Lubrication and Care," contains information that every owner should have regardless of the extent to which he expects to delegate the care of the car to others. Especially should he be familiar with lubrication, for correct lubrication is an essential without which it is impossible for the car to render unfaltering performance.

Part III, "General Information," may be considered as a supplement to the Manual. It contains information that may never be required by some owners, but that is included for use should occasion arise. In other words, it is a reference section to which the index on page 85 is a sufficient guide.

All written instructions are subject to limitations. The owner is asked to remember that the Manual is only one means by which the Cadillac organization desires to assist the Cadillac owner to realize the most from his car. Cadillac distributors and dealers everywhere invite the Cadillac owner to consult them on any matters pertaining to the operation and care of his car. If preferred, a request for information may be made direct to the factory, where it will receive the attention of the Technical Department.

Contents

Part I—Operation

Part II—Lubrication and Care

Part III—General Information

PART I

OPERATION

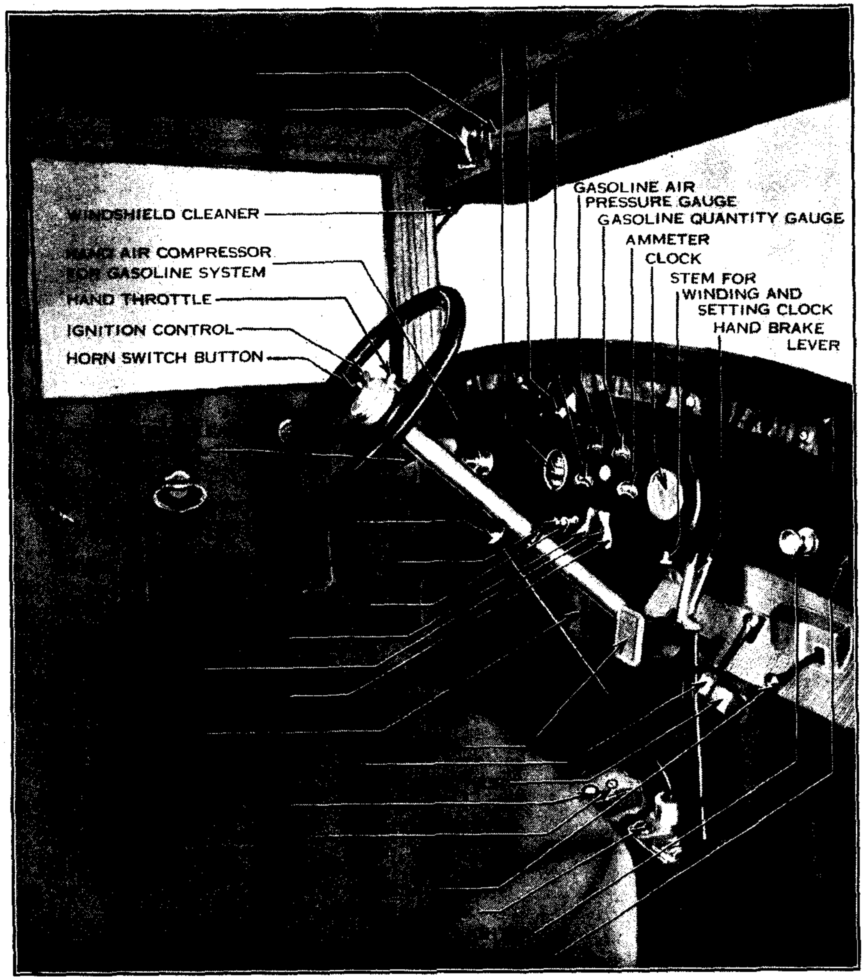

FIGURE 1. ***Instruments and controls***

CHAPTER I

Controls and Instruments

One of the first things the driver of a new car has to do is to familiarize himself with the various controls. In the following chapter are described the levers, pedals, instruments, and other devices used in the operation of the car. The experienced motorist, as well as the beginner, should read this chapter to avoid overlooking any detail of operation in which the car may differ from cars he has previously driven.

Locks

The Cadillac car is provided with the following cylinder locks, all of which on any one car are operated by the same key: ignition switch, transmission control lever, tool compartment, battery compartment, tire holder, and, on closed cars, the doors and various package compartments.

The lock on the switch acts only on the ignition or left-hand lever, which must be *down* in order to be locked. The transmission control lever can be locked in neutral or in any one of the four other positions of the lever.

The lock number is stamped on each key, but not upon the face of the lock. It is urged that the owner make a record of the key number as soon as he takes delivery of his car, so that in the event both keys are lost, a duplicate key can be easily ordered.

Gasoline Gauges and Air Compressor

The two upper dials on the instrument panel (Fig. 1) are gauges for the gasoline system. The gauge at the right marked "Gas" indicates in gallons the quantity of fuel in the tank at the rear of the car, and is operated electrically.

The gauge at the left marked "Air" is a pressure gauge and indicates in pounds per square inch the air pressure in the gasoline system. This pressure is necessary to force the fuel from the tank to the carburetor.

Initial pressure is secured by operating the hand air compressor at the left-hand end of the instrument board. While the engine is running, pressure is automatically maintained by a compressor driven by the engine camshaft.

The normal pressure maintained by the automatic compressor is from one to two pounds. There is sufficient pressure for starting the engine when the car is on level ground, if the gauge pointer is even one division away from the pin at zero. On a steep upgrade an initial pressure of one pound may be necessary.

In order to prevent leakage of the air pressure in the gasoline system it is important that the gasoline tank filler cap be air-tight. After screwing on the filler cap be sure to tighten the thumb screw in the center of the cap.

Before operating the hand compressor, the plunger must be released by turning the handle counter-clockwise. When the necessary pressure has been

obtained, push the compressor handle all the way in and lock it, turning it clockwise as far as it will go.

Throttle Control

The power and speed of the engine are controlled by opening and closing a throttle valve in the carburetor. This throttle is operated both by a hand lever and a foot pedal.

The foot pedal, or accelerator, is at the right of the brake pedal (Fig. 1). The hand control is the right-hand lever of the two levers above the steering wheel. Both controls operate the same throttle; the hand lever, however, remains in the position to which it is moved, whereas the accelerator must be held down to keep the throttle open.

The normal position of the throttle hand lever for driving the car is all the way up. In this position the throttle of the carburetor is open just enough to permit the engine to run at idling speed after it is warm. For starting, however, the lever should be moved approximately one-fourth the way down, and should be left in this position until the engine is warm enough to permit the lever to be returned to the idling position without stalling the engine.

The throttle should normally be controlled by the accelerator. In starting the car on a hill, however, the hand lever should be used rather than the accelerator. This permits the brake pedal to be released with the right foot at the same time that the clutch is engaged with the left.

In cold weather, the accelerator should not be pushed down suddenly before the engine is warm. Sudden opening of the throttle before the engine is warm causes "popping-back" in the carburetor. This should be avoided as much as possible by judicious opening of the throttle during the warming-up period. (See page 32 under "Use of Accelerator Before Engine Is Warm.")

The accelerator can be used in cold weather to prime the carburetor by pushing the accelerator to the floor once or twice. This is not necessary except in very cold weather and should never be done unnecessarily. Excessive priming is likely to prevent the engine from starting. (See page 31 under "Priming the Carburetor.")

Ignition Control Lever

Correct timing of the ignition in relation to the positions of the pistons is accomplished automatically by a governor which is a part of the timer-distributor and which provides for all ordinary advancing and retarding of the spark. (See page 66 under "Timer-Distributor.") A hand control is also provided for still farther advancing or retarding the spark on certain occasions as hereafter described.

The hand control is the left-hand lever of the two levers above the steering wheel. For average driving, the correct position of this lever is about one-

third down from the extreme top or advanced position. The lever should be left in this position except on the following occasions:

1. If the engine is being cranked by hand, the lever should be moved all the way down. If this is not done, a "kick-back" may occur resulting in personal injury.
2. In pulling at low speeds with the throttle well open, the lever should be moved farther down.
3. In driving at high speeds, the lever should be moved all the way up.
4. In starting the engine in extremely cold weather, the lever should be moved all the way up unless the engine is being cranked by hand.

Carburetor Enriching Button

The button at the left of the ignition switch lever (Fig. 1) controls a device on the carburetor for temporarily enriching the fuel mixture supplied to the engine. In starting the engine it is necessary to have the proportion of liquid gasoline in the fuel mixture greater than at other times because in a cold mixture only a part of the gasoline is vaporized. Pulling out the enriching button increases the proportion of liquid gasoline to air, the normal proportions being restored when the button is released and permitted to return to its original position.

Correct use of the enriching control not only is essential to quick starting of the engine, but also has an important bearing on the life of the engine. The enriching button must be pulled out far enough in starting to provide an explosive mixture quickly so that the battery is not unnecessarily discharged by useless cranking. The button must also be held out far enough during the warming-up period so that the engine will run without missing and "popping back." On the other hand, it should not be pulled out any farther or held out any longer than is necessary to accomplish these results, because some of the excess liquid gasoline in the enriched mixture does not burn.

If the engine still retains heat from previous running, the enriching control should not be used without first attempting to start the engine on the normal mixture. If the enriching button is pulled out for starting a hot engine the mixture may be made so rich that starting will be impossible.

The enriching button is not a priming device. It has no effect whatever on the fuel or the fuel mixture unless the engine is being cranked or is running under its own power. The button must be pulled out and held partly out during the cranking operation.

Ignition and Lighting Switch

The ignition and lighting switch (Fig. 1) controls the current for the ignition and for the following lamps: headlamps, instrument lamp, and rear

lamp. The ignition lever is the left-hand lever and has two positions: "off," when down, and "on," when up. The lighting lever is the right-hand lever and has four positions besides the "off" position. Starting with the lowest position, these are:

First Position—Instrument lamp and rear lamp.
Second Position—Parking lights, instrument lamp and rear lamp.
Third Position—Headlamp lower beams, instrument lamp and rear lamp.
Fourth Position—Headlamp upper beams, instrument lamp and rear lamp.

Cadillac headlamp bulbs have two filaments, one above the other, instead of the customary single filament. Both filaments are of the same candle-power (21), but because they are located in different positions with respect to the focus of the parabolic reflector, the beam of light from one filament is projected at a different angle from the other. When the switch lever is in the fourth position, the lower filaments are lighted and the beams are projected straight ahead, illuminating the road at a distance. When the lever is in the third position, the upper filaments are lighted and the beams are projected down at an angle, illuminating more brightly the road directly in front of the car.

The practice to be followed by the driver in using this double-beam feature of the headlamps will depend upon the regulations imposed by local authorities. In general, it is expected that the upper beams will be used except on the following occasions: when passing a vehicle approaching from the opposite direction, when rounding a sharp curve and when topping the crest of a hill. On these occasions and at other times when illumination is desired directly in front of the car, the lower beams should be used. For a further description of the headlamps, see page 68.

Starter Pedal

The starter pedal is at the right of the accelerator (Fig. 1). Pushing this pedal forward brings into action the electric motor that cranks the engine for starting. *Do not push the starter pedal when the engine is running.*

The starter pedal is only one of the controls that must be manipulated to start the engine. Unless there is an explosive mixture in the cylinders and a spark to ignite it, it is useless to crank the engine. The starter pedal should not be operated, therefore, until the necessary preliminary steps have been taken. The following, in their proper order, are the various steps that must be performed to start the engine. As each control is mentioned, reference is made to the page on which that control is explained in detail.

1. Unlock the transmission. (Page 9.)
2. Make sure that the transmission control lever is in neutral. (Page 15.)
3. Unlock the ignition switch. (Page 11.)

4. Note whether pressure is indicated on the gasoline pressure gauge; if not, operate the hand compressor. (Page 9.)
5. Place the ignition control lever at the steering wheel about one-third* the way down. (Page 10.)
6. Place the throttle lever about one-fourth the way down from the idling position. (Page 10.)
7. *Cold Weather Only*—In extremely cold weather, prime the carburetor by pushing the accelerator to the floor once or twice. Do not prime the carburetor in warm weather or unnecessarily in cold weather. Excessive priming is likely to prevent the engine from starting. (Page 10.)
8. Pull back the carburetor enriching button unless the engine is still warm. If the engine is still warm, do not pull back the enriching button unless the engine fails to start on the normal mixture. (Page 11.)
9. Switch on the ignition. (Page 11.)
10. Push the starter pedal forward and hold it until the engine starts under its own power. Release it immediately as soon as the engine starts. (See below for probable causes for the engine failing to start.)
11. Let the carburetor enriching button partly in as soon as the engine starts, and all the way in as soon as the engine is warm enough to permit it. (Page 11.)
12. Note whether pressure is indicated on the oil pressure gauge and stop the engine at once if no pressure is indicated. (Page 14.)
13. Move the throttle lever up to the idling position as soon as the engine is warm enough to permit it.

In cold weather, disengage the clutch before pressing down the starter pedal, and hold it down during the cranking operation. This relieves the starter of the necessity of turning the transmission gears, which are immersed in lubricant. The additional load is small in warm weather when the lubricant is thin, but in cold weather the power required to turn the gears through the thickened lubricant adds unnecessarily to the demand upon the battery.

If the Engine Fails to Start—If the engine fails to start after being cranked for a few seconds, do not continue to operate the starter. To do so is a useless expenditure of battery energy. Release the starter pedal and investigate the cause, which may be one of the following:

No fuel in the tank.

No air pressure in the gasoline system.

Ignition not switched on.

Carburetor flooded by unnecessary use of the enriching device or by unnecessary priming of the carburetor when the engine is warm.

*In extremely cold weather move the ignition control lever all the way up unless the engine should be cranked by hand. If the engine is cranked by hand, be sure to move the ignition control lever all the way down.

Oil Pressure Gauge

The lower left-hand dial on the instrument panel (Fig. 1) is the oil pressure gauge. This gauge indicates, not the *quantity* of oil in the engine, but the *pressure* under which the oil is forced to the engine bearings.

When the engine is not running, the pointer on the oil pressure gauge should remain at zero, but as soon as the engine is started and as long as it runs the gauge should show pressure. If the gauge does not show pressure when the engine is running, stop the engine at once and determine the cause. Serious damage may be done if the engine is run without oil pressure. (See page 41 under "Oil Pressure.")

The amount of the pressure indicated by the gauge depends upon the speed of the engine, the viscosity of the oil, and the adjustment of the oil pressure regulator. At idling speed with fresh oil of the correct viscosity, the pressure after the engine is warm should be 1 to 4 lbs. Before the engine is warm, higher pressures than those specified will be indicated. After the oil has become thin from use, lower pressures than those specified will be indicated. These are normal variations from the standard and do not indicate need for readjustment of the oil pressure regulator.

Clutch Pedal

The clutch pedal is the left-hand pedal. When this pedal is in its normal or released position, the clutch is engaged. The flywheel of the engine is then coupled to the transmission by a series of discs, every other one of which is faced on both sides with friction material, and which are pressed together by a powerful spring. When the clutch pedal is pushed down, the spring is compressed and the clutch discs are allowed to separate. The clutch is then disengaged and the flywheel, if the engine is running, revolves independently of the transmission.

The clutch has two uses: First, to enable the car to be started gradually and without jerk or jar; second, to permit shifting of the transmission gears. The operation of the clutch pedal is discussed in connection with the transmission control on page 15. Further comment is unnecessary at this point except the following suggestions to the driver:

Do not drive with the foot resting on the clutch pedal. The Cadillac clutch operates so easily that even the weight of the driver's foot may unintentionally cause the clutch to slip.

Do not form the practice of disengaging the clutch whenever the brakes are applied. Most occasions for use of the brakes require only slowing down without stopping or even shifting of gears. A skilled driver will not touch the clutch pedal until the car is just about to stop or until he is about to shift to a lower gear. It is a mistaken idea that applying the brakes with the clutch engaged is more severe on the brake lining. The opposite is actually

the case, proof of which is in the fact that in coasting down grades the resistance of the engine is used to assist the brakes in controlling the car speed.

It will be observed in operating the clutch pedal that the pedal offers almost no resistance until it has been moved about one inch. It is at this point that it actually begins to disengage the clutch. It is important that the pedal have this "lost motion." If the full pressure of the clutch spring is felt just as soon as the pedal is moved from its released position, necessity for readjustment of the pedal connections is indicated. Failure to make this adjustment will result in the clutch slipping. (See page 72.)

Transmission Control

The Cadillac transmission has three forward speeds and reverse. It is controlled by a lever, the handle of which describes the letter "H" as it is moved from one position to another. It should be observed by those who have driven other makes of cars that, although most cars have this conventional H-type of transmission control, all these cars do not have the same positions of the lever. The driver should study Fig. 2 carefully, and if the various positions of the lever are different from those to which he has been accustomed, he should master this arrangement before attempting to drive.

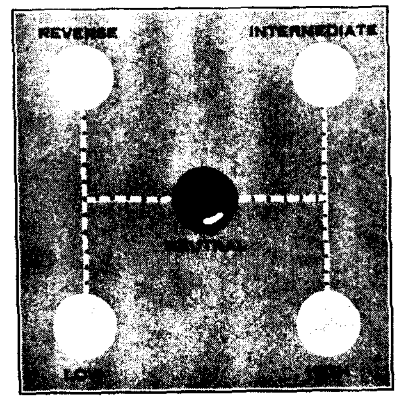

FIGURE 2. ***Positions of transmission control lever***

No attempt can be made here to teach the beginner the technique of gear shifting. It is recommended that the beginner secure individual instruction from the Cadillac distributor or dealer from whom the car was purchased and who will be glad to give this instruction. There are, however, certain rules and suggestions for the operation of the transmission control that it will be to the advantage of every driver to learn or to recall if he already knows them.

Always disengage the clutch before moving the control lever and hold the pedal down until the shift is completed.

Do not attempt to start the car with the transmission control in high gear.

Do not start with the transmission control in intermediate except when the car is on a smooth level road or on a down grade; even under these conditions do not start the car in intermediate unless the engine is thoroughly warm.

Do not make any of the following shifts when the car is moving:

From reverse to any forward gear.

From any forward gear to reverse.

From high gear to low gear.

From intermediate to low gear (except when the car is moving very slowly).

In shifting from high to intermediate, the car should not be traveling faster than fifteen miles per hour and the control lever should be moved very quickly and with no hesitation in neutral.

There are times when it is desirable to be able to shift from high to intermediate at higher car speeds. It is possible to do this by the following method, which is called "double de-clutching":

Disengage the clutch and shift the transmission control lever at once to neutral. Re-engage the clutch at the same time accelerating the engine; then disengage the clutch again and instantly shift to intermediate, after which re-engage the clutch. The speed to which the engine should be accelerated while the transmission control is in neutral depends upon the speed at which the car is traveling when the shift is made.

It is not recommended that the driver attempt the double de-clutching method until he has become expert in shifting from high to intermediate in the usual manner at lower speeds.

Make a practice of shifting the transmission control to intermediate or even to low before commencing the descent of steep grades. The reason for this is explained on page 19, where will also be found further suggestions for coasting.

Brakes

The foot brakes, which consist of external brake bands on the rear wheels and internal bands on the front wheels, are operated by the right-hand pedal. This pedal differs from the conventional brake pedal in a construction that provides automatically for notifying the driver when re-adjustment of the brakes is necessary. Every driver is familiar with the fact that, as the brake lining wears, the brake pedal must be pushed farther toward the floorboard to apply the brakes. On most cars this proceeds until an occasion arises for an emergency stop and then it is found that the pedal goes all the way to the floorboard before the brakes are fully applied.

The Cadillac brake pedal has two stages in its travel. The first stage, which consists of the first four or five inches of the pedal travel, is sufficient for all ordinary stops when the brake band clearance is properly adjusted. When, as the result of wear on the lining, the pedal must be pushed farther toward the floorboard, an inch or inch and a half from the floorboard the second stage of pedal travel is reached. In the second stage, the pedal has

somewhat less leverage than in the first stage and the point of division is marked by increased resistance to movement of the pedal. This serves as a notice to the driver that the brakes require readjustment. If it is not convenient to have the adjustment made at once, the brakes can still be operated for some time. The adjustment should be made, however, as soon thereafter as possible.

The hand brakes, which are internal brakes on the rear wheels, are operated by the hand lever at the right of the transmission control lever.

Speedometer

The speedometer has three dials. The upper dial indicates the speed of the car. The center dial indicates the total mileage traveled. The lower dial also indicates mileage, but it can be reset to zero by pushing up and turning the knurled stem back of the instrument board. The right-hand figure on the lower dial indicates tenths of a mile.

Across the speedometer cover glass and below the total mileage dial is a strip of black celluloid on which are two white spaces. These spaces are for the lubrication notice described on page 38 in connection with the lubrication schedule.

An automobile repairman should never be permitted to attempt to adjust or repair the speedometer head or to replace the glass. This work can be done only by men experienced in speedometer work and only with special machinery and tools. If the speedometer head is removed, handle it as carefully as a fine watch. The speedometer head may easily be damaged by rough handling.

Ammeter

The lower right-hand dial on the instrument panel (Fig. 1) is the ammeter, which measures the electric current flowing to the battery and the current flowing from the battery at all times except when the starter is cranking the engine. When current is flowing from the battery, the ammeter shows a reading on the side marked "Discharge"; when current is flowing to the battery, the ammeter reading is on the "Charge" side.

The ammeter should indicate on the "Charge" side most of the time. Otherwise, more current will be taken out of the battery than is put into it and the battery will eventually become fully discharged. The exact amount of current that should be indicated by the ammeter at any time depends upon various conditions, which are explained on page 62.

Ordinarily, when no lights are in use, the ammeter should show "Charge" as soon as the car is running ten or twelve miles per hour in high gear. If the ammeter indicates "Discharge" with all lights off, either when the engine is not running or when the car is running more than twelve miles per hour in high gear, need for readjustment of the generator is indicated.

CHAPTER II

Driving

The preceding chapter of the Manual has aimed to familiarize the driver with the controls and instruments used in operating the car. Actual skill in driving is, of course, more than knowledge of and familiarity with these individual devices. It is not the purpose of this Manual to discuss all phases of driving, but there are a few matters of sufficient importance to Cadillac owners to warrant devoting a chapter to them.

Driving Speed When Car Is New

The parts of the Cadillac car are machined and ground to secure the most accurate fit and the finest finish. Proper functioning of the assembled mechanism is further assured by testing the engine and chassis both on shop dynamometers and on the road. Nevertheless, it is not possible by manufacturing processes and tests to give to bearing surfaces the fine polish that results from continued operation at moderate speeds and loads.

Until a new car has been driven far enough to produce this effect on the bearing surfaces, the car should not be driven at high speeds. It is recommended that the car be driven no faster than twenty miles per hour for the first two hundred and fifty miles, and no faster than twenty-five miles per hour for the second two hundred and fifty miles. Moderate driving during the first five hundred miles will increase the life of the car more than enough to repay any inconvenience. Manufacturers of locomotives and stationary steam engines have always recognized the necessity for an initial "running-in" period.

Danger of Running Engine in Closed Garage

Every person having to do with the operation or care of a motor car should be warned of the danger that attends running the engine while the car is in a small closed garage.

Carbon monoxide, a deadly poisonous gas, is present in the exhaust of all internal combustion engines. Most people are already familiar with carbon monoxide in the form of illuminating gas, or in the gas produced by furnaces and stoves when insufficient air is supplied to give complete combustion. But illuminating gas and coal gas have an unpleasant odor, which serves as a warning, whereas carbon monoxide, as produced in the internal-combustion engine, is colorless, tasteless, and almost odorless, so that the victim may be overcome before he is aware of the danger.

When the engine exhausts into the open air, the carbon monoxide is so

diluted that it has no effect. It is when the engine is run for a time in a closed room that the proportion of carbon monoxide in the air may increase to the point at which continued breathing of it would be fatal. The United States Public Health Service advises that the average automobile engine warming up in a single-car garage will give off enough carbon monoxide in three minutes to endanger life.

Unusual precaution must be taken in cold weather when the natural tendency is to keep the garage doors and windows closed. The practice of letting the engine warm up before running the car out of the garage is unsafe. The risk is made greater by the fact that the enriching of the mixture by manipulation of the carburetor enriching device increases the amount of carbon monoxide formed.

Coasting

To coast *on the level,* simply release the accelerator pedal and disengage the clutch. If coasting to a stop, the transmission control may also be shifted to neutral and the clutch re-engaged.

In coasting *down grades,* however, it is recommended that the transmission be left in gear and the clutch engaged. With the throttle in the idling position, the car is thus made to drive the engine, the resistance of which assists the brakes and saves wear on the brake lining. It must be remembered that the brakes are subjected to much more severe use on grades than on the level because gravity acts continuously, whereas on the level the brakes need absorb only the momentum of the car. Even on slight grades, coasting with the transmission in neutral or the clutch disengaged is not advisable. On any grade steep enough to warrant coasting, it is worth while to save the brakes as much as possible by utilizing the braking effect of the engine.

Ordinarily, the resistance offered by the engine when the transmission is in high is sufficient to control the speed of the car, supplemented by moderate use of the brakes. On steep grades, however, the transmission control should be shifted to intermediate or even to low if the grade is very steep. Shifting should always be done before commencing the descent of the grade, because, after the car has once gained speed, considerable braking may be necessary to slow down to the speed at which the shift can be made easily.

Do not switch off the ignition when coasting with the car driving the engine. Contrary to a common impression, this does not appreciably increase the resistance and is likely to cause damage to the engine. Even with the throttle closed, some fuel is admitted to the cylinders and if this is not burned it condenses on the cylinder walls and washes off the oil by which the pistons are lubricated.

General Driving Suggestions

Road and traffic laws vary greatly in different localities. It is unfortunately impossible to set down a complete list of rules that may be followed in all parts of the country. The following are some of the rules that are universal in practically all parts of the United States:

In meeting a vehicle going in the opposite direction pass to the right.

In overtaking a vehicle going in the same direction pass to the left.

Always stop with the right-hand side of the car next to the curb. If it is necessary to turn the car around to do this, it should be done.

Never turn around or turn off on another road without making absolutely certain that there is no other vehicle directly behind.

Never start to cross street car tracks without making sure that there is no car directly behind. No matter how sure you feel, look and see.

Do not cross street car or steam railroad tracks without making certain that it is absolutely safe to do so. At any railroad crossing that is on an up grade or which for any reason must be approached very slowly, it is a wise precaution to shift to intermediate gear before crossing because the car can thereby be accelerated more quickly, if necessary.

In crowded traffic do not apply the brakes suddenly unless it is absolutely necessary. A vehicle following may not have brakes as efficient as Cadillac four-wheel brakes.

On wet asphalt streets or slippery roads do not apply the brakes suddenly unless it is absolutely necessary. Cadillac four-wheel brakes minimize the possibility of skidding under these conditions, but their effectiveness should not induce anyone to drive less carefully.

Slow down in passing vehicles going in the opposite direction.

Never take a chance.

Don'ts for General Operation

Don't fail to change the engine oil as frequently as recommended.

Don't fail to release the carburetor enriching button as soon after starting as possible.

Don't fill the lubricating system of the engine alone and neglect to lubricate all other parts of the car.

Don't neglect the lubrication of any part of the car.

Don't run the car at sustained high speed when it is new.

Don't allow the clutch to engage suddenly.

Don't prime the carburetor too much.

Don't attempt to shift from neutral to any gear, or from one gear to another gear, without first disengaging the clutch.

Don't attempt to shift from the reverse gear to any other gear when the car is moving.

Don't attempt to shift from any forward gear to the reverse gear when the car is moving.

Don't attempt to shift from the high gear to the low gear when the car is moving.

Don't attempt to shift from the intermediate gear to the low gear when the car is moving, unless it is moving very slowly. Ordinarily it is best to stop the car altogether.

Don't switch off the ignition when coasting with the car driving the engine.

Don't push the starter pedal when the engine is running.

Don't turn the steering gear when the car is standing. This is not only unnecessary but is also bad practice. The front wheels pivot more easily if they are rotating.

Don't fail to investigate any unusual sound which may develop in the car. The car should be inspected at a Cadillac maintenance station.

Don't neglect to inspect the level of the acid solution in the storage battery every 500 miles and add distilled water if necessary.

Don't turn corners at high speed.

Don't neglect to keep the cooling system filled.

Don't drive fast or attempt to stop suddenly on wet pavements.

Don't attempt to start the engine with the switch turned off, without air pressure or without gasoline in the tank.

Don't neglect to keep the tires inflated properly.

Don't race the engine when it is not driving the car. There is no worse abuse.

CHAPTER III

Equipment

The controls and instruments used in driving have already been described. In addition to these the car is equipped with various devices which are for the convenience and comfort of the occupants, and are used only as occasion demands. It is suggested that the driver anticipate his use of such equipment by becoming familiar at once with the directions contained in this chapter.

Windshield and Ventilation

Closed Cars—Cadillac closed cars are equipped with a one-piece windshield, which can be moved up and down. Movement of the glass is controlled by a handle above the windshield. To raise the glass, the handle should be turned clockwise, and to lower the glass the handle should be turned counter-clockwise.

For moderate ventilation, the windshield should be raised not more than one inch so that the lower edge of the glass is still below the ledge over the instrument board. With the windshield in this position, air is deflected into the driving compartment through an opening in the cowl just forward of the instrument board. For additional ventilation, the windshield can be raised above the level of the ledge over the instrument board, and air then enters directly into the car.

Open Cars—Cadillac open cars are equipped with a cowl ventilator which is operated by a lever just in front of the instrument board and at the right of the steering column. Additional ventilation for warmer weather can be secured by manipulating the windshield.

The open-car windshield is in one section, which is pivoted at the upper corners. To secure more ventilation than can be obtained through the cowl ventilator, the windshield can be tilted out.

The thumb screws on the windshield supports must be loosened before adjusting the position of the windshield and must be tightened to hold it in the desired position.

Windshield Cleaner

The windshield cleaner is attached to the car outside and above the windshield. It is operated by the suction or vacuum in the passages between the carburetor and the engine, and is controlled by a lever on the instrument

board (Fig. 1). The lever has three positions: in the extreme right-hand position, the cleaner is shut off; in the center position, the cleaner operates slowly; and in the left-hand position, the cleaner operates at its full speed.

Rear Vision Mirror

The rear vision mirror may be adjusted by the driver to suit his preference, after loosening the clamp screws that hold the mirror to its supporting bracket.

Cigar Lighter and Inspection Lamp

The car is equipped with a combination cigar lighter and inspection lamp that makes use of a single reel with twelve feet of flexible cord attached to the back of the instrument board. The flexible cord ends in a bayonet type socket to which may be attached either the inspection lamp or the heating element of the cigar lighter. The method of attachment is identical with that of an ordinary lamp bulb. Ordinarily the cigar lighter will be carried in place in the socket on the cord and the inspection lamp in a stationary socket provided on the front of the dash, where it is useful to illuminate the engine. (The inspection lamp is packed with the tool equipment when the car is shipped.)

To use the cigar lighter pull it out from the instrument board at least a foot, wait a few seconds for the heating element to heat and apply it to the cigar or cigarette. The current is automatically switched on as soon as ten or twelve inches of the cord has been unreeled. To light a pipe, remove the nickel plated shield by turning it slightly counter-clockwise and pulling it straight off.

To lock the cord in any desired position, pull out the button on the instrument board at the right of the cigar lighter (Fig. 1). This engages a ratchet which prevents the reel from rewinding. To rewind the cord, press the button back to its original position.

The inspection lamp socket on the dash has a double bayonet lock with two sets of slots. To install the lamp, simply insert it in the socket, press in, and turn it clockwise as soon as the pins on the lamp engage the first or outer set of slots. In this position the current is not switched on. To switch the current on, turn the lamp slightly counter-clockwise, press in, and turn it clockwise again, engaging the pins in the second or inner set of slots. To switch off the light, turn the lamp counter-clockwise and pull it out of the socket far enough to engage the first set of slots.

Clock

The clock has an eight-day movement and is wound in the same manner as a watch. The stem is under the clock back of the instrument board.

Side Curtains on Open Cars

The side curtains, with which the open cars are equipped, are carried in an envelope provided with cloth partitions to prevent rubbing and chafing. The Touring car curtains are stowed under the front seat; the Phaeton curtains in a compartment back of the front seat, with a door opening in the tonneau; the Roadster curtains in the package compartment just back of the seat.

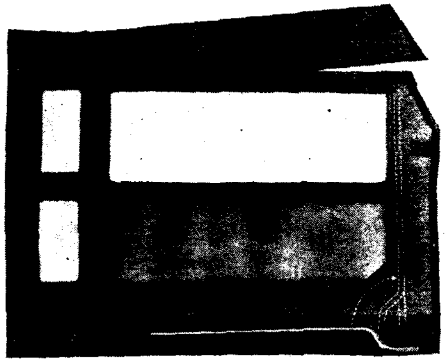

FIGURE 3. ***Side curtains***

The Touring car and Phaeton curtains are in six sections, each of which is marked to indicate its position, as "Left Front," "Right Center." The front and center sections on both sides are each provided with a rod, the lower end of which fits a socket in the top of the door. When a curtain is folded for stowing, this rod is parallel with the bottom of the curtain as shown in Fig. 3. Before the curtain can be attached to the door, the rod must be moved to the position shown by the dotted lines. The upper end of the rod is slotted to engage with the stiffener that runs along the upper edge of the curtain.

The rear sections should be applied first, followed by the center and front sections. The rear sections should be fastened to the rear bows *under* the side flaps of the permanent rear curtains.

Before stowing the curtains, they should be dry and clean.

Curtain Fasteners

Most of the curtain fasteners used on the top and side curtains are of the type illustrated in Fig. 4. When this type of fastener is snapped on its stud, it becomes locked on three sides. To release the fastener it must be lifted on the side that is not locked. This side is indicated by the small projection to which the arrow points in Fig. 4. This type of fastener cannot be released by lifting it at any other side. The remainder of the fasteners used on the top and curtains are of the usual glove type.

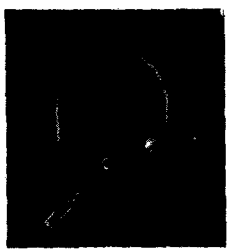

FIGURE 4
Curtain fastener

Tools

The compartment for carrying the tool equipment is just forward of the right-hand running board. The

lock on this compartment is operated by the switch key. The following are the tools comprising the standard equipment. The numbers refer to the numbers by which the tools are designated in Fig. 5. Items listed opposite Nos. 25, 26, 27, 28 and 29 are not illustrated.

1. Open end wrenches (two) for adjusting rear foot brakes
2. Small screw driver
3. Socket wrench for oil pan drain plug
4. Large screw driver
5. Center punch
6. Cold chisel
7. Hammer
8. File
9. Pliers
10. Wrench for spark plugs and compression relief cocks
11. Distributor wrench (with gauge for adjusting timer contact points and spark plugs)
12. Distributor wrench (plain)
13. Bicycle wrench
14. Monkey wrench
15. Wrench for rim clamping nuts
16. Rim assembling tool
17. Hose for tire air compressor
18. Adapter for grease gun for lubricating clutch thrust bearing
19. Grease gun
20. Hand starting crank
21. Hub cap wrench
22. Oil can
23. Jack handle
24. Jack
25. Inspection lamp. Note: The inspection lamp is packed with the tool equipment when the car is shipped but is ordinarily carried in the socket provided for it on the dash.
26. Small tool bag
27. Large tool bag
28. Lubrication chart
29. Operator's Manual

Tires

Tire Valve Caps

The valve caps used with some makes of tires are a combination dust and valve cap. This type of cap can be removed and installed without screwing the cap the entire length of the threads on the valve stem.

To remove one of these valve caps, turn it two or three turns counter-clockwise. This loosens the sliding nut inside the cap (Fig. 6). Next, pull the cap up as far as it will go. Then remove the cap by unscrewing it the rest of the way.

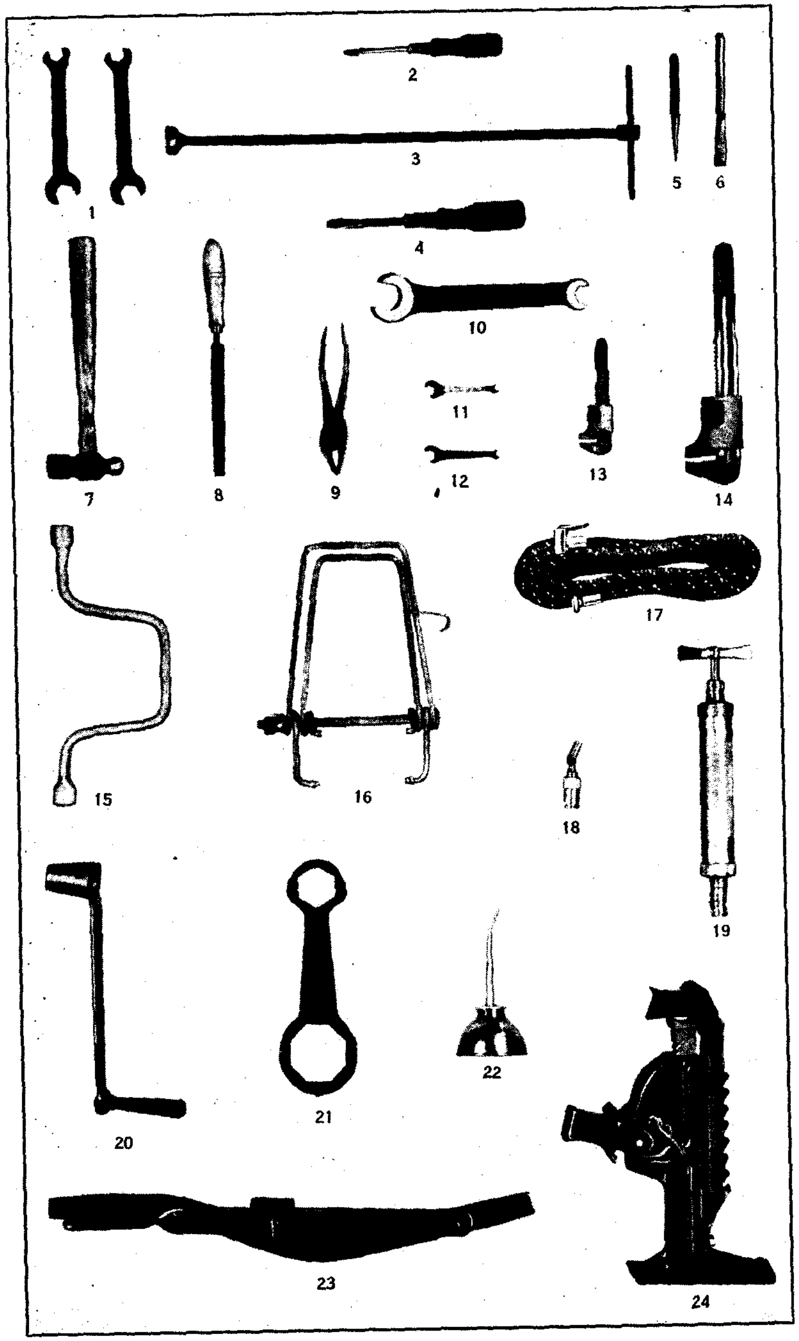

FIGURE 5. *Standard tool equipment*

To install a valve cap, place the cap over the valve stem and turn it a few turns clockwise to engage the threads in the sliding nut. If the sliding nut is too far inside the cap to be reached by the valve stem, shake the nut down by tapping the bottom of the cap on some solid object. When the valve stem has been started in the sliding nut, push the cap down over the stem as far as it will go. Then turn the cap until it locks tightly.

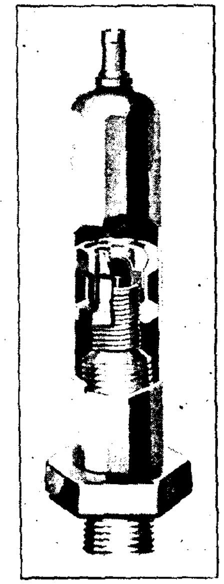

FIGURE 6
Tire valve cap

Inflation Pressure

For normal driving, the 33 by 6.75 low pressure tires, which are standard equipment on Cadillac cars, should be inflated to a pressure of 40 lbs. per square inch. The inflation pressure should be checked at least weekly and should not be permitted to drop more than 5 lbs.

On cars driven at high speeds, the front tires should be inflated to 45 lbs. or higher if necessary. *This is important.*

Tire Air Compressor

To use the tire air compressor with which the car is equipped, proceed as follows:

Turn back the left-hand side of the front carpet and lift the small oval-shaped cover which is in the floor just to the left of the transmission control lever. Reach through the hole in the floor and remove the knurled cap from the connection on top of the compressor. Connect one end of the air hose (in the tool equipment) to this connection and the other end of the hose to the valve of the tire to be inflated. *Do not connect the hose to the tire first if there is pressure in the tire.*

The control shaft by which the compressor driving gear is placed in mesh with the transmission gears projects through a small hole in the floor just in front of the large hole over the compressor. To start the compressor, if the engine is running, disengage the clutch and hold the pedal down until the transmission gears have ceased to revolve. Then, with a screw driver, turn the slotted head of the compressor control shaft clockwise. If the engine is not running, simply turn the control shaft clockwise without disengaging the clutch and then start the engine.

The compressor gives best results when the engine runs at a speed of approximately 1,000 r.p.m., which is about three times the normal speed of the engine when idling. Do not race the engine in operating the compressor, or, for that matter, at any other time when it is not driving the car. Racing the engine beyond the recommended speed not only decreases the efficiency

(*Continued on page 30*)

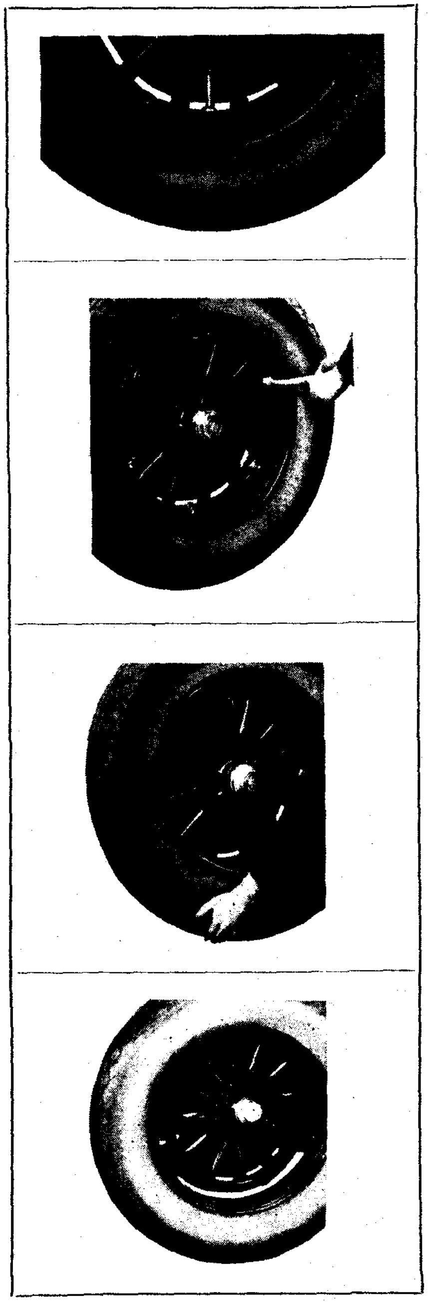

Figure 7a

Jack up the axle until the tire clears the ground. Unscrew the dust cap and the clamping nut from the tire valve stem.

Figure 7b

With the brace wrench, supplied in the tool kit, loosen the six rim clamping nuts. Turn each clamp so that the lug is away from the rim and tighten the nut enough to hold the clamp in this position.

Figure 7c

Rotate the wheel so that the valve stem is at the top, and pull the bottom of the rim away from the wheel. If the rim does not come off easily, pull the top of the rim as far out as the valve stem will permit and then pull the bottom part of the rim away from the wheel.

Figure 7d

Rotate the wheel until the valve stem approaches the bottom. At the point shown in the illustration, the rim and tire will roll free from the wheel and can be removed without lifting.

FIGURE 7. ***Removing rim with tire from wheel***

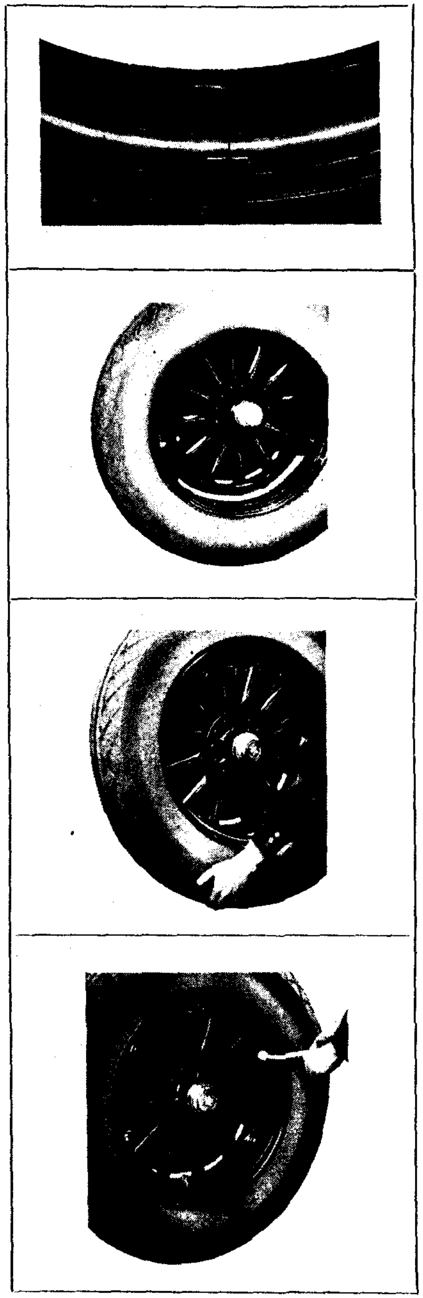

Figure 8a

If the rim has no split clamping ring, take the one from the rim removed. The correct position for the ring is just inside the three lugs and with the split opposite one of the lugs. If the ends of the ring overlap, they can be sprung into place with a screw driver.

Figure 8b

Rotate the wheel so that the hole for the valve stem is in the position shown. Hold the rim so that the three lugs are on the side away from the car and insert the valve stem into the hole in the wheel.

Figure 8c

Rotate the wheel, which will carry the rim with it, until the valve stem is at the top. Then push the lower part of the rim into place, guiding the hinge on the rim through the notch provided for it in the edge of the wheel.

Figure 8d

Turn each rim clamp so that the lug is over the clamping ring, drawing the nut down until the end of the bolt is flush, or nearly so, with the outer surface of the nut. Then go over the six nuts again, tightening them firmly. (See page 30 in regard to truing up the rim on the wheel.) Install the valve stem clamping nut and the dust cap. It is important that the clamping nut be firmly tightened.

FIGURE 8. ***Installing rim with tire on wheel***

of the compressor, but is one of the worst forms of abuse. To stop the compressor, turn the control shaft counter-clockwise.

Do not turn the compressor control shaft to start the compressor when the engine is running and the clutch is engaged.

Tire Holder

The tire holder is designed to carry either one or two standard size tires mounted on rims and inflated. Each rim has on it three lugs which are located so as to engage with notches on the support arms and on the adjustable clamp. There are two sets of these notches.

When two rims are carried, the rim nearest the car should be placed so that the side with the lugs is away from the car and the lugs should be inserted in the inner set of notches. The outer rim should then be placed so that the side with the lugs faces toward the car and the lugs of this rim should be inserted in the outer set of notches.

When only one rim is carried, the side of the rim with the lugs should face away from the car and the lugs should be inserted in the outer set of notches.

The tire holder lock is in the upper end of the clamp screw and is protected by a dust cap which must be unscrewed to insert the key. Turning the key clockwise disengages the lock, permitting the clamp screw to be turned.

To lock the tire holder, screw the clamp down firmly against the rim or rims. Adjust the clamp screw handle so that it points squarely across the car. Then turn the key counter-clockwise. Care should be exercised in removing or replacing a spare tire not to strike the body of the car.

Changing Tires

If a spare rim with inflated tire is always carried on the tire holder, the driver will seldom or never have occasion to disassemble a tire from the rim. In case of tire trouble it is then merely necessary to remove the rim with tire from the wheel and to install on the wheel the spare rim and tire. Illustrated directions for making this change are on pages 28 and 29. Disassembly of the tire from the rim is necessary only if the tire is to be repaired or a new one installed. Directions for this work, which is usually left to the repair shop, will be found on pages 78 and 79. Never attempt to remove a tire from its rim without first deflating the tire.

Truing Up Rim

If a rim does not run true, it may be trued up in the following manner: Rotate the wheel slowly and mark the part that runs farthest out from the face of the wheel. Loosen slightly the nuts diametrically opposite the mark and then tighten the nuts on the marked side. Test the wheel again and if it still does not run true repeat the operation.

CHAPTER IV

Cold Weather Operation

The Cadillac car is an all-season car and no owner need hesitate to make full use of his car in severe winter weather as well as at other times. It is necessary in freezing weather, however, to observe certain precautions and to follow a somewhat different procedure, particularly in starting the engine. In this chapter has been grouped all the information relating to operation of the car during cold weather. It should be reviewed just prior to the beginning of the winter season.

Starting the Engine

Carburetor Enriching Button

The first difference between starting the engine in cold weather and starting the engine in warm weather is in the greater use of the carburetor enriching device necessary in cold weather. Gasoline does not vaporize as readily at low temperatures, and in order to supply the cylinders with a gaseous mixture rich enough to be ignited, the proportion of liquid gasoline to air must be increased.

At the same time it is important not to apply the enriching device more than is necessary. The unvaporized gasoline collects on the cylinder walls and works down past the pistons, washing off the lubricant as it goes. Although dilution of the oil supply with this unburned gasoline is minimized in the Cadillac engine by an exclusive system for ventilating the crankcase (see page 42), it is best to avoid an excess of liquid gasoline in the combustion chambers by careful and judicious use of the enriching device.

The following rule should govern the use of the enriching button in winter weather: Pull the enriching button back just as far as it is necessary to start the engine, but as soon as the engine starts, let the button return as far as possible without causing the engine to stop or slow down. Then release the button entirely as soon as the engine is warm enough to permit doing so.

Priming the Carburetor

In extremely cold weather, if the engine does not start after cranking for a few seconds with the enriching device fully applied, release the starter pedal. Then prime the carburetor by opening and closing the throttle once or twice rather rapidly with the accelerator. Opening and closing the throttle operates

a throttle pump on the carburetor and raises the level of gasoline in the carburetor bowl. The carburetor should never be primed in warm weather and should not be primed unnecessarily in cold weather. Excessive priming is likely to prevent the engine from starting.

Position of Throttle Hand Lever

The correct position of the throttle hand lever for starting in cold weather is the same as for starting under other conditions, that is, about one-fourth the way down from the idling position. In warm weather, however, the lever may be returned to the idling position almost as soon as the engine is started. In cold weather, the throttle must be left slightly open until the engine becomes warm.

Position of Ignition Control Lever

Unless the weather is extremely cold, the correct position of the ignition control lever for starting is the same as that recommended on page 10, that is, about one-third the way down. In extremely cold weather, however, the lever should be moved all the way up for starting, unless the engine should be cranked by hand, in which case the lever should be moved all the way down.

It is the practice of some drivers to move the ignition control lever all the way down whenever starting the engine. This is the correct position if the engine is to be cranked by hand, but if the engine is to be cranked with the starter, there is no reason for retarding the spark, and in extremely cold weather "popping back" in the carburetor is less likely to occur if the spark is fully advanced.

Use of Starter

In extremely cold weather, when the car has been standing long enough to become thoroughly chilled, it is a good plan to disengage the clutch during the cranking operation. If this is not done, the starter is called upon to turn the jackshaft gears in the transmission in addition to cranking the engine. At ordinary temperatures, the additional energy required is negligible, but in extremely cold weather, the lubricant in the transmission offers sufficient resistance to rotation of the transmission gears to increase considerably the demand upon the battery and to retard the cranking speed.

Use of Accelerator Before Engine Is Warm

In cold weather, after the engine has been started and before it has run long enough to become warm, the engine cannot deliver its normal power and it should not be called upon to do so. In accelerating the engine to start the car and in accelerating the car after the transmission is in gear, do not open the throttle suddenly or too far. To do so is not only to invite "popping

back" in the carburetor, but to increase the amount of excess unvaporized gasoline in the combustion chambers, both of which results are undesirable. For this reason also, starting in intermediate should never be attempted in cold weather.

Additional Cold Weather Suggestions

Engine Oil for Cold Weather

All engine lubricating oil is more viscous at lower temperatures than at higher temperatures. An engine oil of the proper viscosity for summer weather will not flow freely at freezing temperatures, and will not lubricate the cylinders and bearings properly until the engine is warm. If the oil congeals it also offers considerable resistance to cranking of the engine, causing a severe drain on the battery, and retarding the cranking speed.

In cold weather, therefore, it is essential that an oil be used that has a sufficiently low cold test. The light grade of the Cadillac Motor Oil is recommended generally for winter use. If in doubt as to a suitable oil for cold weather, consult an authorized Cadillac maintenance station.

Strainers in Gasoline System

During cold weather, it is especially important to remove and clean the strainers in the gasoline line (see page 58). An accumulation of water at these points that would have no bad effect in warm weather might freeze in cold weather and prevent the gasoline from flowing to the carburetor.

Anti-Freezing Solutions

In freezing weather, the water in the cooling system must be replaced with some solution that has a lower freezing temperature than that of water. A solution of alcohol and water or of glycerin and water is recommended. Solutions containing calcium chloride or other ingredients injurious to the metal parts of the cooling system should never be used.

Alcohol and Water

The following table gives the freezing temperatures of solutions of denatured alcohol and water:

Denatured Alcohol (Parts by volume)	Water (Parts by volume)	Freezing Temperature (Degrees Fahr.)
1	4	10°
1	3	0°
1	2	−10°
1	1	−25°

Alcohol is more volatile than water and an alcohol solution tends to decrease in strength. It is a good plan, if an alcohol anti-freezing solution is used, to test a sample occasionally with a hydrometer. Hydrometers graduated to indicate the freezing temperature of the solution can be obtained.

Glycerin and Water

The following table gives the freezing temperatures of solutions of commercial glycerin and water:

Glycerin (Parts by volume)	Water (Parts by volume)	Freezing Temperature (Degrees Fahr.)
1	3	20°
1	2	12°
1	1	0°
3	2	−4°

Capacity of Cooling System

The capacity of the cooling system is five and one-half gallons.

Effect of Alcohol on Finish

Strong solutions of alcohol have a harmful effect on the finish. In adding pure alcohol or solutions containing 50 per cent or more alcohol, extreme care must be used not to let the liquid spatter or spill. A funnel and a pouring vessel with a suitable spout are necessary. Especially avoid pouring cold alcohol into very hot water. The effect of this is to make the mixture foam up and possibly bubble over on the finish.

PART II

LUBRICATION AND CARE

Cadillac 4000-Mile Lubrication Schedule

Note: Engine oil must be added whenever the oil level indicator ball drops to "Fill," regardless of the changing of oil specified every 2000 miles on the schedule. The oil level should be checked every 100 to 150 miles. This is especially important on cars driven at high speeds.

Lubrication group	Explanation: The figures and letters following the items in this column refer to the chassis lubrication diagram, Fig. 11	Refer to page	Lubrication No. and Mileage at which due							
			1	2	3	4	5	6	7	8
			500	1000	1500	2000	2500	3000	3500	4000
1, 3, 5, and 7	Add engine oil as necessary*	41	O	O	O	O	O	O	O	O
1, 3, 5, and 7	Grease gun connections: G	45	O	O	O	O	O	O	O	O
1, 3, 5, and 7	Spring leaves: 2, 10, 13, 23	48	O	O	O	O	O	O	O	O
1, 3, 5, and 7	Add water to storage battery	63	O	O	O	O	O	O	O	O
LUBRICATION Nos. 2 and 6	Universal joints: 16, 17	46		O		O		O		O
LUBRICATION Nos. 2 and 6	Generator and distributor oil cups: 20, 21, 22	45		O		O		O		O
LUBRICATION Nos. 2 and 6	Engine rear supports: 7, 19	45		O		O		O		O
LUBRICATION Nos. 2 and 6	Steering column oil holes: 4	47		O		O		O		O
LUBRICATION Nos. 2 and 6	Brake pins and connections	77		O		O		O		O
LUBRICATION Nos. 2 and 6	Door hardware	48		O		O		O		O
LUBRICATION NUMBER 4	Drain and replace engine oil*: 24	43				O				O
LUBRICATION NUMBER 4	Transmission‡—add lubricant: 18	46				O				O
LUBRICATION NUMBER 4	Rear axle‡—add lubricant: 14	46				O				O
LUBRICATION NUMBER 4	Clutch thrust bearing: 6	45				O				O
LUBRICATION NUMBER 4	Steering gear—add lubricant: 8	47				O				O
LUBRICATION NUMBER 4	Speedometer drive shaft	47				O				O
LUBRICATION NUMBER 8	Transmission‡—drain and replace lubricant: 18	46								O
LUBRICATION NUMBER 8	Rear axle‡—drain and replace lubricant: 14	46								O
LUBRICATION NUMBER 8	Wheel bearings—clean and repack: 3, 11, 15, 25	46								O
LUBRICATION NUMBER 8	Front brake trunnions: 12, 26	47								O
RECORD	Speedometer Reading									
RECORD	Date									

*Change to light grade of engine oil at beginning of cold weather and to heavy grade of engine oil at beginning of warm weather, regardless of mileage.
‡Change to light grade of lubricant at beginning of cold weather and to heavy grade of lubricant at beginning of warm weather, regardless of mileage.

FIGURE 9
Lubrication schedule

CHAPTER I

Systematic Lubrication

Necessity for Lubrication

Lubrication has made machinery possible. Without it the destructive effects of friction would render the most ingeniously designed mechanism useless. Especially is this so of the gasoline engine, in which heat of combustion is added to that of friction. Absence of lubrication for even a brief instant while the engine is running would heat the surfaces in contact to the melting point.

But it is not enough to know that friction, unrestrained by lubrication, is capable of ruining an engine in less time than it takes to tell it. No motorist expects to run out of oil. What is frequently not fully appreciated is that, if improper lubricants are used and are infrequently applied, friction is still a powerful destructive agent capable of shortening the useful life of the car from years to months.

The quiet, dependable operation of a new car is primarily the result of the accurate finishing of surfaces separated from each other by a few thousandths of an inch. In the Cadillac, there are hundreds of such surfaces. If the clearances between these surfaces are to be maintained, so that the car will continue to operate quietly and dependably, friction must be prevented from taking its toll in wear.

Cadillac engineers have provided for the lubrication of all surfaces where friction is a factor. The most that a manufacturer can do, however, is to provide a place for the lubricant and means for it to reach the surfaces to be lubricated. The car cannot be equipped with an inexhaustible supply of lubricant. Upon the car owner devolves the responsibility of replenishing the supply at the proper time with lubricant of the prescribed specifications.

Because of the importance to the car owner of proper lubrication of his car, every effort has been made in this Manual to give explicit information for his guidance. Lubricants are prescribed for each point requiring lubrication, directions are given for applying the lubricant, and recommendations are made as to the frequency with which the lubricant should be applied. All this information is based upon actual operation of Cadillac cars over hundreds of thousands of miles.

Lubrication Schedule

Lubrication is effective only insofar as it is regular and systematic. To be systematic, lubrication must be performed at regular mileage intervals. The

Cadillac technical staff has accordingly developed for the Cadillac car a complete lubrication schedule which, if faithfully followed, will insure for each bearing surface ample, but not superfluous, lubrication. This schedule is shown in Fig. 9.

The unit of the Cadillac lubrication schedule is 4,000 miles, which is divided into eight 500-mile intervals. Corresponding to these is a series of eight consecutive groups of lubricating operations. When the car has traveled 500 miles, the points enumerated under Lubrication No. 1 should receive attention. At 1,000 miles, Lubrication No. 2 is due, and so on until at 4,000 miles Lubrication No. 8 should be performed. At 4,500 miles the schedule begins again with Lubrication No. 1.

In order that the driver may be continually reminded of the mileage at which the next lubrication is due, provision is made on the speedometer for a lubrication notice. This consists of a strip of black celluloid (Fig. 10) which is placed across the speedometer cover glass below the total mileage dial and which has two white spaces, one for the lubrication number and one for the mileage at which it is due. Whenever the car is lubricated on the schedule, the figures then on the celluloid should be erased and the next lubrication number and the mileage at which it is due should be written or stamped in their places, If this notice is used, the driver need only glance occasionally at the speedometer and compare the mileage on the dial with the figures on the notice in order to plan for the necessary attention.

Cadillac distributors and dealers are prepared to sell lubrication based on this schedule. A car that is being lubricated on the schedule can be taken to any authorized Cadillac maintenance station, and without further ordering than to specify "Schedule Lubrication," the car will receive the necessary attention.

The schedule in Fig. 9 is in outline form. Detailed information as to the location of the points to which lubricant is to be applied, the method of lubricating, and the kind and amount of lubricant will be found in Chapters VI and VII. For each point on the schedule, two reference numbers are given: the number of the page on which detailed directions will be found and the number designating the point on the chassis lubrication diagram (Fig. 11).

The schedule is the most effective aid to systematic lubrication that has been devised. Used in conjunction with a notice on the speedometer cover glass, it reduces lubrication to the simplest possible terms. Whether the car is lubricated in the owner's private garage or in a Cadillac authorized maintenance station, it is strongly urged that this schedule be followed from the first mile of operation.

Lubricants

The selection of proper lubricants for the Cadillac car is one of the first concerns of the owner in his attention to the lubrication of his car.

The lubricants must not only be of high quality, but their viscosity and other characteristics must be suited to the Cadillac car. The difficulty of securing suitable lubricants on the open market has induced us to provide lubricants under the Cadillac trade mark. These lubricants are prepared according to specifications prescribed by the Cadillac technical staff and are based upon hundreds of actual tests. Cadillac lubricants include the following and can be obtained from Cadillac distributors or dealers:

Cadillac Engine Oil—Light, Medium and Heavy
Cadillac Rear Axle and Transmission Lubricant—Light and Heavy
Cadillac Roller Bearing and Cup Grease
Cadillac Universal Joint Grease
Cadillac Steering Gear Lubricant

Engine Oil

Except in extremely hot or extremely cold weather, the medium grade of Cadillac Engine Oil is recommended. In extremely hot weather, the heavy grade should be used and in freezing weather, the light grade.

The names of other engine oils approved for use in the Cadillac engine will be supplied by our Technical Department on request.

Rear Axle and Transmission Lubricant

The heavy grade of Cadillac Rear Axle and Transmission Lubricant should be used except in cold weather. The light grade should then be used. If the heavy grade is used in cold weather the transmission gears will be difficult to shift.

The names of other lubricants suitable for use in the Cadillac rear axle and transmission will be supplied upon request.

Roller Bearing and Cup Grease

Cadillac Roller Bearing and Cup Grease is recommended for the wheel bearings and for all points for which grease gun connections are provided, with the exception of the steering gear and the universal joints. In the absence of Cadillac Roller Bearing and Cup Grease, No. 3 cup grease may be used for the grease gun connections and No. 1½ cup grease for the wheel bearings.

Universal Joint Grease

Cadillac Universal Joint Grease is recommended for the universal joints on the drive shaft. In its absence a No. 3 fibre grease may be used.

Steering Gear Lubricant

Cadillac Steering Gear Lubricant is recommended for lubricating the steering gear worm and sector. In its absence, use a mixture consisting of 75 per cent rear axle and transmission lubricant and 25 per cent cup grease.

CHAPTER II

Engine Lubrication

Oil Circulating System

The supply of engine oil is carried in the pressed steel reservoir that covers the bottom of the crankcase. The oil is forced to the bearings by a gear pump attached to the right-hand side of the engine toward the front and driven by a spiral gear on the crankshaft.

The pump draws the oil from the bottom of the oil pan and delivers it under pressure to a supply pipe running the length of the engine parallel with the crankshaft. From this supply pipe, three leads branch off to feed the three main bearings. A fourth lead connects the supply pipe to the oil pressure regulator which is attached to the crankcase just back of the right-hand cylinder block. A fifth lead at the front end of the supply pipe directs a stream of oil upon the spiral gears. A separate passage drilled through the crankcase conducts oil direct from the pump to the camshaft front bearing from which the oil enters the hollow camshaft and is carried to the other camshaft bearings and to the distributor driving gear.

At the oil pressure regulator there are four paths for the oil to follow:

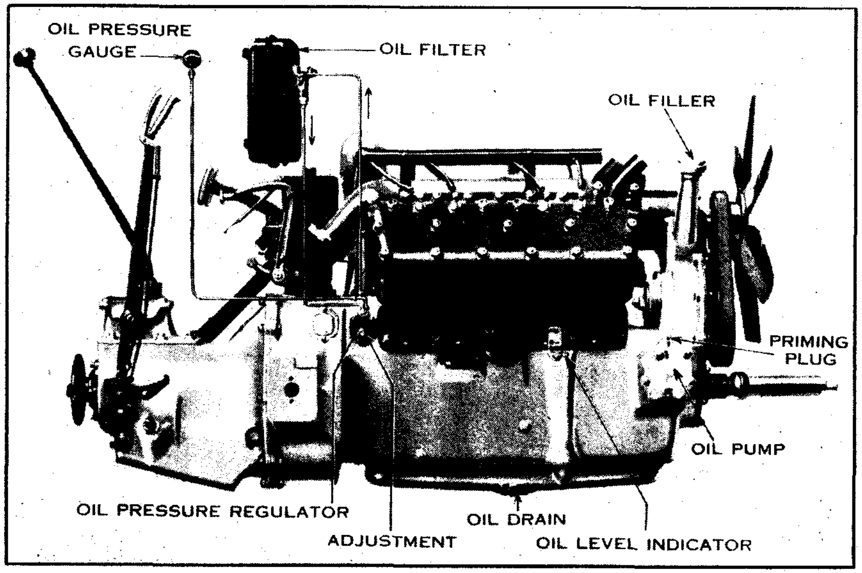

FIGURE 10. ***Engine lubrication features***

two through passages within the regulator and two through outside connections. The first passage is a small by-pass which leads back to the crankcase and which has an adjustable metering screw. Oil flows through this by-pass whenever the engine is running. The second passage leads to a valve which is under spring tension and which does not open until the pressure in the supply pipe reaches approximately 30 lbs. Oil passing this valve also flows back to the crankcase.

The T-connection on the outside of the oil pressure regulator leads to the pressure gauge on the instrument panel and to the oil filter on the dash. Oil flows through the filter whenever the engine is running, the filtered oil being returned to the oil pressure regulator and thence to the crankcase.

The crankpin bearings are fed from the main bearings through ducts in the crankshaft. Oil thrown from the crankpins as the crankshaft revolves becomes a fine mist or spray which pervades the interior of the crankcase and cylinders and lubricates the pistons, piston pins, cams, camslides, and rollers.

The valve stems are automatically lubricated by oil sprayed from two small holes drilled in the wall of each cylinder at such a distance from the bottom of the cylinder that, when the piston is at the bottom of its stroke, these holes register with a groove in the piston between the second and third piston rings. As the piston descends on the power stroke, oil collects in this groove and as soon as the groove registers with the holes, the pressure of the gases above the piston forces oil out upon the valve stems. Surplus oil collecting in the valve compartments is returned to the crankcase through drain passages.

All oil returns to the oil pan through a fine mesh screen placed above the oil pan and separating it from the crankcase.

Oil Level

The normal capacity of the oil pan is two gallons which fills it to the level of the screen above the pan. When the oil pan contains this amount, the oil level indicator on the right-hand side of the engine (Fig. 10) indicates "Full." As the oil level descends, the indicator indicates "Fill" and then "Empty." Oil should be added as soon as the indicator ball has dropped to "Fill." If the indicator indicates "Empty," under no circumstances should the engine be run until oil has been added.

The mileage interval at which oil must be added depends upon individual circumstances. It is recommended that the oil level indicator be checked every one hundred to one hundred and fifty miles, although it is improbable that oil will be required as frequently as this.

Oil Pressure

The pressure of the oil in the supply pipe is indicated by the oil pressure gauge on the instrument panel (Fig. 1). The purpose of the oil pressure gauge

is, first, to enable the driver to make sure that there is pressure whenever the engine is running, and second, to verify the adjustment of the oil pressure regulator.

It is absolutely necessary that there should be oil pressure just as soon as the engine starts and as long as the engine is running. If the oil pressure gauge does not indicate pressure as soon as the engine starts, stop the engine at once and investigate the cause. First, check the level of oil in the oil pan. If the level is above "Fill," prime the oil pump by removing the plug shown in Fig. 10 and pouring oil in through a funnel. Be sure to replace the plug before starting the engine. If, after priming the oil pump and starting the engine, the oil pressure gauge does not indicate pressure, stop the engine immediately and consult the nearest Cadillac maintenance station.

Before the adjustment of the oil pressure regulator can be verified, the factors affecting the viscosity of the oil must be standardized. The oil pressure changes with the viscosity, which in turn depends upon the kind of oil, the extent to which it has been thinned by use, and the temperature. It is therefore necessary that the oil be fresh and of the viscosity specified for the Cadillac engine. The engine must also be run long enough to become thoroughly warm. Under these conditions the pressure at idling speed (300 r.p.m.) should be from 1 to 4 lbs.

Adjustment of the pressure at idling speeds is made by the screw shown in Fig. 10. To increase the pressure, turn the screw clockwise; to decrease the pressure turn the screw counter-clockwise. This adjustment should be made while the engine is running.

Crankcase Ventilating System

In every internal combustion engine, seepage of vapors by the pistons takes place to some extent, permitting water vapor and other products resulting from combustion, as well as unburned gasoline, to enter the crankcase. Contamination of the lubricating oil from this source makes it necessary in most engines to replace the oil supply at frequent intervals.

Cadillac engines are equipped with an exclusive system to prevent the seepage vapors from entering the crankcase. To bring about this result, advantage is taken of the fact that the Cadillac crankshaft with its compensating weights acts naturally to draw air through an inlet in the left-hand side of the engine, building up within the crankcase a pressure slightly above atmospheric pressure. No outlet is provided in the crankcase itself but in the wall of each cylinder is a port connecting the space below the piston with the valve compartment. This port is open except when the piston is at the extreme bottom of its stroke.

The effect of this arrangement is as follows: The seepage vapors that pass the two upper piston rings are forced through slots milled in the circumference of the lower piston ring and through corresponding holes in the piston into the space inside the piston, where they are carried down as the piston descends. The vapors cannot enter the crankcase, however, because they are prevented from doing so by the pressure built up in the crankcase by the revolving crankshaft. Instead, the vapors are expelled through the port into the valve compartment. From the valve compartments the expelled vapors are conducted through flexible pipes underneath the car where they are discharged.

Oil Filter

Another source of contamination of the oil supply is dirt. In the Cadillac engine all solid matter in the oil is removed by means of a filter (Fig. 10) which is attached to the dash and which is connected to the oil circulating system.

The filter consists of a metal container in which is a series of eight envelopes made of special fabric. As the oil is forced through these fabric envelopes, the total area of which is over five square feet, it leaves all solid matter behind, returning to the engine as clean oil.

The filter is connected to the oil pressure regulator at the same point as the oil pressure gauge. Oil is thus forced to the filter whenever the engine is running and there is pressure in the oil lines. The normal flow when the filter is new is approximately one quart per minute so that an amount of oil equal to the entire capacity of the lubricating system passes through the filter every eight to ten minutes.

The filtered oil, which is returned to the oil pressure regulator and thence to the crankcase, leaves the filter through a sight-feed glass. When the filter is new, the stream of filtered oil visible through the glass should be about ⅛ inch in diameter. As dirt accumulates in the filter, the flow of oil gradually decreases. When the stream has diminished to the size of a pencil lead, the filter unit should be replaced. When checking the flow of oil through the sight-feed the engine should be warm and the throttle should be opened until the oil pressure gauge indicates approximately 15 lbs.

Under average driving conditions the filter unit should not require replacement for 12,000 to 15,000 miles. Filter units for replacement can be obtained from Cadillac distributors and dealers.

Replacing Engine Oil

Although the crankcase ventilating system and the oil filter described in the preceding sections greatly prolong the useful life of the oil, it is recommended that the oil be drained and replaced with fresh oil every 2,000 miles.

To drain the oil, simply remove the drain plug (Fig. 10). A special socket wrench for the oil pan drain plug is supplied as part of the tool equipment.

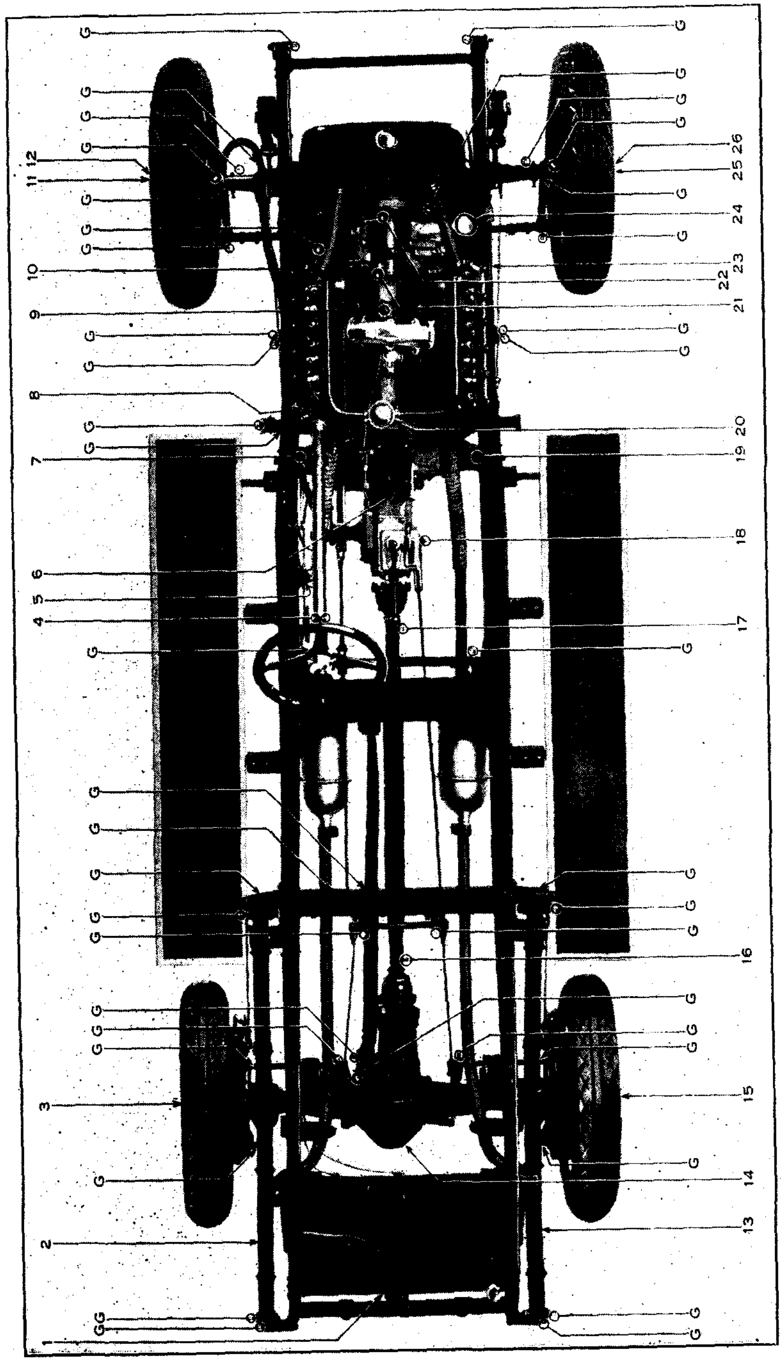

FIGURE 11. *Chassis lubrication diagram*

Each "G" indicates a grease gun connection. Each number indicates a lubricating point for which instructions are given in Chapters II and III. Lubricating points that are visible in the diagram are surrounded by circles, others are indicated by arrows.

Be sure to reinstall the drain plug before adding the fresh oil. Two gallons of fresh oil should be added, or enough to bring the oil level indicator ball to "Full."

At the end of the first 1,000 miles, it is recommended that the car be taken to a Cadillac maintenance station to have the oil pan and screen removed and cleaned with gasoline or kerosene. This should be repeated once a year or whenever the filter unit is replaced.

*Generator Oil Cups: 21, 22**

Two oil cups on the generator conduct lubricant to the forward and rear bearings on the armature shaft. A few drops of engine oil should be applied to each cup every 1,000 miles.

Timer-Distributor Oil Cup: 20

The oil cup at "20" is for lubricating the ball bearing at the upper end of the timer-distributor shaft. A few drops of engine oil should be applied every 1,000 miles.

Engine Rear Supports: 7, 19

The brackets on the frame to which the engine rear supports are bolted are provided with felt wicks. Engine oil should be applied at these points every 1,000 miles.

CHAPTER III

General Lubrication

Grease Gun Connections: G

Spring bolts, steering connections, brake rocker shafts and other points are provided with connections to fit the grease gun supplied with the tool equipment. These points are indicated by "G" in Fig. 11. Cadillac Roller Bearing and Cup Grease should be applied to these points with the grease gun every 500 miles.

Clutch Thrust Bearing: 6

The clutch thrust bearing is provided with a grease gun connection, which is accessible after removing the floor boards and the cover plate shown at

*The numbers following the headings in this chapter and in Chapter III refer to Fig.11.

"6." Before the grease gun can be applied to the connection, it is necessary to attach to the connection the adapter furnished with the tool equipment.

If the connection does not point upward so that the adapter can be applied, turn the bearing until it does. This must be done with the engine not *running.*

The clutch thrust bearing should be lubricated every 2,000 miles with Cadillac Roller Bearing and Cup Grease.

Caution: Do not inject too much grease into the clutch thrust bearing. One or two turns of the grease gun handle are sufficient.

Transmission: 18

The transmission case should contain sufficient lubricant to bring the level up to the filling hole at the right-hand side. The level should be inspected every 2,000 miles and lubricant added if necessary. Cadillac Rear Axle and Transmission Lubricant is recommended. The heavy grade should be used except in cold weather. The light grade should then be used. If the heavy grade is used in cold weather, the transmission gears will be difficult to shift.

Every 4,000 miles the drain plug should be removed from the bottom of the transmission case and the lubricant should be drained and replaced with fresh lubricant. Three quarts of lubricant are required to fill the transmission case to the proper level.

Universal Joints: 16, 17

The forward and rear universal joints on the drive shaft are provided with grease gun connections as indicated at "16" and "17." It may be necessary to roll the car forward or backward a few inches to bring the connections underneath where they can be reached with the grease gun. Cadillac Universal Joint Grease should be applied every 1,000 miles.

Rear Axle: 14

The rear axle housing should contain enough lubricant to bring the level up to the filling hole in the rear cover plate. The level should be inspected every 2,000 miles and lubricant added if necessary. Cadillac Rear Axle and Transmission Lubricant is recommended. The heavy grade should be used except in cold weather. The light grade should then be used.

Every 4,000 miles the drain plug should be removed from the bottom of the axle housing and the lubricant should be drained and replaced with fresh lubricant. Three and one-half quarts of lubricant are necessary to fill the rear axle housing to the proper level.

Wheels: 3, 11, 15, 25

The front and rear wheel bearings are packed in grease when the car is assembled. Every 4,000 miles all the wheels should be removed and the bearings should be thoroughly cleaned in gasoline or kerosene. They should then be repacked and the bearings adjusted in accordance with the directions on pages 80, 81 and 82.

Cadillac Roller Bearing and Cup Grease is recommended for the wheel bearings. Do not use heavy grease as it will roll away from the path of the rollers and will not return.

Front Brake Trunnions: 12, 26

Every 4,000 miles, at the same time that the wheels are removed for lubrication of the wheel bearings, the brake operating trunnions inside the front wheel brake drums should be lubricated by applying the grease gun to the connection at "A" (Fig. 12). Cadillac Roller Bearing and Cup Grease should be used. It should be injected only until it begins to appear around the trunnion bearings. Do not inject too much grease. Before replacing the wheels, wipe off any grease appearing around the trunnion bearings. Do not inject any grease at "A" except when the wheel is off and the application of too much grease can be definitely avoided.

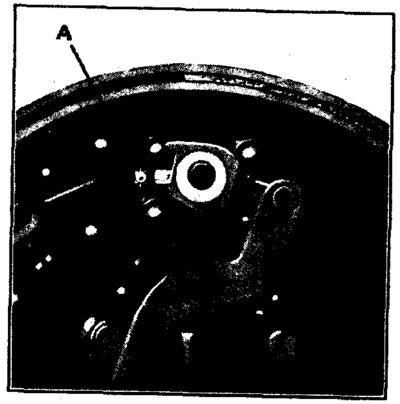

FIGURE 12
Lubrication of front brake trunnions

Steering Gear: 8

A grease gun connection is provided on the steering gear housing for injecting lubricant for the steering gear worm and sector. Cadillac Steering Gear Lubricant is recommended for the steering gear and it should be applied every 2,000 miles.

Oil Holes in Steering Column: 4

There are two oil holes in the steering column just below the steering wheel. A few drops of engine oil should be applied to these every 1,000 miles. The holes are closed by screw plugs which must be removed before the oil can be applied.

Speedometer Flexible Drive Shaft

The flexible shaft by which the speedometer is driven is housed in a flexible casing. To lubricate the speedometer drive shaft, the shaft should be removed from its casing and lubricant applied to it for its entire length. Cadillac Roller Bearing and Cup Grease is recommended for this lubrication, which should be performed every 2,000 miles.

Do not under any circumstances attempt to lubricate the speedometer itself. Any parts in the speedometer requiring lubrication are amply supplied when it is assembled.

Horn

The horn is lubricated when assembled and does not require further lubrication, but it is a good plan to inspect the commutator of the horn motor occasionally and clean it, if necessary. To do this, remove the horn from its bracket and the motor shell from the horn. If the commutator appears to be dirty, clean it with a dry cloth. This should be done with the horn motor running so that the commutator will be cleaned on all sides. Do not attempt to polish the commutator or brushes with oil or vaseline. These parts are designed to run without lubricant.

Springs: 2, 10, 13, 23

To lubricate the spring leaves, it is recommended that the edges and ends of the leaves be painted with engine oil every 500 miles. A small stiff brush should be used. After applying the oil, the car should not be washed until it has been driven far enough to allow the lubricant to work in between the leaves. Do not separate the leaves and insert lubricant. A certain amount of friction between the spring leaves is necessary in order to give the springs the desired characteristics.

If spring covers are used, it is not necessary to lubricate the spring leaves as directed in the preceding paragraph.

Stabilators

The stabilators, with which the car is equipped and which are for the purpose of controlling the recoil of the springs, not only need no lubrication—they *must not* be lubricated. To lubricate the stabilators would defeat their purpose just as oil or grease on the brakes would prevent them from holding.

Door Hardware

Whenever the chassis is being lubricated, the door locks and other door hardware should also be lubricated as follows:

Place a few drops of oil on each door lock plunger or striker, turning the handle back and forth so that the oil will work into the lock. Also place a drop of oil on each of the striker plates against which the strikers engage when the doors are closed. The hinge pins should also be oiled sparingly so as not to get oil on the finish.

Each door has a wedge-shaped tongue that dovetails into a receptacle on the body when the door is closed. These tongues should receive a small amount of grease or oil.

Each closed car door is also fitted with a check at the top which limits the outward movement of the door. A small amount of grease should be applied to the pin that slides in the slot at the top of the door.

CHAPTER IV

Care of Body

Care of Finish When New

On cars finished with varnish, more careful and more frequent attention is necessary when the car is new than after the varnish has hardened. Particular care should be taken to keep mud from the body and hood for the first few weeks. Even after the varnish has hardened, mud should not be permitted to remain on the finish over night or long enough to dry. If it is not possible to wash the car thoroughly before putting it away for the night, flush it off and then thoroughly wash the car the next morning. Mud permitted to remain on the car until it has dried is not only difficult to remove, but stains and dulls the finish.

The same degree of caution, although commendable, is not as necessary on cars finished with Duco, because Duco hardens much more quickly than paint or varnish.

Washing Varnished Cars

Use clean water and plenty of it. Do not use water containing alkali. In parts of the country where the regular water supply contains alkali, use rain water.

Do not use hot water as it destroys the lustre. The temperature of the water should be between 40 and 60 degrees Fahrenheit. Do not wash the hood while it is hot, because the effect on the finish is the same as washing it with hot water. Unless the hood is allowed to cool before washing, the lustre will soon disappear.

If a hose is used in washing, do not have pressure greater than will carry the water six inches beyond the end of the hose. Water under higher pressure drives the grit and dirt into the varnish. It is best not to use a nozzle.

Wash the chassis first, going over the under sides of the fenders, the wheels, and the running gear with water flowing gently from the hose. This will flush off most of the mud and dirt.

If it is necessary to use soap to remove road oil from the under side of the fenders, or machine oil or grease from the chassis, use a good automobile soap dissolved in a pail of water and apply the soapy solution with a sponge.

Do not let this soapy solution remain on the finish more than two or three minutes, but immediately wash it off thoroughly with a soft carriage sponge.

After washing the chassis, begin at the front of the car, and flow water from the hose upon the body, hood, and upper surfaces of the fenders. This will soften the accumulation of road dirt, removing most of it. Then go over the car again and remove all dirt by rubbing lightly with a soft wool sponge, at the same time applying an abundance of water from the hose. The sponge, which should be kept exclusively for the body, hood, and upper surfaces of the fenders, should be rinsed frequently in clean water to remove any grit.

After the washing is completed, squeeze the sponge as dry as possible and pick up all water from crevices. Then thoroughly wet a clean soft chamois, wring it as dry as possible, and dry the finish. Be sure and use a chamois that has not been used on the chassis. Rinse the chamois and wring it out frequently. Do not rub the finish or apply more pressure than is necessary to dry off the surplus water. The remaining water will evaporate quickly, leaving the finish in good condition.

If it is desired to chamois the wheels and chassis, and they have become dry, wet these parts with clean water and then wipe them. Be sure to use a separate chamois for the chassis. The chamois that has been used on the body should be saved for the body exclusively.

Do not use soap, gasoline, kerosene, or anything of similar nature on the finish. Such materials attack the finish.

Washing Duco

Although it is not necessary in washing cars finished in Duco to use the same degree of care as in washing varnished cars, nevertheless the same general directions should be followed.

Cleaning Windows

Do not clean the window glass with preparations that may contain harmful ingredients. Use only cleaning compounds that are known to have no destructive effects on highly polished glass.

Cleaning Upholstery

To keep the upholstery in closed cars in the best condition, it should be cleaned thoroughly at least once a month with a whisk broom and vacuum cleaner. Dirt and grit accumulating in the fabric wear it out faster than use.

Spots on the upholstery may be cleaned with any good dry cleaner. When the cleaner has thoroughly evaporated, apply a hot flatiron wrapped in a wet cloth. Steaming the fabric and rubbing lightly against the nap will raise the nap to its normal position.

CHAPTER V

Care of Tires

EACH tire maker publishes a booklet with instructions for care and repair of tires. Every motorist should provide himself with one of these and thoroughly familiarize himself with the contents. The suggestions here apply to pneumatic tires in general.

Three-fourths of so-called "tire trouble" is the result of misuse. We give here some suggestions regarding the more important points of the care of tires.

Result of Under-Inflation

Under-inflation causes a tire to flatten out under load. This causes the side walls to bend sharply as the tire revolves. The result is the breaking of the side walls. An under-inflated tire is susceptible to bruise, broken cords and blow-out.

Result of Improperly Aligned Front Wheels

Running a car with the front wheels out of alignment causes rapid tread wear. This usually affects both tires similarly, although sometimes only one tire is affected. An incorrect adjustment of the front axle parallel rod or a bent steering arm is responsible for the condition. Unless the wheels are in proper alignment the treads of the front tires will wear away in a remarkably short time.

Neglect of Small Cuts

If cuts extending to the cords are neglected deterioration and blistering of the tire tread is the result. It is unnecessary to remove a tire to treat small cuts of this nature. Tire companies furnish a plastic compound for filling cuts. This prevents moisture and dirt from getting in. If a cut is large, it should be vulcanized at once.

Result of Improperly Adjusted Tire Chains

Tires are sometimes badly damaged through the use of tire chains which are incorrectly adjusted or which are fastened to the spokes of the wheel holding the chains tightly in place.

The least injury results when chains are applied loosely leaving play enough to permit them to work around. The wear on the tire is thus distributed evenly. Probably the greatest amount of injury comes from using chains unnecessarily on paved streets.

Result of Sudden Application of the Brakes

The sudden application of the brakes resulting in sliding the wheels causes the treads to wear away in spots. A tire will give away very rapidly under this severe treatment.

Additional Suggestions

The tires are constructed for the purpose of carrying up to certain maximum loads and no more. It should be realized that overloading a car beyond the intended carrying capacity is sure to materially shorten the life of the tires. Do not turn corners or run over sharp obstructions, like car tracks, at a high rate of speed. Such practice is sure to strain or possibly break the cords, with the result that the further life of the tires will be limited. Remember that most tire troubles are the result of abuse.

Avoid scraping the tires against the curb and running in ruts. This kind of wear scrapes off the rubber side wall and exposes the layers of cords to dirt and moisture, which soon starts to rot the cords.

In turning in a narrow street, avoid striking the curb.

If a tire goes flat without any indication of injury to the tire, see that the valve is not leaking. A little moisture on the tip will show bubbles if the air is escaping.

In case of puncture, the car should be stopped at once and the tube repaired or replaced, or the tire replaced by the extra one. The tire should also be examined carefully and the cause of the puncture ascertained and the nail, glass or whatever it may be, should be extracted. Before replacing the tire on the rim, examine the inside of the casing to see that the cause of the puncture is not still protruding. It is also advisable to look over the outside of the tires frequently and take out any pieces of glass or other particles which may have become imbedded in the casing.

Don't run in ruts or car tracks; the sides of a tire will soon wear out under such treatment. Avoid large stones or other obstructions in the road. To hit one of these may break the carcass even though no external injury be visible.

The garage floor should be kept free from oil or gasoline. The tires on a car left standing on a grease-covered floor deteriorate quickly, the natural enemies of rubber being oil and gasoline. These destroy the nature of the rubber, rendering it soft, so that it cuts and wears away quickly.

If the car is not used during the winter, it is better to remove the tires from the rims, keeping casings and tubes in a fairly warm atmosphere away from the light. It will be better to slightly inflate the tubes, as that keeps them very nearly in the position in which they will be used later on. If the tires are not removed and the car is stored in a light place, it will be well to cover the tires to protect them from the strong light, which has a deteriorating effect on rubber.

CHAPTER VI

Storing Car

If the car is not to be used for a period of several months, it should be protected from deterioration during the period when it is not in use by carefully preparing it for storage.

Engine

To prepare the engine for storage, proceed as follows: Run the engine until opening of the radiator shutters indicates that the engine is warm. This may be done by driving on the road or by running the engine idle. In the latter case, care should be taken that there is sufficient ventilation to avoid injury from carbon monoxide poisoning. (See page 18.)

After the engine is warm, place the car where it is to be stored and stop the flow of gasoline to the carburetor by removing the gasoline tank filler cap, thus relieving the air pressure. As soon as the engine starts to slow down, raise the polished aluminum cap on top of the carburetor and inject three or four tablespoonfuls of clean fresh engine oil into the carburetor. Injection of the oil will stop the engine.

Open the compression relief cocks by turning them counter-clockwise. Inject two or three tablespoonfuls of engine oil into each compression relief cock, and before closing the cocks crank the engine three or four revolutions with the ignition switched off. This will tend to distribute the oil over the cylinder walls. The engine should not be started again after injecting the oil. If it is started, it will be necessary to repeat the treatment.

Drain the cooling system by opening the drain valve in the water pump.

Storage Battery

If the car is to be stored during the winter, the storage battery should have special treatment in order to protect it against freezing.

Shortly before the car is used for the last time, distilled water should be added to bring the level of the solution up to the bottom of the fillers. (See page 63.) After the water added has had an opportunity to mix thoroughly with the acid solution, the specific gravity should be taken with a hydrometer. If the specific gravity of the solution is above 1.270 there will be no danger of the acid solution freezing. If, however, the specific gravity is below 1.270, the battery should be removed and charged. *Unless the battery is fully charged or nearly so it is probable that the acid solution in the battery will freeze and cause extensive damage.*

It is important that one of the battery leads should in all cases be disconnected during storage as a slight leak in the wiring will discharge the battery

and lower the specific gravity to the point where the solution may freeze.

If possible, the storage battery should be removed and charged from an outside source every two months during the storage period.

Tires

During storage of the car, it is best to remove the tires *from the rims* and to keep the casings and tubes in a fairly warm atmosphere away from the light. The tubes should be inflated slightly after the tires have been removed.

If it is not convenient to remove the tires from the car and the car is stored in a light place, cover the tires to protect them from strong light, which has a deteriorating effect on rubber.

The weight of the car should not be allowed to rest on the tires during the storage period. If tires are not removed, the car should be blocked up so that no weight is borne by the tires. The tires should also be partly deflated.

Body and Top

A cover should be placed over the entire car to protect it from dust. In storing an open car, the top should be up.

Taking Car Out of Storage

In putting into use again a car that has been stored, it is advisable, unless the storage battery has been removed and charged at periodic intervals, to remove the battery from the car and give it a fifty-hour charge at a four-ampere rate. If the battery has received periodic charges, or if the specific gravity is above 1.200, simply add distilled water to the proper level and connect the leads. If there is a greenish deposit on the terminals of the battery, remove this with a solution of bicarbonate of soda (common cooking soda) and water. Do not allow any of this solution to get into the battery.

Before starting the engine, drain the oil from the oil pan and remove and clean the oil pan and screen. After reinstalling the oil pan, add eight quarts of fresh engine oil. Fill the cooling system, being sure to use anti-freezing solution in freezing weather. Open the compression release cocks and inject two or three tablespoonfuls of engine oil into each cylinder. Close the compression release cocks, and, with the ignition switched off, crank the engine a few seconds with the starter to distribute the oil over the cylinder walls.

Start the engine in the usual manner. As soon as the engine starts, immediately let the carburetor enriching button go as far forward as possible without causing the engine to stop or slow down materially and then open the throttle until the ammeter reads approximately 10 with all lights switched off. While the engine is running lift the aluminum cap on top of the carburetor and inject from two to three tablespoonfuls of engine oil into the carburetor. It is a good plan to run the car outdoors as soon as this has been done. Release the carburetor enriching button entirely as soon as the engine is warm enough to permit it.

PART III

GENERAL INFORMATION

CHAPTER I

Engine

Important Features of Construction

The Cadillac engine is of the water-cooled, four-cycle type with two L-head cylinder blocks of four cylinders each, placed at an angle of ninety degrees between the blocks. The cylinders of one block are directly opposite those of the other block, the lower end of each connecting rod on the left-hand side working in the forked end of the connecting rod opposite. This construction makes the engine shorter and more compact than any other type, the smooth running being largely the result of the short, rigid crankshaft.

The crankshaft has four throws or cranks, three main bearings, and carries on its front end the sprocket by which the camshaft is driven. The camshaft has six bearings, and is driven by the crankshaft through a silent chain in which the proper tension is maintained by an automatically adjusted idler gear. The camshaft has sixteen cams, each operating one valve through a camslide in which is carried a roller.

The fan is mounted on the front end of the generator shaft, which is driven by the camshaft through a special V-shaped belt.

The water pump and oil pump are driven by a cross shaft, which in turn is driven by a spiral gear on the crankshaft. The water pump is at the left-hand end of the cross shaft and the oil pump at the right-hand end.

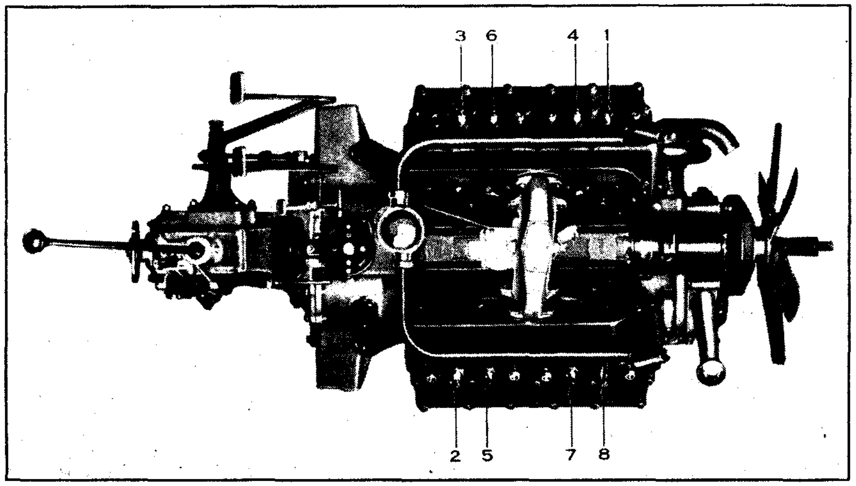

FIGURE 13. ***Firing order***

The engine base is the aluminum crankcase that supports the cylinder blocks and carries the crankshaft and camshaft bearings. The crankcase is supported at the rear end by two arms which are cast integrally with the crankcase and which are bolted to brackets on the frame. The front end of the engine is supported on a cross member of the frame below the radiator.

General Principle of Gasoline Engine

The production of power by the engine may be described briefly as follows:

Gasoline is fed by air pressure from the tank to the carburetor where it is mixed with air in the proper proportions to form an explosive vapor or gas. This gas is then drawn through the intake manifold and inlet valves into the cylinders of the engine where it is compressed by the pistons and then ignited by electric sparks. The pressure of the resulting explosions acting on the pistons produces the power.

The series of operations through which the pistons and valves of each cylinder must go to produce one power stroke is called a "cycle" and for such a cycle four strokes of each piston and two revolutions of the flywheel are required. The four strokes, each of which has a different function, take place in the following order:

Suction Stroke—The suction stroke commences with the piston at its highest point in the cylinder and with the inlet and exhaust valves closed. As soon as the piston starts to descend, the inlet valve immediately opens and a charge of gas is drawn from the carburetor through the valve opening into the space above the piston.

Compression Stroke—When the piston starts upward again after completing the suction stroke, the inlet valve closes. The gas, which has no means of escape, is compressed, the maximum compression being reached when the piston is at the top of its stroke.

Power Stroke—At the completion of the compression stroke, a spark, timed to occur at exactly the right instant, jumps between the electrodes of the spark plug and ignites the compressed charge of gas. The heat that results from the rapid combustion causes the pressure of the confined gas to rise almost instantaneously to several times its pressure before the explosion. This pressure, exerted on the piston, forces the piston down and produces the impulse which is transmitted by the connecting rod to the crankshaft, causing the crankshaft to revolve.

Exhaust Stroke—Just before the piston reaches the end of the power stroke, the exhaust valve opens. It remains open while the piston travels upward on the fourth, or exhaust stroke, driving the burned gas from the cylinders. By

the time the piston has reached its highest point it has forced out the burned gas and the exhaust valve closes. This completes the four strokes of the cycle and the piston is ready to draw in a new charge and to repeat the cycle.

Firing Order

Such a cycle as has been described takes place in each of the eight cylinders but no two pistons are at the same point in the cycle at the same time. In the Cadillac eight-cylinder V-type engine the impulses of the eight pistons are so timed that a power stroke is begun every quarter-turn of the crankshaft. The crankshaft thus receives four overlapping power impulses every revolution.

The order in which the eight cylinders fire is indicated by the numbers in Fig. 13. These numbers are the numbers used in marking the flywheel for valve and ignition adjustments.

CHAPTER II

Gasoline System

THE general arrangement of the gasoline system is illustrated in Fig. 14. There are two sets of tubes, one for air and one for gasoline.

The air tubes connect the automatic compressor at the left-hand front end of the engine, the hand compressor on the instrument board, and the air pressure relief valve, to the top of the gasoline tank. As described on page 9, the automatic and hand compressors are for the purpose of furnishing the necessary pressure to force the gasoline to the carburetor. The air pressure relief valve, which is fastened to the left-hand side of the frame under the front floor boards, prevents excessive pressure that might accompany the use of high-test or casing-head gasoline.

The gasoline line starts at the bottom of the gasoline tank and runs to a combination settling chamber and strainer from which tubes lead to the pressure gauge on the instrument panel and to the carburetor.

Settling Chambers and Strainers

The combination settling chamber and strainer in the gasoline line is attached to the left-hand side of the frame under the front floor boards. There is also a settling chamber at the bottom of the gasoline tank and a strainer at the point where the gasoline pipe enters the carburetor.

It is recommended that both settling chambers be drained and both strainers be cleaned at the beginning of freezing weather and at least

every 4,000 miles during the winter season. An accumulation of water at these points might freeze and prevent gasoline from flowing to the carburetor.

Before removing either settling chamber drain plug, or the strainer at the carburetor, first relieve the air pressure by removing the gasoline tank filler cap. Be sure there is no fire near.

To drain the settling chamber at the gasoline tank, remove the drain plug at the rear of the chamber as shown in Fig. 14. It is necessary to drain out only enough gasoline to flush the chamber.

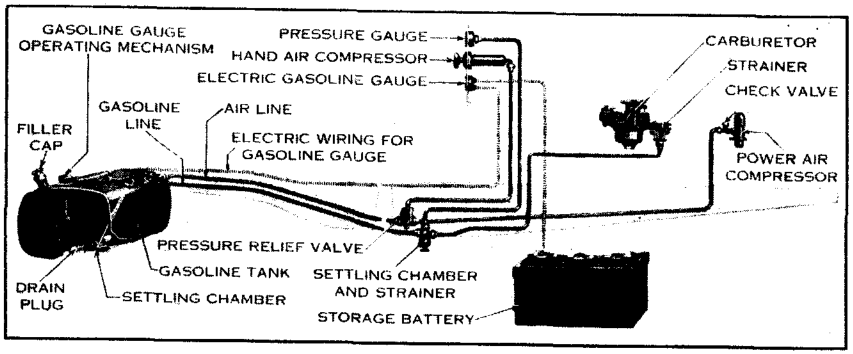

FIGURE 14. ***Gasoline system***

To drain the settling chamber in the gasoline line, remove the drain plug in the bottom of the chamber. While the plug is removed, the strainer, which is attached to the plug, should be carefully cleaned of any accumulated matter.

To clean the strainer at the carburetor, remove the six screws that fasten the cap on the strainer. Remove and clean the three gauze discs. In reinstalling the discs, be sure to place them in their original positions. The two discs with fine mesh gauze should be installed first.

Carburetor

The carburetor is correctly adjusted when the engine is assembled and, unless tampered with, should not require readjustment. It is unnecessary to change the adjustment for changes in season, weather or altitude.

Good carburetor action cannot be expected until the engine is thoroughly warmed. Imperfect carburetor action while the engine is cold does not indicate that the carburetor requires adjustment.

If adjustment of the carburetor seems to be necessary, it should, if possible, be made by an authorized Cadillac maintenance station. The adjustment should not be attempted by one unfamiliar with it.

CHAPTER III

Cooling System

Water Circulation

The Cadillac engine is cooled with water circulated through the jackets of the cylinder blocks by a centrifugal pump. This pump is mounted on the left-hand side of the engine near the front and is driven by a cross-shaft, which in turn is driven by a spiral gear on the crankshaft. The pump draws cold water from the bottom of the radiator and delivers it to a connection on the left-hand side of the engine where the stream divides, half going to the left-hand cylinder block and half through a passage in the crankcase to the right-hand cylinder block. From the front end of each cylinder head an outlet pipe with hose connection carries the heated water to the top of the radiator.

Radiator and Shutters

The radiator consists of an upper tank and a lower tank connected by water passages around the outside of which air is circulated by the fan. The water passages are so constructed that they expose a large amount of surface to the air, which cools the water as it passes from the upper to the lower tank.

Until the water in the cylinder blocks and radiator is warm, the cooling effect of the radiator is not only unnecessary, but is undesirable. The radiator is accordingly provided with shutters that prevent air from circulating around the water passages until the engine becomes warm. The shutters are pivoted vertically and are controlled automatically by a powerful thermostat contained in the upper tank of the radiator.

When the engine is cold, the shutters are held tightly closed and circulation of air is prevented. The water from the cylinders consequently undergoes little change in temperature as it flows through the radiator and the engine quickly becomes warm. As soon as the water entering the upper tank of the radiator reaches the temperature at which the engine operates best, the shutters are forced open by the thermostat and air begins to circulate. The resulting cooling effect checks the rising temperature of the water, which is thereafter maintained uniformly at the temperature of most efficient operation as long as the engine is running.

Filling and Draining the Cooling System

Except during freezing weather, water should be used in the cooling system. In freezing weather, a suitable anti-freezing solution such as those described on page 34 must be used.

To add liquid to the cooling system or to refill the cooling system after it has been drained, remove the radiator filler cap and pour the liquid in through the filler.

To drain the cooling system, open the drain valve at the bottom of the water pump by turning the hexagonal end of the valve counter-clockwise.

Cleaning the Cooling System

The cooling system should be drained and flushed every two or three months. This can be done in the following manner:

Run the engine until the opening of the radiator shutters indicates that the engine is warm. Stop the engine and immediately open the water pump drain valve.

If an alcohol anti-freezing solution is drawn off, part of it may be used again if the sediment is allowed to settle. If it is used, the specific gravity should be tested with a hydrometer after it has cooled thoroughly.

After the liquid has drained off, refill the cooling system with hot water and repeat the operation described above. If in draining the second time the water is very dirty it may be advisable to repeat the flushing operation a third time, placing one or two handfuls of sal-soda in through the radiator filler. The sal-soda must not be permitted to get on the finish of the hood or radiator. If sal-soda is used, the cooling system must be drained and flushed again before refilling for use.

CHAPTER IV

Electrical System

THE electrical system comprises the following units: The generator or source of electrical energy; the storage battery, which stores the current generated; the starting motor, which cranks the engine for starting; the ignition system; the lamps and other devices using electrical current; the ammeter; the ignition and lighting switch; and the circuit breakers, which protect the system. The wiring system connecting these units is the single wire or grounded type, the engine and frame forming one side of the electrical circuit.

Generation of Current

Generator

The generator is attached to the crankcase at the front of the engine and is driven by a specially made V-shaped belt from a pulley on the front end of the camshaft.

At very low engine speeds the voltage of the current generated is not sufficient to provide current for lighting or ignition and the battery is then the source of current. To prevent the battery at such times from discharging through the generator, a cut-out relay on the generator automatically opens the circuit whenever the generated voltage drops below the battery voltage. At approximately eight miles per hour the generated voltage is sufficient to operate the cut-out, which then closes the circuit between the generator and the battery and lighting circuits. If no lights are switched on, the entire output of the generator, less the current required for ignition, flows to the battery for recharging it. If all the lights are on, the generator will not generate sufficient current to start charging the battery until a speed of twelve to fifteen miles per hour is reached.

The amount of current generated by the generator at any instant is the ammeter reading (with all lights off) plus the current for ignition, which is two to three amperes. The generator output reaches its maximum at speeds between twenty and twenty-five miles per hour. This maximum should not exceed eighteen amperes, which is equivalent to an ammeter reading of sixteen when all lights are off.

Do not put oil on the commutator of either the generator or the starting motor.

Ammeter

The ammeter on the instrument board indicates the amount of current flowing to or from the battery except when the starter pedal is down and the starting motor is cranking the engine. When the engine is not running, the ammeter will indicate a current on the discharge side depending in amount upon the number of lights in use. The rate of charge or discharge when the engine is running depends upon the speed of the engine and the number of lights in use, and is equal in amount to the difference between the current generated and the current used by the lights, horn, ignition, and other electrical devices. The ammeter does not indicate the current used in cranking the engine.

If the ammeter should indicate "discharge" with the engine running at normal driving speed and with no lights in use, it is an indication of abnormal conditions and the electrical system should then be checked by a Cadillac maintenance station.

Storage Battery

The storage battery is a three-cell, six-volt Exide battery made especially for the Cadillac electrical system by the Electric Storage Battery Company, of Philadelphia, Pennsylvania. The battery compartment is just forward

of the left-hand running board. The hinged cover of the compartment is provided with a lock that is operated by the switch key.

Adding Water to Storage Battery

The battery is filled with a solution from which the water slowly evaporates and fresh distilled water must be added at intervals to maintain the correct level. The level should be inspected every 500 miles and distilled water should be added to bring the level up to the bottom of the fillers.

The battery compartment has been purposely made convenient of access to facilitate the adding of water. It is important in touring that nothing be placed on top of the compartment that would interfere with this regular attention.

Each cell is provided with a filler and filler plug. To remove a filler plug, turn it as far as possible counter-clockwise and then lift it straight up. To install it, set the plug in place and turn it clockwise until tight. If a plug is lost or broken, obtain a new one and install it as soon as possible.

Nothing but pure distilled water should be added to the battery solution. In the absence of distilled water, melted artificial ice or rain water caught in

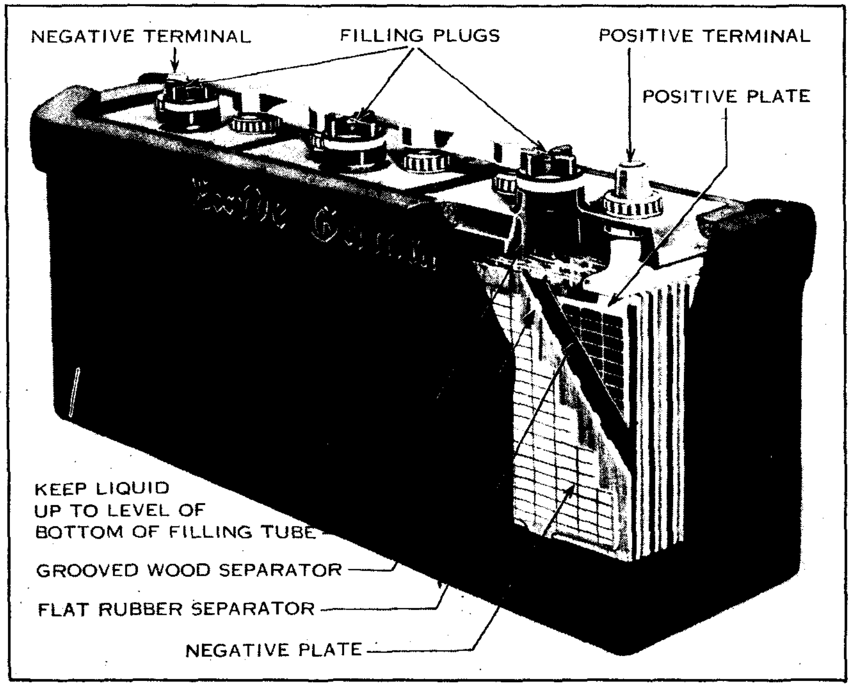

FIGURE 15. ***Storage battery***

an earthenware receptacle may be used. Hydrant water or water that has been in contact with metallic surfaces will cause trouble if used. *Acid must never be added to the battery.*

After adding water to the storage battery in freezing weather, the car should immediately be run far enough to mix the water and acid solution thoroughly. If the car is parked immediately after adding water, the water is likely to stay on top of the acid solution and may freeze, causing extensive damage.

If one cell regularly requires more water than the other, a leaky jar is indicated. A leaky jar should be replaced immediately by a new one as even a very slow leak will in time result in the loss of all the solution in the cell.

Specific Gravity of Battery Solution

As the storage battery is charged and discharged, the solution reacts chemically with the plates of the battery, the specific gravity of the solution changing as the reaction proceeds. The state of charge of the battery is thus indicated by the specific gravity of the solution. As the battery is charged, the specific gravity of the solution increases, reaching 1.270 to 1.290 when the battery is fully charged. The specific gravity of the solution decreases as the battery is discharged. A fully discharged battery has a specific gravity of 1.150 to 1.170.

A hydrometer is the instrument used to measure the specific gravity of a solution. A hydrometer syringe is a hydrometer especially designed for convenience in testing the specific gravity of the acid solution in the storage battery. A hydrometer syringe can be obtained at any battery service station.

The specific gravity of the acid solution should never be tested immediately after adding distilled water. If the solution is below the plates so that it cannot be reached with the syringe, add the necessary amount of distilled water and then drive the car for a few hours before taking the hydrometer reading.

Disconnecting Battery

Do not remove the generator or attempt any adjustment of the circuit breakers or remove any of the wires to the circuit breakers without first disconnecting the storage battery.

Never run the engine with the storage battery disconnected. Serious damage to the generator may result.

Exide Depots and Sales Offices

The Electric Storage Battery Company, whose general offices and works are at Alleghany Avenue and Nineteenth Street, Philadelphia, Pennsylvania, has representative stations in towns of any considerable size as well as sales offices and Exide battery depots in a number of the larger cities. If a storage battery is in need of attention other than recharging, it is advisable to communicate either with a Cadillac maintenance station or with the nearest Exide station or depot. Do not ship a storage battery without receiving instructions.

Starting Motor

Operation of Starter

The starting motor is a series-wound motor mounted vertically at the rear end of the crankcase directly over the flywheel. When cranking the engine, the starting motor drives the flywheel through a pinion which meshes with teeth machined on the rear face of the flywheel. The pinion is normally held out of engagement with the teeth on the flywheel. It is moved down into mesh with the teeth on the flywheel by pushing forward on the starter pedal. Further movement of the pedal operates a switch that closes the battery circuit and starts the armature revolving.

If, in pushing down the starter pedal, the ends of the teeth on the pinion strike against the ends of the teeth on the flywheel preventing further movement of the pinion, continued movement of the pedal compresses a spring. As soon as the pedal has been pushed down far enough to close the starting switch, the armature starts to revolve. The pressure of the spring then forces the pinion the rest of the way, completing the meshing operation.

An over-running clutch on the armature shaft prevents the flywheel from driving the starting motor after the engine is running under its own power and before the starter pedal is released.

Ignition

General Description

The function of the ignition system is, first, to multiply the low voltage (six to eight volts) of the storage battery and generator into voltage of sufficient intensity to cause a spark to jump between the electrodes of the spark plugs; and second, to time this spark so that ignition will take place in the proper cylinder at the proper instant.

The Delco single-spark system is used, consisting of a combination timer-distributor unit in connection with a transformer or induction coil. The primary circuit, through which flows the current from the storage battery or generator, includes the primary winding of the ignition coil; the resistance unit, which is attached to the ignition coil; the timer contact arms and points; and the condenser, which is enclosed in the timer. The secondary or

high-voltage circuit includes the secondary winding on the ignition coil, the distributor and the spark plugs.

Current flows through the primary circuit whenever and as long as either of the two sets of timer contact points is closed. Current flows through the secondary circuit for an instant only when either set of contact points is opened; but the voltage of this current is several thousand times that of the primary circuit and is sufficient to cause a spark at the spark plug.

Timer-Distributor

The timer-distributor is mounted on the top of the crankcase at the rear end and is driven by a spiral gear on the rear end of the camshaft. The shaft of the timer-distributor, which revolves at one-half crankshaft speed, carries a four-lobed cam. As this cam revolves, it actuates the two contact arms alternately, opening and closing first one set of contact points and then the the other. The circuit is thus made and broken eight times during each revolution of the cam and eight corresponding sparks are produced at the spark plugs.

In order to procure the maximum power from each explosion, ignition must occur at the right instant in relation to the position of the piston. But the ignition process, although apparently a matter of an instant, consumes a measurable amount of time. It is therefore necessary to break the circuit at the contact points far enough in advance so that actual ignition will take place in the cylinder at the correct time. The lapse of time is always the same, regardless of the speed of the engine, but because the pistons move faster when the engine is running at higher speeds than when it is running at lower speeds, the degree of advance in relation to the positions of the pistons must be increased as the engine speed increases.

This advancing of the relative timing of the spark for higher engine speeds is automatically accomplished by a centrifugal ring governor on the timer shaft below the cam. As the speed of the engine increases, the governor ring assumes a position more nearly horizontal, forcing the cam ahead of the shaft by which it is driven. This causes the contact points to open earlier, starting the ignition process earlier in relation to the positions of the pistons in the cylinders.

In addition to the automatic advance, the timer has a manual control by which the opening of the contact points may be still further advanced or still further delayed. This is operated by the left-hand lever at the steering wheel, as described on page 10.

The distributor is the mechanism that insures that the high voltage current in the secondary circuit is switched to the proper spark plug at the proper time. It consists of a rotor which is carried on the upper end of the timer shaft and which has a metal contact button electrically connected at

all times with the secondary current from the coil. As the rotor revolves, the button makes contact successively with eight metal contacts which are set in the distributor head, and which are connected to the spark plugs. The relation between the rotor and the timer shaft is such that when the cam causes one set of timer contact points to open, the rotor will be in correct position for conducting the resulting high voltage in the secondary circuit to the proper spark plug.

Spark Plugs

For best results the electrodes of the spark plugs should be .023 inch apart. If the spark plugs should be removed, it is recommended that the electrodes be inspected and adjusted to this clearance if necessary.

Lighting System

Lamp Bulbs

It is recommended that bulbs for the lamps, particularly the two-filament bulbs for the headlamps, be purchased from a Cadillac distributor or dealer. In any event bulbs should have the correct voltage and candle-power ratings. Only three different types of lamp bulbs are used in the entire lighting system. The bulbs and the lamps in which they are used are as follows:

Lamp	Voltage	Candle-power
Headlamp	8	21 (two-filament) (Mazda No. 1110)
Back-up light	8	21 (single filament)
Stop light	8	
Inspection lamp	8	
Parking lights	8	3
Instrument lamp	8	
Rear lamp	8	
Closed car dome and quarter lamps	8	

Cadillac two-filament bulbs are equipped with fog caps or metal screens placed over the upper part of the bulb for the purpose of stopping direct unreflected light from the filament. It is this direct unreflected light from the filament that causes the dazzling reflection from fog or smoke. Headlamps equipped with fog caps have the appearance of being dimmed when seen from the front, but they do not perceptibly affect the useful light from the headlamps.

In replacing a headlamp bulb, transfer the fog cap from the old bulb to the new, adjusting the cap to the position shown in Fig. 18. Then adjust the lamp as directed on page 69.

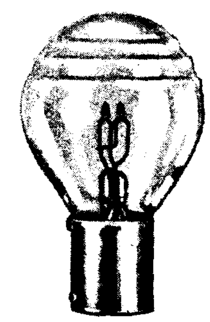

FIGURE 16.
Double-filament headlamp bulb

Cleaning Headlamp Reflectors

The headlamp reflectors are plated with pure silver. Although the reflectors ordinarily require no attention, if they should require polishing extreme care must be exercised to select materials that will not scratch the silver.

Powdered dry rouge and a chamois skin are recommended. If the reflectors are tarnished, the rouge may be moistened with alcohol. Afterward, polish with a dry chamois and rouge.

The chamois used for the headlamp reflectors must not be used for any other purpose. It must be soft and free from dust.

Official Approval of Headlamps

Cadillac headlamps have been approved by practically every state in the country. For purposes of official identification, the following description of the headlamps is given:

A complete headlamp containing a parabolic reflector with axis inclined two and one-half degrees; screw adjustment on shell of headlamp to adjust the bulb filament with relation to the reflector in both axial and vertical planes to compensate for filament variation in bulbs; a cover glass containing cylindrical flutes vertically grouped in three distinct zones, the outer zone having greater refractory power and the flutes being more pronounced than

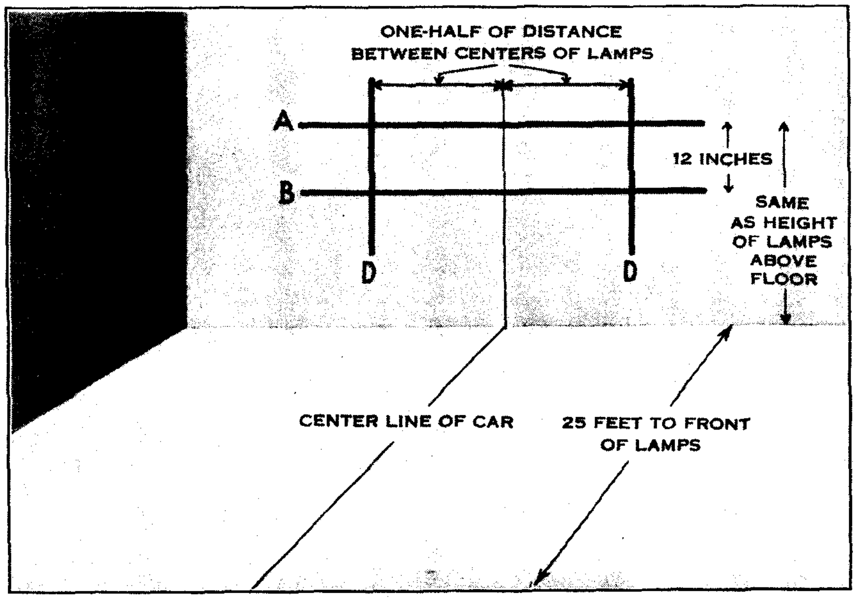

FIGURE 17. ***Marks for adjustment of headlamps***

in the center; and a cap over the upper front portion of the bulb to intercept the direct unreflected light above the horizontal.

Approval by the state authorities is conditioned upon the headlamps being adjusted to a definite standard. The directions which follow are for this standard adjustment.

Adjustment of Headlamps

Select a level spot where the car with an average load can be placed facing toward and twenty-five feet distant from a wall upon which the lines shown in Fig. 17 can be drawn. The adjustment should be made when it is dark enough so that the outlines of the projected beams are plainly visible.

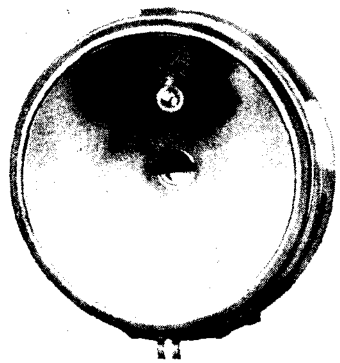

FIGURE 18. ***Headlamp fog cap***

Locate a point on the wall directly opposite the front of the car by sighting through the center of the rear curtain toward the radiator cap. Draw a vertical line on the wall through this point: Measure the distance between the centers of the headlamps, and draw two vertical lines "D" parallel to the center line and distant from it by an amount equal to one-half of the distance between the headlamps. Measure the distance of the headlamp centers above the ground or floor and draw the horizontal line "A" at the same elevation. Draw the line "B" twelve inches below the line "A."

Upper Adjusting Screw—The first adjustment should be made with the lower beam on, that is, with the lighting switch lever in the third position. Cover the headlamp that is not being adjusted, or disconnect the plug connector that supplies current to the lamp. Remove the headlamp door. Make sure that the fog cap is properly placed on the bulb as shown in Fig. 18.

The adjusting screws, of which there are two, are in the back of the headlamp shell. Turn the upper or large adjusting screw until the light spot on the screen is the smallest that can be obtained.

Loosen the nut on the headlamp support and aim the headlamp so that the top center of the spot of light is at the intersection of lines "B" and "D" as shown in Fig. 20a. When the lamp has been properly aimed, tighten the nut securely. *(Continued on page 71)*

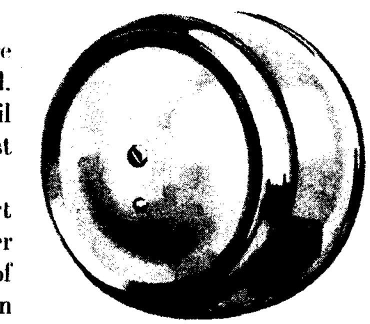

FIGURE 19
Headlamp adjusting screws

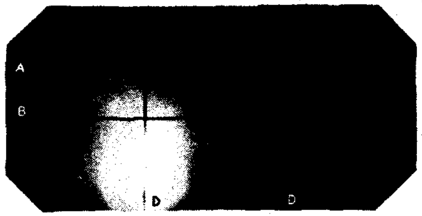

Figure 20a
Left-hand lower beam without lens.

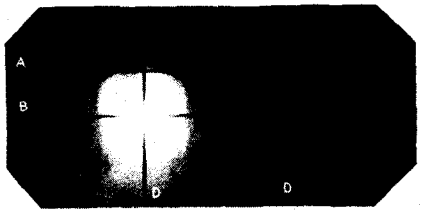

Figure 20b
Left-hand upper beam without lens.

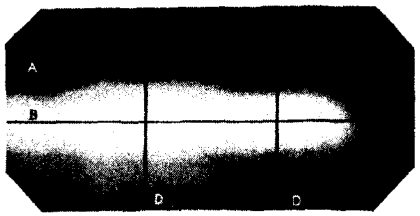

Figure 20c
Left-hand upper beam with lens.

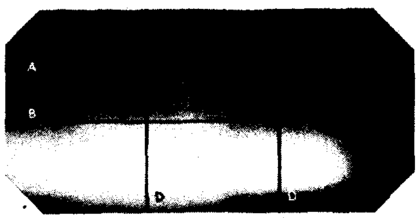

Figure 20d
Left-hand lower beam with lens.

Figure 20e
Both upper beams with lenses.

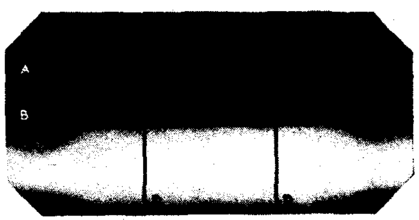

Figure 20f
Both lower beams with lenses.

FIGURE 20. ***Beams from headlamps***

Lower Adjusting Screw—Turn the lighting switch to the fourth position so that the upper beam is on. Adjust the lower or small screw until the top of the beam is at the intersection of lines "A" and "D" as shown in Fig. 20b. The beam should be of approximately the same proportionate size as shown, and the greatest intensity of the beam should be near the top of the spot and at its center. If the lower beam is now switched on, it should appear as in Fig. 20a and should be of the same proportionate size with the greatest intensity near the bottom, rather than at the center of the spot.

Install the door with the lens. If the lens is for any reason removed from the headlamp door, it should be replaced with the cylindrical flutes vertical and the smooth side facing out.

With the lens in place, the upper beam from the left-hand headlamp should appear as in Fig. 20c. The pattern of the lower beam from the left-hand headlamp should appear as in Fig. 20d.

After adjusting the one headlamp, repeat the adjustment on the other. When both headlamps have been adjusted and both headlamp doors are in place, the combined light from both headlamps should appear as in Fig. 20e when the upper beams are on, and as in Fig.20f when the lower beams are on.

CHAPTER V

Clutch and Transmission

Clutch

The Cadillac clutch is a dry multiple-disc clutch with eight smooth driven discs and seven driving discs faced with friction material composed largely of asbestos. The driving discs have gear teeth machined on their outer circumference to engage with teeth machined internally in the flywheel. The driven discs have gear teeth machined on their inner circumference to mesh with teeth machined on the outside of the clutch hub, which in turn drives the transmission. Except when the clutch pedal is pushed down, the clutch discs are pressed together by a spring having a pressure of 300 lbs. The driven discs then revolve with the driving discs and the engine, if running, drives the transmission.

When the clutch pedal is pushed down to disengage the clutch a forked lever presses against the clutch spring through a ball thrust bearing, releasing the discs from the pressure of the spring. The discs then separate and the driven discs rotate independently of the driving discs.

The clutch itself requires no adjustment or attention other than lubrication of the clutch thrust bearing as directed on page 45. Adjustment of the clutch release rod, however, may be necessary after the car has been driven some distance.

Adjustment of Clutch Release Rod

As described on page 15, the clutch pedal is purposely given about one inch of "lost motion." That is, the clutch does not begin to disengage until the pedal has been moved down about an inch from its released position. This lost motion is necessary in order to allow the clutch discs to come closer together as the facings are reduced in thickness. The lost motion gradually decreases as the clutch is used and eventually will be all taken up. Before this happens, the clutch release rod must be readjusted to restore the lost motion; otherwise, the clutch discs will slip and the engine will not drive the car.

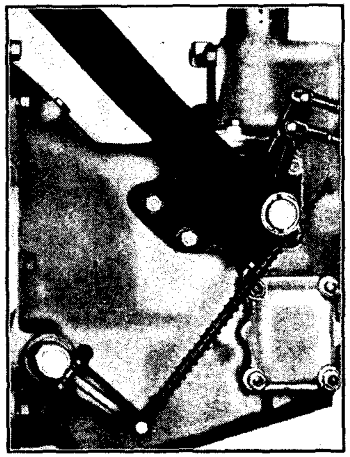

FIGURE 21
Adjustment of clutch release rod

To make the adjustment unscrew the nut "A" (Fig. 21) until the clutch pedal has a movement of one inch without starting to disengage the clutch.

The nut "A" must be turned a half-turn at a time.

Transmission

The purpose of the transmission is to provide a means for varying the ratio and direction of the rear axle speed in relation to the engine speed. Three things are accomplished by doing this: First, the engine is enabled to drive the car backwards. Second, the engine is permitted to revolve fast enough to develop the power necessary for starting and for driving the car at extremely low speeds. Third, the turning effort of the engine is multiplied so that it may be sufficient for climbing steep hills and pulling through deep sand and mud.

The Cadillac transmission is known as the selective, sliding gear type. It has three speeds forward, of which one is direct drive, and one speed in reverse. Selection of the various speeds is accomplished by movement of two shifter gears, "A" and "D," (Fig. 22) which are controlled by the transmission control lever. The positions of the gears corresponding to the five positions of the control lever as illustrated in Fig. 2 are as follows:

Neutral—When the control lever is in neutral position, the shifter gears "A" and "D" are in the positions shown in Fig. 22; that is, they are not in mesh with any of the other gears.

Low—When the control lever is moved from neutral to low, the gear "A" is moved forward into mesh with gear "R." Power is then transmitted from

the clutch shaft "Z" to the transmission main shaft "C" through gears "E," "U," "R" and "A." The ratio of engine speed to propeller shaft speed in low is approximately 3 to 1.

Intermediate—When the control lever is moved from low to intermediate the gear "A" is first returned to its neutral position and gear "D" is then moved back into mesh with gear "S." Power is then transmitted through gears "E," "U," "S" and "D." The ratio of engine speed to propeller shaft speed in intermediate is approximately 1.7 to 1.

High—When the control lever is moved from intermediate to high, the gear "D" is first moved forward out of mesh with gear "S" and then farther forward until teeth cut internally in a recess in gear "D" engage teeth on the

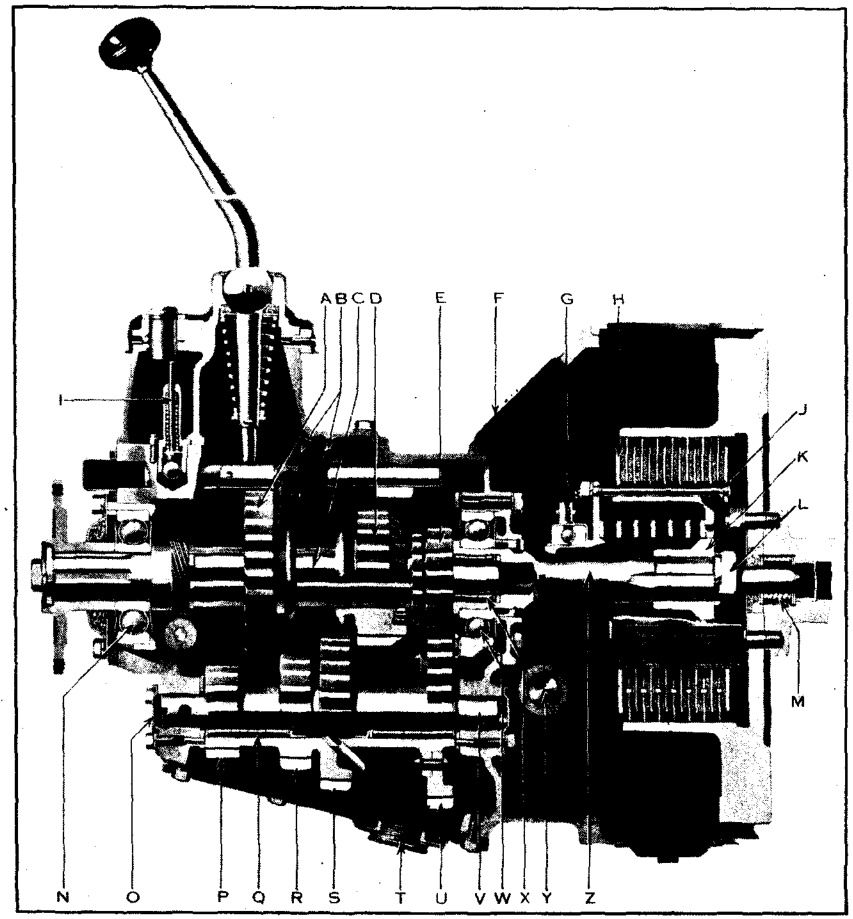

FIGURE 22. ***Sectional view of transmission***

extreme end of gear "E." The drive is then direct from the clutch shaft to the transmission main shaft without reduction.

Reverse—When the control lever is moved from neutral to low, the gear "A" is moved back into mesh with an idler gear, not shown in Fig. 22, which is at all times in mesh with gear "P." Power is then transmitted through gears "E," "U," "P," the reverse idler gear, and gear "A." The interposition of the idler gear reverses the direction of rotation. The ratio of engine speed to propeller shaft speed in reverse is approximately 3.8 to 1.

CHAPTER VI

Brakes

General Description

There are three pairs of brakes: the rear wheel external brakes, the rear wheel internal brakes, and the front wheel brakes, which are also internal. The rear wheel external brakes and the front wheel brakes are operated by the brake pedal and comprise the foot brakes. The rear wheel internal brakes are operated by the hand lever and are used principally for locking the rear wheels when the car is standing.

The purpose of the front wheel brakes is to add to the braking ability as much as is consistent with safety. It is not desirable to attempt to secure the maximum possible braking effect on the front wheels for the reason that, when a front wheel slides without rotating, it has no power to change the direction of the car.

Cadillac front wheel brakes are accordingly designed so that when the foot brakes are applied while the steering wheel is turned to the right or left, only the brake on the inside wheel is effective and the brake on the outer wheel is released, leaving the outer wheel free to rotate. It is thus impossible to lock both front wheels even on slippery pavement unless the car is moving straight ahead. If, while the car is moving straight ahead on slippery pavement, the brakes should be applied with sufficient pressure to lock both front wheels and it then becomes necessary to make a turn, the car will instantly respond because the brake on the outer wheel is automatically released as soon as the steering wheel is turned.

Adjustment

Each foot brake has provision to compensate for wear on the brake lining. The adjustment by which this compensation is effected is at the brake itself

rather than in the connections. Cadillac brakes must *not* be adjusted to compensate for wear by adjusting the pull rods or stop screws.

As described on page 16, the Cadillac two-stage brake pedal automatically notifies the driver when the foot brakes require adjustment. It is recommended that the car be taken to a Cadillac maintenance station for attention when necessity for adjustment is thus indicated.

If, however, the adjustment is neglected and as a result the pedal touches the floor boards before the brakes are fully applied, an emergency adjustment can be made by screwing down the adjusting nuts "F" (Fig. 23) one or more half-turns. The nuts "F" lock every half-turn and must be turned a half-turn at a time. The nuts "F" must not be turned down far enough to cause the brakes to heat and they must be turned down the same amount on both sides.

If adjustment of the nuts "F" is not sufficient, or if the occasion gives opportunity for a complete adjustment, this adjustment should be made as follows:

Loosen the three locking nuts "B," "D" and "N" (Fig. 23) and screw the three stop screws "A", "C" and "M" away from the brake band. Observe the clearance between those parts of the brake lining nearest the hexagonal

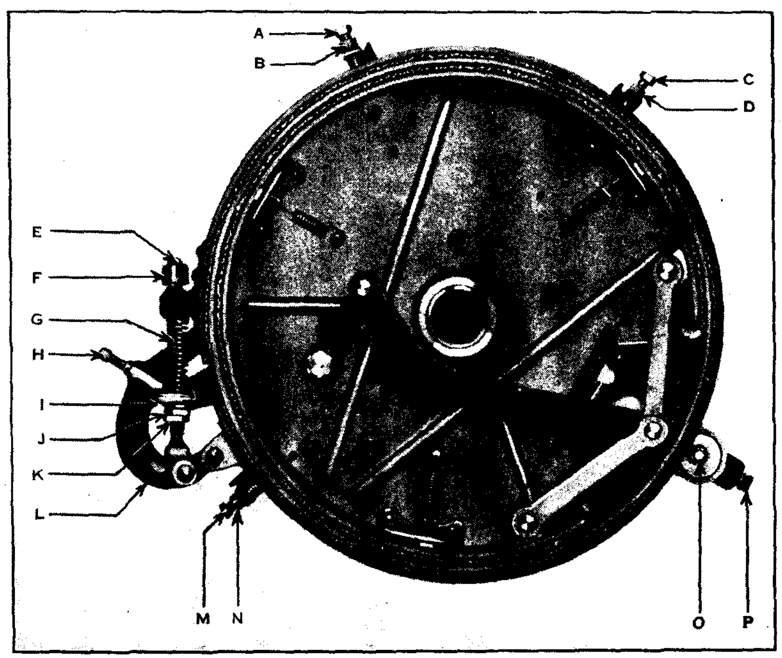

FIGURE 23. ***Rear wheel brakes***

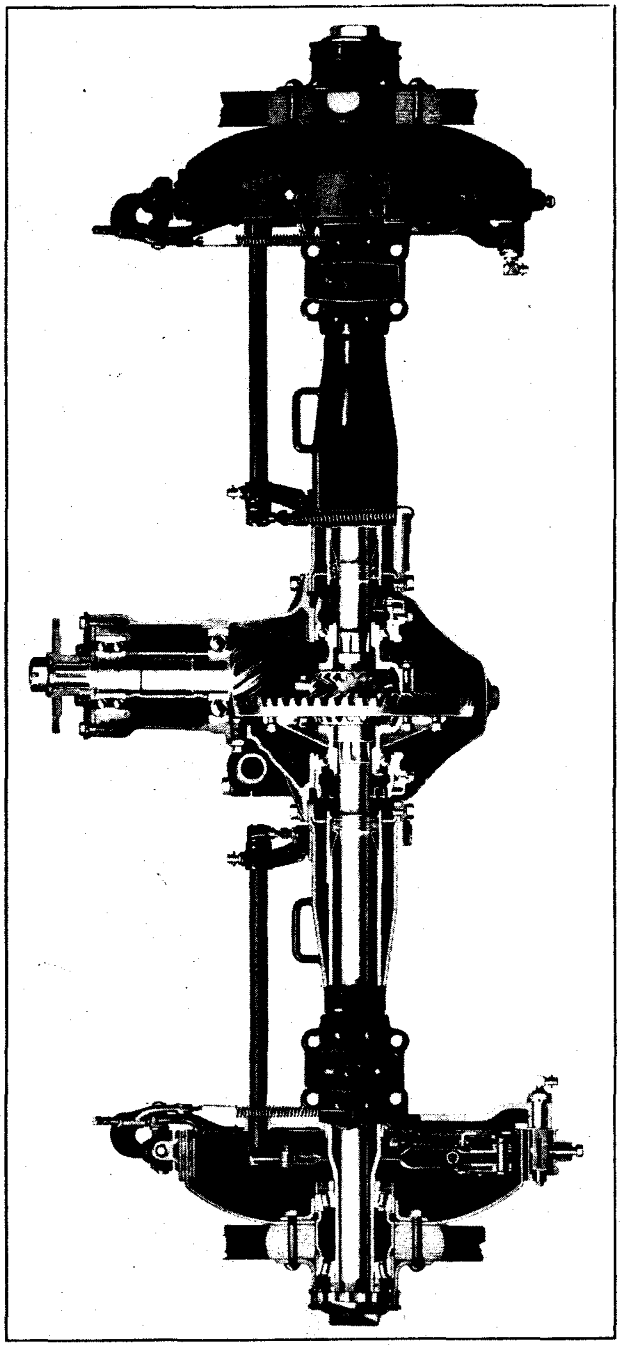

FIGURE 24. *Sectional view of rear axle*

head screw "P" and the brake drum. This clearance should be .030 to .035 inch. If the clearance is not correct, adjust the screw "P" until it is. The screw "P" is kept from turning of its own accord by a lock washer which turns with the screw and locks every half-turn. It must accordingly be turned a half-turn at a time.

Loosen the locking nuts "K" and adjust the nuts "J" and the screws "M" so that there is a uniform clearance of .030 to .035 inch between the *lower* part of the brake lining and the brake drum. To decrease the clearance between the brake lining and the drum, screw the nut "J" farther down on the yoke bolt "E."

Adjust the nuts "F" and the two stop screws "A" and "C" so that there is a uniform clearance of .030 to .035 inch between the *upper* part of the brake lining and the drum.

After making the foregoing adjustments so that there is a uniform clearance of .030 to .035 inch between the drum and the lining, check the results by applying the brakes, and measuring the travel of the upper end of the lever "L." This travel should not be less than ⅞ inch. If the end of the lever "L" travels less than ⅞ inch in moving from the released position to the applied position, readjust one or all of the nuts "F" and "J" and the screws "P," "A," "C" and "M" to increase the clearance slightly, keeping the clearance uniform at all points around the drum. Do not fail to tighten the locking nuts "B," "D," "N" and "K" when the adjustment has been made.

Do not change the adjustment of the screw "H." This screw is properly set when the car is assembled and does not require readjustment in taking up wear on the lining.

Inasmuch as the brakes are designed so that the greater proportion of the braking load is taken by the rear wheel brakes, adjustment of the front wheel brakes is usually not necessary until the rear wheel foot brakes have been adjusted several times. Before the limit of adjustment for the rear wheel foot brakes has been reached, the car should be taken to a Cadillac maintenance station for adjustment of the front wheel brakes.

Adjustment of the hand brakes is unnecessary. The hand brakes retain their effectiveness without adjustment throughout the life of the lining.

All joints in the brake connections should be oiled at regular intervals. The brakes should also be tested occasionally to be sure that they are in serviceable condition. When the brake band linings have worn so that further adjustment is impossible, they can be renewed.

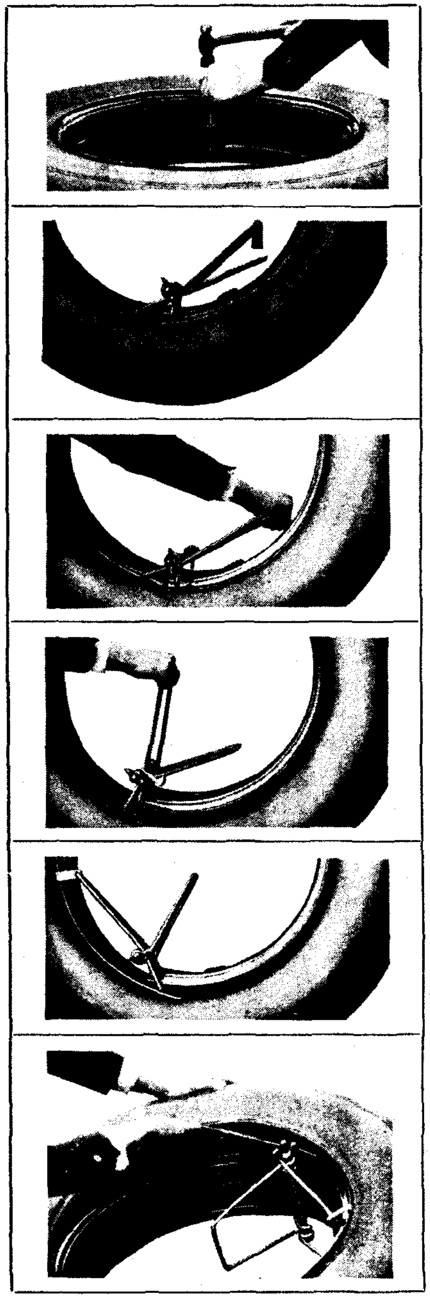

Figure 25a

Lay the tire and rim flat on the ground and drive out the locking pin, using the hammer and punch in the tool kit.

Figure 25b

Apply the rim tool, which is furnished in the tool kit, as shown in the illustration. Note that there are two pairs of holes in the rim near the split and that one pair is nearer the split than the other. The short end of the tool must be inserted in the holes nearer the split and the long end in the holes farther from the split. Clamp the tool firmly in position by tightening the wing nut.

Figure 25c

Grasp the two handles and bring them together, spreading the ends of the rim farther apart at the split. Then pull both handles together toward the other side of the rim until one end of the rim is forced up and over the other end.

Figure 25d

Release the short handle of the tool but continue pulling the long handle until it is against the rim.

Figure 25e

Engage the hook that is attached to the long handle over the edge of the rim to hold the rim in the collapsed position.

Figure 25f

Lay the rim and tire on the ground and remove the tire from the rim by working it off first on the side where the rim is split. The handle of the large wrench is flat to serve as a prying tool.

FIGURE 25. ***Removing tire from rim***

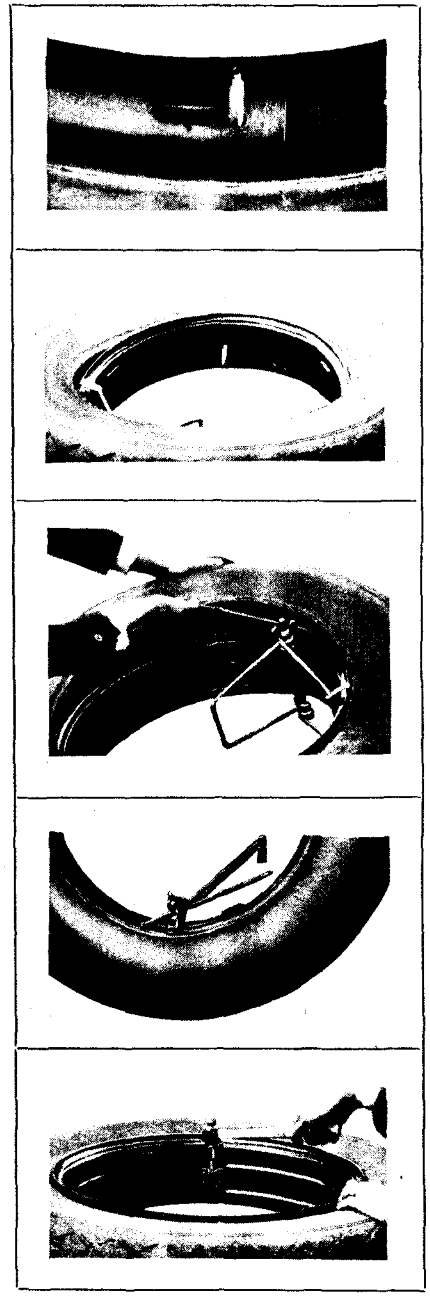

Figure 26a

Make sure that the tube flap is in place and that the valve stem passes through the holes in both ends of the flap.

Figure 26b

Insert the valve stem in the hole in the rim and work the tire well into place on each side of the valve stem.

Figure 26c

Pry the tire over the projecting end of the rim where it is split. The rest of the tire can then be pushed down into place.

Figure 26d

Release the hook on the tool and push the handles of the tool back to their original position. Then remove the tool.

Figure 26e

Replace the pin which locks the two ends of the rim together. This is important.

FIGURE 26. ***Installing tire on rim***

CHAPTER VII

Wheels

Tires and Rims

Illustrated directions for removing a rim with tire from a wheel and installing a rim with tire on a wheel are given in Figs. 7 and 8. Directions for removing a tire from a rim and installing a tire on a rim are given in Figs. 25 and 26.

Do not under any circumstances attempt to remove a tire from a rim without deflating the tire.

Caution in Adjusting Wheel Bearings

The adjustment of wheel bearings or the removal of the wheels should not be attempted by one unfamiliar with work of this nature. It is recommended that the car be taken to a Cadillac maintenance station if possible. In any event great care must be exercised in adjusting wheel bearings not to get them tight. These bearings will revolve even when adjusted very tightly, but that condition is sure to prove disastrous. They should be adjusted so that a very slight amount of play or looseness may be discerned.

If, after a bearing has been adjusted to a point that is apparently correct, the locking device cannot be placed in position without changing the adjustment, it is far better to loosen the adjustment until it can be secured with the locking device than to tighten the bearing adjustment.

Removing Front Wheel

To remove a front wheel, first jack up the axle until the wheel is free from the ground and then proceed as follows:

Remove the hub cap by unscrewing it. Remove the cotter pin "E" (Fig. 27). Remove the lock nut "A." Remove the serrated washer "B." Remove the adjusting nut "C." The wheel may then be removed by pulling it straight off.

Installing Front Wheel and Adjusting Bearings

Before installing the wheel, make sure the bearings are clean and that they are packed in a light grease that is free from dirt and grit.

Set the wheel in place on the spindle and adjust the nut "C" (Fig. 27) very carefully, following the caution above. Install the serrated washer "B," making sure that one of the notches in the washer fits over the stud "D" on

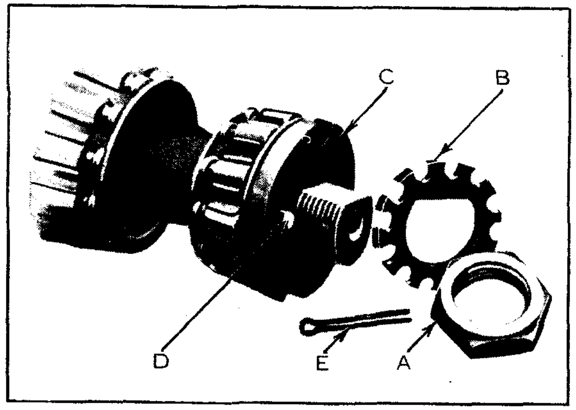

FIGURE 27. ***Front wheel bearings***

the adjusting nut. Replace the lock nut "A" and tighten it firmly, locking it with the cotter pin "E."

It is always better to adjust wheel bearings too loosely than too tightly. If after the adjustment is apparently correct, the notch in the washer "B" is not directly over the stud "D," loosen the adjustment rather than tighten it.

Removing Rear Wheel

To remove a rear wheel, first jack up the axle until the wheel is free from the ground and then proceed as follows:

Remove the hub cap "D" (Fig. 28) by unscrewing it. Remove the spring locking ring "F." Withdraw the axle shaft "E." With a screw driver or blunt

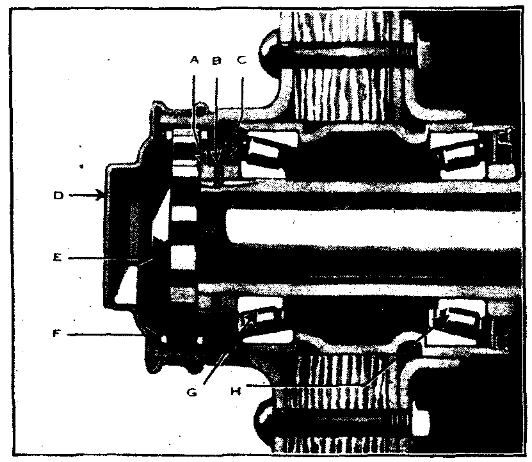

FIGURE 28. ***Sectional view of rear wheel hub, showing bearings***

tool straighten the lug of the outer lock washer "B" where it has been bent over the lock nut "A." Unscrew the lock nut "A." Remove the washers "B" and the adjusting nut "C." The wheel can then be removed by pulling it straight off.

Installing Rear Wheel and Adjusting Bearings

Before installing the wheel, make sure that the bearings are clean and packed in a light grease that is free from dirt and grit.

Set the wheel in place upon the axle and adjust the nut "C" (Fig. 28) very carefully. Install the lock washers "B," using new washers or straightening the ones removed if new ones are not available. In placing the washers in position, reverse the outer one with respect to the inner so that the lugs on one washer are opposite the spaces between the lugs on the other washer; that is, so that the lugs on the two washers are staggered. Install and tighten the lock nut "A." Next, select that lug on the inner washer that falls nearest to the center of one of the flat sides of the adjusting or inner nut, and with a screw driver or other suitable tool bend this lug over the nut. In the same way bend one of the lugs of the outer washer over one of the flat sides of the locking or outer nut. In bending the lugs of the locking washers, take care not to alter the adjustment of the inner nut or loosen the outer nut.

CHAPTER VIII

Repair Parts

Genuine Cadillac Parts

Cadillac owners are cautioned against permitting the use of other than genuine Cadillac parts in the repair of their cars. The quality of the Cadillac car is identical with the quality of its component parts, the production of which is based upon more than twenty years of experience in designing, manufacturing, and inspecting. No other individual or organization has access to the data resulting frcm this experience nor could they possibly have the same interest in protecting the owners of Cadillac cars.

Uniform Parts Prices

Cadillac parts are sold at uniform prices throughout the United States, and are not subject to the addition of transportation, excise or other supplementary charges. Printed price lists published by the Cadillac Motor Car Company are open to inspection by owners at any authorized Cadillac distributor's or dealer's establishment.

Ordering New Parts

With many thousands of Cadillac automobiles in use, it is obviously impractical to deal directly with each Cadillac owner. We cannot open accounts with any except regular distributors with whom annual contracts are made.

To avoid unnecessary delay and correspondence new parts should, where possible, be ordered from the distributor or dealer from whom the car was purchased or from the nearest Cadillac distributor or dealer, who carries a large stock and is generally in a position to supply a part immediately. If he cannot do so, he can order it. Where, however, conditions are such as in our judgment to warrant it, we will fill orders for parts at current list prices, f.o.b. factory, provided the order is accompanied by cash.

In ordering parts either from a Cadillac distributor or from the factory, send the engine number and the unit number (see page 84) with an accurate description of the part desired, perferably accompanied by a sketch with dimensions. If this cannot be done, send the part itself properly tagged and with transportation charges prepaid (See below under "Returning Parts.") Otherwise prompt and intelligent filling of the order will be impossible.

Our responsibility ceases in all cases, with delivery to the transportation company.

Returning Parts

In the event parts are returned, transportation charges must be prepaid or the parts cannot be accepted. They should be tagged properly with the name of the owner and the engine number of the car. A letter should be sent, giving complete instructions regarding the disposition of the parts.

Tires, Speedometer and Clock

In cases of repairs to tires, speedometers, or clocks, correspondence should be opened with the manufacturers or their representatives. If necessary the parts should be sent to them. Transportation charges should be prepaid.

CHAPTER IX

Specifications and License Data

Type of engine	8 cyl. V-type
Diameter of cylinder bore	$3\frac{1}{8}$ in.
Length of stroke	$5\frac{1}{8}$ in.
Piston displacement	314 cu. in.
Horsepower (N. A. C. C. rating)	31.25
Engine number	See below
Diameter of crankshaft main bearings	$2\frac{3}{8}$ in.
Length of crankshaft between inner ends of front and rear bearings	$18\frac{5}{8}$ in.
Exhaust valves	$1\frac{9}{16}$ in.
Inlet valves	$1\frac{11}{16}$ in.
Capacity of gasoline tank	20 gals.
Capacity of engine lubricating system	2 gals.
Capacity of cooling system	$5\frac{1}{2}$ gals.
Capacity of transmission	3 qts.
Capacity of rear axle	$3\frac{1}{2}$ qts.
Tires	33x6.75 (low pressure)
Wheelbase	132 in. and 138 in.
Tread	56 in.

Engine and Unit Numbers

Each Cadillac car when shipped carries an engine number which is also a serial number. This is the number to be used in filling out license and insurance applications and in general reference to the car. The engine number is stamped on the car in two places: On the name plate on the front face of the dash and on the crankcase at the base of the oil filler.

The various units such as the transmission, steering gear, etc., also carry unit numbers. These are located as described below. It is important in ordering parts to give, not only the engine number of the car, but also the unit number of the unit to which the part belongs.

Transmission number—on the upper surface of the boss to which the clutch and brake pedal bracket is attached.

Steering gear number—on the steering gear housing just above the grease gun connection.

Carburetor number—on the left-hand rear face of the flange by which the carburetor is attached to the intake header.

Generator number—on the name plate on top of the generator.

Starting motor number—on the name plate on the left-hand side of the starting motor.

Front axle number—on the upper surface of the axle I-beam at the right-hand end just above the steering stop screw.

Frame number—on the upper surface of the left-hand side bar opposite the steering gear.

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A

B

C

D

E

The Cadillac Motor Car Company reserves the right without notice to make changes in design, construction and specifications

9-25-5500

CADILLAC

Operator's Manual

Price Thirty-Five Cents

CADILLAC MOTOR CAR COMPANY
DETROIT

EDITION NO. 314-120

In ordering a duplicate of this Manual specify the above number or the engine number of the car

Foreword

THE experienced motorist whose new Cadillac succeeds other cars, some of which may also have been Cadillacs, requires less elementary operating instructions than the beginner, learning for the first time to drive. Likewise, the owner who takes advantage of the facilities offered by the maintenance station has less need for detailed information in regard to care of the car than the owner who provides for all necessary attention in his private garage.

In preparing this Manual, it has been taken for granted that the typical Cadillac purchaser is no longer a novice in motor car operation and that the greatest number of Cadillac owners will be best served by omitting that which is extremely elementary in character. It has also been assumed that, although he should at least know what care his car must regularly receive in order to render the best possible performance with the fewest possible interruptions, the typical Cadillac owner prefers to depend upon the maintenance station for occasional adjustments and repairs.

By thus omitting both that which is very elementary and that which is too technical, the first two divisions of the Manual have been made to include only information that is vital to every Cadillac owner regardless of his previous motoring experience. Part I, "Operation," is important because, no matter what car the owner may have driven before, his new car will differ in some feature, even from an earlier Cadillac. Part II, "Lubrication and Care," contains information that every owner should have regardless of the extent to which he expects to delegate the care of the car to others. Especially should he be familiar with lubrication, for correct lubrication is an essential without which it is impossible for the car to render unfaltering performance.

Part III, "General Information," may be considered as a supplement to the Manual. It contains information that may never be required by some owners, but that is included for use should occasion arise. In other words, it is a reference section to which the index on page 85 is a sufficient guide.

All written instructions are subject to limitations. The owner is asked to remember that the Manual is only one means by which the Cadillac organization desires to assist the Cadillac owner to realize the most from his car. Cadillac distributors and dealers everywhere invite the Cadillac owner to consult them on any matters pertaining to the operation and care of his car. If preferred, a request for information may be made direct to the factory, where it will receive the attention of the Technical Department.

Contents

Part I—Operation

Part II—Lubrication and Care

Part III—General Information

PART I

OPERATION

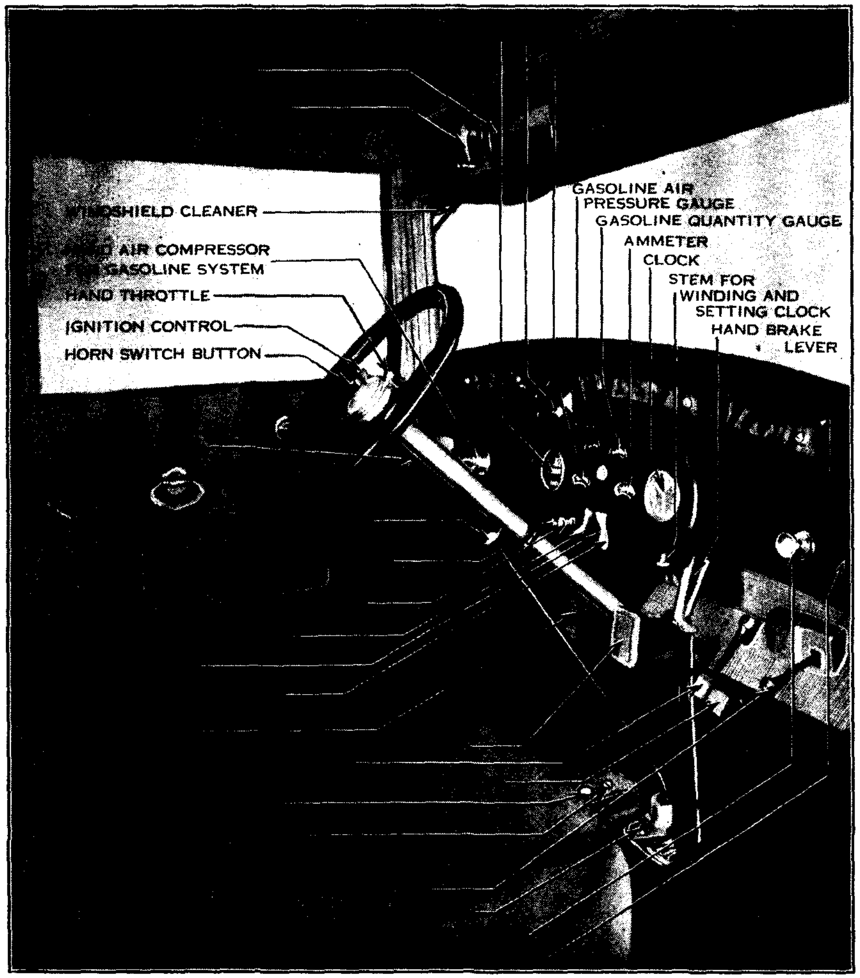

FIGURE 1. ***Instruments and controls***

CHAPTER I

Controls and Instruments

One of the first things the driver of a new car has to do is to familiarize himself with the various controls. In the following chapter are described the levers, pedals, instruments, and other devices used in the operation of the car. The experienced motorist, as well as the beginner, should read this chapter to avoid overlooking any detail of operation in which the car may differ from cars he has previously driven.

Locks

The Cadillac car is provided with the following cylinder locks, all of which on any one car are operated by the same key: ignition switch, transmission control lever, tool compartment, battery compartment, tire holder, and, on closed cars, the doors and various package compartments.

The lock on the switch acts only on the ignition or left-hand lever, which must be *down* in order to be locked. The transmission control lever can be locked in neutral or in any one of the four other positions of the lever.

The lock number is stamped on each key, but not upon the face of the lock. It is urged that the owner make a record of the key number as soon as he takes delivery of his car, so that in the event both keys are lost, a duplicate key can be easily ordered.

Gasoline Gauges and Air Compressor

The two upper dials on the instrument panel (Fig. 1) are gauges for the gasoline system. The gauge at the right marked "Gas" indicates in gallons the quantity of fuel in the tank at the rear of the car, and is operated electrically.

The gauge at the left marked "Air" is a pressure gauge and indicates in pounds per square inch the air pressure in the gasoline system. This pressure is necessary to force the fuel from the tank to the carburetor.

Initial pressure is secured by operating the hand air compressor at the left-hand end of the instrument board. While the engine is running, pressure is automatically maintained by a compressor driven by the engine camshaft.

The normal pressure maintained by the automatic compressor is from one to two pounds. There is sufficient pressure for starting the engine when the car is on level ground, if the gauge pointer is even one division away from the pin at zero. On a steep upgrade an initial pressure of one pound may be necessary.

In order to prevent leakage of the air pressure in the gasoline system it is important that the gasoline tank filler cap be air-tight. After screwing on the filler cap be sure to tighten the thumb screw in the center of the cap.

Before operating the hand compressor, the plunger must be released by turning the handle counter-clockwise. When the necessary pressure has been

obtained, push the compressor handle all the way in and lock it, turning it clockwise as far as it will go.

Throttle Control

The power and speed of the engine are controlled by opening and closing a throttle valve in the carburetor. This throttle is operated both by a hand lever and a foot pedal.

The foot pedal, or accelerator, is at the right of the brake pedal (Fig. 1). The hand control is the right-hand lever of the two levers above the steering wheel. Both controls operate the same throttle; the hand lever, however, remains in the position to which it is moved, whereas the accelerator must be held down to keep the throttle open.

The normal position of the throttle hand lever for driving the car is all the way up (at "Close"). In this position the throttle of the carburetor is open just enough to permit the engine to run at idling speed after it is warm. For starting, however, the lever should be moved approximately one-fourth the way down, and should be left in this position until the engine is warm enough to permit the lever to be returned to the idling position without stalling the engine.

The throttle should normally be controlled by the accelerator. In starting the car on a hill, however, the hand lever should be used rather than the accelerator. This permits the brake pedal to be released with the right foot at the same time that the clutch is engaged with the left.

In cold weather, the accelerator should not be pushed down suddenly before the engine is warm. Sudden opening of the throttle before the engine is warm causes "popping-back" in the carburetor. This should be avoided as much as possible by judicious opening of the throttle during the warming-up period. (See page 32 under "Use of Accelerator Before Engine Is Warm.")

The accelerator can be used in cold weather to prime the carburetor by pushing the accelerator to the floor once or twice. This is not necessary except in very cold weather and should never be done unnecessarily. Excessive priming is likely to prevent the engine from starting. (See page 31 under "Priming the Carburetor.")

Ignition Control Lever

Correct timing of the ignition in relation to the positions of the pistons is accomplished automatically by a governor which is a part of the timer-distributor and which provides for all ordinary advancing and retarding of the spark. (See page 66 under "Timer-Distributor.") A hand control is also provided for still farther advancing or retarding the spark on certain occasions as hereafter described.

The hand control is the left-hand lever of the two levers above the steering wheel. For average driving, the correct position of this lever is about one-

third down from the extreme top or "Advance" position. The lever should be left in this position except on the following occasions:

1. If the engine is being cranked by hand, the lever should be moved all the way down. If this is not done, a "kick-back" may occur resulting in personal injury.
2. In pulling at low speeds with the throttle well open, the lever should be moved farther down.
3. In driving at high speeds, the lever should be moved all the way up.
4. In starting the engine in extremely cold weather, the lever should be moved all the way up unless the engine is being cranked by hand.

Carburetor Enriching Button

The button at the left of the ignition switch lever (Fig. 1) controls a device on the carburetor for temporarily enriching the fuel mixture supplied to the engine. In starting the engine it is necessary to have the proportion of liquid gasoline in the fuel mixture greater than at other times because in a cold mixture only a part of the gasoline is vaporized. Pulling out the enriching button increases the proportion of liquid gasoline to air, the normal proportions being restored when the button is released and permitted to return to its original position.

Correct use of the enriching control not only is essential to quick starting of the engine, but also has an important bearing on the life of the engine. The enriching button must be pulled out far enough in starting to provide an explosive mixture quickly so that the battery is not unnecessarily discharged by useless cranking. The button must also be held out far enough during the warming-up period so that the engine will run without missing and "popping back." On the other hand, it should not be pulled out any farther or held out any longer than is necessary to accomplish these results, because some of the excess liquid gasoline in the enriched mixture does not burn.

If the engine still retains heat from previous running, the enriching control should not be used without first attempting to start the engine on the normal mixture. If the enriching button is pulled out for starting a hot engine the mixture may be made so rich that starting will be impossible.

The enriching button is not a priming device. It has no effect whatever on the fuel or the fuel mixture unless the engine is being cranked or is running under its own power. The button must be pulled out and held partly out during the cranking operation.

Ignition and Lighting Switch

The ignition and lighting switch (Fig. 1) controls the current for the ignition and for the following lamps: headlamps, instrument lamp, and rear

lamp. The ignition lever is the left-hand lever and has two positions: "off," when down, and "on," when up. The lighting lever is the right-hand lever and has four positions besides the "off" position. Starting with the lowest position, these are:

First Position—Instrument lamp and rear lamp.
Second Position—Parking lights, instrument lamp and rear lamp.
Third Position—Headlamp lower beams, instrument lamp and rear lamp.
Fourth Position—Headlamp upper beams, instrument lamp and rear lamp.

Cadillac headlamp bulbs have two filaments, one above the other, instead of the customary single filament. Both filaments are of the same candle-power (21), but because they are located in different positions with respect to the focus of the parabolic reflector, the beam of light from one filament is projected at a different angle from the other. When the switch lever is in the fourth position, one set of filaments is lighted and the beams are projected straight ahead, illuminating the road at a distance. When the lever is in the third position, the other filaments are lighted and the beams are projected down at an angle, illuminating more brightly the road directly in front of the car.

The practice to be followed by the driver in using this double-beam feature of the headlamps will depend upon the regulations imposed by local authorities. In general, it is expected that the upper beams will be used except on the following occasions: when passing a vehicle approaching from the opposite direction, when rounding a sharp curve and when topping the crest of a hill. On these occasions and at other times when illumination is desired directly in front of the car, the lower beams should be used. For a further description of the headlamps, see page 68.

Starter Pedal

The starter pedal is at the right of the accelerator (Fig. 1). Pushing this pedal forward brings into action the electric motor that cranks the engine for starting. *Do not push the starter pedal when the engine is running.*

The starter pedal is only one of the controls that must be manipulated to start the engine. Unless there is an explosive mixture in the cylinders and a spark to ignite it, it is useless to crank the engine. The starter pedal should not be operated, therefore, until the necessary preliminary steps have been taken. The following, in their proper order, are the various steps that must be performed to start the engine. As each control is mentioned, reference is made to the page on which that control is explained in detail.

1. Unlock the transmission. (Page 9.)
2. Make sure that the transmission control lever is in neutral. (Page 15.)
3. Unlock the ignition switch. (Page 11.)

4. Note whether pressure is indicated on the gasoline pressure gauge; if not, operate the hand compressor. (Page 9.)
5. Place the ignition control lever at the steering wheel about one-third* the way down. (Page 10.)
6. Place the throttle lever about one-fourth the way down from the idling position. (Page 10.)
7. *Cold Weather Only*—In extremely cold weather, prime the carburetor by pushing the accelerator to the floor once or twice. Do not prime the carburetor in warm weather or unnecessarily in cold weather. Excessive priming is likely to prevent the engine from starting. (Page 10.)
8. Pull back the carburetor enriching button unless the engine is still warm. If the engine is still warm, do not pull back the enriching button unless the engine fails to start on the normal mixture. (Page 11.)
9. Switch on the ignition. (Page 11.)
10. Push the starter pedal forward and hold it until the engine starts under its own power. Release it immediately as soon as the engine starts. (See below for probable causes for the engine failing to start.)
11. Let the carburetor enriching button partly in as soon as the engine starts, and all the way in as soon as the engine is warm enough to permit it. (Page 11.)
12. Note whether pressure is indicated on the oil pressure gauge and stop the engine at once if no pressure is indicated. (Page 14.)
13. Move the throttle lever up to the idling position as soon as the engine is warm enough to permit it.

In cold weather, disengage the clutch before pressing down the starter pedal, and hold it down during the cranking operation. This relieves the starter of the necessity of turning the transmission gears, which are immersed in lubricant. The additional load is small in warm weather when the lubricant is thin, but in cold weather the power required to turn the gears through the thickened lubricant adds unnecessarily to the demand upon the battery.

If the Engine Fails to Start—If the engine fails to start after being cranked for a few seconds, do not continue to operate the starter. To do so is a useless expenditure of battery energy. Release the starter pedal and investigate the cause, which may be one of the following:

No fuel in the tank.

No air pressure in the gasoline system.

Ignition not switched on.

Carburetor flooded by unnecessary use of the enriching device or by unnecessary priming of the carburetor when the engine is warm.

---

*In extremely cold weather move the ignition control lever all the way up unless the engine should be cranked by hand. If the engine is cranked by hand, be sure to move the ignition control lever all the way down.

Oil Pressure Gauge

The lower left-hand dial on the instrument panel (Fig. 1) is the oil pressure gauge. This gauge indicates, not the *quantity* of oil in the engine, but the *pressure* under which the oil is forced to the engine bearings.

When the engine is not running, the pointer on the oil pressure gauge should remain at zero, but as soon as the engine is started and as long as it runs the gauge should show pressure. If the gauge does not show pressure when the engine is running, stop the engine at once and determine the cause. Serious damage may be done if the engine is run without oil pressure. (See page 41 under "Oil Pressure.")

The amount of the pressure indicated by the gauge depends upon the speed of the engine, the viscosity of the oil, and the adjustment of the oi pressure regulator. At idling speed with fresh oil of the correct viscosity, the pressure after the engine is warm should be 1 to 4 lbs. Before the engine is warm, higher pressures than those specified will be indicated. After the oil has become thin from use, lower pressures than those specified will be indicated. These are normal variations from the standard and do not indicate need for readjustment of the oil pressure regulator.

Clutch Pedal

The clutch pedal is the left-hand pedal. When this pedal is in its normal or released position, the clutch is engaged. The flywheel of the engine is then coupled to the transmission by a series of discs, every other one of which is faced on both sides with friction material, and which are pressed together by a powerful spring. When the clutch pedal is pushed down, the spring is compressed and the clutch discs are allowed to separate. The clutch is then disengaged and the flywheel, if the engine is running, revolves independently of the transmission.

The clutch has two uses: First, to enable the car to be started gradually and without jerk or jar; second, to permit shifting of the transmission gears. The operation of the clutch pedal is discussed in connection with the transmission control on page 15. Further comment is unnecessary at this point except the following suggestions to the driver:

Do not drive with the foot resting on the clutch pedal. The Cadillac clutch operates so easily that even the weight of the driver's foot may unintentionally cause the clutch to slip.

Do not form the practice of disengaging the clutch whenever the brakes are applied. Most occasions for use of the brakes require only slowing down without stopping or even shifting of gears. A skilled driver will not touch the clutch pedal until the car is just about to stop or until he is about to shift to a lower gear. It is a mistaken idea that applying the brakes with the clutch engaged is more severe on the brake lining. The opposite is actually

the case, proof of which is in the fact that in coasting down grades the resistance of the engine is used to assist the brakes in controlling the car speed.

It will be observed in operating the clutch pedal that the pedal offers almost no resistance until it has been moved about one inch. It is at this point that it actually begins to disengage the clutch. It is important that the pedal have this "lost motion." If the full pressure of the clutch spring is felt just as soon as the pedal is moved from its released position, necessity for readjustment of the pedal connections is indicated. Failure to make this adjustment will result in the clutch slipping. (See page 72.)

Transmission Control

The Cadillac transmission has three forward speeds and reverse. It is controlled by a lever, the handle of which describes the letter "H" as it is moved from one position to another. It should be observed by those who have driven other makes of cars that, although most cars have this conventional H-type of transmission control, all these cars do not have the same positions of the lever. The driver should study Fig. 2 carefully, and if the various positions of the lever are different from those to which he has been accustomed, he should master this arrangement before attempting to drive.

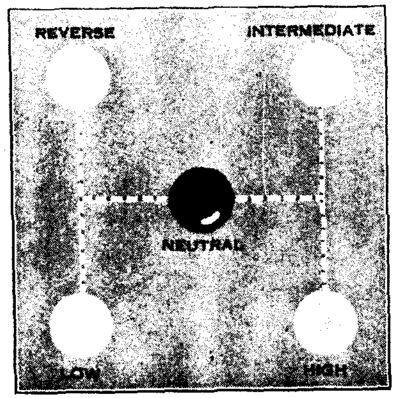

FIGURE 2. ***Positions of transmission control lever***

No attempt can be made here to teach the beginner the technique of gear shifting. It is recommended that the beginner secure individual instruction from the Cadillac distributor or dealer from whom the car was purchased and who will be glad to give this instruction. There are, however, certain rules and suggestions for the operation of the transmission control that it will be to the advantage of every driver to learn or to recall if he already knows them.

Always disengage the clutch before moving the control lever and hold the pedal down until the shift is completed.

Do not attempt to start the car with the transmission control in high gear.

Do not start with the transmission control in intermediate except when the car is on a smooth level road or on a down grade; even under these conditions do not start the car in intermediate unless the engine is thoroughly warm.

Do not make any of the following shifts when the car is moving:

From reverse to any forward gear.

From any forward gear to reverse.

From high gear to low gear.

From intermediate to low gear (except when the car is moving very slowly).

In shifting from high to intermediate, the car should not be traveling faster than fifteen miles per hour and the control lever should be moved very quickly and with no hesitation in neutral.

There are times when it is desirable to be able to shift from high to intermediate at higher car speeds. It is possible to do this by the following method, which is called "double de-clutching":

Disengage the clutch and shift the transmission control lever at once to neutral. Re-engage the clutch at the same time accelerating the engine; then disengage the clutch again and instantly shift to intermediate, after which re-engage the clutch. The speed to which the engine should be accelerated while the transmission control is in neutral depends upon the speed at which the car is traveling when the shift is made.

It is not recommended that the driver attempt the double de-clutching method until he has become expert in shifting from high to intermediate in the usual manner at lower speeds.

Make a practice of shifting the transmission control to intermediate or even to low before commencing the descent of steep grades. The reason for this is explained on page 19, where will also be found further suggestions for coasting.

Brakes

The foot brakes, which consist of external brake bands on the rear wheels and internal bands on the front wheels, are operated by the right-hand pedal. This pedal differs from the conventional brake pedal in a construction that provides automatically for notifying the driver when re-adjustment of the brakes is necessary. Every driver is familiar with the fact that, as the brake lining wears, the brake pedal must be pushed farther toward the floorboard to apply the brakes. On most cars this proceeds until an occasion arises for an emergency stop and then it is found that the pedal goes all the way to the floorboard before the brakes are fully applied.

The Cadillac brake pedal has two stages in its travel. The first stage, which consists of the first four or five inches of the pedal travel, is sufficient for all ordinary stops when the brake band clearance is properly adjusted. When, as the result of wear on the lining, the pedal must be pushed farther toward the floorboard, an inch or inch and a half from the floorboard the second stage of pedal travel is reached. In the second stage, the pedal has

somewhat less leverage than in the first stage and the point of division is marked by increased resistance to movement of the pedal. This serves as a notice to the driver that the brakes require readjustment. If it is not convenient to have the adjustment made at once, the brakes can still be operated for some time. The adjustment should be made, however, as soon thereafter as possible.

The hand brakes, which are internal brakes on the rear wheels, are operated by the hand lever at the right of the transmission control lever.

Speedometer

The speedometer has three dials. The upper dial indicates the speed of the car. The center dial indicates the total mileage traveled. The lower dial also indicates mileage, but it can be reset to zero by pushing up and turning the knurled stem back of the instrument board. The right-hand figure on the lower dial indicates tenths of a mile.

Across the speedometer cover glass and below the total mileage dial is a strip of black celluloid on which are two white spaces. These spaces are for the lubrication notice described on page 38 in connection with the lubrication schedule.

An automobile repairman should never be permitted to attempt to adjust or repair the speedometer head or to replace the glass. This work can be done only by men experienced in speedometer work and only with special machinery and tools. If the speedometer head is removed, handle it as carefully as a fine watch. The speedometer head may easily be damaged by rough handling.

Ammeter

The lower right-hand dial on the instrument panel (Fig. 1) is the ammeter, which measures the electric current flowing to the battery and the current flowing from the battery at all times except when the starter is cranking the engine. When current is flowing from the battery, the ammeter shows a reading on the side marked "Discharge"; when current is flowing to the battery, the ammeter reading is on the "Charge" side.

The ammeter should indicate on the "Charge" side most of the time. Otherwise, more current will be taken out of the battery than is put into it and the battery will eventually become fully discharged. The exact amount of current that should be indicated by the ammeter at any time depends upon various conditions, which are explained on page 62.

Ordinarily, when no lights are in use, the ammeter should show "Charge" as soon as the car is running ten or twelve miles per hour in high gear. If the ammeter shows "Discharge" with all lights off, when the car is running more than twelve miles per hour in high gear, it indicates either that the fan belt is slipping or that the generator charging rate should be readjusted. The fan belt should be inspected first, and tightened if necessary, before any attempt is made to change the generator charging rate.

CHAPTER II

Driving

The preceding chapter of the Manual has aimed to familiarize the driver with the controls and instruments used in operating the car. Actual skill in driving is, of course, more than knowledge of and familiarity with these individual devices. It is not the purpose of this Manual to discuss all phases of driving, but there are a few matters of sufficient importance to Cadillac owners to warrant devoting a chapter to them.

Driving Speed When Car Is New

The parts of the Cadillac car are machined and ground to secure the most accurate fit and the finest finish. Proper functioning of the assembled mechanism is further assured by testing the engine and chassis both on shop dynamometers and on the road. Nevertheless, it is not possible by manufacturing processes and tests to give to bearing surfaces the fine polish that results from continued operation at moderate speeds and loads.

Until a new car has been driven far enough to produce this effect on the bearing surfaces, the car should not be driven at high speeds. It is recommended that the car be driven no faster than twenty miles per hour for the first two hundred and fifty miles, and no faster than twenty-five miles per hour for the second two hundred and fifty miles. Moderate driving during the first five hundred miles will increase the life of the car more than enough to repay any inconvenience. Manufacturers of locomotives and stationary steam engines have always recognized the necessity for an initial "running-in" period.

Danger of Running Engine in Closed Garage

Every person having to do with the operation or care of a motor car should be warned of the danger that attends running the engine while the car is in a small closed garage.

Carbon monoxide, a deadly poisonous gas, is present in the exhaust of all internal combustion engines. Most people are already familiar with carbon monoxide in the form of illuminating gas, or in the gas produced by furnaces and stoves when insufficient air is supplied to give complete combustion. But illuminating gas and coal gas have an unpleasant odor, which serves as a warning, whereas carbon monoxide, as produced in the internal-combustion engine, is colorless, tasteless, and almost odorless, so that the victim may be overcome before he is aware of the danger.

When the engine exhausts into the open air, the carbon monoxide is so diluted that it has no effect. It is when the engine is run for a time in a closed room that the proportion of carbon monoxide in the air may increase to the point at which continued breathing of it would be fatal. The United States Public Health Service advises that the average automobile engine warming up in a single-car garage will give off enough carbon monoxide in three minutes to endanger life.

Unusual precaution must be taken in cold weather when the natural tendency is to keep the garage doors and windows closed. The practice of letting the engine warm up before running the car out of the garage is unsafe. The risk is made greater by the fact that the enriching of the mixture by manipulation of the carburetor enriching device increases the amount of carbon monoxide formed.

Coasting

To coast *on the level*, simply release the accelerator pedal and disengage the clutch. If coasting to a stop, the transmission control may also be shifted to neutral and the clutch re-engaged.

In coasting *down grades*, however, it is recommended that the transmission be left in gear and the clutch engaged. With the throttle in the idling position, the car is thus made to drive the engine, the resistance of which assists the brakes and saves wear on the brake lining. It must be remembered that the brakes are subjected to much more severe use on grades than on the level because gravity acts continuously, whereas on the level the brakes need absorb only the momentum of the car. Even on slight grades, coasting with the transmission in neutral or the clutch disengaged is not advisable. On any grade steep enough to warrant coasting, it is worth while to save the brakes as much as possible by utilizing the braking effect of the engine.

Ordinarily, the resistance offered by the engine when the transmission is in high is sufficient to control the speed of the car, supplemented by moderate use of the brakes. On steep grades, however, the transmission control should be shifted to intermediate or even to low if the grade is very steep. Shifting should always be done before commencing the descent of the grade, because, after the car has once gained speed, considerable braking may be necessary to slow down to the speed at which the shift can be made easily.

Do not switch off the ignition when coasting with the car driving the engine. Contrary to a common impression, this does not appreciably increase the resistance and is likely to cause damage to the engine. Even with the throttle closed, some fuel is admitted to the cylinders and if this is not burned it condenses on the cylinder walls and washes off the oil by which the pistons are lubricated.

General Driving Suggestions

Road and traffic laws vary greatly in different localities. It is unfortunately impossible to set down a complete list of rules that may be followed in all parts of the country. The following are some of the rules that are universal in practically all parts of the United States:

In meeting a vehicle going in the opposite direction pass to the right.

In overtaking a vehicle going in the same direction pass to the left.

Always stop with the right-hand side of the car next to the curb. If it is necessary to turn the car around to do this, it should be done.

Never turn around or turn off on another road without making absolutely certain that there is no other vehicle directly behind.

Never start to cross street car tracks without making sure that there is no car directly behind. No matter how sure you feel, look and see.

Do not cross street car or steam railroad tracks without making certain that it is absolutely safe to do so. At any railroad crossing that is on an up grade or which for any reason must be approached very slowly, it is a wise precaution to shift to intermediate gear before crossing because the car can thereby be accelerated more quickly, if necessary.

In crowded traffic do not apply the brakes suddenly unless it is absolutely necessary. A vehicle following may not have brakes as efficient as Cadillac four-wheel brakes.

On wet asphalt streets or slippery roads do not apply the brakes suddenly unless it is absolutely necessary. Cadillac four-wheel brakes minimize the possibility of skidding under these conditions, but their effectiveness should not induce anyone to drive less carefully.

Slow down in passing vehicles going in the opposite direction.

Never take a chance.

Don'ts for General Operation

Don't fail to change the engine oil as frequently as recommended.

Don't fail to release the carburetor enriching button as soon after starting as possible.

Don't fill the lubricating system of the engine alone and neglect to lubricate all other parts of the car.

Don't neglect the lubrication of any part of the car.

Don't run the car at sustained high speed when it is new.

Don't allow the clutch to engage suddenly.

Don't prime the carburetor too much.

Don't attempt to shift from neutral to any gear, or from one gear to another gear, without first disengaging the clutch.

Don't attempt to shift from the reverse gear to any other gear when the car is moving.

Don't attempt to shift from any forward gear to the reverse gear when the car is moving.

Don't attempt to shift from the high gear to the low gear when the car is moving.

Don't attempt to shift from the intermediate gear to the low gear when the car is moving, unless it is moving very slowly. Ordinarily it is best to stop the car altogether.

Don't switch off the ignition when coasting with the car driving the engine.

Don't push the starter pedal when the engine is running.

Don't turn the steering gear when the car is standing. This is not only unnecessary but is also bad practice. The front wheels pivot more easily if they are rotating.

Don't fail to investigate any unusual sound which may develop in the car. The car should be inspected at a Cadillac maintenance station.

Don't neglect to inspect the level of the acid solution in the storage battery every 500 miles and add distilled water if necessary.

Don't turn corners at high speed.

Don't neglect to keep the cooling system filled.

Don't drive fast or attempt to stop suddenly on wet pavements.

Don't attempt to start the engine with the switch turned off, without air pressure or without gasoline in the tank.

Don't neglect to keep the tires inflated properly.

Don't race the engine when it is not driving the car. There is no worse abuse.

CHAPTER III

Equipment

The controls and instruments used in driving have already been described. In addition to these the car is equipped with various devices which are for the convenience and comfort of the occupants, and are used only as occasion demands. It is suggested that the driver anticipate his use of such equipment by becoming familiar at once with the directions contained in this chapter.

Windshield and Ventilation

Closed Cars—Cadillac closed cars are equipped with a one-piece windshield, which can be moved up and down. Movement of the glass is controlled by a handle above the windshield. To raise the glass, the handle should be turned clockwise, and to lower the glass the handle should be turned counter-clockwise.

For moderate ventilation, the windshield should be raised not more than one inch so that the lower edge of the glass is still below the ledge over the instrument board. With the windshield in this position, air is deflected into the driving compartment through an opening in the cowl just forward of the instrument board. For additional ventilation, the windshield can be raised above the level of the ledge over the instrument board, and air then enters directly into the car.

Open Cars—Cadillac open cars are equipped with a cowl ventilator which is operated by a lever just in front of the instrument board and at the right of the steering column. Additional ventilation for warmer weather can be secured by manipulating the windshield.

The open-car windshield is in one section, which is pivoted at the upper corners. To secure more ventilation than can be obtained through the cowl ventilator, the windshield can be tilted out.

The thumb screws on the windshield supports must be loosened before adjusting the position of the windshield and must be tightened to hold it in the desired position.

Windshield Cleaner

The windshield cleaner is attached to the car outside and above the windshield (except on open cars). It is operated by the suction or vacuum in the passages between the carburetor and the engine, and is controlled by a lever

on the instrument board (Fig. 1). The lever has three positions: in the extreme right-hand position, the cleaner is shut off; in the center position, the cleaner operates slowly; and in the left-hand position, the cleaner operates at its full speed. (On some cars these positions are marked "P," "S" and "F," respectively.)

Rear Vision Mirror

The rear vision mirror may be adjusted by the driver to suit his preference, after loosening the clamp screws that hold the mirror to its supporting bracket.

Cigar Lighter and Inspection Lamp

The car is equipped with a combination cigar lighter and inspection lamp that makes use of a single reel with twelve feet of flexible cord attached to the back of the instrument board. The flexible cord ends in a bayonet type socket to which may be attached either the inspection lamp or the heating element of the cigar lighter. The method of attachment is identical with that of an ordinary lamp bulb. Ordinarily the cigar lighter will be carried in place in the socket on the cord and the inspection lamp in a stationary socket provided on the front of the dash, where it is useful to illuminate the engine. (The inspection lamp is packed with the tool equipment when the car is shipped.)

To use the cigar lighter pull it out from the instrument board at least a foot, wait a few seconds for the heating element to heat and apply it to the cigar or cigarette. The current is automatically switched on as soon as ten or twelve inches of the cord has been unreeled. To light a pipe, remove the nickel plated shield by turning it slightly counter-clockwise and pulling it straight off.

To lock the cord in any desired position, pull out the button on the instrument board at the right of the cigar lighter (Fig. 1). This engages a ratchet which prevents the reel from rewinding. To rewind the cord, press the button back to its original position.

The inspection lamp socket on the dash has a double bayonet lock with two sets of slots. To install the lamp, simply insert it in the socket, press in, and turn it clockwise as soon as the pins on the lamp engage the first or outer set of slots. In this position the current is not switched on. To switch the current on, turn the lamp slightly counter-clockwise, press in, and turn it clockwise again, engaging the pins in the second or inner set of slots. To switch off the light, turn the lamp counter-clockwise and pull it out of the socket far enough to engage the first set of slots.

Clock

The clock has an eight-day movement and is wound in the same manner as a watch. The stem is under the clock back of the instrument board.

Side Curtains on Open Cars

The side curtains, with which the open cars are equipped, are carried in an envelope provided with cloth partitions to prevent rubbing and chafing. The Touring car curtains are stowed under the front seat; the Phaeton curtains in a compartment back of the front seat, with a door opening in the tonneau; the Roadster curtains in the package compartment just back of the seat.

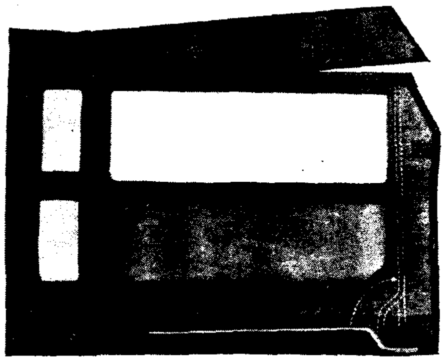
FIGURE 3. ***Side curtains***

The Touring car and Phaeton curtains are in six sections, each of which is marked to indicate its position, as "Left Front," "Right Center." The front and center sections on both sides are each provided with a rod, the lower end of which fits a socket in the top of the door. When a curtain is folded for stowing, this rod is parallel with the bottom of the curtain as shown in Fig. 3. Before the curtain can be attached to the door, the rod must be moved to the position shown by the dotted lines. The upper end of the rod is slotted to engage with the stiffener that runs along the upper edge of the curtain.

The rear sections should be applied first, followed by the center and front sections. The rear sections should be fastened to the rear bows *under* the side flaps of the permanent rear curtains.

Before stowing the curtains, they should be dry and clean.

Curtain Fasteners

Most of the curtain fasteners used on the top and side curtains are of the type illustrated in Fig. 4. When this type of fastener is snapped on its stud, it becomes locked on three sides. To release the fastener it must be lifted on the side that is not locked. This side is indicated by the small projection to which the arrow points in Fig. 4. This type of fastener cannot be released by lifting it at any other side. The remainder of the fasteners used on the top and curtains are of the usual glove type.

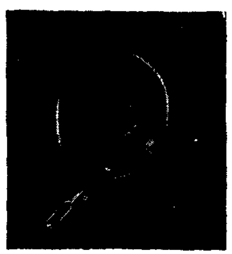
FIGURE 4
Curtain fastener

Tools

The compartment for carrying the tool equipment is just forward of the right-hand running board. The

lock on this compartment is operated by the switch key. The following are the tools comprising the standard equipment. The numbers refer to the numbers by which the tools are designated in Fig. 5. Items listed opposite Nos. 25, 26, 27, 28 and 29 are not illustrated.

1. Open end wrenches (two) for adjusting rear foot brakes
2. Small screw driver
3. Socket wrench for oil pan drain plug
4. Large screw driver
5. Center punch
6. Cold chisel
7. Hammer
8. File
9. Pliers
10. Wrench for spark plugs and compression relief cocks
11. Distributor wrench (with gauge for adjusting timer contact points and spark plugs)
12. Distributor wrench (plain)
13. Bicycle wrench
14. Monkey wrench
15. Wrench for rim clamping nuts
16. Rim assembling tool
17. Hose for tire air compressor
18. Adapter for grease gun for lubricating clutch thrust bearing
19. Grease gun
20. Hand starting crank
21. Hub cap wrench
22. Oil can
23. Jack handle
24. Jack
25. Inspection lamp. Note: The inspection lamp is packed with the tool equipment when the car is shipped but is ordinarily carried in the socket provided for it on the dash.
26. Small tool bag
27. Large tool bag
28. Lubrication chart
29. Operator's Manual

Tires

Tire Valve Caps

The valve caps used with some makes of tires are a combination dust and valve cap. This type of cap can be removed and installed without screwing the cap the entire length of the threads on the valve stem.

To remove one of these valve caps, turn it two or three turns counterclockwise. This loosens the sliding nut inside the cap (Fig. 6). Next, pull the cap up as far as it will go. Then remove the cap by unscrewing it the rest of the way.

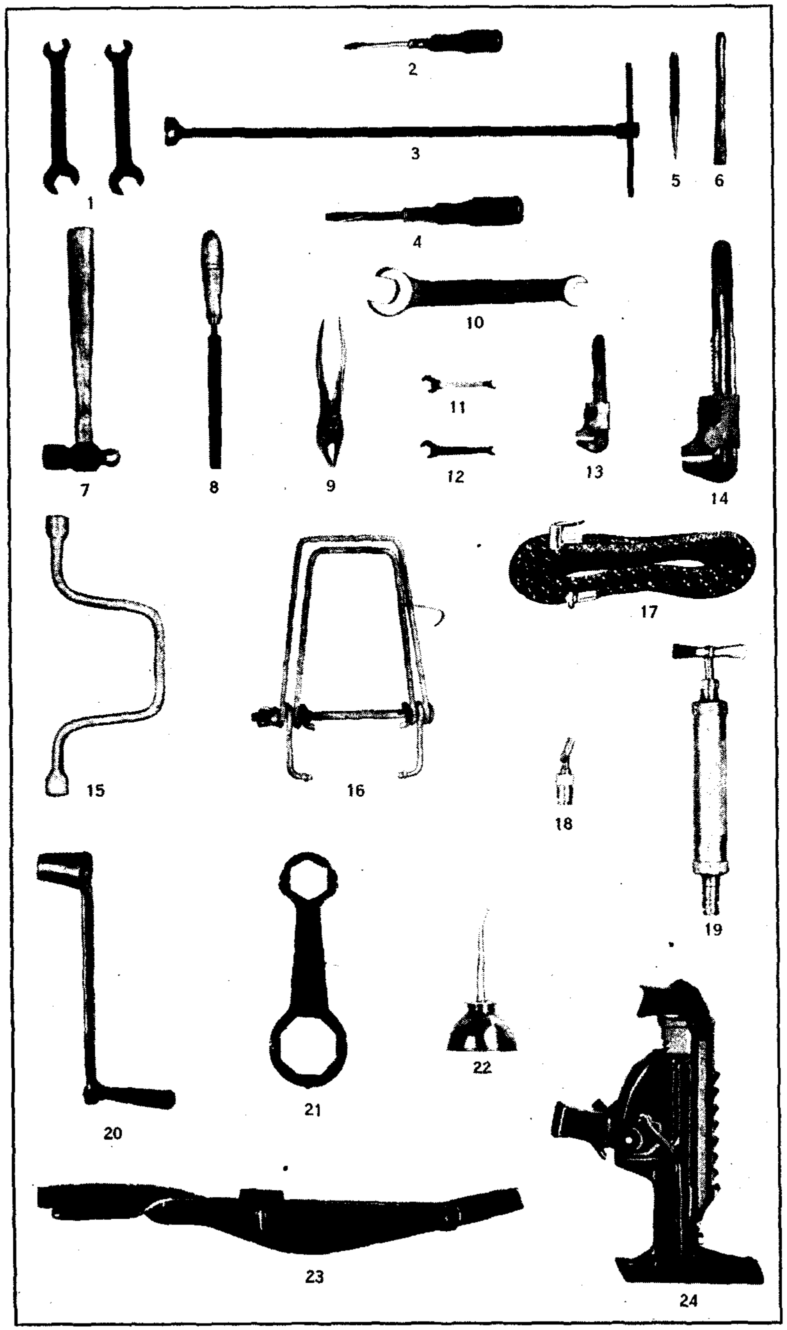

FIGURE 5. ***Standard tool equipment***

To install a valve cap, place the cap over the valve stem and turn it a few turns clockwise to engage the threads in the sliding nut. If the sliding nut is too far inside the cap to be reached by the valve stem, shake the nut down by tapping the bottom of the cap on some solid object. When the valve stem has been started in the sliding nut, push the cap down over the stem as far as it will go. Then turn the cap until it locks tightly.

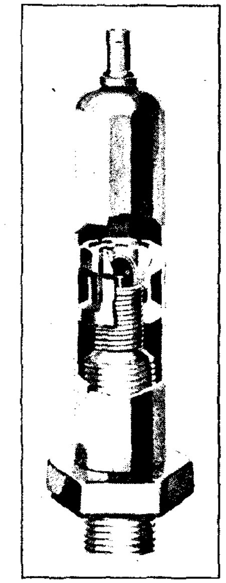

FIGURE 6
Tire valve cap

Inflation Pressure

For normal driving, the 33 by 6.75 low pressure tires, which are standard equipment on Cadillac cars, should be inflated to a pressure of 40 lbs. per square inch. The inflation pressure should be checked at least weekly and should not be permitted to drop more than 5 lbs.

On cars driven at high speeds, the front tires should be inflated to 45 lbs. or higher if necessary. *This is important.*

Tire Air Compressor

To use the tire air compressor with which the car is equipped, proceed as follows:

Turn back the left-hand side of the front carpet and lift the small oval-shaped cover which is in the floor just to the left of the transmission control lever. Reach through the hole in the floor and remove the knurled cap from the connection on top of the compressor. Connect one end of the air hose (in the tool equipment) to this connection and the other end of the hose to the valve of the tire to be inflated. *Do not connect the hose to the tire first if there is pressure in the tire.*

The control shaft by which the compressor driving gear is placed in mesh with the transmission gears projects through a small hole in the floor just in front of the large hole over the compressor. To start the compressor, if the engine is running, disengage the clutch and hold the pedal down until the transmission gears have ceased to revolve. Then, with a screw driver, turn the slotted head of the compressor control shaft clockwise. If the engine is not running, simply turn the control shaft clockwise without disengaging the clutch and then start the engine.

The compressor gives best results when the engine runs at a speed of approximately 1,000 r.p.m., which is about three times the normal speed of the engine when idling. Do not race the engine in operating the compressor, or, for that matter, at any other time when it is not driving the car. Racing the engine beyond the recommended speed not only decreases the efficiency

(*Continued on page 30*)

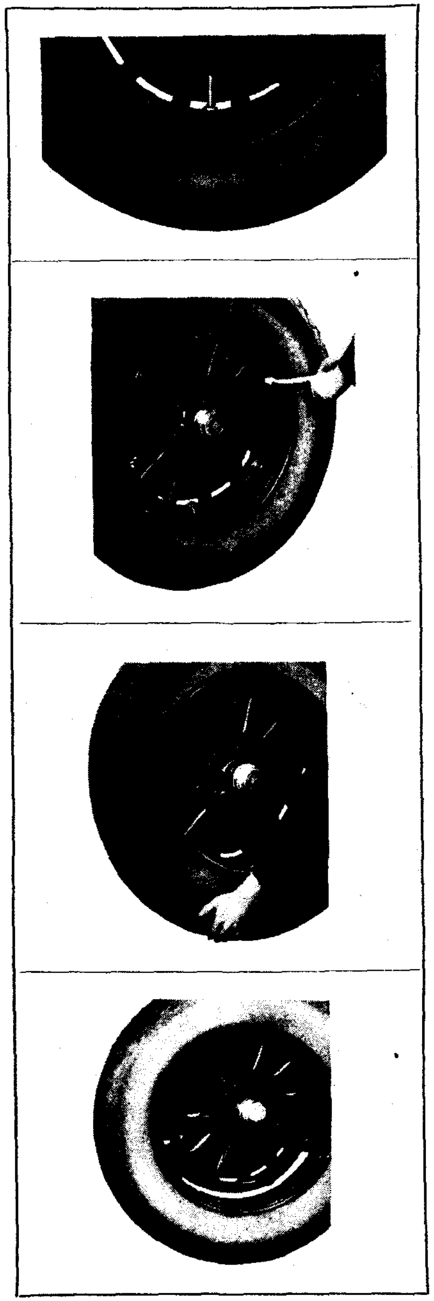

Figure 7a

Jack up the axle until the tire clears the ground. Unscrew the dust cap and the clamping nut from the tire valve stem.

Figure 7b

With the brace wrench, supplied in the tool kit, loosen the six rim clamping nuts. Turn each clamp so that the lug is away from the rim and tighten the nut enough to hold the clamp in this position.

Figure 7c

Rotate the wheel so that the valve stem is at the top, and pull the bottom of the rim away from the wheel. If the rim does not come off easily, pull the top of the rim as far out as the valve stem will permit and then pull the bottom part of the rim away from the wheel.

Figure 7d

Rotate the wheel until the valve stem approaches the bottom. At the point shown in the illustration, the rim and tire will roll free from the wheel and can be removed without lifting

FIGURE 7. ***Removing rim with tire from wheel***

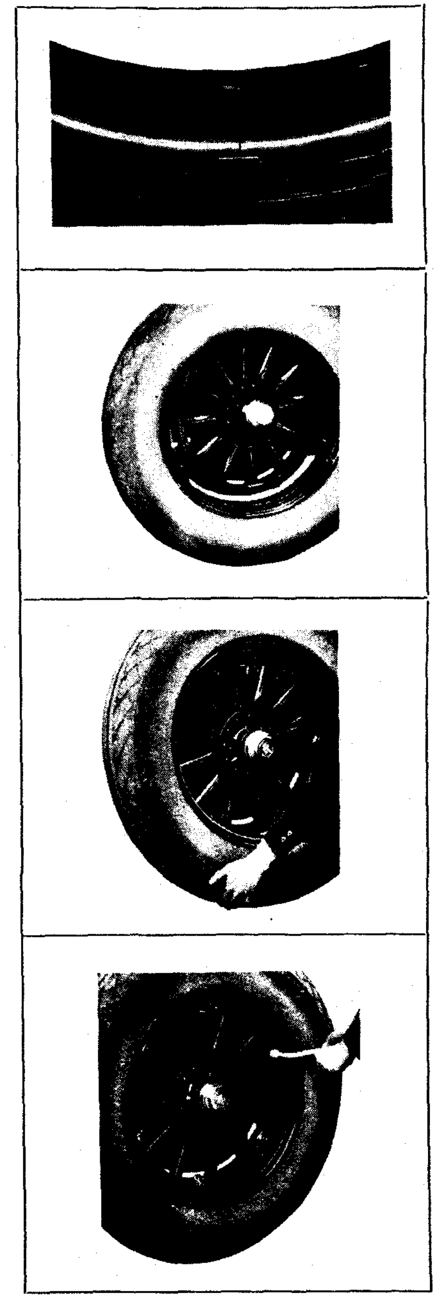

Figure 8a

If the rim has no split clamping ring, take the one from the rim removed. The correct position for the ring is just inside the three lugs and with the split opposite one of the lugs. If the ends of the ring overlap, they can be sprung into place with a screw driver.

Figure 8b

Rotate the wheel so that the hole for the valve stem is in the position shown. Hold the rim so that the three lugs are on the side away from the car and insert the valve stem into the hole in the wheel.

Figure 8c

Rotate the wheel, which will carry the rim with it, until the valve stem is at the top. Then push the lower part of the rim into place, guiding the hinge on the rim through the notch provided for it in the edge of the wheel.

Figure 8d

Turn each rim clamp so that the lug is over the clamping ring, drawing the nut down until the end of the bolt is flush, or nearly so, with the outer surface of the nut. Then go over the six nuts again, tightening them firmly. (See page 30 in regard to truing up the rim on the wheel.) Install the valve stem clamping nut and the dust cap. It is important that the clamping nut be firmly tightened.

FIGURE 8. ***Installing rim with tire on wheel***

of the compressor, but is one of the worst forms of abuse. To stop the compressor, turn the control shaft counter-clockwise.

Do not turn the compressor control shaft to start the compressor when the engine is running and the clutch is engaged.

Tire Holder

The tire holder is designed to carry either one or two standard size tires mounted on rims and inflated. Each rim has on it three lugs which are located so as to engage with notches on the support arms and on the adjustable clamp. There are two sets of these notches.

When two rims are carried, the rim nearest the car should be placed so that the side with the lugs is away from the car and the lugs should be inserted in the inner set of notches. The outer rim should then be placed so that the side with the lugs faces toward the car and the lugs of this rim should be inserted in the outer set of notches.

When only one rim is carried, the side of the rim with the lugs should face toward the car and the lugs should be inserted in the inner set of notches.

The tire holder lock is in the upper end of the clamp screw and is protected by a dust cap which must be unscrewed to insert the key. Turning the key clockwise disengages the lock, permitting the clamp screw to be turned.

To lock the tire holder, screw the clamp down firmly against the rim or rims. Adjust the clamp screw handle so that it points squarely across the car. Then turn the key counter-clockwise. Care should be exercised in removing or replacing a spare tire not to strike the body of the car.

Note: If a tire cover is used, it should have slots cut in it opposite the two upper lugs on the rim so as to permit these lugs to seat in the notches in the support arms.

Changing Tires

If a spare rim with inflated tire is always carried on the tire holder, the driver will seldom or never have occasion to disassemble a tire from the rim. In case of tire trouble it is then merely necessary to remove the rim with tire from the wheel and to install on the wheel the spare rim and tire. Illustrated directions for making this change are on pages 28 and 29. Disassembly of the tire from the rim is necessary only if the tire is to be repaired or a new one installed. Directions for this work, which is usually left to the repair shop, will be found on pages 78 and 79. Never attempt to remove a tire from its rim without first deflating the tire.

Truing Up Rim

If a rim does not run true, it may be trued up in the following manner: Rotate the wheel slowly and mark the part that runs farthest out from the face of the wheel. Loosen slightly the nuts diametrically opposite the mark and then tighten the nuts on the marked side. Test the wheel again and if it still does not run true repeat the operation.

CHAPTER IV

Cold Weather Operation

THE Cadillac car is an all-season car and no owner need hesitate to make full use of his car in severe winter weather as well as at other times. It is necessary in freezing weather, however, to observe certain precautions and to follow a somewhat different procedure, particularly in starting the engine. In this chapter has been grouped all the information relating to operation of the car during cold weather. It should be reviewed just prior to the beginning of the winter season.

Starting the Engine

Carburetor Enriching Button

The first difference between starting the engine in cold weather and starting the engine in warm weather is in the greater use of the carburetor enriching device necessary in cold weather. Gasoline does not vaporize as readily at low temperatures, and in order to supply the cylinders with a gaseous mixture rich enough to be ignited, the proportion of liquid gasoline to air must be increased.

At the same time it is important not to apply the enriching device more than is necessary. The unvaporized gasoline collects on the cylinder walls and works down past the pistons, washing off the lubricant as it goes. Although dilution of the oil supply with this unburned gasoline is minimized in the Cadillac engine by an exclusive system for ventilating the crankcase (see page 42), it is best to avoid an excess of liquid gasoline in the combustion chambers by careful and judicious use of the enriching device.

The following rule should govern the use of the enriching button in winter weather: Pull the enriching button back just as far as it is necessary to start the engine, but as soon as the engine starts, let the button return as far as possible without causing the engine to stop or slow down. Then release the button entirely as soon as the engine is warm enough to permit doing so.

Priming the Carburetor

In extremely cold weather, if the engine does not start after cranking for a few seconds with the enriching device fully applied, release the starter pedal. Then prime the carburetor by opening and closing the throttle once or twice rather rapidly with the accelerator. Opening and closing the throttle operates

a throttle pump on the carburetor and raises the level of gasoline in the carburetor bowl. The carburetor should never be primed in warm weather and should not be primed unnecessarily in cold weather. Excessive priming is likely to prevent the engine from starting.

Position of Throttle Hand Lever

The correct position of the throttle hand lever for starting in cold weather is the same as for starting under other conditions, that is, about one-fourth the way down from the idling position. In warm weather, however, the lever may be returned to the idling position almost as soon as the engine is started. In cold weather, the throttle must be left slightly open until the engine becomes warm.

Position of Ignition Control Lever

Unless the weather is extremely cold, the correct position of the ignition control lever for starting is the same as that recommended on page 10, that is, about one-third the way down. In extremely cold weather, however, the lever should be moved all the way up for starting, unless the engine should be cranked by hand, in which case the lever should be moved all the way down.

It is the practice of some drivers to move the ignition control lever all the way down whenever starting the engine. This is the correct position if the engine is to be cranked by hand, but if the engine is to be cranked with the starter, there is no reason for retarding the spark, and in extremely cold weather "popping back" in the carburetor is less likely to occur if the spark is fully advanced.

Use of Starter

In extremely cold weather, when the car has been standing long enough to become thoroughly chilled, it is a good plan to disengage the clutch during the cranking operation. If this is not done, the starter is called upon to turn the jackshaft gears in the transmission in addition to cranking the engine. At ordinary temperatures, the additional energy required is negligible, but in extremely cold weather, the lubricant in the transmission offers sufficient resistance to rotation of the transmission gears to increase considerably the demand upon the battery and to retard the cranking speed.

Use of Accelerator Before Engine Is Warm

In cold weather, after the engine has been started and before it has run long enough to become warm, the engine cannot deliver its normal power and it should not be called upon to do so. In accelerating the engine to start the car and in accelerating the car after the transmission is in gear, do not open the throttle suddenly or too far. To do so is not only to invite "popping

back" in the carburetor, but to increase the amount of excess unvaporized gasoline in the combustion chambers, both of which results are undesirable. For this reason also, starting in intermediate should never be attempted in cold weather.

Additional Cold Weather Suggestions

Engine Oil for Cold Weather

All engine lubricating oil is more viscous at lower temperatures than at higher temperatures. An engine oil of the proper viscosity for summer weather will not flow freely at freezing temperatures, and will not lubricate the cylinders and bearings properly until the engine is warm. If the oil congeals it also offers considerable resistance to cranking of the engine, causing a severe drain on the battery, and retarding the cranking speed.

In cold weather, therefore, it is essential that an oil be used that has a sufficiently low cold test. The light grade of the Cadillac Motor Oil is recommended generally for winter use. If in doubt as to a suitable oil for cold weather, consult an authorized Cadillac maintenance station.

Strainers in Gasoline System

During cold weather, it is especially important to remove and clean the strainers in the gasoline line (see page 58). An accumulation of water at these points that would have no bad effect in warm weather might freeze in cold weather and prevent the gasoline from flowing to the carburetor.

Anti-Freezing Solutions

In freezing weather, the water in the cooling system must be replaced with some solution that has a lower freezing temperature than that of water. A solution of glycerin and water is recommended. There is practically no loss of glycerin by evaporation and a solution of suitable strength placed in the cooling system at the beginning of freezing weather will ordinarily last the entire season.

Some of the patented substitutes for glycerin may be safely used. Such preparations should not be used unless tested and approved. Cadillac distributors and dealers should be consulted as to the suitability of an anti-freeze other than commercial glycerine, or inquiry may be made to the factory Technical Department. Solutions containing calcium chloride or other ingredients injurious to the metal parts of the cooling system must never be used.

A solution of denatured alcohol may be used if its strength is periodically inspected by testing it with a hydrometer, and if care is taken not to let the solution get on the finish of the hood or radiator. Alcohol vaporizes more readily than water and the loss by evaporation must be replaced at frequent intervals or the weakened solution will afford little protection against freezing.

Glycerin and Water

The following table gives the freezing temperatures of solutions of commercial glycerin and water:

Specific Gravity	Glycerin (Parts by volume)		Water (Parts by volume)	Freezing Temperature (Degrees Fahr.)
1.057	1	20 %	4	21°
1.070	1	25 %	3	~~20°~~ 17°
1.092	1	33 1/3 %	2	~~12°~~ 8.5°
1.132	1	50 %	1	~~0°~~ −15°
	~~3~~		2	−4°

Alcohol and Water

The following table gives the freezing temperatures of solutions of denatured alcohol and water:

Denatured Alcohol (Parts by volume)	Water (Parts by volume)	Freezing Temperature (Degrees Fahr.)
1	4	10°
1	3	0°
1	2	−10°
1	1	−25°

Capacity of Cooling System

The capacity of the cooling system is five and one-half gallons.

Effect of Alcohol on Finish

Strong solutions of alcohol have a harmful effect on the finish. In adding pure alcohol or solutions containing 50 per cent or more alcohol, extreme care must be used not to let the liquid spatter or spill. A funnel and a pouring vessel with a suitable spout are necessary. Especially avoid pouring cold alcohol into very hot water. The effect of this is to make the mixture foam up and possibly bubble over on the finish.

PART II

LUBRICATION AND CARE

Cadillac 4000-Mile Lubrication Schedule

Note: Do not wait for schedule lubrications before adding engine oil. The oil level should be checked every 100 to 150 miles and oil added if the indicator ball is below "Full." This is especially important on cars driven at high speeds.

Lubrication group	Explanation: The figures and letters following the items in this column refer to the chassis lubrication diagram, Fig. 11	Refer to page	1 (500)	2 (1000)	3 (1500)	4 (2000)	5 (2500)	6 (3000)	7 (3500)	8 (4000)
Lubrication Number 8 / Lubrication Number 4 / Lubrication Nos. 2 and 6 / 1, 3, 5, and 7	Add engine oil as necessary*; 21	41	O	O	O	O	O	O	O	O
1, 3, 5, and 7	Grease gun connections: G	45	O	O	O	O	O	O	O	O
1, 3, 5, and 7	Spring leaves: 1, 7, 10, 20	48	O	O	O	O	O	O	O	O
1, 3, 5, and 7	Add water to storage battery	63	O	O	O	O	O	O	O	O
Lubrication Nos. 2 and 6	Universal joints: 13, 14	46		O		O		O		O
Lubrication Nos. 2 and 6	Generator and distributor oil cups: 17, 18, 19	45		O		O		O		O
Lubrication Nos. 2 and 6	Engine rear supports: 5, 16	45		O		O		O		O
Lubrication Nos. 2 and 6	Steering column oil holes: 3	47		O		O		O		O
Lubrication Nos. 2 and 6	Brake pins and connections	77		O		O		O		O
Lubrication Nos. 2 and 6	Door hardware	48		O		O		O		O
Lubrication Number 4	Drain and replace engine oil*: 21	43				O				O
Lubrication Number 4	Transmission‡—add lubricant: 15	46				O				O
Lubrication Number 4	Rear axle‡—add lubricant: 11	46				O				O
Lubrication Number 4	Clutch thrust bearing: 4	45				O				O
Lubrication Number 4	Steering gear—add lubricant: 6	47				O				O
Lubrication Number 8	Transmission‡—drain and replace lubricant: 15	46								O
Lubrication Number 8	Rear axle‡—drain and replace lubricant: 11	46								O
Lubrication Number 8	Wheel bearings—clean and repack: 2, 8, 12, 22	46								O
Lubrication Number 8	Front brake trunnions: 9, 23	47								O
Lubrication Number 8	Speedometer drive shaft	47								O
Record	Speedometer Reading									
Record	Date									

*Change to light grade of engine oil at beginning of cold weather and to heavy grade of engine oil at beginning of warm weather, regardless of mileage.
‡Change to light grade of lubricant at beginning of cold weather and to heavy grade of lubricant at beginning of warm weather, regardless of mileage.

CHAPTER I

Systematic Lubrication

Necessity for Lubrication

Lubrication has made machinery possible. Without it the destructive effects of friction would render the most ingeniously designed mechanism useless. Especially is this so of the gasoline engine, in which heat of combustion is added to that of friction. Absence of lubrication for even a brief instant while the engine is running would heat the surfaces in contact to the melting point.

But it is not enough to know that friction, unrestrained by lubrication, is capable of ruining an engine in less time than it takes to tell it. No motorist expects to run out of oil. What is frequently not fully appreciated is that, if improper lubricants are used and are infrequently applied, friction is still a powerful destructive agent capable of shortening the useful life of the car from years to months.

The quiet, dependable operation of a new car is primarily the result of the accurate finishing of surfaces separated from each other by a few thousandths of an inch. In the Cadillac, there are hundreds of such surfaces. If the clearances between these surfaces are to be maintained, so that the car will continue to operate quietly and dependably, friction must be prevented from taking its toll in wear.

Cadillac engineers have provided for the lubrication of all surfaces where friction is a factor. The most that a manufacturer can do, however, is to provide a place for the lubricant and means for it to reach the surfaces to be lubricated. The car cannot be equipped with an inexhaustible supply of lubricant. Upon the car owner devolves the responsibility of replenishing the supply at the proper time with lubricant of the prescribed specifications.

Because of the importance to the car owner of proper lubrication of his car, every effort has been made in this Manual to give explicit information for his guidance. Lubricants are prescribed for each point requiring lubrication, directions are given for applying the lubricant, and recommendations are made as to the frequency with which the lubricant should be applied. All this information is based upon actual operation of Cadillac cars over hundreds of thousands of miles.

Lubrication Schedule

Lubrication is effective only insofar as it is regular and systematic. To be systematic, lubrication must be performed at regular mileage intervals. The

Cadillac technical staff has accordingly developed for the Cadillac car a complete lubrication schedule which, if faithfully followed, will insure for each bearing surface ample, but not superfluous, lubrication. This schedule is shown on page 36.

The unit of the Cadillac lubrication schedule is 4,000 miles, which is divided into eight 500-mile intervals. Corresponding to these is a series of eight consecutive groups of lubricating operations. When the car has traveled 500 miles, the points enumerated under Lubrication No. 1 should receive attention. At 1,000 miles, Lubrication No. 2 is due, and so on until at 4,000 miles Lubrication No. 8 should be performed. At 4,500 miles the schedule begins again with Lubrication No. 1.

In order that the driver may be continually reminded of the mileage at which the next lubrication is due, provision is made on the speedometer for a lubrication notice. This consists of a strip of black celluloid (Fig. 9) which is placed across the speedometer cover glass below the total mileage dial and which has two white spaces, one for the lubrication number and one for the mileage at which it is due. Whenever the car is lubricated on the schedule, the figures then on the celluloid should be erased and the next lubrication number and the mileage at which it is due should be written or stamped in their places. If this notice is used, the driver need only glance occasionally at the speedometer and compare the mileage on the dial with the figures on the notice in order to plan for the necessary attention.

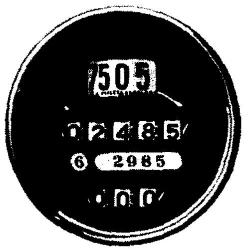

FIGURE 9.
Lubrication notice

Note: Do not wait for the mileage indicated on the notice before adding engine oil. The oil level should be checked every 100 to 150 miles and oil added, if the indicator ball is below "Full."

Cadillac distributors and dealers are prepared to sell lubrication based on this schedule. A car that is being lubricated on the schedule can be taken to any authorized Cadillac maintenance station, and without further ordering than to specify "Schedule Lubrication," the car will receive the necessary attention.

The schedule on page 36 is in outline form. Detailed information as to the location of the points to which lubricant is to be applied, the method of lubricating, and the kind and amount of lubricant will be found in Chapters VI and VII. For each point on the schedule, two reference numbers are given: the number of the page on which detailed directions will be found and the number designating the point on the chassis lubrication diagram (Fig. 11).

Lubricants

The selection of proper lubricants for the Cadillac car is one of the first concerns of the owner in his attention to the lubrication of his car.

The lubricants must not only be of high quality, but their viscosity and other characteristics must be suited to the Cadillac car. The difficulty of securing suitable lubricants on the open market has induced us to provide lubricants under the Cadillac trade mark. These lubricants are prepared according to specifications prescribed by the Cadillac technical staff and are based upon hundreds of actual tests. Cadillac lubricants include the following and can be obtained from Cadillac distributors or dealers: Cadillac Engine Oil—Light, Medium and Heavy. Cadillac Rear Axle and Transmission Lubricant—Light and Heavy. Cadillac Roller Bearing and Cup Grease. Cadillac Universal Joint Grease. Cadillac Steering Gear Lubricant.

Engine Oil

Except in extremely hot or extremely cold weather, the medium grade of Cadillac Engine Oil is recommended. In extremely hot weather, the heavy grade should be used and in freezing weather, the light grade.

The names of other engine oils approved for use in the Cadillac engine will be supplied by our Technical Department on request.

Rear Axle and Transmission Lubricant

The heavy grade of Cadillac Rear Axle and Transmission Lubricant should be used except in cold weather. The light grade should then be used. If the heavy grade is used in cold weather the transmission gears will be difficult to shift. The names of other lubricants suitable for use in the Cadillac rear axle and transmission will be supplied upon request.

Roller Bearing and Cup Grease

Cadillac Roller Bearing and Cup Grease is recommended for the wheel bearings and for all points for which grease gun connections are provided, with the exception of the steering gear and the universal joints. In the absence of Cadillac Roller Bearing and Cup Grease, No. 3 cup grease may be used for the grease gun connections and No. 1½ cup grease for the wheel bearings.

Universal Joint Grease

Cadillac Universal Joint Grease is recommended for the universal joints on the drive shaft. In its absence a No. 3 fibre grease may be used.

Steering Gear Lubricant

Cadillac Steering Gear Lubricant is recommended for lubricating the steering gear worm and sector. In its absence, use a mixture consisting of 75 per cent rear axle and transmission lubricant and 25 per cent cup grease.

CHAPTER II

Engine Lubrication

Oil Circulating System

The supply of engine oil is carried in the pressed steel reservoir that covers the bottom of the crankcase. The oil is forced to the bearings by a gear pump attached to the right-hand side of the engine toward the front and driven by a spiral gear on the crankshaft.

The pump draws the oil from the bottom of the oil pan and delivers it under pressure to a supply pipe running the length of the engine parallel with the crankshaft. From this supply pipe, three leads branch off to feed the three main bearings. A fourth lead connects the supply pipe to the oil pressure regulator which is attached to the crankcase just back of the right-hand cylinder block. A fifth lead at the front end of the supply pipe directs a stream of oil upon the spiral gears. A separate passage drilled through the crankcase conducts oil direct from the pump to the camshaft front bearing from which the oil enters the hollow camshaft and is carried to the other camshaft bearings and to the distributor driving gear.

At the oil pressure regulator there are four paths for the oil to follow:

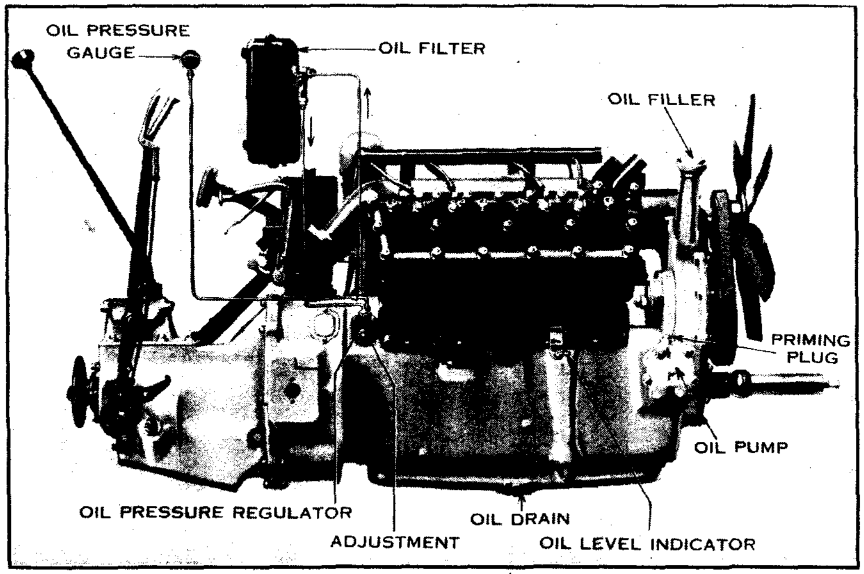

FIGURE 10. ***Engine lubrication features***

two through passages within the regulator and two through outside connections. The first passage is a small by-pass which leads back to the crankcase and which has an adjustable metering screw. Oil flows through this by-pass whenever the engine is running. The second passage leads to a valve which is under spring tension and which does not open until the pressure in the supply pipe reaches approximately 30 lbs. Oil passing this valve also flows back to the crankcase.

The T-connection on the outside of the oil pressure regulator leads to the pressure gauge on the instrument panel and to the oil filter on the dash. Oil flows through the filter whenever the engine is running, the filtered oil being returned to the oil pressure regulator and thence to the crankcase.

The crankpin bearings are fed from the main bearings through ducts in the crankshaft. Oil thrown from the crankpins as the crankshaft revolves becomes a fine mist or spray which pervades the interior of the crankcase and cylinders and lubricates the pistons, piston pins, cams, camslides, and rollers.

The valve stems are automatically lubricated by oil sprayed from two small holes drilled in the wall of each cylinder at such a distance from the bottom of the cylinder that, when the piston is at the bottom of its stroke, these holes register with a groove in the piston between the second and third piston rings. As the piston descends on the power stroke, oil collects in this groove and as soon as the groove registers with the holes, the pressure of the gases above the piston forces oil out upon the valve stems. Surplus oil collecting in the valve compartments is returned to the crankcase through drain passages.

All oil returns to the oil pan through a fine mesh screen placed above the oil pan and separating it from the crankcase.

Oil Level

The normal capacity of the oil pan is two gallons which fills it to the level of the screen above the pan. When the oil pan contains this amount, the oil level indicator on the right-hand side of the engine (Fig. 10) indicates "Full." As the oil level descends, the indicator indicates "Fill" and then "Empty." Oil should be added as soon as the indicator ball has dropped to "Fill." If the indicator indicates "Empty," under no circumstances should the engine be run until oil has been added.

The mileage interval at which oil must be added depends upon individual circumstances. *It is recommended that the oil level indicator be checked every one hundred to one hundred and fifty miles, although it is improbable that oil will be required as frequently as this.*

Oil Pressure

The pressure of the oil in the supply pipe is indicated by the oil pressure gauge on the instrument panel (Fig. 1). The purpose of the oil pressure gauge

is, first, to enable the driver to make sure that there is pressure whenever the engine is running, and second, to verify the adjustment of the oil pressure regulator.

It is absolutely necessary that there should be oil pressure just as soon as the engine starts and as long as the engine is running. If the oil pressure gauge does not indicate pressure as soon as the engine starts, stop the engine at once and investigate the cause. First, check the level of oil in the oil pan. If the level is above "Fill," prime the oil pump by removing the plug shown in Fig. 10 and pouring oil in through a funnel. Be sure to replace the plug before starting the engine. If, after priming the oil pump and starting the engine, the oil pressure gauge does not indicate pressure, stop the engine immediately and consult the nearest Cadillac maintenance station.

Before the adjustment of the oil pressure regulator can be verified, the factors affecting the viscosity of the oil must be standardized. The oil pressure changes with the viscosity, which in turn depends upon the kind of oil, the extent to which it has been thinned by use, and the temperature. It is therefore necessary that the oil be fresh and of the viscosity specified for the Cadillac engine. The engine must also be run long enough to become thoroughly warm. Under these conditions the pressure at idling speed (300 r.p.m.) should be from 1 to 4 lbs.

Adjustment of the pressure at idling speeds is made by the screw shown in Fig. 10. To increase the pressure, turn the screw clockwise; to decrease the pressure turn the screw counter-clockwise. This adjustment should be made while the engine is running.

Crankcase Ventilating System

In every internal combustion engine, seepage of vapors by the pistons takes place to some extent, permitting water vapor and other products resulting from combustion, as well as unburned gasoline, to enter the crankcase. Contamination of the lubricating oil from this source makes it necessary in most engines to replace the oil supply at frequent intervals.

Cadillac engines are equipped with an exclusive system to prevent the seepage vapors from entering the crankcase. To bring about this result, advantage is taken of the fact that the Cadillac crankshaft with its compensating weights acts naturally to draw air through an inlet in the left-hand side of the engine, building up within the crankcase a pressure slightly above atmospheric pressure. No outlet is provided in the crankcase itself but in the wall of each cylinder is a port connecting the space below the piston with the valve compartment. This port is open except when the piston is at the extreme bottom of its stroke.

The effect of this arrangement is as follows: The seepage vapors that pass the two upper piston rings are forced through slots milled in the circumference of the lower piston ring and through corresponding holes in the piston into the space inside the piston, where they are carried down as the piston descends. The vapors cannot enter the crankcase, however, because they are prevented from doing so by the pressure built up in the crankcase by the revolving crankshaft. Instead, the vapors are expelled through the port into the valve compartment. From the valve compartments the expelled vapors are conducted through flexible pipes underneath the car where they are discharged.

Oil Filter

Another source of contamination of the oil supply is dirt. In the Cadillac engine all solid matter in the oil is removed by means of a filter (Fig. 10) which is attached to the dash and which is connected to the oil circulating system.

The filter consists of a metal container in which is a series of eight envelopes made of special fabric. As the oil is forced through these fabric envelopes, the total area of which is over five square feet, it leaves all solid matter behind, returning to the engine as clean oil.

The filter is connected to the oil pressure regulator at the same point as the oil pressure gauge. Oil is thus forced to the filter whenever the engine is running and there is pressure in the oil lines. The normal flow when the filter is new is approximately one quart per minute so that an amount of oil equal to the entire capacity of the lubricating system passes through the filter every eight to ten minutes.

As dirt accumulates in the filter, the flow of oil through the filter decreases, and eventually the filter unit must be replaced.

Under average driving conditions this should not be necessary for 12,000 to 15,000 miles. Filter units for replacement can be obtained from Cadillac distributors and dealers.

Replacing Engine Oil

Although the crankcase ventilating system and the oil filter described in the preceding sections greatly prolong the useful life of the oil, it is recommended that the oil be drained and replaced with fresh oil every 2,000 miles.

To drain the oil, simply remove the drain plug (Fig. 10). A special socket wrench for the oil pan drain plug is supplied as part of the tool equipment. Be sure to reinstall the drain plug before adding the fresh oil. Two gallons of fresh oil should be added, or enough to bring the oil level indicator ball to "Full."

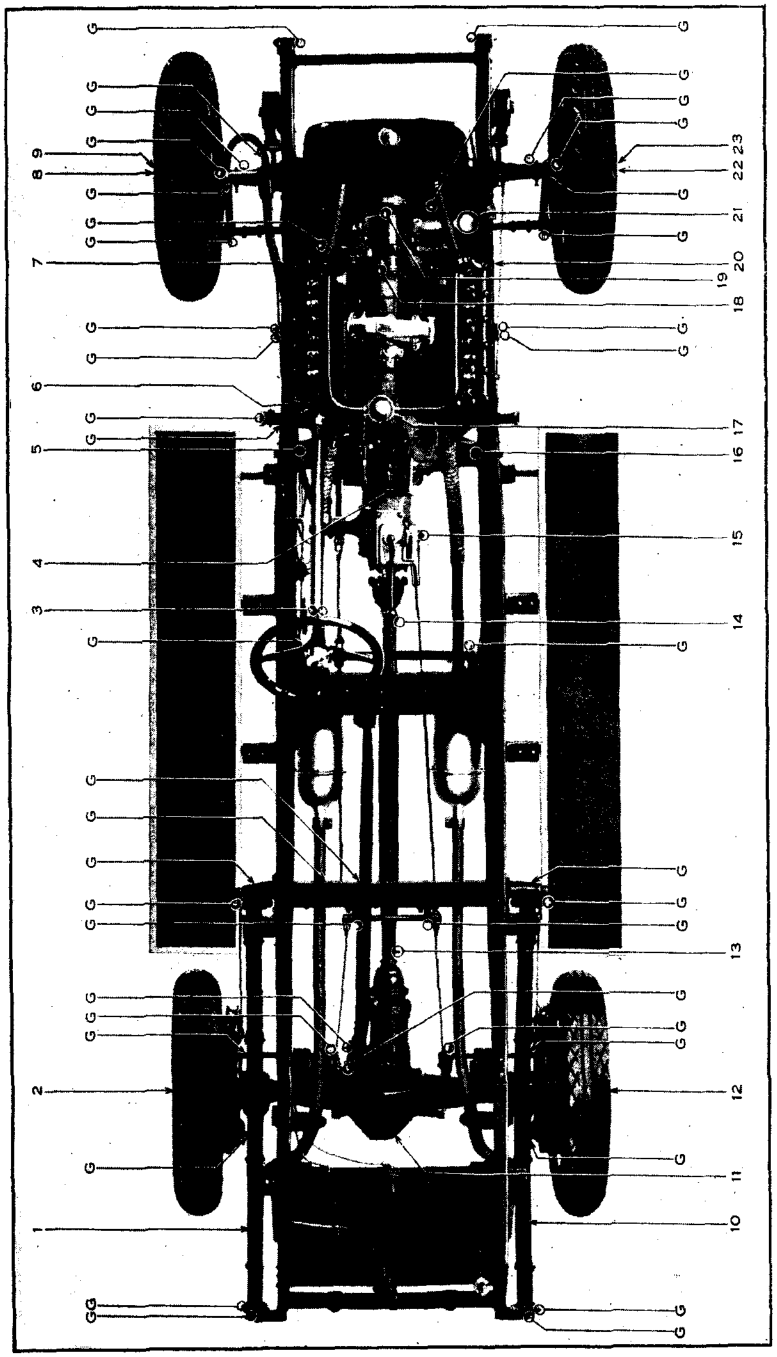

FIGURE 11. *Chassis lubrication diagram*

Each "G" indicates a grease gun connection. Each number indicates a lubricating point for which instructions are given in Chapters II and III. Lubricating points that are visible in the diagram are surrounded by circles, others are indicated by arrows.

At the end of the first 1,000 miles, it is recommended that the car be taken to a Cadillac maintenance station to have the oil pan and screen removed and cleaned with gasoline or kerosene. This should be repeated once a year or whenever the filter unit is replaced.

Generator Oil Cups: 18, 19*

Two oil cups on the generator conduct lubricant to the forward and rear bearings on the armature shaft. A few drops of engine oil should be applied to each cup every 1,000 miles.

Timer-Distributor Oil Cup: 17

The oil cup at "17" is for lubricating the ball bearing at the upper end of the timer-distributor shaft. A few drops of engine oil should be applied every 1,000 miles.

Engine Rear Supports: 5, 16

The brackets on the frame to which the engine rear supports are bolted are provided with felt wicks. Engine oil should be applied at these points every 1,000 miles.

CHAPTER III

General Lubrication

Grease Gun Connections: G

Spring bolts, steering connections, brake rocker shafts and other points are provided with connections to fit the grease gun supplied with the tool equipment. These points are indicated by "G" in Fig. 11. Cadillac Roller Bearing and Cup Grease should be applied to these points with the grease gun every 500 miles.

Clutch Thrust Bearing: 4

The clutch thrust bearing is provided with a grease gun connection, which is accessible after removing the floor boards and the cover plate shown at

***The numbers following the headings in this chapter and in Chapter III refer to Fig.11.**

"4." Before the grease gun can be applied to the connection, it is necessary to attach to the connection the adapter furnished with the tool equipment.

If the connection does not point upward so that the adapter can be applied, turn the bearing until it does. This must be done with the engine not running.

The clutch thrust bearing should be lubricated every 2,000 miles with Cadillac Roller Bearing and Cup Grease.

Caution: Do not inject too much grease into the clutch thrust bearing. One or two turns of the grease gun handle are sufficient.

Transmission: 15

The transmission case should contain sufficient lubricant to bring the level up to the filling hole at the right-hand side. The level should be inspected every 2,000 miles and lubricant added if necessary. Cadillac Rear Axle and Transmission Lubricant is recommended. The heavy grade should be used except in cold weather. The light grade should then be used. If the heavy grade is used in cold weather, the transmission gears will be difficult to shift.

Every 4,000 miles the drain plug should be removed from the bottom of the transmission case and the lubricant should be drained and replaced with fresh lubricant. Three quarts of lubricant are required to fill the transmission case to the proper level.

Universal Joints: 13, 14

The forward and rear universal joints on the drive shaft are provided with grease gun connections as indicated at "13" and "14." It may be necessary to roll the car forward or backward a few inches to bring the connections underneath where they can be reached with the grease gun. Cadillac Universal Joint Grease should be applied every 1,000 miles.

Rear Axle: 11

The rear axle housing should contain enough lubricant to bring the level up to the filling hole in the rear cover plate. The level should be inspected every 2,000 miles and lubricant added if necessary. Cadillac Rear Axle and Transmission Lubricant is recommended. The heavy grade should be used except in cold weather. The light grade should then be used.

Every 4,000 miles the drain plug should be removed from the bottom of the axle housing and the lubricant should be drained and replaced with fresh lubricant. Three and one-half quarts of lubricant are necessary to fill the rear axle housing to the proper level.

Wheels: 2, 8, 12, 22

The front and rear wheel bearings are packed in grease when the car is assembled. Every 4,000 miles all the wheels should be removed and the bear-

ings should be thoroughly cleaned in gasoline or kerosene. They should then be repacked and the bearings adjusted in accordance with the directions on pages 80, 81 and 82.

Cadillac Roller Bearing and Cup Grease is recommended for the wheel bearings. Do not use heavy grease as it will roll away from the path of the rollers and will not return.

Front Brake Trunnions: 9, 23

Every 4,000 miles, at the same time that the wheels are removed for lubrication of the wheel bearings, the brake operating trunnions inside the front wheel brake drums should be lubricated by applying the grease gun to the connection at "A" (Fig. 12). Cadillac Roller Bearing and Cup Grease should be used. It should be injected only until it begins to appear around the trunnion bearings. Do not inject too much grease. Before replacing the wheels, wipe off any grease appearing around the trunnion bearings. Do not inject any grease at "A" except when the wheel is off and the application of too much grease can be definitely avoided.

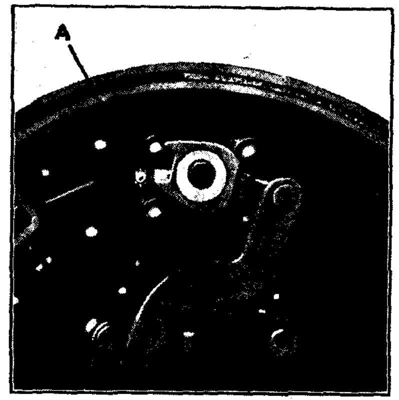

FIGURE 12
Lubrication of front brake trunnions

Steering Gear: 6

A grease gun connection is provided on the steering gear housing for injecting lubricant for the steering gear worm and sector. Cadillac Steering Gear Lubricant is recommended for the steering gear and it should be applied every 2,000 miles.

Oil Holes in Steering Column: 3

There are two oil holes in the steering column just below the steering wheel. A few drops of engine oil should be applied to these every 1,000 miles. The holes are closed by screw plugs which must be removed before the oil can be applied.

Speedometer Flexible Drive Shaft

The flexible shaft by which the speedometer is driven is housed in a flexible casing. To lubricate the speedometer drive shaft, the shaft should be removed from its casing and lubricant applied to it for its entire length. Cadillac Roller Bearing and Cup Grease is recommended for this lubrication, which should be performed every 4,000 miles.

Do not under any circumstances attempt to lubricate the speedometer itself. Any parts in the speedometer requiring lubrication are amply supplied when it is assembled.

Horn

The horn is lubricated when assembled and does not require further lubrication, but it is a good plan to inspect the commutator of the horn motor occasionally and clean it, if necessary. To do this, remove the horn from its bracket and the motor shell from the horn. If the commutator appears to be dirty, clean it with a dry cloth. This should be done with the horn motor running so that the commutator will be cleaned on all sides. Do not attempt to polish the commutator or brushes with oil or vaseline. These parts are designed to run without lubricant.

Springs: 1, 7, 10, 20

To lubricate the spring leaves, it is recommended that the edges and ends of the leaves be painted with engine oil every 500 miles. A small stiff brush should be used. After applying the oil, the car should not be washed until it has been driven far enough to allow the lubricant to work in between the leaves. Do not separate the leaves and insert lubricant. A certain amount of friction between the spring leaves is necessary in order to give the springs the desired characteristics.

If spring covers are used, it is not necessary to lubricate the spring leaves as directed in the preceding paragraph.

Stabilators

The stabilators, with which the car is equipped and which are for the purpose of controlling the recoil of the springs, not only need no lubrication—they *must not* be lubricated. To lubricate the stabilators would defeat their purpose just as oil or grease on the brakes would prevent them from holding.

Door Hardware

Whenever the chassis is being lubricated, the door locks and other door hardware should also be lubricated as follows:

Place a few drops of oil on each door lock plunger or striker, turning the handle back and forth so that the oil will work into the lock. Also place a drop of oil on each of the striker plates against which the strikers engage when the doors are closed. The hinge pins should also be oiled sparingly so as not to get oil on the finish.

Each door has a wedge-shaped tongue that dovetails into a receptacle on the body when the door is closed. These tongues should receive a small amount of grease or oil.

Each closed car door is also fitted with a check at the top which limits the outward movement of the door. A small amount of grease should be applied to the pin that slides in the slot at the top of the door.

CHAPTER IV

Care of Body

Care of Finish When New

On cars finished with varnish, more careful and more frequent attention is necessary when the car is new than after the varnish has hardened. Particular care should be taken to keep mud from the body and hood for the first few weeks. Even after the varnish has hardened, mud should not be permitted to remain on the finish over night or long enough to dry. If it is not possible to wash the car thoroughly before putting it away for the night, flush it off and then thoroughly wash the car the next morning. Mud permitted to remain on the car until it has dried is not only difficult to remove, but stains and dulls the finish.

The same degree of caution, although commendable, is not as necessary on cars finished with Duco, because Duco hardens much more quickly than paint or varnish.

Washing Varnished Cars

Use clean water and plenty of it. Do not use water containing alkali. In parts of the country where the regular water supply contains alkali, use rain water.

Do not use hot water as it destroys the lustre. The temperature of the water should be between 40 and 60 degrees Fahrenheit. Do not wash the hood while it is hot, because the effect on the finish is the same as washing it with hot water. Unless the hood is allowed to cool before washing, the lustre will soon disappear.

If a hose is used in washing, do not have pressure greater than will carry the water six inches beyond the end of the hose. Water under higher pressure drives the grit and dirt into the varnish. It is best not to use a nozzle.

Wash the chassis first, going over the under sides of the fenders, the wheels, and the running gear with water flowing gently from the hose. This will flush off most of the mud and dirt.

If it is necessary to use soap to remove road oil from the under side of the fenders, or machine oil or grease from the chassis, use a good automobile soap dissolved in a pail of water and apply the soapy solution with a sponge.

Do not let this soapy solution remain on the finish more than two or three minutes, but immediately wash it off thoroughly with a soft carriage sponge.

After washing the chassis, begin at the front of the car, and flow water from the hose upon the body, hood, and upper surfaces of the fenders. This will soften the accumulation of road dirt, removing most of it. Then go over the car again and remove all dirt by rubbing lightly with a soft wool sponge, at the same time applying an abundance of water from the hose. The sponge, which should be kept exclusively for the body, hood, and upper surfaces of the fenders, should be rinsed frequently in clean water to remove any grit.

After the washing is completed, squeeze the sponge as dry as possible and pick up all water from crevices. Then thoroughly wet a clean soft chamois, wring it as dry as possible, and dry the finish. Be sure and use a chamois that has not been used on the chassis. Rinse the chamois and wring it out frequently. Do not rub the finish or apply more pressure than is necessary to dry off the surplus water. The remaining water will evaporate quickly, leaving the finish in good condition.

If it is desired to chamois the wheels and chassis, and they have become dry, wet these parts with clean water and then wipe them. Be sure to use a separate chamois for the chassis. The chamois that has been used on the body should be saved for the body exclusively.

Do not use soap, gasoline, kerosene, or anything of similar nature on the finish. Such materials attack the finish.

Washing Duco

Although it is not necessary in washing cars finished in Duco to use the same degree of care as in washing varnished cars, nevertheless the same general directions should be followed.

Cleaning Windows

Do not clean the window glass with preparations that may contain harmful ingredients. Use only cleaning compounds that are known to have no destructive effects on highly polished glass.

Cleaning Upholstery

To keep the upholstery in closed cars in the best condition, it should be cleaned thoroughly at least once a month with a whisk broom and vacuum cleaner. Dirt and grit accumulating in the fabric wear it out faster than use.

Spots on the upholstery may be cleaned with any good dry cleaner. When the cleaner has thoroughly evaporated, apply a hot flatiron wrapped in a wet cloth. Steaming the fabric and rubbing lightly against the nap will raise the nap to its normal position.

CHAPTER V

Care of Tires

Each tire maker publishes a booklet with instructions for care and repair of tires. Every motorist should provide himself with one of these and thoroughly familiarize himself with the contents. The suggestions here apply to pneumatic tires in general.

Three-fourths of so-called "tire trouble" is the result of misuse. We give here some suggestions regarding the more important points of the care of tires.

Result of Under-Inflation

Under-inflation causes a tire to flatten out under load. This causes the side walls to bend sharply as the tire revolves. The result is the breaking of the side walls. An under-inflated tire is susceptible to bruise, broken cords and blow-out.

Result of Improperly Aligned Front Wheels

Running a car with the front wheels out of alignment causes rapid tread wear. This usually affects both tires similarly, although sometimes only one tire is affected. An incorrect adjustment of the front axle parallel rod or a bent steering arm is responsible for the condition. Unless the wheels are in proper alignment the treads of the front tires will wear away in a remarkably short time.

Neglect of Small Cuts

If cuts extending to the cords are neglected deterioration and blistering of the tire tread is the result. It is unnecessary to remove a tire to treat small cuts of this nature. Tire companies furnish a plastic compound for filling cuts. This prevents moisture and dirt from getting in. If a cut is large, it should be vulcanized at once.

Result of Improperly Adjusted Tire Chains

Tires are sometimes badly damaged through the use of tire chains which are incorrectly adjusted or which are fastened to the spokes of the wheel holding the chains tightly in place.

The least injury results when chains are applied loosely leaving play enough to permit them to work around. The wear on the tire is thus distributed evenly. Probably the greatest amount of injury comes from using chains unnecessarily on paved streets.

Result of Sudden Application of the Brakes

The sudden application of the brakes resulting in sliding the wheels causes the treads to wear away in spots. A tire will give away very rapidly under this severe treatment.

Additional Suggestions

The tires are constructed for the purpose of carrying up to certain maximum loads and no more. It should be realized that overloading a car beyond the intended carrying capacity is sure to materially shorten the life of the tires. Do not turn corners or run over sharp obstructions, like car tracks, at a high rate of speed. Such practice is sure to strain or possibly break the cords, with the result that the further life of the tires will be limited. Remember that most tire troubles are the result of abuse.

Avoid scraping the tires against the curb and running in ruts. This kind of wear scrapes off the rubber side wall and exposes the layers of cords to dirt and moisture, which soon starts to rot the cords.

In turning in a narrow street, avoid striking the curb.

If a tire goes flat without any indication of injury to the tire, see that the valve is not leaking. A little moisture on the tip will show bubbles if the air is escaping.

In case of puncture, the car should be stopped at once and the tube repaired or replaced, or the tire replaced by the extra one. The tire should also be examined carefully and the cause of the puncture ascertained and the nail, glass or whatever it may be, should be extracted. Before replacing the tire on the rim, examine the inside of the casing to see that the cause of the puncture is not still protruding. It is also advisable to look over the outside of the tires frequently and take out any pieces of glass or other particles which may have become imbedded in the casing.

Don't run in ruts or car tracks; the sides of a tire will soon wear out under such treatment. Avoid large stones or other obstructions in the road. To hit one of these may break the carcass even though no external injury be visible.

The garage floor should be kept free from oil or gasoline. The tires on a car left standing on a grease-covered floor deteriorate quickly, the natural enemies of rubber being oil and gasoline. These destroy the nature of the rubber, rendering it soft, so that it cuts and wears away quickly.

If the car is not used during the winter, it is better to remove the tires from the rims, keeping casings and tubes in a fairly warm atmosphere away from the light. It will be better to slightly inflate the tubes, as that keeps them very nearly in the position in which they will be used later on. If the tires are not removed and the car is stored in a light place, it will be well to cover the tires to protect them from the strong light, which has a deteriorating effect on rubber.

CHAPTER VI

Storing Car

If the car is not to be used for a period of several months, it should be protected from deterioration during the period when it is not in use by carefully preparing it for storage.

Engine

To prepare the engine for storage, proceed as follows: Run the engine until opening of the radiator shutters indicates that the engine is warm. This may be done by driving on the road or by running the engine idle. In the latter case, care should be taken that there is sufficient ventilation to avoid injury from carbon monoxide poisoning. (See page 18.)

After the engine is warm, place the car where it is to be stored and stop the flow of gasoline to the carburetor by removing the gasoline tank filler cap, thus relieving the air pressure. As soon as the engine starts to slow down, raise the polished aluminum cap on top of the carburetor and inject three or four tablespoonfuls of clean fresh engine oil into the carburetor. Injection of the oil will stop the engine.

Open the compression relief cocks by turning them counter-clockwise. Inject two or three tablespoonfuls of engine oil into each compression relief cock, and before closing the cocks crank the engine three or four revolutions with the ignition switched off. This will tend to distribute the oil over the cylinder walls. The engine should not be started again after injecting the oil. If it is started, it will be necessary to repeat the treatment.

Drain the cooling system by opening the drain valve in the water pump.

Storage Battery

If the car is to be stored during the winter, the storage battery should have special treatment in order to protect it against freezing.

Shortly before the car is used for the last time, distilled water should be added to bring the level of the solution up to the bottom of the fillers. (See page 63.) After the water added has had an opportunity to mix thoroughly with the acid solution, the specific gravity should be taken with a hydrometer. If the specific gravity of the solution is above 1.270 there will be no danger of the acid solution freezing. If, however, the specific gravity is below 1.270, the battery should be removed and charged. *Unless the battery is fully charged or nearly so it is probable that the acid solution in the battery will freeze and cause extensive damage.*

It is important that one of the battery leads should in all cases be disconnected during storage as a slight leak in the wiring will discharge the battery

and lower the specific gravity to the point where the solution may freeze.

If possible, the storage battery should be removed and charged from an outside source every two months during the storage period.

Tires

During storage of the car, it is best to remove the tires *from the rims* and to keep the casings and tubes in a fairly warm atmosphere away from the light. The tubes should be inflated slightly after the tires have been removed.

If it is not convenient to remove the tires from the car and the car is stored in a light place, cover the tires to protect them from strong light, which has a deteriorating effect on rubber.

The weight of the car should not be allowed to rest on the tires during the storage period. If tires are not removed, the car should be blocked up so that no weight is borne by the tires. The tires should also be partly deflated.

Body and Top

A cover should be placed over the entire car to protect it from dust. In storing an open car, the top should be up.

Taking Car Out of Storage

In putting into use again a car that has been stored, it is advisable, unless the storage battery has been removed and charged at periodic intervals, to remove the battery from the car and give it a fifty-hour charge at a four-ampere rate. If the battery has received periodic charges, or if the specific gravity is above 1.200, simply add distilled water to the proper level and connect the leads. If there is a greenish deposit on the terminals of the battery, remove this with a solution of bicarbonate of soda (common cooking soda) and water. Do not allow any of this solution to get into the battery.

Before starting the engine, drain the oil from the oil pan and remove and clean the oil pan and screen. After reinstalling the oil pan, add eight quarts of fresh engine oil. Fill the cooling system, being sure to use anti-freezing solution in freezing weather. Open the compression release cocks and inject two or three tablespoonfuls of engine oil into each cylinder. Close the compression release cocks, and, with the ignition switched off, crank the engine a few seconds with the starter to distribute the oil over the cylinder walls.

Start the engine in the usual manner. As soon as the engine starts, immediately let the carburetor enriching button go as far forward as possible without causing the engine to stop or slow down materially and then open the throttle until the ammeter reads approximately 10 with all lights switched off. While the engine is running lift the aluminum cap on top of the carburetor and inject from two to three tablespoonfuls of engine oil into the carburetor. It is a good plan to run the car outdoors as soon as this has been done. Release the carburetor enriching button entirely as soon as the engine is warm enough to permit it.

PART III

GENERAL INFORMATION

CHAPTER I

Engine

Important Features of Construction

The Cadillac engine is of the water-cooled, four-cycle type with two L-head cylinder blocks of four cylinders each, placed at an angle of ninety degrees between the blocks. The cylinders of one block are directly opposite those of the other block, the lower end of each connecting rod on the left-hand side working in the forked end of the connecting rod opposite. This construction makes the engine shorter and more compact than any other type, the smooth running being largely the result of the short, rigid crankshaft.

The crankshaft has four throws or cranks, three main bearings, and carries on its front end the sprocket by which the camshaft is driven. The camshaft has six bearings, and is driven by the crankshaft through a silent chain in which the proper tension is maintained by an automatically adjusted idler gear. The camshaft has sixteen cams, each operating one valve through a camslide in which is carried a roller.

The fan is mounted on the front end of the generator shaft, which is driven by the camshaft through a special V-shaped belt.

The water pump and oil pump are driven by a cross shaft, which in turn is driven by a spiral gear on the crankshaft. The water pump is at the left-hand end of the cross shaft and the oil pump at the right-hand end.

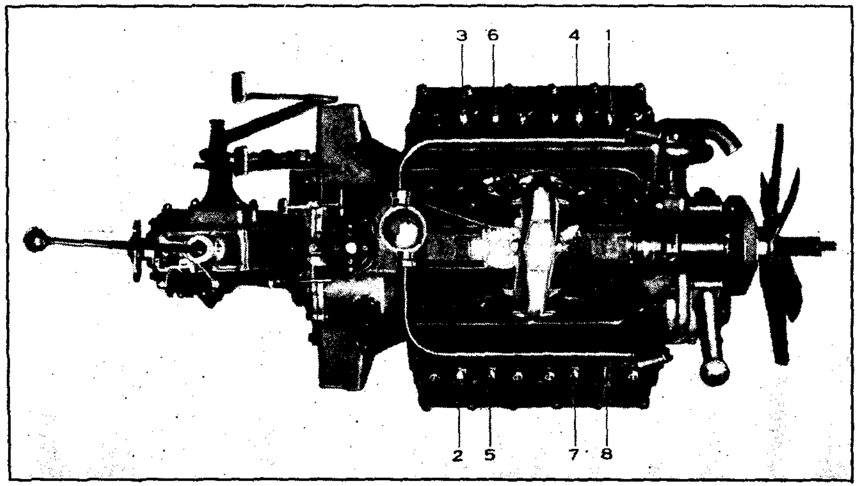

FIGURE 13. ***Firing order***

The engine base is the aluminum crankcase that supports the cylinder blocks and carries the crankshaft and camshaft bearings. The crankcase is supported at the rear end by two arms which are cast integrally with the crankcase and which are bolted to brackets on the frame. The front end of the engine is supported on a cross member of the frame below the radiator.

General Principle of Gasoline Engine

The production of power by the engine may be described briefly as follows:

Gasoline is fed by air pressure from the tank to the carburetor where it is mixed with air in the proper proportions to form an explosive vapor or gas. This gas is then drawn through the intake manifold and inlet valves into the cylinders of the engine where it is compressed by the pistons and then ignited by electric sparks. The pressure of the resulting explosions acting on the pistons produces the power.

The series of operations through which the pistons and valves of each cylinder must go to produce one power stroke is called a "cycle" and for such a cycle four strokes of each piston and two revolutions of the flywheel are required. The four strokes, each of which has a different function, take place in the following order:

Suction Stroke—The suction stroke commences with the piston at its highest point in the cylinder and with the inlet and exhaust valves closed. As soon as the piston starts to descend, the inlet valve immediately opens and a charge of gas is drawn from the carburetor through the valve opening into the space above the piston.

Compression Stroke—When the piston starts upward again after completing the suction stroke, the inlet valve closes. The gas, which has no means of escape, is compressed, the maximum compression being reached when the piston is at the top of its stroke.

Power Stroke—At the completion of the compression stroke, a spark, timed to occur at exactly the right instant, jumps between the electrodes of the spark plug and ignites the compressed charge of gas. The heat that results from the rapid combustion causes the pressure of the confined gas to rise almost instantaneously to several times its pressure before the explosion. This pressure, exerted on the piston, forces the piston down and produces the impulse which is transmitted by the connecting rod to the crankshaft, causing the crankshaft to revolve.

Exhaust Stroke—Just before the piston reaches the end of the power stroke, the exhaust valve opens. It remains open while the piston travels upward on the fourth, or exhaust stroke, driving the burned gas from the cylinders. By

the time the piston has reached its highest point it has forced out the burned gas and the exhaust valve closes. This completes the four strokes of the cycle and the piston is ready to draw in a new charge and to repeat the cycle.

Firing Order

Such a cycle as has been described takes place in each of the eight cylinders but no two pistons are at the same point in the cycle at the same time. In the Cadillac eight-cylinder V-type engine the impulses of the eight pistons are so timed that a power stroke is begun every quarter-turn of the crankshaft. The crankshaft thus receives four overlapping power impulses every revolution.

The order in which the eight cylinders fire is indicated by the numbers in Fig. 13. These numbers are the numbers used in marking the flywheel for valve and ignition adjustments.

CHAPTER II

Gasoline System

THE general arrangement of the gasoline system is illustrated in Fig. 14. There are two sets of tubes, one for air and one for gasoline.

The air tubes connect the automatic compressor at the left-hand front end of the engine, the hand compressor on the instrument board, and the air pressure relief valve, to the top of the gasoline tank. As described on page 9, the automatic and hand compressors are for the purpose of furnishing the necessary pressure to force the gasoline to the carburetor. The air pressure relief valve, which is fastened to the left-hand side of the frame under the front floor boards, prevents excessive pressure that might accompany the use of high-test or casing-head gasoline.

The gasoline line starts at the bottom of the gasoline tank and runs to a combination settling chamber and strainer from which tubes lead to the pressure gauge on the instrument panel and to the carburetor.

Settling Chambers and Strainers

The combination settling chamber and strainer in the gasoline line is attached to the left-hand side of the frame under the front floor boards. There is also a settling chamber at the bottom of the gasoline tank and a strainer at the point where the gasoline pipe enters the carburetor.

It is recommended that both settling chambers be drained and both strainers be cleaned at the beginning of freezing weather and at least

every 4,000 miles during the winter season. An accumulation of water at these points might freeze and prevent gasoline from flowing to the carburetor.

Before removing either settling chamber drain plug, or the strainer at the carburetor, first relieve the air pressure by removing the gasoline tank filler cap. Be sure there is no fire near.

To drain the settling chamber at the gasoline tank, remove the drain plug at the rear of the chamber as shown in Fig. 14. It is necessary to drain out only enough gasoline to flush the chamber.

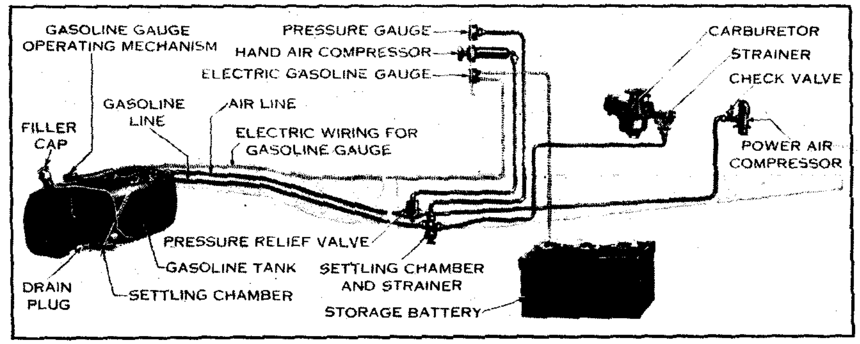

FIGURE 14. ***Gasoline system***

To drain the settling chamber in the gasoline line, remove the drain plug in the bottom of the chamber. While the plug is removed, the strainer, which is attached to the plug, should be carefully cleaned of any accumulated matter.

To clean the strainer at the carburetor, remove the six screws that fasten the cap on the strainer. Remove and clean the three gauze discs. In reinstalling the discs, be sure to place them in their original positions. The two discs with fine mesh gauze should be installed first.

Carburetor

The carburetor is correctly adjusted when the engine is assembled and, unless tampered with, should not require readjustment. It is unnecessary to change the adjustment for changes in season, weather or altitude.

Good carburetor action cannot be expected until the engine is thoroughly warmed. Imperfect carburetor action while the engine is cold does not indicate that the carburetor requires adjustment.

If adjustment of the carburetor seems to be necessary, it should, if possible, be made by an authorized Cadillac maintenance station. The adjustment should not be attempted by one unfamiliar with it.

CHAPTER III

Cooling System

Water Circulation

The Cadillac engine is cooled with water circulated through the jackets of the cylinder blocks by a centrifugal pump. This pump is mounted on the left-hand side of the engine near the front and is driven by a cross-shaft, which in turn is driven by a spiral gear on the crankshaft. The pump draws cold water from the bottom of the radiator and delivers it to a connection on the left-hand side of the engine where the stream divides, half going to the left-hand cylinder block and half through a passage in the crankcase to the right-hand cylinder block. From the front end of each cylinder head an outlet pipe with hose connection carries the heated water to the top of the radiator.

Radiator and Shutters

The radiator consists of an upper tank and a lower tank connected by water passages around the outside of which air is circulated by the fan. The water passages are so constructed that they expose a large amount of surface to the air, which cools the water as it passes from the upper to the lower tank.

Until the water in the cylinder blocks and radiator is warm, the cooling effect of the radiator is not only unnecessary, but is undesirable. The radiator is accordingly provided with shutters that prevent air from circulating around the water passages until the engine becomes warm. The shutters are pivoted vertically and are controlled automatically by a powerful thermostat contained in the upper tank of the radiator.

When the engine is cold, the shutters are held tightly closed and circulation of air is prevented. The water from the cylinders consequently undergoes little change in temperature as it flows through the radiator and the engine quickly becomes warm. As soon as the water entering the upper tank of the radiator reaches the temperature at which the engine operates best, the shutters are forced open by the thermostat and air begins to circulate. The resulting cooling effect checks the rising temperature of the water, which is thereafter maintained uniformly at the temperature of most efficient operation as long as the engine is running.

Filling and Draining the Cooling System

Except during freezing weather, water should be used in the cooling system. In freezing weather, a suitable anti-freezing solution such as those described on page 34 must be used.

To add liquid to the cooling system or to refill the cooling system after it has been drained, remove the radiator filler cap and pour the liquid in through the filler.

To drain the cooling system, open the drain valve at the bottom of the water pump by turning the hexagonal end of the valve counter-clockwise.

Cleaning the Cooling System

The cooling system should be drained and flushed every two or three months. This can be done in the following manner:

Run the engine until the opening of the radiator shutters indicates that the engine is warm. Stop the engine and immediately open the water pump drain valve.

If an alcohol anti-freezing solution is drawn off, part of it may be used again if the sediment is allowed to settle. If it is used, the specific gravity should be tested with a hydrometer after it has cooled thoroughly.

After the liquid has drained off, refill the cooling system with hot water and repeat the operation described above. If in draining the second time the water is very dirty it may be advisable to repeat the flushing operation a third time, placing one or two handfuls of sal-soda in through the radiator filler. The sal-soda must not be permitted to get on the finish of the hood or radiator. If sal-soda is used, the cooling system must be drained and flushed again before refilling for use.

CHAPTER IV

Electrical System

THE electrical system comprises the following units: The generator or source of electrical energy; the storage battery, which stores the current generated; the starting motor, which cranks the engine for starting; the ignition system; the lamps and other devices using electrical current; the ammeter; the ignition and lighting switch; and the circuit breakers, which protect the system. The wiring system connecting these units is the single wire or grounded type, the engine and frame forming one side of the electrical circuit.

Generation of Current

Generator

The generator is attached to the crankcase at the front of the engine and is driven by a specially made V-shaped belt from a pulley on the front end of the camshaft.

At very low engine speeds the voltage of the current generated is not sufficient to provide current for lighting or ignition and the battery is then the source of current. To prevent the battery at such times from discharging through the generator, a cut-out relay on the generator automatically opens the circuit whenever the generated voltage drops below the battery voltage. At approximately eight miles per hour the generated voltage is sufficient to operate the cut-out, which then closes the circuit between the generator and the battery and lighting circuits. If no lights are switched on, the entire output of the generator, less the current required for ignition, flows to the battery for recharging it. If all the lights are on, the generator will not generate sufficient current to start charging the battery until a speed of twelve to fifteen miles per hour is reached.

The amount of current generated by the generator at any instant is the ammeter reading (with all lights off) plus the current for ignition, which is two to three amperes. The generator output reaches its maximum at speeds between twenty and twenty-five miles per hour. This maximum should not exceed eighteen amperes, which is equivalent to an ammeter reading of sixteen when all lights are off.

Do not put oil on the commutator of either the generator or the starting motor.

Ammeter

The ammeter on the instrument board indicates the amount of current flowing to or from the battery except when the starter pedal is down and the starting motor is cranking the engine. When the engine is not running, the ammeter will indicate a current on the discharge side depending in amount upon the number of lights in use. The rate of charge or discharge when the engine is running depends upon the speed of the engine and the number of lights in use, and is equal in amount to the difference between the current generated and the current used by the lights, horn, ignition, and other electrical devices. The ammeter does not indicate the current used in cranking the engine.

If the ammeter should show "Discharge" with the car running twelve miles an hour or more and with no lights in use, it is an indication either that the fan belt is slipping or that the generator charging rate should be readjusted. The fan belt should be inspected first, and tightened if necessary, before any attempt is made to change the generator charging rate.

Storage Battery

The storage battery is a three-cell, six-volt Exide battery made especially for the Cadillac electrical system by the Electric Storage Battery Company, of Philadelphia, Pennsylvania. The battery compartment is just forward

of the left-hand running board. The hinged cover of the compartment is provided with a lock that is operated by the switch key.

Adding Water to Storage Battery

The battery is filled with a solution from which the water slowly evaporates and fresh distilled water must be added at intervals to maintain the correct level. The level should be inspected every 500 miles and distilled water should be added to bring the level up to the bottom of the fillers.

The battery compartment has been purposely made convenient of access to facilitate the adding of water. It is important in touring that nothing be placed on top of the compartment that would interfere with this regular attention.

Each cell is provided with a filler and filler plug. To remove a filler plug, turn it as far as possible counter-clockwise and then lift it straight up. To install it, set the plug in place and turn it clockwise until tight. If a plug is lost or broken, obtain a new one and install it as soon as possible.

Nothing but pure distilled water should be added to the battery solution. In the absence of distilled water, melted artificial ice or rain water caught in

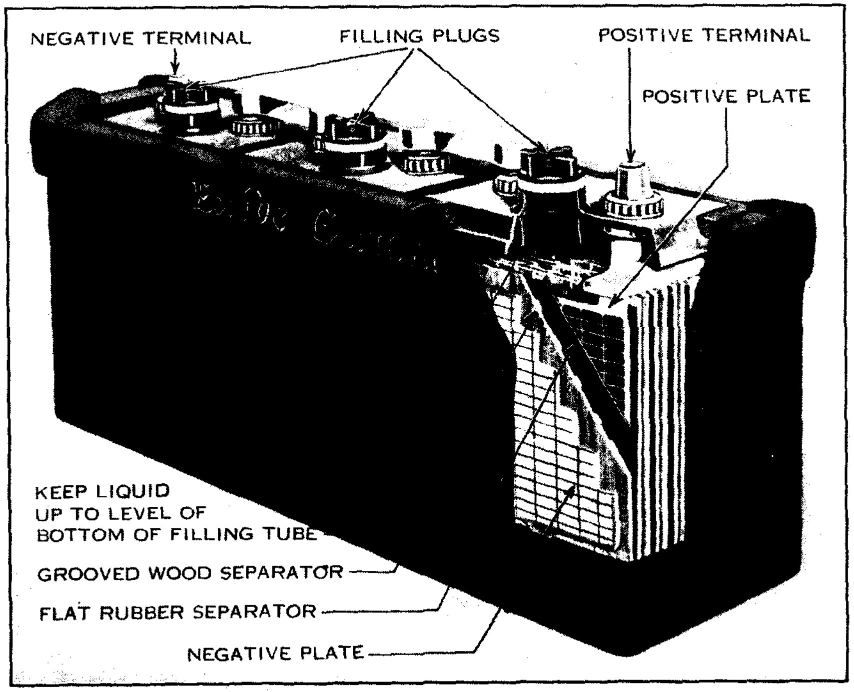

FIGURE 15. ***Storage battery***

an earthenware receptacle may be used. Hydrant water or water that has been in contact with metallic surfaces will cause trouble if used. *Acid must never be added to the battery.*

After adding water to the storage battery in freezing weather, the car should immediately be run far enough to mix the water and acid solution thoroughly. If the car is parked immediately after adding water, the water is likely to stay on top of the acid solution and may freeze, causing extensive damage.

If one cell regularly requires more water than the other, a leaky jar is indicated. A leaky jar should be replaced immediately by a new one as even a very slow leak will in time result in the loss of all the solution in the cell.

Specific Gravity of Battery Solution

As the storage battery is charged and discharged, the solution reacts chemically with the plates of the battery, the specific gravity of the solution changing as the reaction proceeds. The state of charge of the battery is thus indicated by the specific gravity of the solution. As the battery is charged, the specific gravity of the solution increases, reaching 1.270 to 1.290 when the battery is fully charged. The specific gravity of the solution decreases as the battery is discharged. A fully discharged battery has a specific gravity of 1.150 to 1.170.

A hydrometer is the instrument used to measure the specific gravity of a solution. A hydrometer syringe is a hydrometer especially designed for convenience in testing the specific gravity of the acid solution in the storage battery. A hydrometer syringe can be obtained at any battery service station.

The specific gravity of the acid solution should never be tested immediately after adding distilled water. If the solution is below the plates so that it cannot be reached with the syringe, add the necessary amount of distilled water and then drive the car for a few hours before taking the hydrometer reading.

Disconnecting Battery

Do not remove the generator or attempt any adjustment of the circuit breakers or remove any of the wires to the circuit breakers without first disconnecting the storage battery.

Never run the engine with the storage battery disconnected. Serious damage to the generator may result.

Exide Depots and Sales Offices

The Electric Storage Battery Company, whose general offices and works are at Alleghany Avenue and Nineteenth Street, Philadelphia, Pennsylvania, has representative stations in towns of any considerable size as well as sales offices and Exide battery depots in a number of the larger cities. If a storage battery is in need of attention other than recharging, it is advisable to communicate either with a Cadillac maintenance station or with the nearest Exide station or depot. Do not ship a storage battery without receiving instructions.

Starting Motor

Operation of Starter

The starting motor is a series-wound motor mounted vertically at the rear end of the crankcase directly over the flywheel. When cranking the engine, the starting motor drives the flywheel through a pinion which meshes with teeth machined on the rear face of the flywheel. The pinion is normally held out of engagement with the teeth on the flywheel. It is moved down into mesh with the teeth on the flywheel by pushing forward on the starter pedal. Further movement of the pedal operates a switch that closes the battery circuit and starts the armature revolving.

If, in pushing down the starter pedal, the ends of the teeth on the pinion strike against the ends of the teeth on the flywheel preventing further movement of the pinion, continued movement of the pedal compresses a spring. As soon as the pedal has been pushed down far enough to close the starting switch, the armature starts to revolve. The pressure of the spring then forces the pinion the rest of the way, completing the meshing operation.

An over-running clutch on the armature shaft prevents the flywheel from driving the starting motor after the engine is running under its own power and before the starter pedal is released.

Ignition

General Description

The function of the ignition system is, first, to multiply the low voltage (six to eight volts) of the storage battery and generator into voltage of sufficient intensity to cause a spark to jump between the electrodes of the spark plugs; and second, to time this spark so that ignition will take place in the proper cylinder at the proper instant.

The Delco single-spark system is used, consisting of a combination timer-distributor unit in connection with a transformer or induction coil. The primary circuit, through which flows the current from the storage battery or generator, includes the primary winding of the ignition coil; the resistance unit, which is attached to the ignition coil; the timer contact arms and points; and the condenser, which is enclosed in the timer. The secondary or

high-voltage circuit includes the secondary winding on the ignition coil, the distributor and the spark plugs.

Current flows through the primary circuit whenever and as long as either of the two sets of timer contact points is closed. Current flows through the secondary circuit for an instant only when either set of contact points is opened; but the voltage of this current is several thousand times that of the primary circuit and is sufficient to cause a spark at the spark plug.

Timer-Distributor

The timer-distributor is mounted on the top of the crankcase at the rear end and is driven by a spiral gear on the rear end of the camshaft. The shaft of the timer-distributor, which revolves at one-half crankshaft speed, carries a four-lobed cam. As this cam revolves, it actuates the two contact arms alternately, closing and opening first one set of contact points and then the the other. The circuit is thus made and broken eight times during each revolution of the cam and eight corresponding sparks are produced at the spark plugs.

In order to procure the maximum power from each explosion, ignition must occur at the right instant in relation to the position of the piston. But the ignition process, although apparently a matter of an instant, consumes a measurable amount of time. It is therefore necessary to break the circuit at the contact points far enough in advance so that actual ignition will take place in the cylinder at the correct time. The lapse of time is always the same, regardless of the speed of the engine, but because the pistons move faster when the engine is running at higher speeds than when it is running at lower speeds, the degree of advance in relation to the positions of the pistons must be increased as the engine speed increases.

This advancing of the relative timing of the spark for higher engine speeds is automatically accomplished by a centrifugal ring governor on the timer shaft below the cam. As the speed of the engine increases, the governor ring assumes a position more nearly horizontal, forcing the cam ahead of the shaft by which it is driven. This causes the contact points to open earlier, starting the ignition process earlier in relation to the positions of the pistons in the cylinders.

In addition to the automatic advance, the timer has a manual control by which the opening of the contact points may be still further advanced or still further delayed. This is operated by the left-hand lever at the steering wheel, as described on page 10.

The distributor is the mechanism that insures that the high voltage current in the secondary circuit is switched to the proper spark plug at the proper time. It consists of a rotor which is carried on the upper end of the timer shaft and which has a metal contact button electrically connected at

all times with the secondary current from the coil. As the rotor revolves, the button makes contact successively with eight metal contacts which are set in the distributor head, and which are connected to the spark plugs. The relation between the rotor and the timer shaft is such that when the cam causes one set of timer contact points to open, the rotor will be in correct position for conducting the resulting high voltage in the secondary circuit to the proper spark plug.

Spark Plugs

For best results the electrodes of the spark plugs should be .025 inch apart. If the spark plugs should be removed, it is recommended that the electrodes be inspected and adjusted to this clearance if necessary.

Lighting System

Lamp Bulbs

It is recommended that bulbs for the lamps, particularly the two-filament bulbs for the headlamps, be purchased from a Cadillac distributor or dealer. In any event bulbs should have the correct voltage and candle-power ratings. Only three different types of lamp bulbs are used in the entire lighting system. The bulbs and the lamps in which they are used are as follows:

Lamp	Voltage	Candle-power
Headlamp	6–8	21 (two-filament) (Mazda No. 1110)
Back-up light	6–8	21 (single filament)
Stop light	6–8	
Inspection lamp	6–8	
Parking lights	6–8	3
*Instrument lamp	6–8	
*Rear lamp	6–8	
Closed car dome and quarter lamps	6–8	

Cadillac two-filament bulbs are equipped with fog caps or metal screens placed over the upper part of the bulb for the purpose of stopping direct unreflected light from the filament. It is this direct unreflected light from the filament that causes the dazzling reflection from fog or smoke. Headlamps equipped with fog caps have the appearance of being dimmed when seen from the front, but they do not perceptibly affect the useful light from the headlamps.

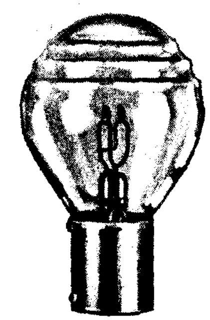

FIGURE 16. *Double-filament headlamp bulb*

In replacing a headlamp bulb, transfer the fog cap from the old bulb to the new, adjusting the cap to the position shown in Fig. 18. Then adjust the lamp as directed on page 69.

*Bulbs rated at 3–4 volts, such as are used in the rear lamps of some cars, must not be used in these lamps. If installed, they will burn out almost immediately.

Cleaning Headlamp Reflectors

The headlamp reflectors are plated with pure silver. Although the reflectors ordinarily require no attention, if they should require polishing extreme care must be exercised to select materials that will not scratch the silver.

Powdered dry rouge and a chamois skin are recommended. If the reflectors are tarnished, the rouge may be moistened with alcohol. Afterward, polish with a dry chamois and rouge.

The chamois used for the headlamp reflectors must not be used for any other purpose. It must be soft and free from dust.

Official Approval of Headlamps

Cadillac headlamps have been approved by practically every state in the country. For purposes of official identification, the following description of the headlamps is given:

A complete headlamp containing a parabolic reflector with axis inclined two and one-half degrees; screw adjustment on shell of headlamp to adjust the bulb filament with relation to the reflector in both axial and vertical planes to compensate for filament variation in bulbs; a cover glass containing cylindrical flutes vertically grouped in three distinct zones, the outer zone having greater refractory power and the flutes being more pronounced than

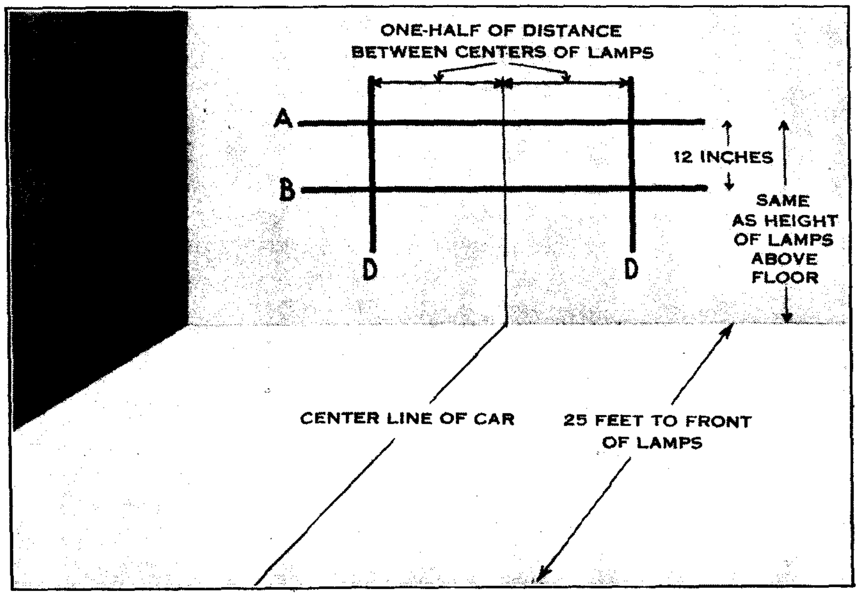

FIGURE 17. ***Marks for adjustment of headlamps***

in the center; and a cap over the upper front portion of the bulb to intercept the direct unreflected light above the horizontal.

Approval by the state authorities is conditioned upon the headlamps being adjusted to a definite standard. The directions which follow are for this standard adjustment.

Adjustment of Headlamps

Select a level spot where the car with an average load can be placed facing toward and twenty-five feet distant from a wall upon which the lines shown in Fig. 17 can be drawn. The adjustment should be made when it is dark enough so that the outlines of the projected beams are plainly visible.

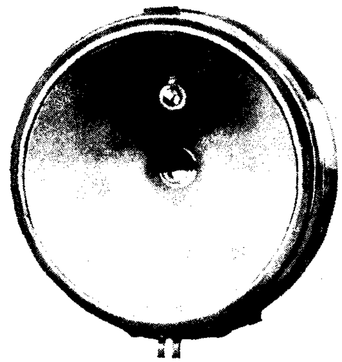

FIGURE 18. ***Headlamp fog cap***

Locate a point on the wall directly opposite the front of the car by sighting through the center of the rear curtain toward the radiator cap. Draw a vertical line on the wall through this point: Measure the distance between the centers of the headlamps, and draw two vertical lines "D" parallel to the center line and distant from it by an amount equal to one-half of the distance between the headlamps. Measure the distance of the headlamp centers above the ground or floor and draw the horizontal line "A" at the same elevation. Draw the line "B" twelve inches below the line "A."

Upper Adjusting Screw—The first adjustment should be made with the lower beam on, that is, with the lighting switch lever in the third position. Cover the headlamp that is not being adjusted, or disconnect the plug connector that supplies current to the lamp. Remove the headlamp door. Make sure that the fog cap is properly placed on the bulb as shown in Fig. 18.

The adjusting screws, of which there are two, are in the back of the headlamp shell. Turn the upper or large adjusting screw until the light spot on the screen is the smallest that can be obtained.

Loosen the nut on the headlamp support and aim the headlamp so that the top center of the spot of light is at the intersection of lines "B" and "D" as shown in Fig. 20a. When the lamp has been properly aimed, tighten the nut securely. *(Continued on page 71)*

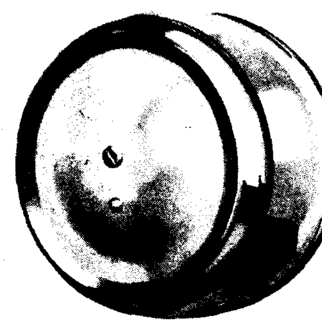

FIGURE 19
Headlamp adjusting screws

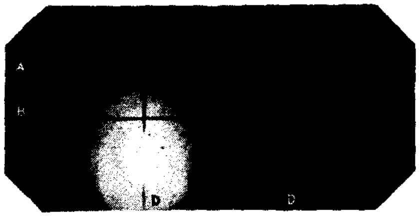

Figure 20a
Left-hand lower beam without lens.

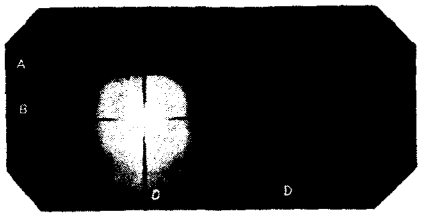

Figure 20b
Left-hand upper beam without lens.

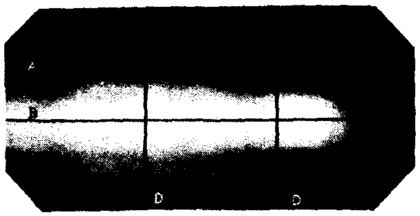

Figure 20c
Left-hand upper beam with lens.

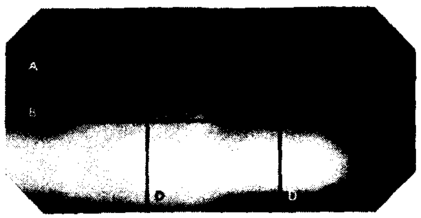

Figure 20d
Left-hand lower beam with lens.

Figure 20e
Both upper beams with lenses.

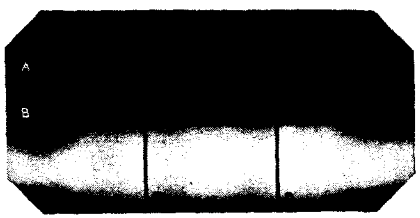

Figure 20f
Both lower beams with lenses.

FIGURE 20. ***Beams from headlamps***

Lower Adjusting Screw—Turn the lighting switch to the fourth position so that the upper beam is on. Adjust the lower or small screw until the top of the beam is at the intersection of lines "A" and "D" as shown in Fig. 20b. The beam should be of approximately the same proportionate size as shown, and the greatest intensity of the beam should be near the top of the spot and at its center. If the lower beam is now switched on, it should appear as in Fig. 20a and should be of the same proportionate size with the greatest intensity near the bottom, rather than at the center of the spot.

Install the door with the lens. If the lens is for any reason removed from the headlamp door, it should be replaced with the cylindrical flutes vertical and the smooth side facing out.

With the lens in place, the upper beam from the left-hand headlamp should appear as in Fig. 20c. The pattern of the lower beam from the left-hand headlamp should appear as in Fig. 20d.

After adjusting the one headlamp, repeat the adjustment on the other. When both headlamps have been adjusted and both headlamp doors are in place, the combined light from both headlamps should appear as in Fig. 20e when the upper beams are on, and as in Fig.20f when the lower beams are on.

CHAPTER V

Clutch and Transmission

Clutch

The Cadillac clutch is a dry multiple-disc clutch with eight smooth driven discs and seven driving discs faced with friction material composed largely of asbestos. The driving discs have gear teeth machined on their outer circumference to engage with teeth machined internally in the flywheel. The driven discs have gear teeth machined on their inner circumference to mesh with teeth machined on the outside of the clutch hub, which in turn drives the transmission. Except when the clutch pedal is pushed down, the clutch discs are pressed together by a spring having a pressure of 300 lbs. The driven discs then revolve with the driving discs and the engine, if running, drives the transmission.

When the clutch pedal is pushed down to disengage the clutch a forked lever presses against the clutch spring through a ball thrust bearing, releasing the discs from the pressure of the spring. The discs then separate and the driven discs rotate independently of the driving discs.

The clutch itself requires no adjustment or attention other than lubrication of the clutch thrust bearing as directed on page 45. Adjustment of the clutch release rod, however, may be necessary after the car has been driven some distance.

Adjustment of Clutch Release Rod

As described on page 15, the clutch pedal is purposely given about one inch of "lost motion." That is, the clutch does not begin to disengage until the pedal has been moved down about an inch from its released position. This lost motion is necessary in order to allow the clutch discs to come closer together as the facings are reduced in thickness. The lost motion gradually decreases as the clutch is used and eventually will be all taken up. Before this happens, the clutch release rod must be readjusted to restore the lost motion; otherwise, the clutch discs will slip and the engine will not drive the car.

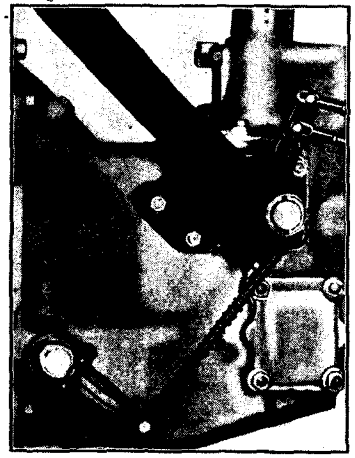

FIGURE 21
Adjustment of clutch release rod

To make the adjustment unscrew the nut "A" (Fig. 21) until the clutch pedal has a movement of one inch without starting to disengage the clutch.

The nut "A" must be turned a half-turn at a time.

Transmission

The purpose of the transmission is to provide a means for varying the ratio and direction of the rear axle speed in relation to the engine speed. Three things are accomplished by doing this: First, the engine is enabled to drive the car backwards. Second, the engine is permitted to revolve fast enough to develop the power necessary for starting and for driving the car at extremely low speeds. Third, the turning effort of the engine is multiplied so that it may be sufficient for climbing steep hills and pulling through deep sand and mud.

The Cadillac transmission is known as the selective, sliding gear type. It has three speeds forward, of which one is direct drive, and one speed in reverse. Selection of the various speeds is accomplished by movement of two shifter gears, "A" and "D," (Fig. 22) which are controlled by the transmission control lever. The positions of the gears corresponding to the five positions of the control lever as illustrated in Fig. 2 are as follows:

Neutral—When the control lever is in neutral position, the shifter gears "A" and "D" are in the positions shown in Fig. 22; that is, they are not in mesh with any of the other gears.

Low—When the control lever is moved from neutral to low, the gear "A" is moved forward into mesh with gear "R." Power is then transmitted from the clutch shaft "Z" to the transmission main shaft "C" through gears "E," "U," "R" and "A." The ratio of engine speed to propeller shaft speed in low is approximately 3 to 1.

Intermediate—When the control lever is moved from low to intermediate the gear "A" is first returned to its neutral position and gear "D" is then moved back into mesh with gear "S." Power is then transmitted through gears "E," "U," "S" and "D." The ratio of engine speed to propeller shaft speed in intermediate is approximately 1.7 to 1.

High—When the control lever is moved from intermediate to high, the gear "D" is first moved forward out of mesh with gear "S" and then farther forward until teeth cut internally in a recess in gear "D" engage teeth on the

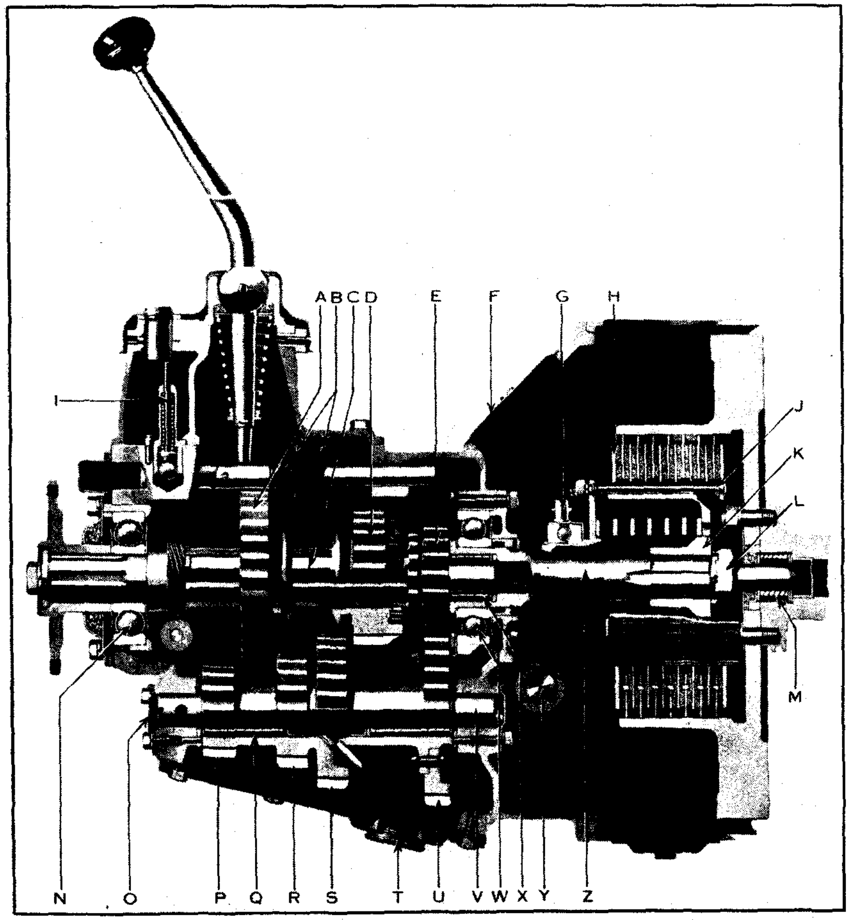

FIGURE 22. ***Sectional view of transmission***

extreme end of gear "E." The drive is then direct from the clutch shaft to the transmission main shaft without reduction.

Reverse—When the control lever is moved from neutral to low, the gear "A" is moved back into mesh with an idler gear, not shown in Fig. 22, which is at all times in mesh with gear "P." Power is then transmitted through gears "E," "U," "P," the reverse idler gear, and gear "A." The interposition of the idler gear reverses the direction of rotation. The ratio of engine speed to propeller shaft speed in reverse is approximately 3.8 to 1.

CHAPTER VI

Brakes

General Description

There are three pairs of brakes: the rear wheel external brakes, the rear wheel internal brakes, and the front wheel brakes, which are also internal. The rear wheel external brakes and the front wheel brakes are operated by the brake pedal and comprise the foot brakes. The rear wheel internal brakes are operated by the hand lever and are used principally for locking the rear wheels when the car is standing.

The purpose of the front wheel brakes is to add to the braking ability as much as is consistent with safety. It is not desirable to attempt to secure the maximum possible braking effect on the front wheels for the reason that, when a front wheel slides without rotating, it has no power to change the direction of the car.

Cadillac front wheel brakes are accordingly designed so that when the foot brakes are applied while the steering wheel is turned to the right or left, only the brake on the inside wheel is effective and the brake on the outer wheel is released, leaving the outer wheel free to rotate. It is thus impossible to lock both front wheels even on slippery pavement unless the car is moving straight ahead. If, while the car is moving straight ahead on slippery pavement, the brakes should be applied with sufficient pressure to lock both front wheels and it then becomes necessary to make a turn, the car will instantly respond because the brake on the outer wheel is automatically released as soon as the steering wheel is turned.

Adjustment

Each foot brake has provision to compensate for wear on the brake lining. The adjustment by which this compensation is effected is at the brake itself

rather than in the connections. Cadillac brakes must *not* be adjusted to compensate for wear by adjusting the pull rods or stop screws.

As described on page 16, the Cadillac two-stage brake pedal automatically notifies the driver when the foot brakes require adjustment. It is recommended that the car be taken to a Cadillac maintenance station for attention when necessity for adjustment is thus indicated.

If, however, the adjustment is neglected and as a result the pedal touches the floor boards before the brakes are fully applied, an emergency adjustment can be made by screwing down the adjusting nuts "F" (Fig. 23) one or more half-turns. The nuts "F" lock every half-turn and must be turned a half-turn at a time. The nuts "F" must not be turned down far enough to cause the brakes to heat and they must be turned down the same amount on both sides.

If adjustment of the nuts "F" is not sufficient, or if the occasion gives opportunity for a complete adjustment, this adjustment should be made as follows:

Loosen the three locking nuts "B," "D" and "N" (Fig. 23) and screw the three stop screws "A", "C" and "M" away from the brake band. Observe the clearance between those parts of the brake lining nearest the hexagonal

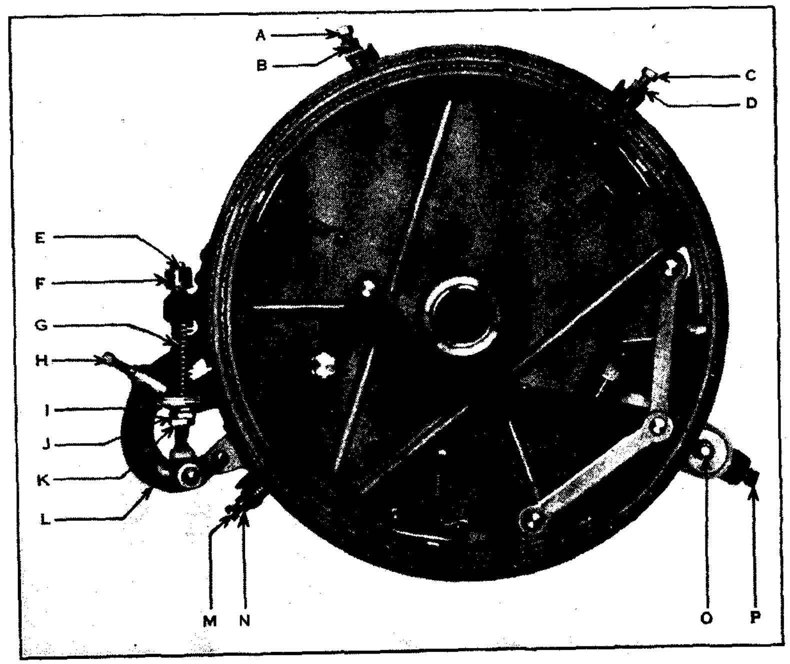

FIGURE 23. ***Rear wheel brakes***

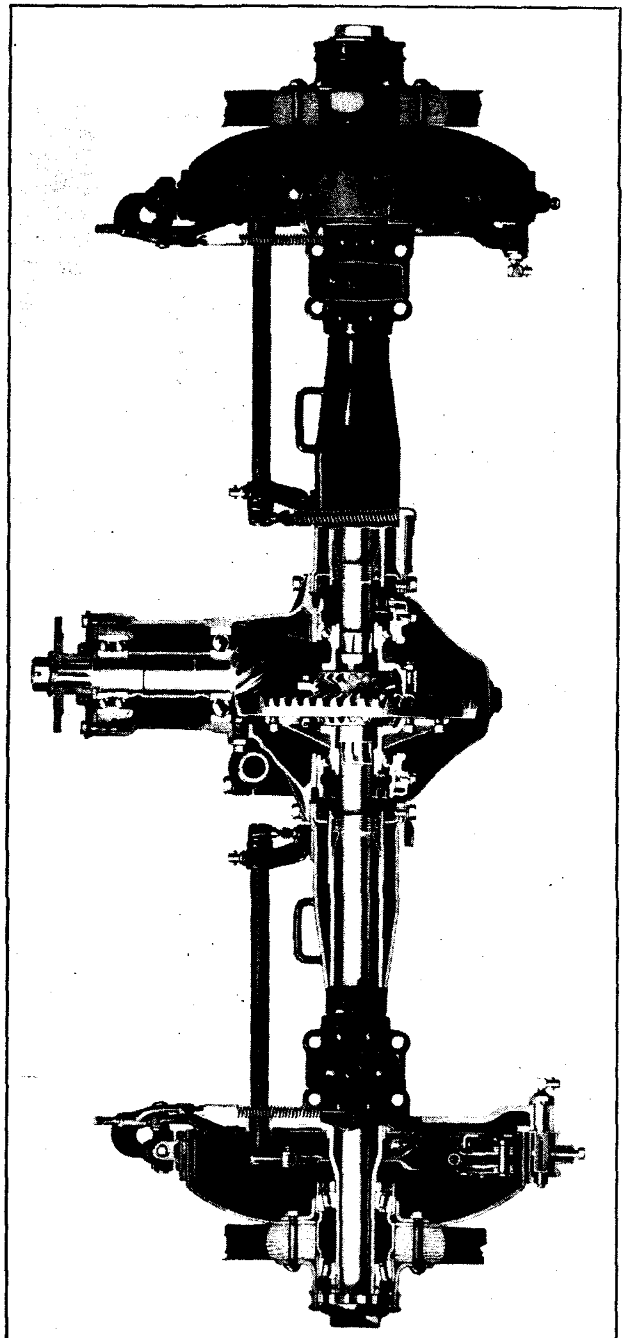

FIGURE 24. *Sectional view of rear axle*

head screw "P" and the brake drum. This clearance should be .030 to .035 inch. If the clearance is not correct, adjust the screw "P" until it is. The screw "P" is kept from turning of its own accord by a lock washer which turns with the screw and locks every half-turn. It must accordingly be turned a half-turn at a time.

Loosen the locking nuts "K" and adjust the nuts "J" and the screws "M" so that there is a uniform clearance of .030 to .035 inch between the *lower* part of the brake lining and the brake drum. To decrease the clearance between the brake lining and the drum, screw the nut "J" farther down on the yoke bolt "E."

Adjust the nuts "F" and the two stop screws "A" and "C" so that there is a uniform clearance of .030 to .035 inch between the *upper* part of the brake lining and the drum.

After making the foregoing adjustments so that there is a uniform clearance of .030 to .035 inch between the drum and the lining, check the results by applying the brakes, and measuring the travel of the upper end of the lever "L." This travel should not be less than ⅞ inch. If the end of the lever "L" travels less than ⅞ inch in moving from the released position to the applied position, readjust one or all of the nuts "F" and "J" and the screws "P," "A," "C" and "M" to increase the clearance slightly, keeping the clearance uniform at all points around the drum. Do not fail to tighten the locking nuts "B," "D," "N" and "K" when the adjustment has been made.

Do not change the adjustment of the screw "H." This screw is properly set when the car is assembled and does not require readjustment in taking up wear on the lining.

Inasmuch as the brakes are designed so that the greater proportion of the braking load is taken by the rear wheel brakes, adjustment of the front wheel brakes is usually not necessary until the rear wheel foot brakes have been adjusted several times. Before the limit of adjustment for the rear wheel foot brakes has been reached, the car should be taken to a Cadillac maintenance station for adjustment of the front wheel brakes.

Adjustment of the hand brakes is unnecessary. The hand brakes retain their effectiveness without adjustment throughout the life of the lining.

All joints in the brake connections should be oiled at regular intervals. The brakes should also be tested occasionally to be sure that they are in serviceable condition. When the brake band linings have worn so that further adjustment is impossible, they can be renewed.

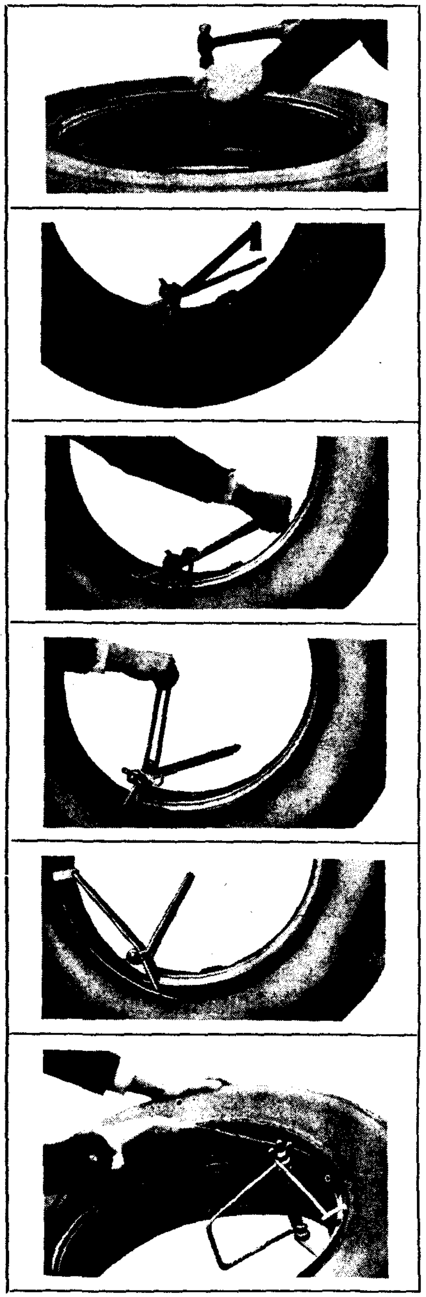

FIGURE 25. ***Removing tire from rim***

Figure 25a

Lay the tire and rim flat on the ground and drive out the locking pin, using the hammer and punch in the tool kit.

Figure 25b

Apply the rim tool, which is furnished in the tool kit, as shown in the illustration. Note that there are two pairs of holes in the rim near the split and that one pair is nearer the split than the other. The short end of the tool must be inserted in the holes nearer the split and the long end in the holes farther from the split. Clamp the tool firmly in position by tightening the wing nut.

Figure 25c

Grasp the two handles and bring them together, spreading the ends of the rim farther apart at the split. Then pull both handles together toward the other side of the rim until one end of the rim is forced up and over the other end.

Figure 25d

Release the short handle of the tool but continue pulling the long handle until it is against the rim.

Figure 25e

Engage the hook that is attached to the long handle over the edge of the rim to hold the rim in the collapsed position.

Figure 25f

Lay the rim and tire on the ground and remove the tire from the rim by working it off first on the side where the rim is split. The handle of the large wrench is flat to serve as a prying tool.

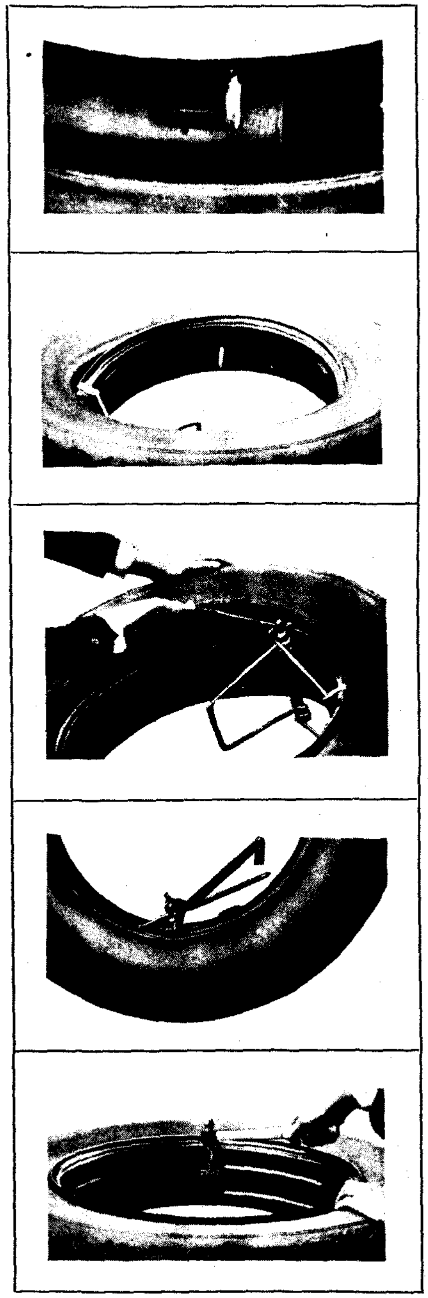

FIGURE 26. ***Installing tire on rim***

Figure 26a

Make sure that the tube flap is in place and that the valve stem passes through the holes in both ends of the flap.

Figure 26b

Insert the valve stem in the hole in the rim and work the tire well into place on each side of the valve stem.

Figure 26c

Pry the tire over the projecting end of the rim where it is split. The rest of the tire can then be pushed down into place.

Figure 26d

Release the hook on the tool and push the handles of the tool back to their original position. Then remove the tool.

Figure 26e

Replace the pin which locks the two ends of the rim together. This is important.

CHAPTER VII

Wheels

Tires and Rims

Illustrated directions for removing a rim with tire from a wheel and installing a rim with tire on a wheel are given in Figs. 7 and 8. Directions for removing a tire from a rim and installing a tire on a rim are given in Figs. 25 and 26.

Do not under any circumstances attempt to remove a tire from a rim without deflating the tire.

Caution in Adjusting Wheel Bearings

The adjustment of wheel bearings or the removal of the wheels should not be attempted by one unfamiliar with work of this nature. It is recommended that the car be taken to a Cadillac maintenance station if possible. In any event great care must be exercised in adjusting wheel bearings not to get them tight. These bearings will revolve even when adjusted very tightly, but that condition is sure to prove disastrous. They should be adjusted so that a very slight amount of play or looseness may be discerned.

If, after a bearing has been adjusted to a point that is apparently correct, the locking device cannot be placed in position without changing the adjustment, it is far better to loosen the adjustment until it can be secured with the locking device than to tighten the bearing adjustment.

Removing Front Wheel

To remove a front wheel, first jack up the axle until the wheel is free from the ground and then proceed as follows:

Remove the hub cap by unscrewing it. Remove the cotter pin "E" (Fig. 27). Remove the lock nut "A." Remove the serrated washer "B." Remove the adjusting nut "C." The wheel may then be removed by pulling it straight off.

Installing Front Wheel and Adjusting Bearings

Before installing the wheel, make sure the bearings are clean and that they are packed in a light grease that is free from dirt and grit.

Set the wheel in place on the spindle and adjust the nut "C" (Fig. 27) very carefully, following the caution above. Install the serrated washer "B," making sure that one of the notches in the washer fits over the stud "D" on

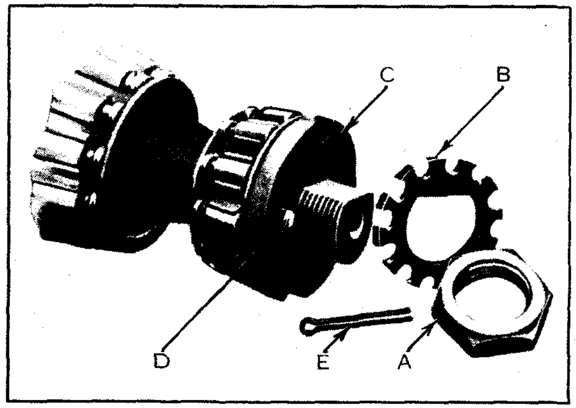

FIGURE 27. ***Front wheel bearings***

the adjusting nut. Replace the lock nut "A" and tighten it firmly, locking it with the cotter pin "E."

It is always better to adjust wheel bearings too loosely than too tightly. If after the adjustment is apparently correct, the notch in the washer "B" is not directly over the stud "D," loosen the adjustment rather than tighten it.

Removing Rear Wheel

To remove a rear wheel, first jack up the axle until the wheel is free from the ground and then proceed as follows:

Remove the hub cap "D" (Fig. 28) by unscrewing it. Remove the spring locking ring "F." Withdraw the axle shaft "E." With a screw driver or blunt

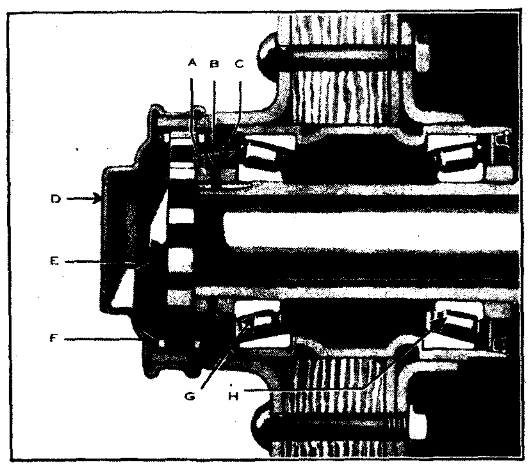

FIGURE 28. ***Sectional view of rear wheel hub, showing bearings***

tool straighten the lug of the outer lock washer "B" where it has been bent over the lock nut "A." Unscrew the lock nut "A." Remove the washers "B" and the adjusting nut "C." The wheel can then be removed by pulling it straight off.

Installing Rear Wheel and Adjusting Bearings

Before installing the wheel, make sure that the bearings are clean and packed in a light grease that is free from dirt and grit.

Set the wheel in place upon the axle and adjust the nut "C" (Fig. 28) very carefully. Install the lock washers "B," using new washers or straightening the ones removed if new ones are not available. In placing the washers in position, reverse the outer one with respect to the inner so that the lugs on one washer are opposite the spaces between the lugs on the other washer; that is, so that the lugs on the two washers are staggered. Install and tighten the lock nut "A." Next, select that lug on the inner washer that falls nearest to the center of one of the flat sides of the adjusting or inner nut, and with a screw driver or other suitable tool bend this lug over the nut. In the same way bend one of the lugs of the outer washer over one of the flat sides of the locking or outer nut. In bending the lugs of the locking washers, take care not to alter the adjustment of the inner nut or loosen the outer nut.

CHAPTER VIII

Repair Parts

Genuine Cadillac Parts

Cadillac owners are cautioned against permitting the use of other than genuine Cadillac parts in the repair of their cars. The quality of the Cadillac car is identical with the quality of its component parts, the production of which is based upon more than twenty years of experience in designing, manufacturing, and inspecting. No other individual or organization has access to the data resulting from this experience nor could they possibly have the same interest in protecting the owners of Cadillac cars.

Uniform Parts Prices

Cadillac parts are sold at uniform prices throughout the United States, and are not subject to the addition of transportation, excise or other supplementary charges. Printed price lists published by the Cadillac Motor Car Company are open to inspection by owners at any authorized Cadillac distributor's or dealer's establishment.

Ordering New Parts

With many thousands of Cadillac automobiles in use, it is obviously impractical to deal directly with each Cadillac owner. We cannot open accounts with any except regular distributors with whom annual contracts are made.

To avoid unnecessary delay and correspondence new parts should, where possible, be ordered from the distributor or dealer from whom the car was purchased or from the nearest Cadillac distributor or dealer, who carries a large stock and is generally in a position to supply a part immediately. If he cannot do so, he can order it. Where, however, conditions are such as in our judgment to warrant it, we will fill orders for parts at current list prices, f. o. b. factory, provided the order is accompanied by cash.

In ordering parts either from a Cadillac distributor or from the factory, send the engine number and the unit number (see page 84) with an accurate description of the part desired, preferably accompanied by a sketch with dimensions. If this cannot be done, send the part itself properly tagged and with transportation charges prepaid. (See below under "Returning Parts.") Otherwise prompt and intelligent filling of the order will be impossible.

Our responsibility ceases in all cases, with delivery to the transportation company.

Returning Parts

In the event parts are returned, transportation charges must be prepaid or the parts cannot be accepted. They should be tagged properly with the name of the owner and the engine number of the car. A letter should be sent, giving complete instructions regarding the disposition of the parts.

Tires, Speedometer and Clock

In cases of repairs to tires, speedometers, or clocks, correspondence should be opened with the manufacturers or their representatives. If necessary the parts should be sent to them. Transportation charges should be prepaid.

CHAPTER IX

Specifications and License Data

Type of engine	8 cyl. V-type
Diameter of cylinder bore	3⅛ in.
Length of stroke	5⅛ in.
Piston displacement	314 cu. in.
Horsepower (N. A. C. C. *rating*)	31.25
Engine number	See below
Diameter of crankshaft main bearings	2⅜ in.
Length of crankshaft between inner ends of front and rear bearings	18⅝ in.
Exhaust valves	1 $\frac{9}{16}$ in.
Inlet valves	1 $\frac{11}{16}$ in.
Capacity of gasoline tank	20 gals.
Capacity of engine lubricating system	2 gals.
Capacity of cooling system	5½ gals.
Capacity of transmission	3 qts.
Capacity of rear axle	3½ qts.
Tires	33x6.75 (low pressure)
Wheelbase	132 in. and 138 in.
Tread	56 in.

Engine and Unit Numbers

Each Cadillac car when shipped carries an engine number which is also a serial number. This is the number to be used in filling out license and insurance applications and in general reference to the car. The engine number is stamped on the car in two places: On the name plate on the front face of the dash and on the crankcase at the base of the oil filler.

The various units such as the transmission, steering gear, etc., also carry unit numbers. These are located as described below. It is important in ordering parts to give, not only the engine number of the car, but also the unit number of the unit to which the part belongs.

Transmission number—on the upper surface of the boss to which the clutch and brake pedal bracket is attached.

Steering gear number—on the steering gear housing just above the grease gun connection.

Carburetor number—on the left-hand rear face of the flange by which the carburetor is attached to the intake header.

Generator number—on the left-hand side of the generator.

Starting motor number—on the left-hand side of the starter almost opposite the distributor.

Front axle number—on the upper surface of the axle I-beam at the right-hand end just above the steering stop screw.

Frame number—on the upper surface of the left-hand side bar opposite the steering gear.

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The Cadillac Motor Car Company reserves the right without notice to make changes in design, construction and specifications

10-25-5000

CADILLAC

Operator's Manual

Price Thirty-Five Cents

CADILLAC MOTOR CAR COMPANY
DETROIT

EDITION NO. 314-130

In ordering a duplicate of this Manual specify the above number or the engine number of the car

Foreword

THE experienced motorist whose new Cadillac succeeds other cars, some of which may also have been Cadillacs, requires less elementary operating instructions than the beginner, learning for the first time to drive. Likewise, the owner who takes advantage of the facilities offered by the maintenance station has less need for detailed information in regard to care of the car than the owner who provides for all necessary attention in his private garage.

In preparing this Manual, it has been taken for granted that the typical Cadillac purchaser is no longer a novice in motor car operation and that the greatest number of Cadillac owners will be best served by omitting that which is extremely elementary in character. It has also been assumed that, although he should at least know what care his car must regularly receive in order to render the best possible performance with the fewest possible interruptions, the typical Cadillac owner prefers to depend upon the maintenance station for occasional adjustments and repairs.

By thus omitting both that which is very elementary and that which is too technical, the first two divisions of the Manual have been made to include only information that is vital to every Cadillac owner regardless of his previous motoring experience. Part I, "Operation," is important because, no matter what car the owner may have driven before, his new car will differ in some feature, even from an earlier Cadillac. Part II, "Lubrication and Care," contains information that every owner should have regardless of the extent to which he expects to delegate the care of the car to others. Especially should he be familiar with lubrication, for correct lubrication is an essential without which it is impossible for the car to render unfaltering performance.

Part III, "General Information," may be considered as a supplement to the Manual. It contains information that may never be required by some owners, but that is included for use should occasion arise. In other words, it is a reference section to which the index on page 85 is a sufficient guide.

All written instructions are subject to limitations. The owner is asked to remember that the Manual is only one means by which the Cadillac organization desires to assist the Cadillac owner to realize the most from his car. Cadillac distributors and dealers everywhere invite the Cadillac owner to consult them on any matters pertaining to the operation and care of his car. If preferred, a request for information may be made direct to the factory, where it will receive the attention of the Technical Department.

Contents

Part I—Operation

Part II—Lubrication and Care

Part III—General Information

PART I

OPERATION

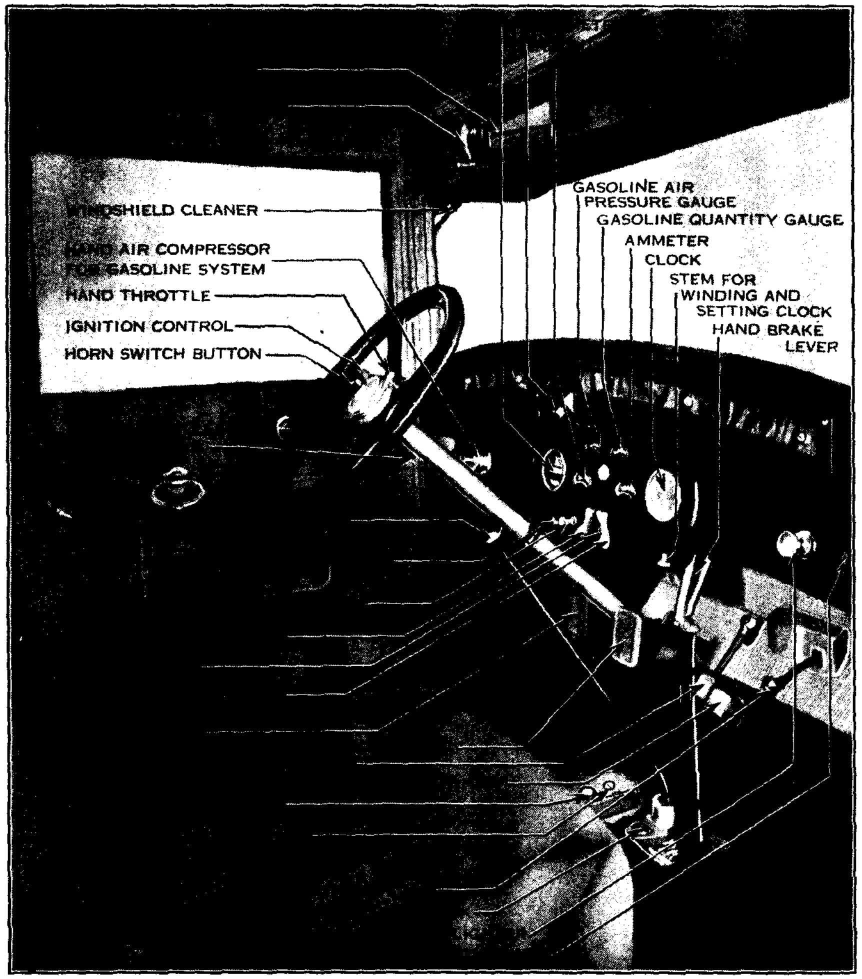

FIGURE 1. ***Instruments and controls***

CHAPTER I

Controls and Instruments

One of the first things the driver of a new car has to do is to familiarize himself with the various controls. In the following chapter are described the levers, pedals, instruments, and other devices used in the operation of the car. The experienced motorist, as well as the beginner, should read this chapter to avoid overlooking any detail of operation in which the car may differ from cars he has previously driven.

Locks

The Cadillac car is provided with the following cylinder locks, all of which on any one car are operated by the same key: ignition switch, transmission control lever, tool compartment, battery compartment, tire holder, and, on closed cars, the doors and various package compartments.

The lock on the switch acts only on the ignition or left-hand lever, which must be *down* in order to be locked. The transmission control lever can be locked in neutral or in any one of the four other positions of the lever.

The lock number is stamped on each key, but not upon the face of the lock. It is urged that the owner make a record of the key number as soon as he takes delivery of his car, so that in the event both keys are lost, a duplicate key can be easily ordered.

Gasoline Gauges and Air Compressor

The two upper dials on the instrument panel (Fig. 1) are gauges for the gasoline system. The gauge at the right marked "Gas" indicates in gallons the quantity of fuel in the tank at the rear of the car, and is operated electrically.

The gauge at the left marked "Air" is a pressure gauge and indicates in pounds per square inch the air pressure in the gasoline system. This pressure is necessary to force the fuel from the tank to the carburetor.

Initial pressure is secured by operating the hand air compressor at the left-hand end of the instrument board. While the engine is running, pressure is automatically maintained by a compressor driven by the engine camshaft.

The normal pressure maintained by the automatic compressor is from one to two pounds. There is sufficient pressure for starting the engine when the car is on level ground, if the gauge pointer is even one division away from the pin at zero. On a steep upgrade an initial pressure of one pound may be necessary.

In order to prevent leakage of the air pressure in the gasoline system it is important that the gasoline tank filler cap be air-tight. After screwing on the filler cap be sure to tighten the thumb screw in the center of the cap.

Before operating the hand compressor, the plunger must be released by turning the handle counter-clockwise. When the necessary pressure has been

obtained, push the compressor handle all the way in and lock it, turning it clockwise as far as it will go.

Throttle Control

The power and speed of the engine are controlled by opening and closing a throttle valve in the carburetor. This throttle is operated both by a hand lever and a foot pedal.

The foot pedal, or accelerator, is at the right of the brake pedal (Fig. 1). The hand control is the right-hand lever of the two levers above the steering wheel. Both controls operate the same throttle; the hand lever, however, remains in the position to which it is moved, whereas the accelerator must be held down to keep the throttle open.

The normal position of the throttle hand lever for driving the car is all the way up (at "Close"). In this position the throttle of the carburetor is open just enough to permit the engine to run at idling speed after it is warm. For starting, however, the lever should be moved approximately one-fourth the way down, and should be left in this position until the engine is warm enough to permit the lever to be returned to the idling position without stalling the engine.

The throttle should normally be controlled by the accelerator. In starting the car on a hill, however, the hand lever should be used rather than the accelerator. This permits the brake pedal to be released with the right foot at the same time that the clutch is engaged with the left.

In cold weather, the accelerator should not be pushed down suddenly before the engine is warm. Sudden opening of the throttle before the engine is warm causes "popping-back" in the carburetor. This should be avoided as much as possible by judicious opening of the throttle during the warming-up period. (See page 32 under "Use of Accelerator Before Engine Is Warm.")

The accelerator can be used in cold weather to prime the carburetor by pushing the accelerator to the floor once or twice. This is not necessary except in very cold weather and should never be done unnecessarily. Excessive priming is likely to prevent the engine from starting. (See page 31 under "Priming the Carburetor.")

Ignition Control Lever

Correct timing of the ignition in relation to the positions of the pistons is accomplished automatically by a governor which is a part of the timer-distributor and which provides for all ordinary advancing and retarding of the spark. (See page 66 under "Timer-Distributor.") A hand control is also provided for still farther advancing or retarding the spark on certain occasions as hereafter described.

The hand control is the left-hand lever of the two levers above the steering wheel. For average driving, the correct position of this lever is about one-

third down from the extreme top or "Advance" position. The lever should be left in this position except on the following occasions:

1. If the engine is being cranked by hand, the lever should be moved all the way down. If this is not done, a "kick-back" may occur resulting in personal injury.
2. In pulling at low speeds with the throttle well open, the lever should be moved farther down.
3. In driving at high speeds, the lever should be moved all the way up.
4. In starting the engine in extremely cold weather, the lever should be moved all the way up unless the engine is being cranked by hand.

Carburetor Enriching Button

The button at the left of the ignition switch lever (Fig. 1) controls a device on the carburetor for temporarily enriching the fuel mixture supplied to the engine. In starting the engine it is necessary to have the proportion of liquid gasoline in the fuel mixture greater than at other times because in a cold mixture only a part of the gasoline is vaporized. Pulling out the enriching button increases the proportion of liquid gasoline to air, the normal proportions being restored when the button is released and permitted to return to its original position.

Correct use of the enriching control not only is essential to quick starting of the engine, but also has an important bearing on the life of the engine. The enriching button must be pulled out far enough in starting to provide an explosive mixture quickly so that the battery is not unnecessarily discharged by useless cranking. The button must also be held out far enough during the warming-up period so that the engine will run without missing and "popping back." On the other hand, it should not be pulled out any farther or held out any longer than is necessary to accomplish these results, because some of the excess liquid gasoline in the enriched mixture does not burn.

If the engine still retains heat from previous running, the enriching control should not be used without first attempting to start the engine on the normal mixture. If the enriching button is pulled out for starting a hot engine the mixture may be made so rich that starting will be impossible.

The enriching button is not a priming device. It has no effect whatever on the fuel or the fuel mixture unless the engine is being cranked or is running under its own power. The button must be pulled out and held partly out during the cranking operation.

Ignition and Lighting Switch

The ignition and lighting switch (Fig. 1) controls the current for the ignition and for the following lamps: headlamps, instrument lamp, and rear

lamp. The ignition lever is the left-hand lever and has two positions: "off," when down, and "on," when up. The lighting lever is the right-hand lever and has four positions besides the "off" position. Starting with the lowest position, these are:

First Position—Instrument lamp and rear lamp.
Second Position—Parking lights, instrument lamp and rear lamp.
Third Position—Headlamp lower beams, instrument lamp and rear lamp.
Fourth Position—Headlamp upper beams, instrument lamp and rear lamp.

Cadillac headlamp bulbs have two filaments, one above the other, instead of the customary single filament. Both filaments are of the same candle-power (21), but because they are located in different positions with respect to the focus of the parabolic reflector, the beam of light from one filament is projected at a different angle from the other. When the switch lever is in the fourth position, one set of filaments is lighted and the beams are projected straight ahead, illuminating the road at a distance. When the lever is in the third position, the other filaments are lighted and the beams are projected down at an angle, illuminating more brightly the road directly in front of the car.

The practice to be followed by the driver in using this double-beam feature of the headlamps will depend upon the regulations imposed by local authorities. In general, it is expected that the upper beams will be used except on the following occasions: when passing a vehicle approaching from the opposite direction, when rounding a sharp curve and when topping the crest of a hill. On these occasions and at other times when illumination is desired directly in front of the car, the lower beams should be used. For a further description of the headlamps, see page 68.

Starter Pedal

The starter pedal is at the right of the accelerator (Fig. 1). Pushing this pedal forward brings into action the electric motor that cranks the engine for starting. *Do not push the starter pedal when the engine is running.*

The starter pedal is only one of the controls that must be manipulated to start the engine. Unless there is an explosive mixture in the cylinders and a spark to ignite it, it is useless to crank the engine. The starter pedal should not be operated, therefore, until the necessary preliminary steps have been taken. The following, in their proper order, are the various steps that must be performed to start the engine. As each control is mentioned, reference is made to the page on which that control is explained in detail.

1. Unlock the transmission. (Page 9.)
2. Make sure that the transmission control lever is in neutral. (Page 15.)
3. Unlock the ignition switch. (Page 11.)

4. Note whether pressure is indicated on the gasoline pressure gauge; if not, operate the hand compressor. (Page 9.)
5. Place the ignition control lever at the steering wheel about one-third* the way down. (Page 10.)
6. Place the throttle lever about one-fourth the way down from the idling position. (Page 10.)
7. *Cold Weather Only*—In extremely cold weather, prime the carburetor by pushing the accelerator to the floor once or twice. Do not prime the carburetor in warm weather or unnecessarily in cold weather. Excessive priming is likely to prevent the engine from starting. (Page 10.)
8. Pull back the carburetor enriching button unless the engine is still warm. If the engine is still warm, do not pull back the enriching button unless the engine fails to start on the normal mixture. (Page 11.)
9. Switch on the ignition. (Page 11.)
10. Push the starter pedal forward and hold it until the engine starts under its own power. Release it immediately as soon as the engine starts. (See below for probable causes for the engine failing to start.)
11. Let the carburetor enriching button partly in as soon as the engine starts, and all the way in as soon as the engine is warm enough to permit it. (Page 11.)
12. Note whether pressure is indicated on the oil pressure gauge and stop the engine at once if no pressure is indicated. (Page 14.)
13. Move the throttle lever up to the idling position as soon as the engine is warm enough to permit it.

In cold weather, disengage the clutch before pressing down the starter pedal, and hold it down during the cranking operation. This relieves the starter of the necessity of turning the transmission gears, which are immersed in lubricant. The additional load is small in warm weather when the lubricant is thin, but in cold weather the power required to turn the gears through the thickened lubricant adds unnecessarily to the demand upon the battery.

If the Engine Fails to Start—If the engine fails to start after being cranked for a few seconds, do not continue to operate the starter. To do so is a useless expenditure of battery energy. Release the starter pedal and investigate the cause, which may be one of the following:

No fuel in the tank.

No air pressure in the gasoline system.

Ignition not switched on.

Carburetor flooded by unnecessary use of the enriching device or by unnecessary priming of the carburetor when the engine is warm.

*In extremely cold weather move the ignition control lever all the way up unless the engine should be cranked by hand. If the engine is cranked by hand, be sure to move the ignition control lever all the way down.

Oil Pressure Gauge

The lower left-hand dial on the instrument panel (Fig. 1) is the oil pressure gauge. This gauge indicates, not the *quantity* of oil in the engine, but the *pressure* under which the oil is forced to the engine bearings.

When the engine is not running, the pointer on the oil pressure gauge should remain at zero, but as soon as the engine is started and as long as it runs the gauge should show pressure. If the gauge does not show pressure when the engine is running, stop the engine at once and determine the cause. Serious damage may be done if the engine is run without oil pressure. (See page 41 under "Oil Pressure.")

The amount of the pressure indicated by the gauge depends upon the speed of the engine, the viscosity of the oil, and the adjustment of the oil pressure regulator. At idling speed with fresh oil of the correct viscosity, the pressure after the engine is warm should be 1 to 4 lbs. Before the engine is warm, higher pressures than those specified will be indicated. After the oil has become thin from use, lower pressures than those specified will be indicated. These are normal variations from the standard and do not indicate need for readjustment of the oil pressure regulator.

Clutch Pedal

The clutch pedal is the left-hand pedal. When this pedal is in its normal or released position, the clutch is engaged. The flywheel of the engine is then coupled to the transmission by a series of discs, every other one of which is faced on both sides with friction material, and which are pressed together by a powerful spring. When the clutch pedal is pushed down, the spring is compressed and the clutch discs are allowed to separate. The clutch is then disengaged and the flywheel, if the engine is running, revolves independently of the transmission.

The clutch has two uses: First, to enable the car to be started gradually and without jerk or jar; second, to permit shifting of the transmission gears. The operation of the clutch pedal is discussed in connection with the transmission control on page 15. Further comment is unnecessary at this point except the following suggestions to the driver:

Do not drive with the foot resting on the clutch pedal. The Cadillac clutch operates so easily that even the weight of the driver's foot may unintentionally cause the clutch to slip.

Do not form the practice of disengaging the clutch whenever the brakes are applied. Most occasions for use of the brakes require only slowing down without stopping or even shifting of gears. A skilled driver will not touch the clutch pedal until the car is just about to stop or until he is about to shift to a lower gear. It is a mistaken idea that applying the brakes with the clutch engaged is more severe on the brake lining. The opposite is actually

the case, proof of which is in the fact that in coasting down grades the resistance of the engine is used to assist the brakes in controlling the car speed.

It will be observed in operating the clutch pedal that the pedal offers almost no resistance until it has been moved about one inch. It is at this point that it actually begins to disengage the clutch. It is important that the pedal have this "lost motion." If the full pressure of the clutch spring is felt just as soon as the pedal is moved from its released position, necessity for readjustment of the pedal connections is indicated. Failure to make this adjustment will result in the clutch slipping. (See page 72.)

Transmission Control

The Cadillac transmission has three forward speeds and reverse. It is controlled by a lever, the handle of which describes the letter "H" as it is moved from one position to another. It should be observed by those who have driven other makes of cars that, although most cars have this conventional H-type of transmission control, all these cars do not have the same positions of the lever. The driver should study Fig. 2 carefully, and if the various positions of the lever are different from those to which he has been accustomed, he should master this arrangement before attempting to drive.

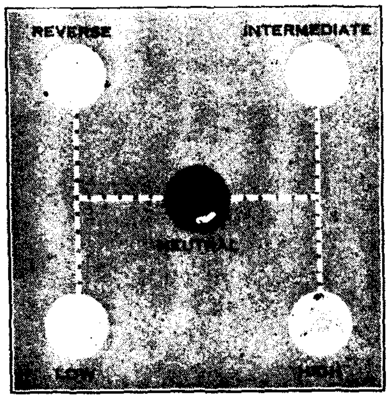

FIGURE 2. ***Positions of transmission control lever***

No attempt can be made here to teach the beginner the technique of gear shifting. It is recommended that the beginner secure individual instruction from the Cadillac distributor or dealer from whom the car was purchased and who will be glad to give this instruction. There are, however, certain rules and suggestions for the operation of the transmission control that it will be to the advantage of every driver to learn or to recall if he already knows them.

Always disengage the clutch before moving the control lever and hold the pedal down until the shift is completed.

Do not attempt to start the car with the transmission control in high gear.

Do not start with the transmission control in intermediate except when the car is on a smooth level road or on a down grade; even under these conditions do not start the car in intermediate unless the engine is thoroughly warm.

Do not make any of the following shifts when the car is moving:

From reverse to any forward gear.
From any forward gear to reverse.
From high gear to low gear.
From intermediate to low gear (except when the car is moving very slowly).

In shifting from high to intermediate, the car should not be traveling faster than fifteen miles per hour and the control lever should be moved very quickly and with no hesitation in neutral.

There are times when it is desirable to be able to shift from high to intermediate at higher car speeds. It is possible to do this by the following method, which is called "double de-clutching":

Disengage the clutch and shift the transmission control lever at once to neutral. Re-engage the clutch at the same time accelerating the engine; then disengage the clutch again and instantly shift to intermediate, after which re-engage the clutch. The speed to which the engine should be accelerated while the transmission control is in neutral depends upon the speed at which the car is traveling when the shift is made.

It is not recommended that the driver attempt the double de-clutching method until he has become expert in shifting from high to intermediate in the usual manner at lower speeds.

Make a practice of shifting the transmission control to intermediate or even to low before commencing the descent of steep grades. The reason for this is explained on page 19, where will also be found further suggestions for coasting.

Brakes

The foot brakes, which consist of external brake bands on the rear wheels and internal bands on the front wheels, are operated by the right-hand pedal. This pedal differs from the conventional brake pedal in a construction that provides automatically for notifying the driver when re-adjustment of the brakes is necessary. Every driver is familiar with the fact that, as the brake lining wears, the brake pedal must be pushed farther toward the floorboard to apply the brakes. On most cars this proceeds until an occasion arises for an emergency stop and then it is found that the pedal goes all the way to the floorboard before the brakes are fully applied.

The Cadillac brake pedal has two stages in its travel. The first stage, which consists of the first four or five inches of the pedal travel, is sufficient for all ordinary stops when the brake band clearance is properly adjusted. When, as the result of wear on the lining, the pedal must be pushed farther toward the floorboard, an inch or inch and a half from the floorboard the second stage of pedal travel is reached. In the second stage, the pedal has somewhat less leverage than in the first stage and the point of division is marked by increased resistance to movement of the pedal. This serves as a notice to the driver that the brakes require readjustment. If it is not convenient to have the adjustment made at once, the brakes can still be operated for some time. The adjustment should be made, however, as soon thereafter as possible.

The hand brakes, which are internal brakes on the rear wheels, are operated by the hand lever at the right of the transmission control lever.

Speedometer

The speedometer has three dials. The upper dial indicates the speed of the car. The center dial indicates the total mileage traveled. The lower dial also indicates mileage, but it can be reset to zero by pushing up and turning the knurled stem back of the instrument board. The right-hand figure on the lower dial indicates tenths of a mile.

Across the speedometer cover glass and below the total mileage dial is a strip of black celluloid on which are two white spaces. These spaces are for the lubrication notice described on page 38 in connection with the lubrication schedule.

An automobile repairman should never be permitted to attempt to adjust or repair the speedometer head or to replace the glass. This work can be done only by men experienced in speedometer work and only with special machinery and tools. If the speedometer head is removed, handle it as carefully as a fine watch. The speedometer head may easily be damaged by rough handling.

Ammeter

The lower right-hand dial on the instrument panel (Fig. 1) is the ammeter, which measures the electric current flowing to the battery and the current flowing from the battery at all times except when the starter is cranking the engine. When current is flowing from the battery, the ammeter shows a reading on the side marked "Discharge"; when current is flowing to the battery, the ammeter reading is on the "Charge" side.

The ammeter should indicate on the "Charge" side most of the time. Otherwise, more current will be taken out of the battery than is put into it and the battery will eventually become fully discharged. The exact amount of current that should be indicated by the ammeter at any time depends upon various conditions, which are explained on page 62.

Ordinarily, when no lights are in use, the ammeter should show "Charge" as soon as the car is running ten or twelve miles per hour in high gear. If the ammeter shows "Discharge" with all lights off, when the car is running more than twelve miles per hour in high gear, it indicates either that the fan belt is slipping or that the generator charging rate should be readjusted. The fan belt should be inspected first, and tightened if necessary, before any attempt is made to change the generator charging rate.

CHAPTER II

Driving

THE preceding chapter of the Manual has aimed to familiarize the driver with the controls and instruments used in operating the car. Actual skill in driving is, of course, more than knowledge of and familiarity with these individual devices. It is not the purpose of this Manual to discuss all phases of driving, but there are a few matters of sufficient importance to Cadillac owners to warrant devoting a chapter to them.

Driving Speed When Car Is New

The parts of the Cadillac car are machined and ground to secure the most accurate fit and the finest finish. Proper functioning of the assembled mechanism is further assured by testing the engine and chassis both on shop dynamometers and on the road. Nevertheless, it is not possible by manufacturing processes and tests to give to bearing surfaces the fine polish that results from continued operation at moderate speeds and loads.

Until a new car has been driven far enough to produce this effect on the bearing surfaces, the car should not be driven at high speeds. It is recommended that the car be driven no faster than twenty miles per hour for the first two hundred and fifty miles, and no faster than twenty-five miles per hour for the second two hundred and fifty miles. Moderate driving during the first five hundred miles will increase the life of the car more than enough to repay any inconvenience. Manufacturers of locomotives and stationary steam engines have always recognized the necessity for an initial "running-in" period.

Danger of Running Engine in Closed Garage

Every person having to do with the operation or care of a motor car should be warned of the danger that attends running the engine while the car is in a small closed garage.

Carbon monoxide, a deadly poisonous gas, is present in the exhaust of all internal combustion engines. Most people are already familiar with carbon monoxide in the form of illuminating gas, or in the gas produced by furnaces and stoves when insufficient air is supplied to give complete combustion. But illuminating gas and coal gas have an unpleasant odor, which serves as a warning, whereas carbon monoxide, as produced in the internal-combustion engine, is colorless, tasteless, and almost odorless, so that the victim may be overcome before he is aware of the danger.

When the engine exhausts into the open air, the carbon monoxide is so

diluted that it has no effect. It is when the engine is run for a time in a closed room that the proportion of carbon monoxide in the air may increase to the point at which continued breathing of it would be fatal. The United States Public Health Service advises that the average automobile engine warming up in a single-car garage will give off enough carbon monoxide in three minutes to endanger life.

Unusual precaution must be taken in cold weather when the natural tendency is to keep the garage doors and windows closed. The practice of letting the engine warm up before running the car out of the garage is unsafe. The risk is made greater by the fact that the enriching of the mixture by manipulation of the carburetor enriching device increases the amount of carbon monoxide formed.

Coasting

To coast *on the level*, simply release the accelerator pedal and disengage the clutch. If coasting to a stop, the transmission control may also be shifted to neutral and the clutch re-engaged.

In coasting *down grades*, however, it is recommended that the transmission be left in gear and the clutch engaged. With the throttle in the idling position, the car is thus made to drive the engine, the resistance of which assists the brakes and saves wear on the brake lining. It must be remembered that the brakes are subjected to much more severe use on grades than on the level because gravity acts continuously, whereas on the level the brakes need absorb only the momentum of the car. Even on slight grades, coasting with the transmission in neutral or the clutch disengaged is not advisable. On any grade steep enough to warrant coasting, it is worth while to save the brakes as much as possible by utilizing the braking effect of the engine.

Ordinarily, the resistance offered by the engine when the transmission is in high is sufficient to control the speed of the car, supplemented by moderate use of the brakes. On steep grades, however, the transmission control should be shifted to intermediate or even to low if the grade is very steep. Shifting should always be done before commencing the descent of the grade, because, after the car has once gained speed, considerable braking may be necessary to slow down to the speed at which the shift can be made easily.

Do not switch off the ignition when coasting with the car driving the engine. Contrary to a common impression, this does not appreciably increase the resistance and is likely to cause damage to the engine. Even with the throttle closed, some fuel is admitted to the cylinders and if this is not burned it condenses on the cylinder walls and washes off the oil by which the pistons are lubricated.

General Driving Suggestions

Road and traffic laws vary greatly in different localities. It is unfortunately impossible to set down a complete list of rules that may be followed in all parts of the country. The following are some of the rules that are universal in practically all parts of the United States:

In meeting a vehicle going in the opposite direction pass to the right.

In overtaking a vehicle going in the same direction pass to the left.

Always stop with the right-hand side of the car next to the curb. If it is necessary to turn the car around to do this, it should be done.

Never turn around or turn off on another road without making absolutely certain that there is no other vehicle directly behind.

Never start to cross street car tracks without making sure that there is no car directly behind. No matter how sure you feel, look and see.

Do not cross street car or steam railroad tracks without making certain that it is absolutely safe to do so. At any railroad crossing that is on an up grade or which for any reason must be approached very slowly, it is a wise precaution to shift to intermediate gear before crossing because the car can thereby be accelerated more quickly, if necessary.

In crowded traffic do not apply the brakes suddenly unless it is absolutely necessary. A vehicle following may not have brakes as efficient as Cadillac four-wheel brakes.

On wet asphalt streets or slippery roads do not apply the brakes suddenly unless it is absolutely necessary. Cadillac four-wheel brakes minimize the possibility of skidding under these conditions, but their effectiveness should not induce anyone to drive less carefully.

Slow down in passing vehicles going in the opposite direction.

Never take a chance.

Don'ts for General Operation

Don't fail to change the engine oil as frequently as recommended.

Don't fail to release the carburetor enriching button as soon after starting as possible.

Don't fill the lubricating system of the engine alone and neglect to lubricate all other parts of the car.

Don't neglect the lubrication of any part of the car.

Don't run the car at sustained high speed when it is new.

Don't allow the clutch to engage suddenly.

Don't prime the carburetor too much.

Don't attempt to shift from neutral to any gear, or from one gear to another gear, without first disengaging the clutch.

Don't attempt to shift from the reverse gear to any other gear when the car is moving.

Don't attempt to shift from any forward gear to the reverse gear when the car is moving.

Don't attempt to shift from the high gear to the low gear when the car is moving.

Don't attempt to shift from the intermediate gear to the low gear when the car is moving, unless it is moving very slowly. Ordinarily it is best to stop the car altogether.

Don't switch off the ignition when coasting with the car driving the engine.

Don't push the starter pedal when the engine is running.

Don't turn the steering gear when the car is standing. This is not only unnecessary but is also bad practice. The front wheels pivot more easily if they are rotating.

Don't fail to investigate any unusual sound which may develop in the car. The car should be inspected at a Cadillac maintenance station.

Don't neglect to inspect the level of the acid solution in the storage battery every 500 miles and add distilled water if necessary.

Don't turn corners at high speed.

Don't neglect to keep the cooling system filled.

Don't drive fast or attempt to stop suddenly on wet pavements.

Don't attempt to start the engine with the switch turned off, without air pressure or without gasoline in the tank.

Don't neglect to keep the tires inflated properly.

Don't race the engine when it is not driving the car. There is no worse abuse.

CHAPTER III

Equipment

THE controls and instruments used in driving have already been described. In addition to these the car is equipped with various devices which are for the convenience and comfort of the occupants, and are used only as occasion demands. It is suggested that the driver anticipate his use of such equipment by becoming familiar at once with the directions contained in this chapter.

Windshield and Ventilation

Closed Cars—Cadillac closed cars are equipped with a one-piece windshield, which can be moved up and down. Movement of the glass is controlled by a handle above the windshield. To raise the glass, the handle should be turned clockwise, and to lower the glass the handle should be turned counter-clockwise.

For moderate ventilation, the windshield should be raised not more than one inch so that the lower edge of the glass is still below the ledge over the instrument board. With the windshield in this position, air is deflected into the driving compartment through an opening in the cowl just forward of the instrument board. For additional ventilation, the windshield can be raised above the level of the ledge over the instrument board, and air then enters directly into the car.

Open Cars—Cadillac open cars are equipped with a cowl ventilator which is operated by a lever just in front of the instrument board and at the right of the steering column. Additional ventilation for warmer weather can be secured by manipulating the windshield.

The open-car windshield is in one section, which is pivoted at the upper corners. To secure more ventilation than can be obtained through the cowl ventilator, the windshield can be tilted out.

The thumb screws on the windshield supports must be loosened before adjusting the position of the windshield and must be tightened to hold it in the desired position.

Windshield Cleaner

The windshield cleaner is operated by the suction or vacuum in the passages between the carburetor and the engine. On open cars the cleaner is controlled by a lever at the cleaner. When the lever is as far toward the right as it will go, the cleaner is shut off. To start the cleaner, move the lever toward the left.

On closed cars the cleaner is controlled by a knurled button on the left-hand end of the instrument board. When the button is turned clockwise as far as it will go, the cleaner is shut off. To start the cleaner, turn the button counter-clockwise. (On some closed cars the cleaner is controlled by a lever on the instrument board similar to that on the open car cleaner.)

Rear Vision Mirror

The rear vision mirror may be adjusted by the driver to suit his preference, after loosening the clamp screws that hold the mirror to its supporting bracket.

Cigar Lighter and Inspection Lamp

The car is equipped with a combination cigar lighter and inspection lamp that makes use of a single reel with twelve feet of flexible cord attached to the back of the instrument board. The flexible cord ends in a bayonet type socket to which may be attached either the inspection lamp or the heating element of the cigar lighter. The method of attachment is identical with that of an ordinary lamp bulb. Ordinarily the cigar lighter will be carried in place in the socket on the cord and the inspection lamp in a stationary socket provided on the front of the dash, where it is useful to illuminate the engine. (The inspection lamp is packed with the tool equipment when the car is shipped.)

To use the cigar lighter pull it out from the instrument board at least a foot, wait a few seconds for the heating element to heat and apply it to the cigar or cigarette. The current is automatically switched on as soon as ten or twelve inches of the cord has been unreeled. To light a pipe, remove the nickel plated shield by turning it slightly counter-clockwise and pulling it straight off.

To lock the cord in any desired position, pull out the button on the instrument board at the right of the cigar lighter (Fig. 1). This engages a ratchet which prevents the reel from rewinding. To rewind the cord, press the button back to its original position.

The inspection lamp socket on the dash has a double bayonet lock with two sets of slots. To install the lamp, simply insert it in the socket, press in, and turn it clockwise as soon as the pins on the lamp engage the first or outer set of slots. In this position the current is not switched on. To switch the current on, turn the lamp slightly counter-clockwise, press in, and turn it clockwise again, engaging the pins in the second or inner set of slots. To switch off the light, turn the lamp counter-clockwise and pull it out of the socket far enough to engage the first set of slots.

Clock

The clock has an eight-day movement and is wound in the same manner as a watch. The stem is under the clock back of the instrument board.

Side Curtains on Open Cars

The side curtains, with which the open cars are equipped, are carried in an envelope provided with cloth partitions to prevent rubbing and chafing. The Touring car curtains are stowed under the front seat; the Phaeton curtains in a compartment back of the front seat, with a door opening in the tonneau; the Roadster curtains in the package compartment just back of the seat.

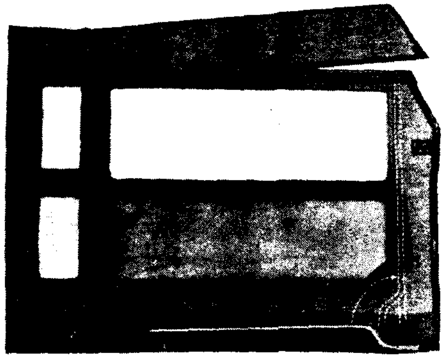

FIGURE 3. *Side curtains*

The Touring car and Phaeton curtains are in six sections, each of which is marked to indicate its position, as "Left Front," "Right Center." The front and center sections on both sides are each provided with a rod, the lower end of which fits a socket in the top of the door. When a curtain is folded for stowing, this rod is parallel with the bottom of the curtain as shown in Fig. 3. Before the curtain can be attached to the door, the rod must be moved to the position shown by the dotted lines. The upper end of the rod is slotted to engage with the stiffener that runs along the upper edge of the curtain.

The rear sections should be applied first, followed by the center and front sections. The rear sections should be fastened to the rear bows *under* the side flaps of the permanent rear curtains.

Before stowing the curtains, they should be dry and clean.

Curtain Fasteners

Most of the curtain fasteners used on the top and side curtains are of the type illustrated in Fig. 4. When this type of fastener is snapped on its stud, it becomes locked on three sides. To release the fastener it must be lifted on the side that is not locked. This side is indicated by the small projection to which the arrow points in Fig. 4. This type of fastener cannot be released by lifting it at any other side. The remainder of the fasteners used on the top and curtains are of the usual glove type.

FIGURE 4
Curtain fastener

Tools

The compartment for carrying the tool equipment is just forward of the right-hand running board. The lock on this compartment is operated by the switch

key. The following are the tools comprising the standard equipment. The numbers refer to the numbers by which the tools are designated in Fig. 5. Items listed opposite Nos. 25, 26, 27, 28 and 29 are not illustrated.

1. Open end wrenches (two) for adjusting rear foot brakes
2. Small screw driver
3. Socket wrench for oil pan drain plug
4. Large screw driver
5. Center punch
6. Cold chisel
7. Hammer
8. File
9. Pliers
10. Wrench for spark plugs and compression relief cocks
11. Distributor wrench (with gauge for adjusting timer contact points and spark plugs)
12. Distributor wrench (plain)
13. Bicycle wrench
14. Monkey wrench
15. Wrench for rim clamping nuts
16. Rim assembling tool
17. Hose for tire air compressor
18. Adapter for grease gun for lubricating clutch thrust bearing for cars with grease gun connection on thrust bearing

18A. Extension fitting for lubricating clutch thrust bearing on cars using screw plug in thrust bearing

19. Grease gun
20. Hand starting crank
21. Hub cap wrench
22. Oil can
23. Jack handle
24. Jack
25. Inspection lamp. Note: The inspection lamp is packed with the tool equipment when the car is shipped but is ordinarily carried in the socket provided for it on the dash
26. Small tool bag
27. Large tool bag
28. Lubrication chart
29. Operator's Manual

Tires

Tire Valve Caps

The valve caps used with some makes of tires are a combination dust and valve cap. This type of cap can be removed and installed without screwing the cap the entire length of the threads on the valve stem.

To remove one of these valve caps, turn it two or three turns counter-clockwise. This loosens the sliding nut inside the cap (Fig. 6). Next, pull the cap up as far as it will go. Then remove the cap by unscrewing it the rest of the way.

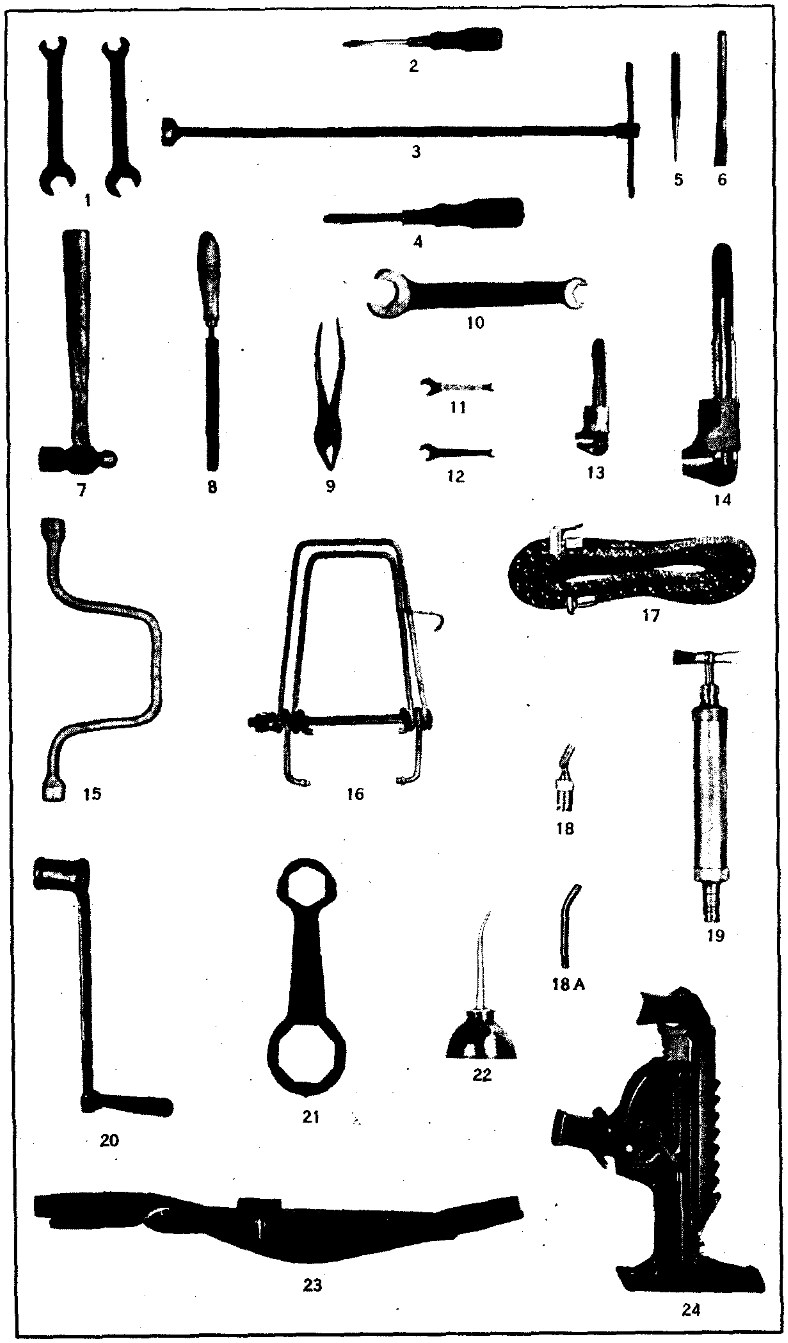

FIGURE 5. ***Standard tool equipment***

(The numbers refer to the list on page 25)

To install a valve cap, place the cap over the valve stem and turn it a few turns clockwise to engage the threads in the sliding nut. If the sliding nut is too far inside the cap to be reached by the valve stem, shake the nut down by tapping the bottom of the cap on some solid object. When the valve stem has been started in the sliding nut, push the cap down over the stem as far as it will go. Then turn the cap until it locks tightly.

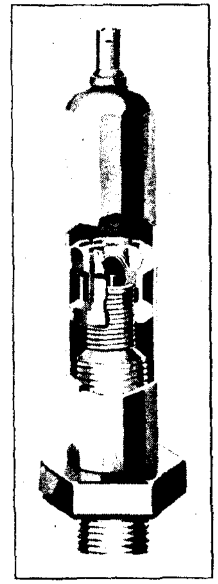

FIGURE 6
Tire valve cap

Inflation Pressure

For normal driving, the 33 by 6.75 low pressure tires, which are standard equipment on Cadillac cars, should be inflated to a pressure of 40 lbs. per square inch. The inflation pressure should be checked at least weekly and should not be permitted to drop more than 5 lbs.

On cars driven at high speeds, the front tires should be inflated to 50 lbs. or higher if necessary. *This is important.*

Tire Air Compressor

To use the tire air compressor with which the car is equipped, proceed as follows:

Turn back the left-hand side of the front carpet and lift the small oval-shaped cover which is in the floor just to the left of the transmission control lever. Reach through the hole in the floor and remove the knurled cap from the connection on top of the compressor. Connect one end of the air hose (in the tool equipment) to this connection and the other end of the hose to the valve of the tire to be inflated. *Do not connect the hose to the tire first if there is pressure in the tire.*

The control shaft by which the compressor driving gear is placed in mesh with the transmission gears projects through a small hole in the floor just in front of the large hole over the compressor. To start the compressor, if the engine is running, disengage the clutch and hold the pedal down until the transmission gears have ceased to revolve. Then, with a screw driver, turn the slotted head of the compressor control shaft clockwise. If the engine is not running, simply turn the control shaft clockwise without disengaging the clutch and then start the engine.

The compressor gives best results when the engine runs at a speed of approximately 1,000 r.p.m., which is about three times the normal speed of the engine when idling. Do not race the engine in operating the compressor, or, for that matter, at any other time when it is not driving the car. Racing the engine beyond the recommended speed not only decreases the efficiency

(Continued on page 30)

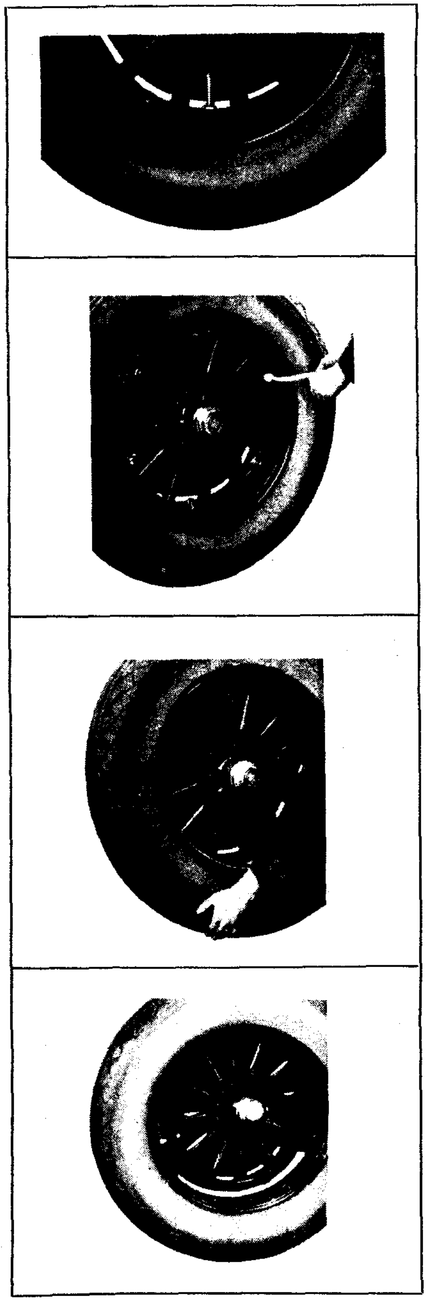

Figure 7a

Jack up the axle until the tire clears the ground. Unscrew the dust cap and the clamping nut from the tire valve stem.

Figure 7b

With the brace wrench, supplied in the tool kit, loosen the six rim clamping nuts. Turn each clamp so that the lug is away from the rim and tighten the nut enough to hold the clamp in this position.

Figure 7c

Rotate the wheel so that the valve stem is at the top, and pull the bottom of the rim away from the wheel. If the rim does not come off easily, pull the top of the rim as far out as the valve stem will permit and then pull the bottom part of the rim away from the wheel.

Figure 7d

Rotate the wheel until the valve stem approaches the bottom. At the point shown in the illustration, the rim and tire will roll free from the wheel and can be removed without lifting

FIGURE 7. ***Removing rim with tire from wheel***

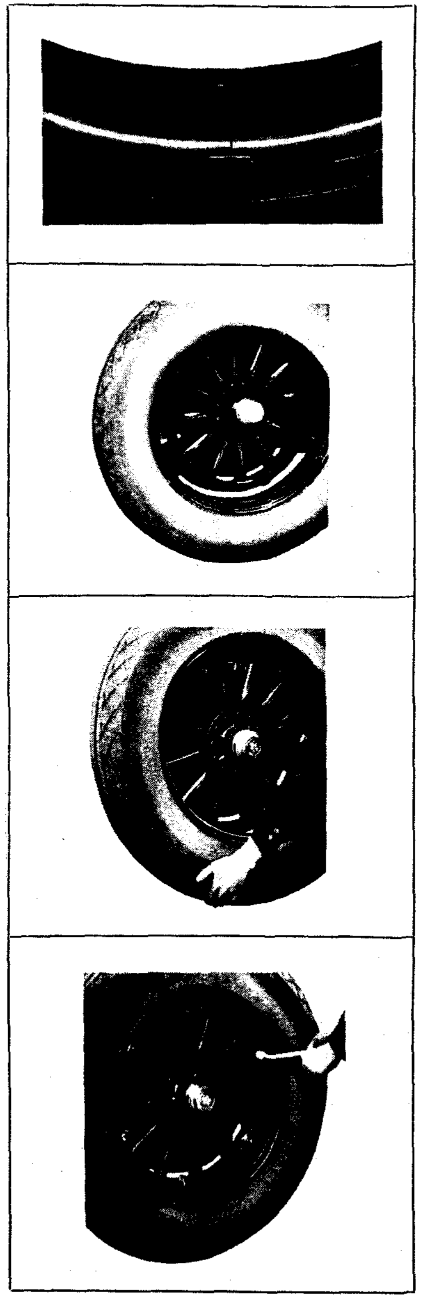

Figure 8a

If the rim has no split clamping ring, take the one from the rim removed. The correct position for the ring is just inside the three lugs and with the split opposite one of the lugs. If the ends of the ring overlap, they can be sprung into place with a screw driver.

Figure 8b

Rotate the wheel so that the hole for the valve stem is in the position shown. Hold the rim so that the three lugs are on the side away from the car and insert the valve stem into the hole in the wheel.

Figure 8c

Rotate the wheel, which will carry the rim with it, until the valve stem is at the top. Then push the lower part of the rim into place, guiding the hinge on the rim through the notch provided for it in the edge of the wheel.

Figure 8d

Turn each rim clamp so that the lug is over the clamping ring, drawing the nut down until the end of the bolt is flush, or nearly so, with the outer surface of the nut. Then go over the six nuts again, tightening them firmly. (See page 30 in regard to truing up the rim on the wheel.) Install the valve stem clamping nut and the dust cap. It is important that the clamping nut be firmly tightened.

FIGURE 8. ***Installing rim with tire on wheel***

of the compressor, but is one of the worst forms of abuse. To stop the compressor, turn the control shaft counter-clockwise.

Do not turn the compressor control shaft to start the compressor when the engine is running and the clutch is engaged.

Tire Holder

The tire holder is designed to carry either one or two standard size tires mounted on rims and inflated. Each rim has on it three lugs which are located so as to engage with notches on the support arms and on the adjustable clamp. There are two sets of these notches.

When two rims are carried, the rim nearest the car should be placed so that the side with the lugs is away from the car and the lugs should be inserted in the inner set of notches. The outer rim should then be placed so that the side with the lugs faces toward the car and the lugs of this rim should be inserted in the outer set of notches.

When only one rim is carried, the side of the rim with the lugs should face toward the car and the lugs should be inserted in the inner set of notches.

The tire holder lock is in the upper end of the clamp screw and is protected by a dust cap which must be unscrewed to insert the key. Turning the key clockwise disengages the lock, permitting the clamp screw to be turned.

To lock the tire holder, screw the clamp down firmly against the rim or rims. Adjust the clamp screw handle so that it points squarely across the car. Then turn the key counter-clockwise. Care should be exercised in removing or replacing a spare tire not to strike the body of the car.

Note: If a tire cover is used, it should have slots cut in it opposite the two upper lugs on the rim so as to permit these lugs to seat in the notches in the support arms.

Changing Tires

If a spare rim with inflated tire is always carried on the tire holder, the driver will seldom or never have occasion to disassemble a tire from the rim. In case of tire trouble it is then merely necessary to remove the rim with tire from the wheel and to install on the wheel the spare rim and tire. Illustrated directions for making this change are on pages 28 and 29. Disassembly of the tire from the rim is necessary only if the tire is to be repaired or a new one installed. Directions for this work, which is usually left to the repair shop, will be found on pages 78 and 79. Never attempt to remove a tire from its rim without first deflating the tire.

Truing Up Rim

If a rim does not run true, it may be trued up in the following manner: Rotate the wheel slowly and mark the part that runs farthest out from the face of the wheel. Loosen slightly the nuts diametrically opposite the mark and then tighten the nuts on the marked side. Test the wheel again and if it still does not run true repeat the operation.

CHAPTER IV

Cold Weather Operation

THE Cadillac car is an all-season car and no owner need hesitate to make full use of his car in severe winter weather as well as at other times. It is necessary in freezing weather, however, to observe certain precautions and to follow a somewhat different procedure, particularly in starting the engine. In this chapter has been grouped all the information relating to operation of the car during cold weather. It should be reviewed just prior to the beginning of the winter season.

Starting the Engine

Carburetor Enriching Button

The first difference between starting the engine in cold weather and starting the engine in warm weather is in the greater use of the carburetor enriching device necessary in cold weather. Gasoline does not vaporize as readily at low temperatures, and in order to supply the cylinders with a gaseous mixture rich enough to be ignited, the proportion of liquid gasoline to air must be increased.

At the same time it is important not to apply the enriching device more than is necessary. The unvaporized gasoline collects on the cylinder walls and works down past the pistons, washing off the lubricant as it goes. Although dilution of the oil supply with this unburned gasoline is minimized in the Cadillac engine by an exclusive system for ventilating the crankcase (see page 42), it is best to avoid an excess of liquid gasoline in the combustion chambers by careful and judicious use of the enriching device.

The following rule should govern the use of the enriching button in winter weather: Pull the enriching button back just as far as it is necessary to start the engine, but as soon as the engine starts, let the button return as far as possible without causing the engine to stop or slow down. Then release the button entirely as soon as the engine is warm enough to permit doing so.

Priming the Carburetor

In extremely cold weather, if the engine does not start after cranking for a few seconds with the enriching device fully applied, release the starter pedal. Then prime the carburetor by opening and closing the throttle once or twice rather rapidly with the accelerator. Opening and closing the throttle operates

a throttle pump on the carburetor and raises the level of gasoline in the carburetor bowl. The carburetor should never be primed in warm weather and should not be primed unnecessarily in cold weather. Excessive priming is likely to prevent the engine from starting.

Position of Throttle Hand Lever

The correct position of the throttle hand lever for starting in cold weather is the same as for starting under other conditions, that is, about one-fourth the way down from the idling position. In warm weather, however, the lever may be returned to the idling position almost as soon as the engine is started. In cold weather, the throttle must be left slightly open until the engine becomes warm.

Position of Ignition Control Lever

Unless the weather is extremely cold, the correct position of the ignition control lever for starting is the same as that recommended on page 10, that is, about one-third the way down. In extremely cold weather, however, the lever should be moved all the way up for starting, unless the engine should be cranked by hand, in which case the lever should be moved all the way down.

It is the practice of some drivers to move the ignition control lever all the way down whenever starting the engine. This is the correct position if the engine is to be cranked by hand, but if the engine is to be cranked with the starter, there is no reason for retarding the spark, and in extremely cold weather "popping back" in the carburetor is less likely to occur if the spark is fully advanced.

Use of Starter

In extremely cold weather, when the car has been standing long enough to become thoroughly chilled, it is a good plan to disengage the clutch during the cranking operation. If this is not done, the starter is called upon to turn the jackshaft gears in the transmission in addition to cranking the engine. At ordinary temperatures, the additional energy required is negligible, but in extremely cold weather, the lubricant in the transmission offers sufficient resistance to rotation of the transmission gears to increase considerably the demand upon the battery and to retard the cranking speed.

Use of Accelerator Before Engine Is Warm

In cold weather, after the engine has been started and before it has run long enough to become warm, the engine cannot deliver its normal power and it should not be called upon to do so. In accelerating the engine to start the car and in accelerating the car after the transmission is in gear, do not open the throttle suddenly or too far. To do so is not only to invite "popping

back" in the carburetor, but to increase the amount of excess unvaporized gasoline in the combustion chambers, both of which results are undesirable. For this reason also, starting in intermediate should never be attempted in cold weather.

Additional Cold Weather Suggestions

Engine Oil for Cold Weather

All engine lubricating oil is more viscous at lower temperatures than at higher temperatures. An engine oil of the proper viscosity for summer weather will not flow freely at freezing temperatures, and will not lubricate the cylinders and bearings properly until the engine is warm. If the oil congeals it also offers considerable resistance to cranking of the engine, causing a severe drain on the battery, and retarding the cranking speed.

In cold weather, therefore, it is essential that an oil be used that has a sufficiently low cold test. The medium grade of Cadillac Engine Oil is recommended generally for winter use. If in doubt as to a suitable oil for cold weather, consult an authorized Cadillac maintenance station.

Strainers in Gasoline System

During cold weather, it is especially important to remove and clean the strainers in the gasoline line (see page 58). An accumulation of water at these points that would have no bad effect in warm weather might freeze in cold weather and prevent the gasoline from flowing to the carburetor.

Anti-Freezing Solutions

In freezing weather, the water in the cooling system must be replaced with some solution that has a lower freezing temperature than that of water. A solution of glycerin and water is recommended. There is practically no loss of glycerin by evaporation and a solution of suitable strength placed in the cooling system at the beginning of freezing weather will ordinarily last the entire season.

Some of the patented substitutes for glycerin may be safely used. Such preparations should not be used unless tested and approved. Cadillac distributors and dealers should be consulted as to the suitability of an anti-freeze other than glycerin, or inquiry may be made to the factory Technical Department. Solutions containing calcium chloride or other ingredients injurious to the metal parts of the cooling system must never be used.

A solution of denatured alcohol may be used if its strength is periodically inspected by testing it with a hydrometer, and if care is taken not to let the solution get on the finish of the hood or radiator. Alcohol vaporizes more readily than water and the loss by evaporation must be replaced at frequent intervals or the weakened solution will afford little protection against freezing.

Glycerin and Water

The following table* gives the freezing temperature and specific gravity of solutions of glycerin† and water:

Percentage of Glycerin (by Volume)	Parts by Volume Glycerin	Water	Freezing Temperature (° Fahr.)	Specific Gravity
20	1	4	21°	1.057
25	1	3	17°	1.070
33⅓	1	2	8½°	1.092
50	1	1	–15°	1.132

Alcohol and Water

The following table* gives the freezing temperature and specific gravity of solutions of denatured alcohol and water:

Percentage of Alcohol (by Volume)	Parts by Volume Alcohol	Water	Freezing Temperature (° Fahr.)	Specific Gravity
20	1	4	19°	.980
25	1	3	15°	.975
33⅓	1	2	6°	.965
50	1	1	–18°	.941

Capacity of Cooling System

The capacity of the cooling system is five and one-half gallons.

Effect of Alcohol on Finish

Strong solutions of alcohol have a harmful effect on the finish. In adding pure alcohol or solutions containing 50 per cent or more alcohol, extreme care must be used not to let the liquid spatter or spill. A funnel and a pouring vessel with a suitable spout are necessary. Especially avoid pouring cold alcohol into very hot water. The effect of this is to make the mixture foam up and possibly bubble over on the finish.

*The freezing temperatures and specific gravities in these tables are according to the U. S. Bureau of Standards. The temperature given is in each case the temperature at which the first crystals form and not the temperature at which the solution freezes solid.

†Undiluted commercial glycerin having a specific gravity of 1.250.

PART II

LUBRICATION AND CARE

Cadillac 4000-Mile Lubrication Schedule

Note: *Do not wait for schedule lubrications before adding engine oil. The oil level should be checked every 100 to 150 miles and oil added if the indicator ball is below "Full." This is especially important on cars driven at high speeds.*

Lubrication group	**Explanation:** The figures and letters following the items in this column refer to the chassis lubrication diagram, Fig. 11	Refer to page	Lubrication No. and Mileage at which due: 1 — 500	2 — 1000	3 — 1500	4 — 2000	5 — 2500	6 — 3000	7 — 3500	8 — 4000
1, 3, 5, and 7	Add engine oil as necessary*: 21	41	O	O	O	O	O	O	O	O
1, 3, 5, and 7	Grease gun connections: G	45	O	O	O	O	O	O	O	O
1, 3, 5, and 7	Spring leaves: 1, 7, 10, 20	48	O	O	O	O	O	O	O	O
1, 3, 5, and 7	Add water to storage battery	63	O	O	O	O	O	O	O	O
LUBRICATION Nos. 2 and 6	Universal joints: 13, 14	46		O		O		O		O
LUBRICATION Nos. 2 and 6	Generator and distributor oil cups: 17, 18, 19	45		O		O		O		O
LUBRICATION Nos. 2 and 6	Engine rear supports: 5, 16	45		O		O		O		O
LUBRICATION Nos. 2 and 6	Steering column oil holes: 3	47		O		O		O		O
LUBRICATION Nos. 2 and 6	Brake pins and connections	77		O		O		O		O
LUBRICATION Nos. 2 and 6	Door hardware	48		O		O		O		O
LUBRICATION NUMBER 4	Drain and replace engine oil*: 21	43				O				O
LUBRICATION NUMBER 4	Transmission‡—add lubricant: 15	46				O				O
LUBRICATION NUMBER 4	Rear axle‡—add lubricant: 11	46				O				O
LUBRICATION NUMBER 4	Clutch thrust bearing: 4	45				O				O
LUBRICATION NUMBER 4	Steering gear—add lubricant: 6	47				O				O
LUBRICATION NUMBER 8	Transmission‡—drain and replace lubricant: 15	46								O
LUBRICATION NUMBER 8	Rear axle‡—drain and replace lubricant: 11	46								O
LUBRICATION NUMBER 8	Wheel bearings—clean and repack: 2, 8, 12, 22	46								O
LUBRICATION NUMBER 8	Front brake trunnions: 9, 23	47								O
LUBRICATION NUMBER 8	Speedometer drive shaft	47								O
RECORD	Speedometer Reading									
RECORD	Date									

*Change to medium grade of engine oil at beginning of cold weather and to heavy grade of engine oil at beginning of warm weather, regardless of mileage.
‡Change to light grade of lubricant at beginning of cold weather and to heavy grade of lubricant at beginning of warm weather, regardless of mileage.

CHAPTER I

Systematic Lubrication

Necessity for Lubrication

Lubrication has made machinery possible. Without it the destructive effects of friction would render the most ingeniously designed mechanism useless. Especially is this so of the gasoline engine, in which heat of combustion is added to that of friction. Absence of lubrication for even a brief instant while the engine is running would heat the surfaces in contact to the melting point.

But it is not enough to know that friction, unrestrained by lubrication, is capable of ruining an engine in less time than it takes to tell it. No motorist expects to run out of oil. What is frequently not fully appreciated is that, if improper lubricants are used and are infrequently applied, friction is still a powerful destructive agent capable of shortening the useful life of the car from years to months.

The quiet, dependable operation of a new car is primarily the result of the accurate finishing of surfaces separated from each other by a few thousandths of an inch. In the Cadillac, there are hundreds of such surfaces. If the clearances between these surfaces are to be maintained, so that the car will continue to operate quietly and dependably, friction must be prevented from taking its toll in wear.

Cadillac engineers have provided for the lubrication of all surfaces where friction is a factor. The most that a manufacturer can do, however, is to provide a place for the lubricant and means for it to reach the surfaces to be lubricated. The car cannot be equipped with an inexhaustible supply of lubricant. Upon the car owner devolves the responsibility of replenishing the supply at the proper time with lubricant of the prescribed specifications.

Because of the importance to the car owner of proper lubrication of his car, every effort has been made in this Manual to give explicit information for his guidance. Lubricants are prescribed for each point requiring lubrication, directions are given for applying the lubricant, and recommendations are made as to the frequency with which the lubricant should be applied. All this information is based upon actual operation of Cadillac cars over hundreds of thousands of miles.

Lubrication Schedule

Lubrication is effective only insofar as it is regular and systematic. To be systematic, lubrication must be performed at regular mileage intervals. The

Cadillac technical staff has accordingly developed for the Cadillac car a complete lubrication schedule which, if faithfully followed, will insure for each bearing surface ample, but not superfluous, lubrication. This schedule is shown on page 36.

The unit of the Cadillac lubrication schedule is 4,000 miles, which is divided into eight 500-mile intervals. Corresponding to these is a series of eight consecutive groups of lubricating operations. When the car has traveled 500 miles, the points enumerated under Lubrication No. 1 should receive attention. At 1,000 miles, Lubrication No. 2 is due, and so on until at 4,000 miles Lubrication No. 8 should be performed. At 4,500 miles the schedule begins again with Lubrication No. 1.

In order that the driver may be continually reminded of the mileage at which the next lubrication is due, provision is made on the speedometer for a lubrication notice. This consists of a strip of black celluloid (Fig. 9) which is placed across the speedometer cover glass below the total mileage dial and which has two white spaces, one for the lubrication number and one for the mileage at which it is due. Whenever the car is lubricated on the schedule, the figures then on the celluloid should be erased and the next lubrication number and the mileage at which it is due should be written or stamped in their places. If this notice is used, the driver need only glance occasionally at the speedometer and compare the mileage on the dial with the figures on the notice in order to plan for the necessary attention.

FIGURE 9.
Lubrication notice

Note: Do not wait for the mileage indicated on the notice before adding engine oil. The oil level should be checked every 100 to 150 miles and oil added, if the indicator ball is below "Full"

Cadillac distributors and dealers are prepared to sell lubrication based on this schedule. A car that is being lubricated on the schedule can be taken to any authorized Cadillac maintenance station, and without further ordering than to specify "Schedule Lubrication," the car will receive the necessary attention.

The schedule on page 36 is in outline form. Detailed information as to the location of the points to which lubricant is to be applied, the method of lubricating, and the kind and amount of lubricant will be found in Chapters VI and VII. For each point on the schedule, two reference numbers are given: the number of the page on which detailed directions will be found and the number designating the point on the chassis lubrication diagram (Fig. 11).

Lubricants

The selection of proper lubricants for the Cadillac car is one of the first concerns of the owner in his attention to the lubrication of his car.

The lubricants must not only be of high quality, but their viscosity and

other characteristics must be suited to the Cadillac car. The difficulty of securing suitable lubricants on the open market has induced us to provide lubricants under the Cadillac trade mark. These lubricants are prepared according to specifications prescribed by the Cadillac technical staff and are based upon hundreds of actual tests. Cadillac lubricants include the following and can be obtained from Cadillac distributors or dealers: Cadillac Engine Oil—Heavy, Medium and Light (special). Cadillac Rear Axle and Transmission Lubricant—Light and Heavy. Cadillac Roller Bearing and Cup Grease. Cadillac Fiber Grease—Light and Heavy. Cadillac Steering Gear Lubricant.

Engine Oil

The heavy grade of Cadillac Engine Oil is recommended for summer use and for winter use if the temperature is not much below freezing. For average winter use (temperatures down to zero) the medium grade is recommended. For extremely low temperatures (below zero) the light grade should be used, but should be replaced with the medium grade as soon as more moderate temperatures return.

The names of other engine oils approved for use in the Cadillac engine will be supplied by our Technical Department on request.

Rear Axle and Transmission Lubricant

The heavy grade of Cadillac Rear Axle and Transmission Lubricant should be used except in cold weather. The light grade should then be used. If the heavy grade is used in cold weather the transmission gears will be difficult to shift. The names of other lubricants suitable for use in the Cadillac rear axle and transmission will be supplied upon request.

Roller Bearing and Cup Grease

Cadillac Roller Bearing and Cup Grease is recommended for the wheel bearings and for all points for which grease gun connections are provided, with the exception of the steering gear and the universal joints. In the absence of Cadillac Roller Bearing and Cup Grease, No. 3 cup grease may be used for the grease gun connections and No. 1½ cup grease for the wheel bearings.

Fiber Grease

Cadillac Fiber Grease is supplied in two grades, light and heavy. The light grade is recommended for the clutch thrust bearing and the heavy grade for the universal joints on the drive shaft.

Steering Gear Lubricant

Cadillac Steering Gear Lubricant is recommended for lubricating the steering gear worm and sector. In its absence, use a mixture consisting of 75 per cent rear axle and transmission lubricant and 25 per cent cup grease.

CHAPTER II

Engine Lubrication

Oil Circulating System

The supply of engine oil is carried in the pressed steel reservoir that covers the bottom of the crankcase. The oil is forced to the bearings by a gear pump attached to the right-hand side of the engine toward the front and driven by a spiral gear on the crankshaft.

The pump draws the oil from the bottom of the oil pan and delivers it under pressure to a supply pipe running the length of the engine parallel with the crankshaft. From this supply pipe, three leads branch off to feed the three main bearings. Another lead at the front end of the supply pipe directs a stream of oil upon the spiral gears. A separate passage drilled through the crankcase conducts oil direct from the pump to the camshaft front bearing from which the oil enters the hollow camshaft and is carried to the other camshaft bearings and to the distributor driving gear.

The crankpin bearings are fed from the main bearings through ducts in the crankshaft. Oil thrown from the crankpins as the crankshaft revolves becomes a fine mist or spray which pervades the interior of the crankcase and cylinders and lubricates the pistons, piston pins, cams, camslides, and rollers.

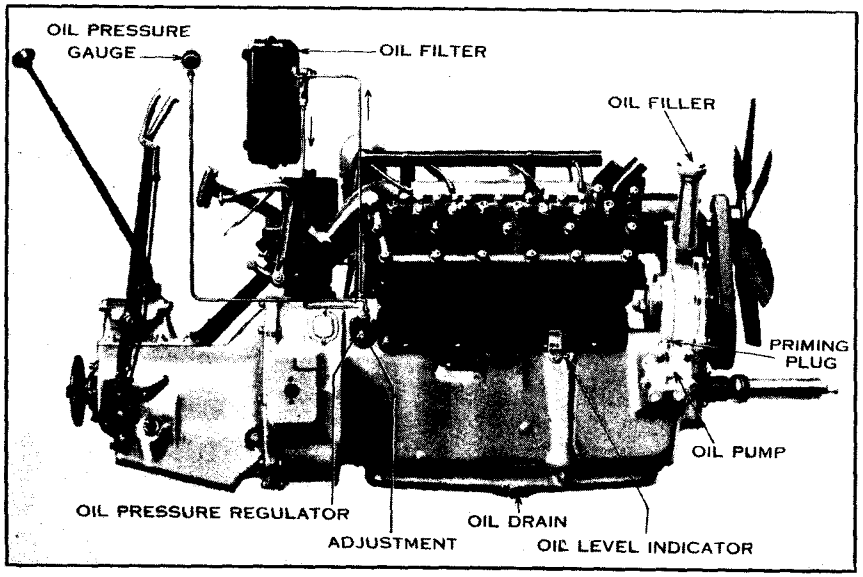

FIGURE 10. ***Engine lubrication features***

The valve stems are automatically lubricated by oil sprayed from two small holes drilled in the wall of each cylinder at such a distance from the bottom of the cylinder that, when the piston is at the bottom of its stroke, these holes register with a groove in the piston between the second and third piston rings. As the piston descends on the power stroke, oil collects in this groove and as soon as the groove registers with the holes, the pressure of the gases above the piston forces oil out upon the valve stems. Surplus oil collecting in the valve compartments is returned to the crankcase through drain passages.

All oil returns to the oil pan through a fine mesh screen placed above the oil pan and separating it from the crankcase.

Oil Level

The normal capacity of the oil pan is two gallons which fills it to the level of the screen above the pan. When the oil pan contains this amount, the oil level indicator on the right-hand side of the engine (Fig. 10) indicates "Full." As the oil level descends, the indicator indicates "Fill" and then "Empty." Oil should be added as soon as the indicator ball has dropped to "Fill." If the indicator indicates "Empty," under no circumstances should the engine be run until oil has been added.

The mileage interval at which oil must be added depends upon individual circumstances. *It is recommended that the oil level indicator be checked every one hundred to one hundred and fifty miles, although it is improbable that oil will be required as frequently as this.*

Oil Pressure

The pressure of the oil in the supply pipe is indicated by the oil pressure gauge on the instrument panel (Fig. 1). The purpose of the oil pressure gauge is, first, to enable the driver to make sure that there is pressure whenever the engine is running, and second, to verify the adjustment of the oil pressure regulator.

It is absolutely necessary that there should be oil pressure just as soon as the engine starts and as long as the engine is running. If the oil pressure gauge does not indicate pressure as soon as the engine starts, stop the engine at once and investigate the cause. First, check the level of oil in the oil pan. If the level is above "Fill," prime the oil pump by removing the plug shown in Fig. 10 and pouring oil in through a funnel. Be sure to replace the plug before starting the engine. If, after priming the oil pump and starting the engine, the oil pressure gauge does not indicate pressure, stop the engine immediately and consult the nearest Cadillac maintenance station.

Before the adjustment of the oil pressure regulator can be verified, the factors affecting the viscosity of the oil must be standardized. The oil pressure changes with the viscosity, which in turn depends upon the kind of oil, the extent to which it has been thinned by use, and the temperature. It is therefore necessary that the oil be fresh and of the viscosity specified for the Cadillac engine. The engine must also be run long enough to become thoroughly warm. Under these conditions the pressure at idling speed (300 r.p.m.) should be from 1 to 4 lbs.

Adjustment of the pressure at idling speeds is made by the screw shown in Fig. 10. To increase the pressure, turn the screw clockwise; to decrease the pressure turn the screw counter-clockwise. This adjustment should be made while the engine is running.

Crankcase Ventilating System

In every internal combustion engine, seepage of vapors by the pistons takes place to some extent, permitting water vapor and other products resulting from combustion, as well as unburned gasoline, to enter the crankcase. Contamination of the lubricating oil from this source makes it necessary in most engines to replace the oil supply at frequent intervals.

Cadillac engines are equipped with an exclusive system to prevent the seepage vapors from entering the crankcase. To bring about this result, advantage is taken of the fact that the Cadillac crankshaft with its compensating weights acts naturally to draw air through an inlet in the left-hand side of the engine, building up within the crankcase a pressure slightly above atmospheric pressure. No outlet is provided in the crankcase itself but in the wall of each cylinder is a port connecting the space below the piston with the valve compartment. This port is open except when the piston is at the extreme bottom of its stroke.

The effect of this arrangement is as follows: The seepage vapors that pass the two upper piston rings are forced through slots milled in the circumference of the lower piston ring and through corresponding holes in the piston into the space inside the piston, where they are carried down as the piston descends. The vapors cannot enter the crankcase, however, because they are prevented from doing so by the pressure built up in the crankcase by the revolving crankshaft. Instead, the vapors are expelled through the port into the valve compartment. From the valve compartments the expelled vapors are conducted through flexible pipes underneath the car where they are discharged.

Oil Filter

Another source of contamination of the oil supply is dirt. In the Cadillac engine all solid matter in the oil is removed by means of a filter (Fig. 10) which is attached to the dash and which is connected to the oil circulating system.

The filter consists of a metal container in which is a series of eight envelopes made of special fabric. As the oil is forced through these fabric envelopes, the total area of which is over five square feet, it leaves all solid matter behind, returning to the engine as clean oil.

The filter is connected to the oil pressure regulator at the same point as the oil pressure gauge. Oil is thus forced to the filter whenever the engine is running and there is pressure in the oil lines. The normal flow when the filter is new is approximately one quart per minute under a gauge pressure of 15 pounds, so that an amount of oil equal to the entire capacity of the lubricating system passes through the filter every eight to ten minutes.

As dirt accumulates in the filter, the flow of oil through the filter decreases, and eventually the filter unit must be replaced. When it takes longer than seven minutes for a quart of oil to flow through the filter under a gauge pressure of 15 pounds, the filter unit should be replaced.

As an approximate check on the condition of the filter, remove the screw plug in the fitting at the filter and note the size of the stream of oil that flows from the opening. In making this test, the engine should be warm and the throttle should be opened until the pressure gauge indicates 15 pounds. Under these conditions a stream of oil as large as a pencil lead, or larger, should flow from the filter. (On some cars the filter has a sight feed glass through which the stream of oil flowing from the filter may be seen.)

Under average driving conditions replacement of the filter unit should not be necessary for 12,000 to 15,000 miles. Filter units for replacement can be obtained from Cadillac distributors and dealers.

Replacing Engine Oil

Although the crankcase ventilating system and the oil filter described in the preceding sections greatly prolong the useful life of the oil, it is recommended that the oil be drained and replaced with fresh oil every 2,000 miles.

To drain the oil, simply remove the drain plug (Fig. 10). A special socket wrench for the oil pan drain plug is supplied as part of the tool equipment. Be sure to reinstall the drain plug before adding the fresh oil. Two gallons of fresh oil should be added, or enough to bring the oil level indicator ball to "Full."

At the end of the first 1,000 miles, it is recommended that the car be taken to a Cadillac maintenance station to have the oil pan and screen removed and

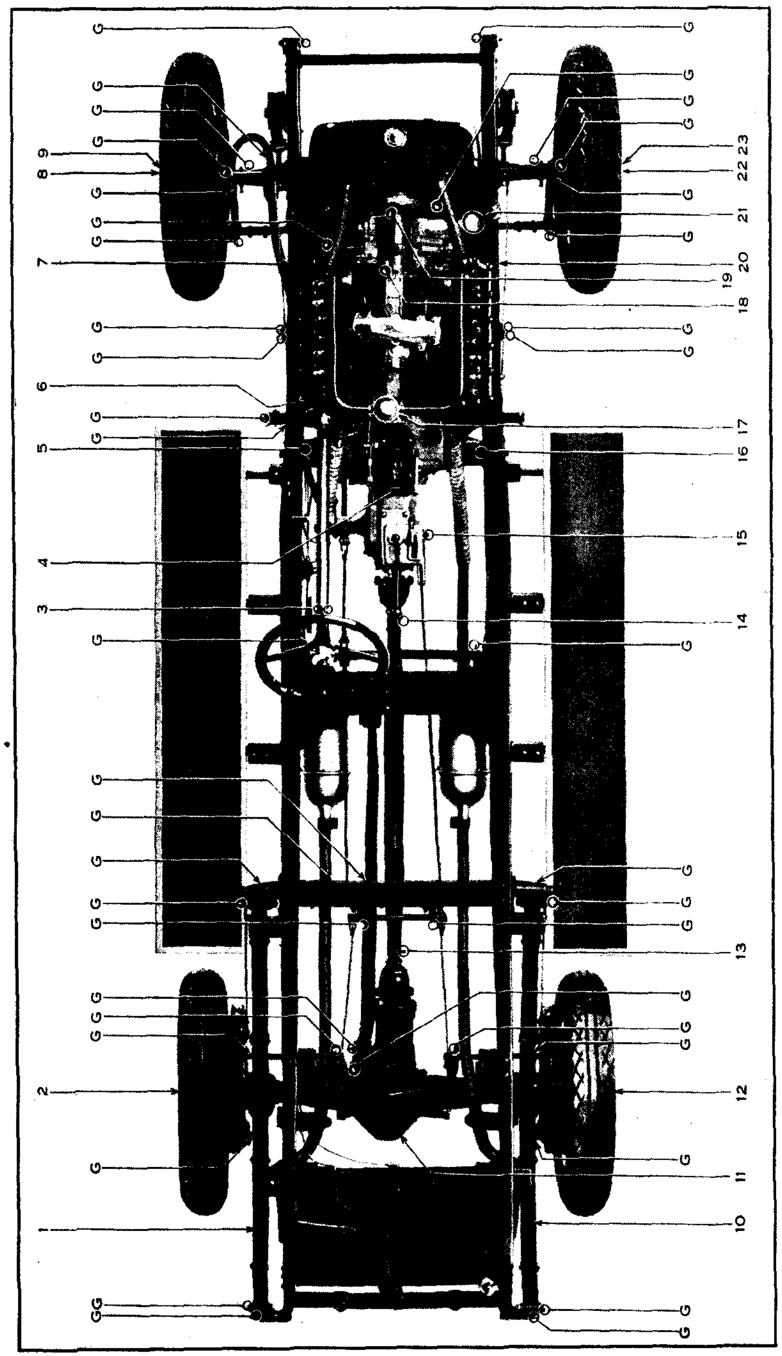

FIGURE 11. *Chassis lubrication diagram*

Each "G" indicates a grease gun connection. Each number indicates a lubricating point for which instructions are given in Chapters II and III. Lubricating points that are visible in the diagram are surrounded by circles, others are indicated by arrows.

cleaned with gasoline or kerosene. This should be repeated once a year or whenever the filter unit is replaced.

Generator Oil Cups: 18, 19*

Two oil cups on the generator conduct lubricant to the forward and rear bearings on the armature shaft. A few drops of engine oil should be applied to each cup every 1,000 miles.

Timer-Distributor Oil Cup: 17

The oil cup at "17" is for lubricating the ball bearing at the upper end of the timer-distributor shaft. A few drops of engine oil should be applied every 1,000 miles.

Engine Rear Supports: 5, 16

The brackets on the frame to which the engine rear supports are bolted are provided with felt wicks. Engine oil should be applied at these points every 1,000 miles.

CHAPTER III

General Lubrication

Grease Gun Connections: G

Spring bolts, steering connections, brake rocker shafts and other points are provided with connections to fit the grease gun supplied with the tool equipment. These points are indicated by "G" in Fig. 11. Cadillac Roller Bearing and Cup Grease should be applied to these points with the grease gun every 500 miles.

Clutch Thrust Bearing: 4

The lubricating joint on the clutch thrust bearing is fitted with a screw plug shown at "G" (Fig. 22). To reach this plug, remove the floor boards and the cover plate shown at "F" (Fig. 11) and turn the thrust bearing until the plug is uppermost. Remove the plug with a screw driver, taking care not to drop the plug into the clutch housing. Screw the extension fitting shown at 18A (Fig. 5) into the threaded hole from which the plug was removed. Attach the grease gun to this fitting.

***The numbers following the headings in this chapter and in Chapter III refer to Fig.11.**

Note: On some cars a grease gun connection is permanently fitted to the thrust bearing in place of the screw plug. On these cars the adapter 18 (Fig. 5) should be used instead of the extension pipe 18A. This must be done with the engine not running.

The clutch thrust bearing should be lubricated every 2,000 miles with the light grade of Cadillac Fiber Grease.

Caution: Do not inject too much grease into the clutch thrust bearing. One or two turns of the grease gun handle are sufficient.

Transmission: 15

The transmission case should contain sufficient lubricant to bring the level up to the filling hole at the right-hand side. The level should be inspected every 2,000 miles and lubricant added if necessary. Cadillac Rear Axle and Transmission Lubricant is recommended. The heavy grade should be used except in cold weather. The light grade should then be used. If the heavy grade is used in cold weather, the transmission gears will be difficult to shift.

Every 4,000 miles the drain plug should be removed from the bottom of the transmission case and the lubricant should be drained and replaced with fresh lubricant. Three quarts of lubricant are required to fill the transmission case to the proper level.

Universal Joints: 13, 14

The forward and rear universal joints on the drive shaft are provided with grease gun connections as indicated at "13" and "14." It may be necessary to roll the car forward or backward a few inches to bring the connections underneath where they can be reached with the grease gun. The heavy grade of Cadillac Fiber Grease should be applied every 1,000 miles.

Rear Axle: 11

The rear axle housing should contain enough lubricant to bring the level up to the filling hole in the rear cover plate. The level should be inspected every 2,000 miles and lubricant added if necessary. Cadillac Rear Axle and Transmission Lubricant is recommended. The heavy grade should be used except in cold weather. The light grade should then be used.

Every 4,000 miles the drain plug should be removed from the bottom of the axle housing and the lubricant should be drained and replaced with fresh lubricant. Three and one-half quarts of lubricant are necessary to fill the rear axle housing to the proper level.

Wheels: 2, 8, 12, 22

The front and rear wheel bearings are packed in grease when the car is assembled. Every 4,000 miles all the wheels should be removed and the bearings should be thoroughly cleaned in gasoline or kerosene. They should then be repacked and the bearings adjusted in accordance with the directions on pages 80, 81 and 82.

Cadillac Roller Bearing and Cup Grease is recommended for the wheel bearings. Do not use heavy grease as it will roll away from the path of the rollers and will not return.

Front Brake Trunnions: 9, 23

Every 4,000 miles, at the same time that the wheels are removed for lubrication of the wheel bearings, the brake operating trunnions inside the front wheel brake drums should be lubricated by applying the grease gun to the connection at "A" (Fig. 12). Cadillac Roller Bearing and Cup Grease should be used. It should be injected only until it begins to appear around the trunnion bearings. Do not inject too much grease. Before replacing the wheels, wipe off any grease appearing around the trunnion bearings. Do not inject any grease at "A" except when the wheel is off and the application of too much grease can be definitely avoided.

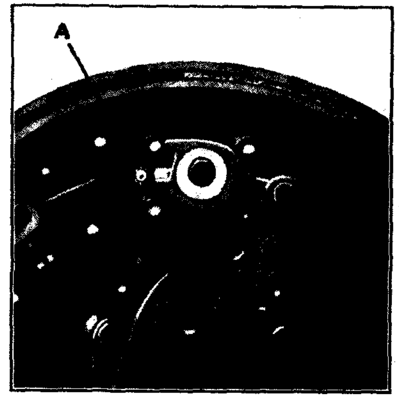

FIGURE 12
Lubrication of front brake trunnions

Steering Gear: 6

A grease gun connection is provided on the steering gear housing for injecting lubricant for the steering gear worm and sector. Cadillac Steering Gear Lubricant is recommended for the steering gear and it should be applied every 2,000 miles.

Oil Holes in Steering Column: 3

There are two oil holes in the steering column just below the steering wheel. A few drops of engine oil should be applied to these every 1,000 miles. The holes are closed by screw plugs which must be removed before the oil can be applied.

Speedometer Flexible Drive Shaft

The flexible shaft by which the speedometer is driven is housed in a flexible casing. To lubricate the speedometer drive shaft, the shaft should be removed from its casing and lubricant applied to it for its entire length. Cadillac Roller Bearing and Cup Grease is recommended for this lubrication, which should be performed every 4,000 miles.

Do not under any circumstances attempt to lubricate the speedometer itself. Any parts in the speedometer requiring lubrication are amply supplied when it is assembled.

Horn

The horn is lubricated when assembled and does not require further lubrication, but it is a good plan to inspect the commutator of the horn motor occasionally and clean it, if necessary. To do this, remove the horn from its bracket and the motor shell from the horn. If the commutator appears to be dirty, clean it with a dry cloth. This should be done with the horn motor running so that the commutator will be cleaned on all sides. Do not attempt to polish the commutator or brushes with oil or vaseline. These parts are designed to run without lubricant.

Springs: 1, 7, 10, 20

To lubricate the spring leaves, it is recommended that the edges and ends of the leaves be painted with engine oil every 500 miles. A small stiff brush should be used. After applying the oil, the car should not be washed until it has been driven far enough to allow the lubricant to work in between the leaves. Do not separate the leaves and insert lubricant. A certain amount of friction between the spring leaves is necessary in order to give the springs the desired characteristics.

If spring covers are used, it is not necessary to lubricate the spring leaves as directed in the preceding paragraph.

Stabilators

The stabilators, with which the car is equipped and which are for the purpose of controlling the recoil of the springs, not only need no lubrication—they *must not* be lubricated. To lubricate the stabilators would defeat their purpose just as oil or grease on the brakes would prevent them from holding.

Door Hardware

Whenever the chassis is being lubricated, the door locks and other door hardware should also be lubricated as follows:

Place a few drops of oil on each door lock plunger or striker, turning the handle back and forth so that the oil will work into the lock. Also place a drop of oil on each of the striker plates against which the strikers engage when the doors are closed. The hinge pins should also be oiled sparingly so as not to get oil on the finish.

Each door has a wedge-shaped tongue that dovetails into a receptacle on the body when the door is closed. These tongues should receive a small amount of grease or oil.

Each closed car door is also fitted with a check at the top which limits the outward movement of the door. A small amount of grease should be applied to the pin that slides in the slot at the top of the door.

CHAPTER IV

Care of Body

Care of Finish When New

On cars finished with varnish, more careful and more frequent attention is necessary when the car is new than after the varnish has hardened. Particular care should be taken to keep mud from the body and hood for the first few weeks. Even after the varnish has hardened, mud should not be permitted to remain on the finish over night or long enough to dry. If it is not possible to wash the car thoroughly before putting it away for the night, flush it off and then thoroughly wash the car the next morning. Mud permitted to remain on the car until it has dried is not only difficult to remove, but stains and dulls the finish.

The same degree of caution, although commendable, is not as necessary on cars finished with Duco, because Duco hardens much more quickly than paint or varnish.

Washing Varnished Cars

Use clean water and plenty of it. Do not use water containing alkali. In parts of the country where the regular water supply contains alkali, use rain water.

Do not use hot water as it destroys the lustre. The temperature of the water should be between 40 and 60 degrees Fahrenheit. Do not wash the hood while it is hot, because the effect on the finish is the same as washing it with hot water. Unless the hood is allowed to cool before washing, the lustre will soon disappear.

If a hose is used in washing, do not have pressure greater than will carry the water six inches beyond the end of the hose. Water under higher pressure drives the grit and dirt into the varnish. It is best not to use a nozzle.

Wash the chassis first, going over the under sides of the fenders, the wheels, and the running gear with water flowing gently from the hose. This will flush off most of the mud and dirt.

If it is necessary to use soap to remove road oil from the under side of the fenders, or machine oil or grease from the chassis, use a good automobile soap dissolved in a pail of water and apply the soapy solution with a sponge.

Do not let this soapy solution remain on the finish more than two or three minutes, but immediately wash it off thoroughly with a soft carriage sponge.

After washing the chassis, begin at the front of the car, and flow water from the hose upon the body, hood, and upper surfaces of the fenders. This will soften the accumulation of road dirt, removing most of it. Then go over the car again and remove all dirt by rubbing lightly with a soft wool sponge, at the same time applying an abundance of water from the hose. The sponge, which should be kept exclusively for the body, hood, and upper surfaces of the fenders, should be rinsed frequently in clean water to remove any grit.

After the washing is completed, squeeze the sponge as dry as possible and pick up all water from crevices. Then thoroughly wet a clean soft chamois, wring it as dry as possible, and dry the finish. Be sure and use a chamois that has not been used on the chassis. Rinse the chamois and wring it out frequently. Do not rub the finish or apply more pressure than is necessary to dry off the surplus water. The remaining water will evaporate quickly, leaving the finish in good condition.

If it is desired to chamois the wheels and chassis, and they have become dry, wet these parts with clean water and then wipe them. Be sure to use a separate chamois for the chassis. The chamois that has been used on the body should be saved for the body exclusively.

Do not use soap, gasoline, kerosene, or anything of similar nature on the finish. Such materials attack the finish.

Washing Duco

Although it is not necessary in washing cars finished in Duco to use the same degree of care as in washing varnished cars, nevertheless the same general directions should be followed.

Cleaning Windows

Do not clean the window glass with preparations that may contain harmful ingredients. Use only cleaning compounds that are known to have no destructive effects on highly polished glass.

Cleaning Upholstery

To keep the upholstery in closed cars in the best condition, it should be cleaned thoroughly at least once a month with a whisk broom and vacuum cleaner. Dirt and grit accumulating in the fabric wear it out faster than use.

Spots on the upholstery may be cleaned with any good dry cleaner. When the cleaner has thoroughly evaporated, apply a hot flatiron wrapped in a wet cloth. Steaming the fabric and rubbing lightly against the nap will raise the nap to its normal position.

CHAPTER V

Care of Tires

Each tire maker publishes a booklet with instructions for care and repair of tires. Every motorist should provide himself with one of these and thoroughly familiarize himself with the contents. The suggestions here apply to pneumatic tires in general.

Three-fourths of so-called "tire trouble" is the result of misuse. We give here some suggestions regarding the more important points of the care of tires.

Result of Under-Inflation

Under-inflation causes a tire to flatten out under load. This causes the side walls to bend sharply as the tire revolves. The result is the breaking of the side walls. An under-inflated tire is susceptible to bruise, broken cords and blow-out.

Result of Improperly Aligned Front Wheels

Running a car with the front wheels out of alignment causes rapid tread wear. This usually affects both tires similarly, although sometimes only one tire is affected. An incorrect adjustment of the front axle parallel rod or a bent steering arm is responsible for the condition. Unless the wheels are in proper alignment the treads of the front tires will wear away in a remarkably short time.

Neglect of Small Cuts

If cuts extending to the cords are neglected deterioration and blistering of the tire tread is the result. It is unnecessary to remove a tire to treat small cuts of this nature. Tire companies furnish a plastic compound for filling cuts. This prevents moisture and dirt from getting in. If a cut is large, it should be vulcanized at once.

Result of Improperly Adjusted Tire Chains

Tires are sometimes badly damaged through the use of tire chains which are incorrectly adjusted or which are fastened to the spokes of the wheel holding the chains tightly in place.

The least injury results when chains are applied loosely leaving play enough to permit them to work around. The wear on the tire is thus distributed evenly. Probably the greatest amount of injury comes from using chains unnecessarily on paved streets.

Result of Sudden Application of the Brakes

The sudden application of the brakes resulting in sliding the wheels causes the treads to wear away in spots. A tire will give away very rapidly under this severe treatment.

Additional Suggestions

The tires are constructed for the purpose of carrying up to certain maximum loads and no more. It should be realized that overloading a car beyond the intended carrying capacity is sure to materially shorten the life of the tires. Do not turn corners or run over sharp obstructions, like car tracks, at a high rate of speed. Such practice is sure to strain or possibly break the cords, with the result that the further life of the tires will be limited. Remember that most tire troubles are the result of abuse.

Avoid scraping the tires against the curb and running in ruts. This kind of wear scrapes off the rubber side wall and exposes the layers of cords to dirt and moisture, which soon starts to rot the cords.

In turning in a narrow street, avoid striking the curb.

If a tire goes flat without any indication of injury to the tire, see that the valve is not leaking. A little moisture on the tip will show bubbles if the air is escaping.

In case of puncture, the car should be stopped at once and the tube repaired or replaced, or the tire replaced by the extra one. The tire should also be examined carefully and the cause of the puncture ascertained and the nail, glass or whatever it may be, should be extracted. Before replacing the tire on the rim, examine the inside of the casing to see that the cause of the puncture is not still protruding. It is also advisable to look over the outside of the tires frequently and take out any pieces of glass or other particles which may have become imbedded in the casing.

Don't run in ruts or car tracks; the sides of a tire will soon wear out under such treatment. Avoid large stones or other obstructions in the road. To hit one of these may break the carcass even though no external injury be visible.

The garage floor should be kept free from oil or gasoline. The tires on a car left standing on a grease-covered floor deteriorate quickly, the natural enemies of rubber being oil and gasoline. These destroy the nature of the rubber, rendering it soft, so that it cuts and wears away quickly.

If the car is not used during the winter, it is better to remove the tires from the rims, keeping casings and tubes in a fairly warm atmosphere away from the light. It will be better to slightly inflate the tubes, as that keeps them very nearly in the position in which they will be used later on. If the tires are not removed and the car is stored in a light place, it will be well to cover the tires to protect them from the strong light, which has a deteriorating effect on rubber.

CHAPTER VI

Storing Car

If the car is not to be used for a period of several months, it should be protected from deterioration during the period when it is not in use by carefully preparing it for storage.

Engine

To prepare the engine for storage, proceed as follows: Run the engine until opening of the radiator shutters indicates that the engine is warm. This may be done by driving on the road or by running the engine idle. In the latter case, care should be taken that there is sufficient ventilation to avoid injury from carbon monoxide poisoning. (See page 18.)

After the engine is warm, place the car where it is to be stored and stop the flow of gasoline to the carburetor by removing the gasoline tank filler cap, thus relieving the air pressure. As soon as the engine starts to slow down, raise the polished aluminum cap on top of the carburetor and inject three or four tablespoonfuls of clean fresh engine oil into the carburetor. Injection of the oil will stop the engine.

Open the compression relief cocks by turning them counter-clockwise. Inject two or three tablespoonfuls of engine oil into each compression relief cock, and before closing the cocks crank the engine three or four revolutions with the ignition switched off. This will tend to distribute the oil over the cylinder walls. The engine should not be started again after injecting the oil. If it is started, it will be necessary to repeat the treatment.

Drain the cooling system by opening the drain valve in the water pump.

Storage Battery

If the car is to be stored during the winter, the storage battery should have special treatment in order to protect it against freezing.

Shortly before the car is used for the last time, distilled water should be added to bring the level of the solution up to the bottom of the fillers. (See page 63.) After the water added has had an opportunity to mix thoroughly with the acid solution, the specific gravity should be taken with a hydrometer. If the specific gravity of the solution is above 1.270 there will be no danger of the acid solution freezing. If, however, the specific gravity is below 1.270, the battery should be removed and charged. *Unless the battery is fully charged or nearly so it is probable that the acid solution in the battery will freeze and cause extensive damage.*

It is important that one of the battery leads should in all cases be disconnected during storage as a slight leak in the wiring will discharge the battery

and lower the specific gravity to the point where the solution may freeze.

If possible, the storage battery should be removed and charged from an outside source every two months during the storage period.

Tires

During storage of the car, it is best to remove the tires *from the rims* and to keep the casings and tubes in a fairly warm atmosphere away from the light. The tubes should be inflated slightly after the tires have been removed.

If it is not convenient to remove the tires from the car and the car is stored in a light place, cover the tires to protect them from strong light, which has a deteriorating effect on rubber.

The weight of the car should not be allowed to rest on the tires during the storage period. If tires are not removed, the car should be blocked up so that no weight is borne by the tires. The tires should also be partly deflated.

Body and Top

A cover should be placed over the entire car to protect it from dust. In storing an open car, the top should be up.

Taking Car Out of Storage

In putting into use again a car that has been stored, it is advisable, unless the storage battery has been removed and charged at periodic intervals, to remove the battery from the car and give it a fifty-hour charge at a four-ampere rate. If the battery has received periodic charges, or if the specific gravity is above 1.200, simply add distilled water to the proper level and connect the leads. If there is a greenish deposit on the terminals of the battery, remove this with a solution of bicarbonate of soda (common cooking soda) and water. Do not allow any of this solution to get into the battery.

Before starting the engine, drain the oil from the oil pan and remove and clean the oil pan and screen. After reinstalling the oil pan, add eight quarts of fresh engine oil. Fill the cooling system, being sure to use anti-freezing solution in freezing weather. Open the compression release cocks and inject two or three tablespoonfuls of engine oil into each cylinder. Close the compression release cocks, and, with the ignition switched off, crank the engine a few seconds with the starter to distribute the oil over the cylinder walls.

Start the engine in the usual manner. As soon as the engine starts, immediately let the carburetor enriching button go as far forward as possible without causing the engine to stop or slow down materially and then open the throttle until the ammeter reads approximately 10 with all lights switched off. While the engine is running lift the aluminum cap on top of the carburetor and inject from two to three tablespoonfuls of engine oil into the carburetor. It is a good plan to run the car outdoors as soon as this has been done. Release the carburetor enriching button entirely as soon as the engine is warm enough to permit it.

PART III

GENERAL INFORMATION

CHAPTER I

Engine

Important Features of Construction

The Cadillac engine is of the water-cooled, four-cycle type with two L-head cylinder blocks of four cylinders each, placed at an angle of ninety degrees between the blocks. The cylinders of one block are directly opposite those of the other block, the lower end of each connecting rod on the left-hand side working in the forked end of the connecting rod opposite. This construction makes the engine shorter and more compact than any other type, the smooth running being largely the result of the short, rigid crankshaft.

The crankshaft has four throws or cranks, three main bearings, and carries on its front end the sprocket by which the camshaft is driven. The camshaft has six bearings, and is driven by the crankshaft through a silent chain in which the proper tension is maintained by an automatically adjusted idler gear. The camshaft has sixteen cams, each operating one valve through a camslide in which is carried a roller.

The fan is mounted on the front end of the generator shaft, which is driven by the camshaft through a special V-shaped belt.

The water pump and oil pump are driven by a cross shaft, which in turn is driven by a spiral gear on the crankshaft. The water pump is at the left-hand end of the cross shaft and the oil pump at the right-hand end.

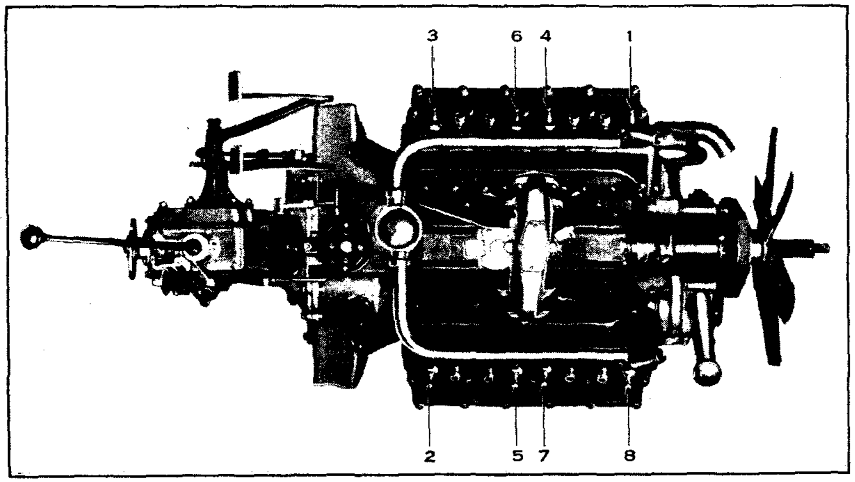

FIGURE 13. ***Firing order***

The engine base is the aluminum crankcase that supports the cylinder blocks and carries the crankshaft and camshaft bearings. The crankcase is supported at the rear end by two arms which are cast integrally with the crankcase and which are bolted to brackets on the frame. The front end of the engine is supported on a cross member of the frame below the radiator.

General Principle of Gasoline Engine

The production of power by the engine may be described briefly as follows:

Gasoline is fed by air pressure from the tank to the carburetor where it is mixed with air in the proper proportions to form an explosive vapor or gas. This gas is then drawn through the intake manifold and inlet valves into the cylinders of the engine where it is compressed by the pistons and then ignited by electric sparks. The pressure of the resulting explosions acting on the pistons produces the power.

The series of operations through which the pistons and valves of each cylinder must go to produce one power stroke is called a "cycle" and for such a cycle four strokes of each piston and two revolutions of the flywheel are required. The four strokes, each of which has a different function, take place in the following order:

Suction Stroke—The suction stroke commences with the piston at its highest point in the cylinder and with the inlet and exhaust valves closed. As soon as the piston starts to descend, the inlet valve immediately opens and a charge of gas is drawn from the carburetor through the valve opening into the space above the piston.

Compression Stroke—When the piston starts upward again after completing the suction stroke, the inlet valve closes. The gas, which has no means of escape, is compressed, the maximum compression being reached when the piston is at the top of its stroke.

Power Stroke—At the completion of the compression stroke, a spark, timed to occur at exactly the right instant, jumps between the electrodes of the spark plug and ignites the compressed charge of gas. The heat that results from the rapid combustion causes the pressure of the confined gas to rise almost instantaneously to several times its pressure before the explosion. This pressure, exerted on the piston, forces the piston down and produces the impulse which is transmitted by the connecting rod to the crankshaft, causing the crankshaft to revolve.

Exhaust Stroke—Just before the piston reaches the end of the power stroke, the exhaust valve opens. It remains open while the piston travels upward on the fourth, or exhaust stroke, driving the burned gas from the cylinders. By

the time the piston has reached its highest point it has forced out the burned gas and the exhaust valve closes. This completes the four strokes of the cycle and the piston is ready to draw in a new charge and to repeat the cycle.

Firing Order

Such a cycle as has been described takes place in each of the eight cylinders but no two pistons are at the same point in the cycle at the same time. In the Cadillac eight-cylinder V-type engine the impulses of the eight pistons are so timed that a power stroke is begun every quarter-turn of the crankshaft. The crankshaft thus receives four overlapping power impulses every revolution.

The order in which the eight cylinders fire is indicated by the numbers in Fig. 13. These numbers are the numbers used in marking the flywheel for valve and ignition adjustments.

CHAPTER II

Gasoline System

THE general arrangement of the gasoline system is illustrated in Fig. 14. There are two sets of tubes, one for air and one for gasoline.

The air tubes connect the automatic compressor at the left-hand front end of the engine, the hand compressor on the instrument board, and the air pressure relief valve, to the top of the gasoline tank. As described on page 9, the automatic and hand compressors are for the purpose of furnishing the necessary pressure to force the gasoline to the carburetor. The air pressure relief valve, which is fastened to the left-hand side of the frame under the front floor boards, prevents excessive pressure that might accompany the use of high-test or casing-head gasoline.

The gasoline line starts at the bottom of the gasoline tank and runs to a combination settling chamber and strainer from which tubes lead to the pressure gauge on the instrument panel and to the carburetor.

Settling Chambers and Strainers

The combination settling chamber and strainer in the gasoline line is attached to the left-hand side of the frame under the front floor boards. There is also a settling chamber at the bottom of the gasoline tank and a strainer at the point where the gasoline pipe enters the carburetor.

It is recommended that both settling chambers be drained and both strainers be cleaned at the beginning of freezing weather and at least

every 4,000 miles during the winter season. An accumulation of water at these points might freeze and prevent gasoline from flowing to the carburetor.

Before removing either settling chamber drain plug, or the strainer at the carburetor, first relieve the air pressure by removing the gasoline tank filler cap. Be sure there is no fire near.

To drain the settling chamber at the gasoline tank, remove the drain plug at the rear of the chamber as shown in Fig. 14. It is necessary to drain out only enough gasoline to flush the chamber.

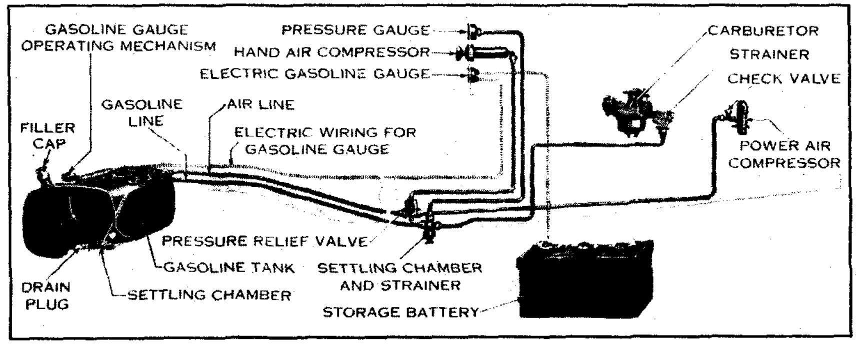

FIGURE 14. ***Gasoline system***

To drain the settling chamber in the gasoline line, remove the drain plug in the bottom of the chamber. While the plug is removed, the strainer, which is attached to the plug, should be carefully cleaned of any accumulated matter.

To clean the strainer at the carburetor, remove the six screws that fasten the cap on the strainer. Remove and clean the three gauze discs. In reinstalling the discs, be sure to place them in their original positions. The two discs with fine mesh gauze should be installed first.

Carburetor

The carburetor is correctly adjusted when the engine is assembled and, unless tampered with, should not require readjustment. It is unnecessary to change the adjustment for changes in season, weather or altitude.

Good carburetor action cannot be expected until the engine is thoroughly warmed. Imperfect carburetor action while the engine is cold does not indicate that the carburetor requires adjustment.

If adjustment of the carburetor seems to be necessary, it should, if possible, be made by an authorized Cadillac maintenance station. The adjustment should not be attempted by one unfamiliar with it.

CHAPTER III

Cooling System

Water Circulation

The Cadillac engine is cooled with water circulated through the jackets of the cylinder blocks by a centrifugal pump. This pump is mounted on the left-hand side of the engine near the front and is driven by a cross-shaft, which in turn is driven by a spiral gear on the crankshaft. The pump draws cold water from the bottom of the radiator and delivers it to a connection on the left-hand side of the engine where the stream divides, half going to the left-hand cylinder block and half through a passage in the crankcase to the right-hand cylinder block. From the front end of each cylinder head an outlet pipe with hose connection carries the heated water to the top of the radiator.

Radiator and Shutters

The radiator consists of an upper tank and a lower tank connected by water passages around the outside of which air is circulated by the fan. The water passages are so constructed that they expose a large amount of surface to the air, which cools the water as it passes from the upper to the lower tank.

Until the water in the cylinder blocks and radiator is warm, the cooling effect of the radiator is not only unnecessary, but is undesirable. The radiator is accordingly provided with shutters that prevent air from circulating around the water passages until the engine becomes warm. The shutters are pivoted vertically and are controlled automatically by a powerful thermostat contained in the upper tank of the radiator.

When the engine is cold, the shutters are held tightly closed and circulation of air is prevented. The water from the cylinders consequently undergoes little change in temperature as it flows through the radiator and the engine quickly becomes warm. As soon as the water entering the upper tank of the radiator reaches the temperature at which the engine operates best, the shutters are forced open by the thermostat and air begins to circulate. The resulting cooling effect checks the rising temperature of the water, which is thereafter maintained uniformly at the temperature of most efficient operation as long as the engine is running.

Filling and Draining the Cooling System

Except during freezing weather, water should be used in the cooling system. In freezing weather, a suitable anti-freezing solution such as those described on page 34 must be used.

To add liquid to the cooling system or to refill the cooling system after it has been drained, remove the radiator filler cap and pour the liquid in through the filler.

To drain the cooling system, open the drain valve at the bottom of the water pump by turning the hexagonal end of the valve counter-clockwise.

Cleaning the Cooling System

The cooling system should be drained and flushed every two or three months. This can be done in the following manner:

Run the engine until the opening of the radiator shutters indicates that the engine is warm. Stop the engine and immediately open the water pump drain valve.

After the liquid has drained off, refill the cooling system with hot water and repeat the operation described above. If in draining the second time the water is very dirty it may be advisable to repeat the flushing operation a third time, placing one or two handfuls of sal-soda in through the radiator filler. The sal-soda must not be permitted to get on the finish of the hood or radiator. If sal-soda is used, the cooling system must be drained and flushed again before refilling for use.

CHAPTER IV

Electrical System

The electrical system comprises the following units: The generator or source of electrical energy; the storage battery, which stores the current generated; the starting motor, which cranks the engine for starting; the ignition system; the lamps and other devices using electrical current; the ammeter; the ignition and lighting switch; and the circuit breakers, which protect the system. The wiring system connecting these units is the single wire or grounded type, the engine and frame forming one side of the electrical circuit.

Generation of Current

Generator

The generator is attached to the crankcase at the front of the engine and is driven by a specially made V-shaped belt from a pulley on the front end of the camshaft.

At very low engine speeds the voltage of the current generated is not sufficient to provide current for lighting or ignition and the battery is then the source of current. To prevent the battery at such times from discharging through the generator, a cut-out relay on the generator automatically opens the circuit whenever the generated voltage drops below the battery voltage. At approximately eight miles per hour the generated voltage is sufficient to operate the cut-out, which then closes the circuit between the generator and the battery and lighting circuits. If no lights are switched on, the entire output of the generator, less the current required for ignition, flows to the battery for recharging it. If all the lights are on, the generator will not generate sufficient current to start charging the battery until a speed of twelve to fifteen miles per hour is reached.

The amount of current generated by the generator at any instant is the ammeter reading (with all lights off) plus the current for ignition, which is two to three amperes. The generator output reaches its maximum at speeds between twenty and twenty-five miles per hour. This maximum should not exceed eighteen amperes, which is equivalent to an ammeter reading of sixteen when all lights are off.

Do not put oil on the commutator of either the generator or the starting motor.

Ammeter

The ammeter on the instrument board indicates the amount of current flowing to or from the battery except when the starter pedal is down and the starting motor is cranking the engine. When the engine is not running, the ammeter will indicate a current on the discharge side depending in amount upon the number of lights in use. The rate of charge or discharge when the engine is running depends upon the speed of the engine and the number of lights in use, and is equal in amount to the difference between the current generated and the current used by the lights, horn, ignition, and other electrical devices. The ammeter does not indicate the current used in cranking the engine.

If the ammeter should show "Discharge" with the car running twelve miles an hour or more and with no lights in use, it is an indication either that the fan belt is slipping or that the generator charging rate should be readjusted. The fan belt should be inspected first, and tightened if necessary, before any attempt is made to change the generator charging rate.

Storage Battery

The storage battery is a three-cell, six-volt Exide battery made especially for the Cadillac electrical system by the Electric Storage Battery Company, of Philadelphia, Pennsylvania. The battery compartment is just forward

of the left-hand running board. The hinged cover of the compartment is provided with a lock that is operated by the switch key.

Adding Water to Storage Battery

The battery is filled with a solution from which the water slowly evaporates and fresh distilled water must be added at intervals to maintain the correct level. The level should be inspected every 500 miles and distilled water should be added to bring the level up to the bottom of the fillers.

The battery compartment has been purposely made convenient of access to facilitate the adding of water. It is important in touring that nothing be placed on top of the compartment that would interfere with this regular attention.

Each cell is provided with a filler and filler plug. To remove a filler plug, turn it as far as possible counter-clockwise and then lift it straight up. To install it, set the plug in place and turn it clockwise until tight. If a plug is lost or broken, obtain a new one and install it as soon as possible.

Nothing but pure distilled water should be added to the battery solution. In the absence of distilled water, melted artificial ice or rain water caught in

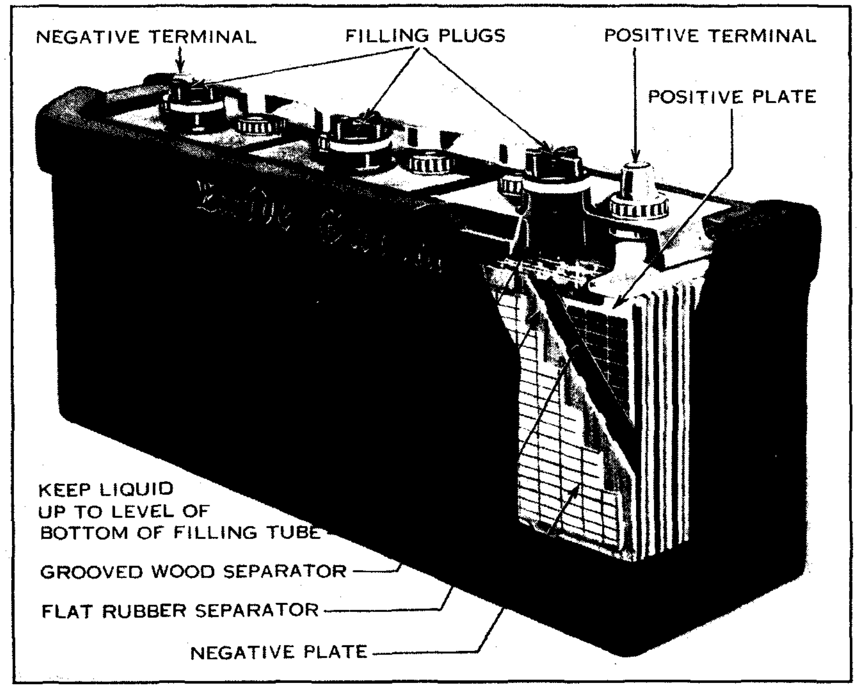

FIGURE 15. ***Storage battery***

an earthenware receptacle may be used. Hydrant water or water that has been in contact with metallic surfaces will cause trouble if used. *Acid must never be added to the battery.*

After adding water to the storage battery in freezing weather, the car should immediately be run far enough to mix the water and acid solution thoroughly. If the car is parked immediately after adding water, the water is likely to stay on top of the acid solution and may freeze, causing extensive damage.

If one cell regularly requires more water than the other, a leaky jar is indicated. A leaky jar should be replaced immediately by a new one as even a very slow leak will in time result in the loss of all the solution in the cell.

Specific Gravity of Battery Solution

As the storage battery is charged and discharged, the solution reacts chemically with the plates of the battery, the specific gravity of the solution changing as the reaction proceeds. The state of charge of the battery is thus indicated by the specific gravity of the solution. As the battery is charged, the specific gravity of the solution increases, reaching 1.270 to 1.290 when the battery is fully charged. The specific gravity of the solution decreases as the battery is discharged. A fully discharged battery has a specific gravity of 1.150 to 1.170.

A hydrometer is the instrument used to measure the specific gravity of a solution. A hydrometer syringe is a hydrometer especially designed for convenience in testing the specific gravity of the acid solution in the storage battery. A hydrometer syringe can be obtained at any battery service station.

The specific gravity of the acid solution should never be tested immediately after adding distilled water. If the solution is below the plates so that it cannot be reached with the syringe, add the necessary amount of distilled water and then drive the car for a few hours before taking the hydrometer reading.

Disconnecting Battery

Do not remove the generator or attempt any adjustment of the circuit breakers or remove any of the wires to the circuit breakers without first disconnecting the storage battery.

Never run the engine with the storage battery disconnected. Serious damage to the generator may result.

Exide Depots and Sales Offices

The Electric Storage Battery Company, whose general offices and works are at Alleghany Avenue and Nineteenth Street, Philadelphia, Pennsylvania, has representative stations in towns of any considerable size as well as sales offices and Exide battery depots in a number of the larger cities. If a storage battery is in need of attention other than recharging, it is advisable to communicate either with a Cadillac maintenance station or with the nearest Exide station or depot. Do not ship a storage battery without receiving instructions.

Starting Motor

Operation of Starter

The starting motor is a series-wound motor mounted vertically at the rear end of the crankcase directly over the flywheel. When cranking the engine, the starting motor drives the flywheel through a pinion which meshes with teeth machined on the rear face of the flywheel. The pinion is normally held out of engagement with the teeth on the flywheel. It is moved down into mesh with the teeth on the flywheel by pushing forward on the starter pedal. Further movement of the pedal operates a switch that closes the battery circuit and starts the armature revolving.

If, in pushing down the starter pedal, the ends of the teeth on the pinion strike against the ends of the teeth on the flywheel preventing further movement of the pinion, continued movement of the pedal compresses a spring. As soon as the pedal has been pushed down far enough to close the starting switch, the armature starts to revolve. The pressure of the spring then forces the pinion the rest of the way, completing the meshing operation.

An over-running clutch on the armature shaft prevents the flywheel from driving the starting motor after the engine is running under its own power and before the starter pedal is released.

Ignition

General Description

The function of the ignition system is, first, to multiply the low voltage (six to eight volts) of the storage battery and generator into voltage of sufficient intensity to cause a spark to jump between the electrodes of the spark plugs; and second, to time this spark so that ignition will take place in the proper cylinder at the proper instant.

The Delco single-spark system is used, consisting of a combination timer-distributor unit in connection with a transformer or induction coil. The primary circuit, through which flows the current from the storage battery or generator, includes the primary winding of the ignition coil; the resistance unit, which is attached to the ignition coil; the timer contact arms and points; and the condenser, which is enclosed in the timer. The secondary or

high-voltage circuit includes the secondary winding on the ignition coil, the distributor and the spark plugs.

Current flows through the primary circuit whenever and as long as either of the two sets of timer contact points is closed. Current flows through the secondary circuit for an instant only when either set of contact points is opened; but the voltage of this current is several thousand times that of the primary circuit and is sufficient to cause a spark at the spark plug.

Timer-Distributor

The timer-distributor is mounted on the top of the crankcase at the rear end and is driven by a spiral gear on the rear end of the camshaft. The shaft of the timer-distributor, which revolves at one-half crankshaft speed, carries a four-lobed cam. As this cam revolves, it actuates the two contact arms alternately, closing and opening first one set of contact points and then the the other. The circuit is thus made and broken eight times during each revolution of the cam and eight corresponding sparks are produced at the spark plugs.

In order to procure the maximum power from each explosion, ignition must occur at the right instant in relation to the position of the piston. But the ignition process, although apparently a matter of an instant, consumes a measurable amount of time. It is therefore necessary to break the circuit at the contact points far enough in advance so that actual ignition will take place in the cylinder at the correct time. The lapse of time is always the same, regardless of the speed of the engine, but because the pistons move faster when the engine is running at higher speeds than when it is running at lower speeds, the degree of advance in relation to the positions of the pistons must be increased as the engine speed increases.

This advancing of the relative timing of the spark for higher engine speeds is automatically accomplished by a centrifugal ring governor on the timer shaft below the cam. As the speed of the engine increases, the governor ring assumes a position more nearly horizontal, forcing the cam ahead of the shaft by which it is driven. This causes the contact points to open earlier, starting the ignition process earlier in relation to the positions of the pistons in the cylinders.

In addition to the automatic advance, the timer has a manual control by which the opening of the contact points may be still further advanced or still further delayed. This is operated by the left-hand lever at the steering wheel, as described on page 10.

The distributor is the mechanism that insures that the high voltage current in the secondary circuit is switched to the proper spark plug at the proper time. It consists of a rotor which is carried on the upper end of the timer shaft and which has a metal contact button electrically connected at

all times with the secondary current from the coil. As the rotor revolves, the button makes contact successively with eight metal contacts which are set in the distributor head, and which are connected to the spark plugs. The relation between the rotor and the timer shaft is such that when the cam causes one set of timer contact points to open, the rotor will be in correct position for conducting the resulting high voltage in the secondary circuit to the proper spark plug.

Spark Plugs

For best results the electrodes of the spark plugs should be .032 to .035 inch apart. If the spark plugs should be removed, it is recommended that the electrodes be inspected and adjusted to this clearance if necessary.

Lighting System

Lamp Bulbs

It is recommended that bulbs for the lamps, particularly the two-filament bulbs for the headlamps, be purchased from a Cadillac distributor or dealer. In any event bulbs should have the correct voltage and candle-power ratings. Only three different types of lamp bulbs are used in the entire lighting system. The bulbs and the lamps in which they are used are as follows:

Lamp	Voltage	Candle-power
Headlamp	6–8	21 (two-filament) (Mazda No. 1110)
Back-up light	6–8	21 (single filament)
Stop light	6–8	21 (single filament)
Inspection lamp	6–8	21 (single filament)
Parking lights	6–8	3
*Instrument lamp	6–8	3
*Rear lamp	6–8	3
Closed car dome and quarter lamps	6–8	3

Cadillac two-filament bulbs are equipped with fog caps or metal screens placed over the upper part of the bulb for the purpose of stopping direct unreflected light from the filament. It is this direct unreflected light from the filament that causes the dazzling reflection from fog or smoke. Headlamps equipped with fog caps have the appearance of being dimmed when seen from the front, but they do not perceptibly affect the useful light from the headlamps.

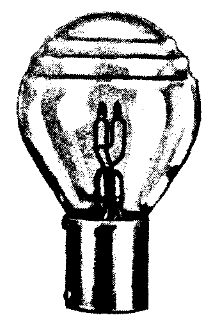

FIGURE 16
Double-filament headlamp bulb

In replacing a headlamp bulb, transfer the fog cap from the old bulb to the new, adjusting the cap to the position shown in Fig. 18. Then adjust the lamp as directed on page 69.

*Bulbs rated at 3–4 volts, such as are used in the rear lamps of some cars, must not be used in these lamps. If installed, they will burn out almost immediately.

Cleaning Headlamp Reflectors

The headlamp reflectors are plated with pure silver. Although the reflectors ordinarily require no attention, if they should require polishing extreme care must be exercised to select materials that will not scratch the silver.

Powdered dry rouge and a chamois skin are recommended. If the reflectors are tarnished, the rouge may be moistened with alcohol. Afterward, polish with a dry chamois and rouge.

The chamois used for the headlamp reflectors must not be used for any other purpose. It must be soft and free from dust.

Official Approval of Headlamps

Cadillac headlamps have been approved by practically every state in the country. For purposes of official identification, the following description of the headlamps is given:

A complete headlamp containing a parabolic reflector with axis inclined two and one-half degrees; screw adjustment on shell of headlamp to adjust the bulb filament with relation to the reflector in both axial and vertical planes to compensate for filament variation in bulbs; a cover glass containing cylindrical flutes vertically grouped in three distinct zones, the outer zone having greater refractory power and the flutes being more pronounced than

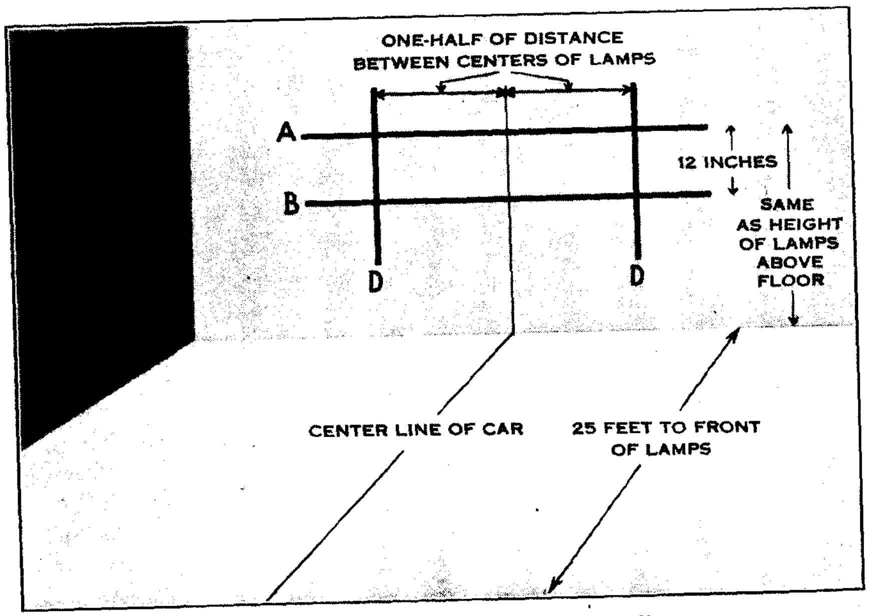

FIGURE 17. ***Marks for adjustment of headlamps***

in the center; and a cap over the upper front portion of the bulb to intercept the direct unreflected light above the horizontal.

Approval by the state authorities is conditioned upon the headlamps being adjusted to a definite standard. The directions which follow are for this standard adjustment.

Adjustment of Headlamps

Select a level spot where the car with an average load can be placed facing toward and twenty-five feet distant from a wall upon which the lines shown in Fig. 17 can be drawn. The adjustment should be made when it is dark enough so that the outlines of the projected beams are plainly visible.

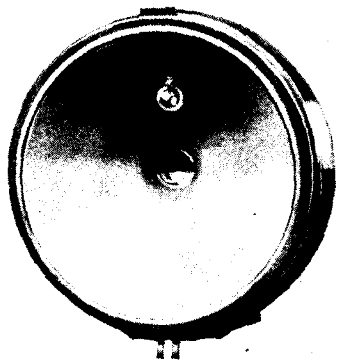

FIGURE 18. ***Headlamp fog cap***

Locate a point on the wall directly opposite the front of the car by sighting through the center of the rear curtain toward the radiator cap. Draw a vertical line on the wall through this point: Measure the distance between the centers of the headlamps, and draw two vertical lines "D" parallel to the center line and distant from it by an amount equal to one-half of the distance between the headlamps. Measure the distance of the headlamp centers above the ground or floor and draw the horizontal line "A" at the same elevation. Draw the line "B" twelve inches below the line "A."

Upper Adjusting Screw—The first adjustment should be made with the lower beam on, that is, with the lighting switch lever in the third position. Cover the headlamp that is not being adjusted, or disconnect the plug connector that supplies current to the lamp. Remove the headlamp door. Make sure that the fog cap is properly placed on the bulb as shown in Fig. 18.

The adjusting screws, of which there are two, are in the back of the headlamp shell. Turn the upper or large adjusting screw until the light spot on the screen is the smallest that can be obtained.

Loosen the nut on the headlamp support and aim the headlamp so that the top center of the spot of light is at the intersection of lines "B" and "D" as shown in Fig. 20a. When the lamp has been properly aimed, tighten the nut securely. *(Continued on page 71)*

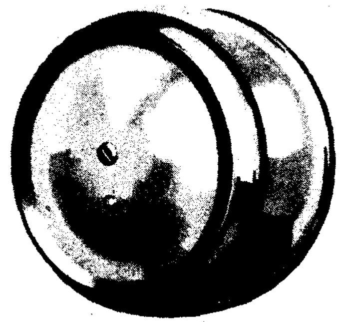

FIGURE 19
Headlamp adjusting screws

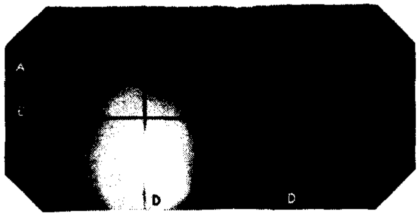

Figure 20a
Left-hand lower beam without lens.

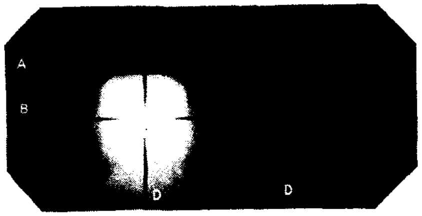

Figure 20b
Left-hand upper beam without lens.

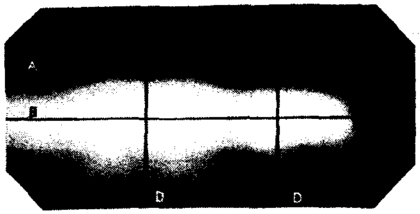

Figure 20c
Left-hand upper beam with lens.

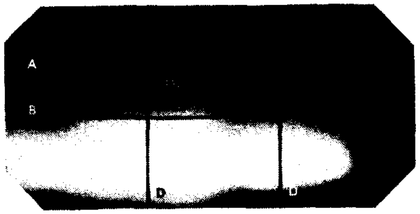

Figure 20d
Left-hand lower beam with lens.

Figure 20e
Both upper beams with lenses.

Figure 20f
Both lower beams with lenses.

FIGURE 20. *Beams from headlamps*

Lower Adjusting Screw—Turn the lighting switch to the fourth position so that the upper beam is on. Adjust the lower or small screw until the top of the beam is at the intersection of lines "A" and "D" as shown in Fig. 20b. The beam should be of approximately the same proportionate size as shown, and the greatest intensity of the beam should be near the top of the spot and at its center. If the lower beam is now switched on, it should appear as in Fig. 20a and should be of the same proportionate size with the greatest intensity near the bottom, rather than at the center of the spot.

Install the door with the lens. If the lens is for any reason removed from the headlamp door, it should be replaced with the cylindrical flutes vertical and the smooth side facing out.

With the lens in place, the upper beam from the left-hand headlamp should appear as in Fig. 20c. The pattern of the lower beam from the left-hand headlamp should appear as in Fig. 20d.

After adjusting the one headlamp, repeat the adjustment on the other. When both headlamps have been adjusted and both headlamp doors are in place, the combined light from both headlamps should appear as in Fig. 20e when the upper beams are on, and as in Fig.20f when the lower beams are on.

CHAPTER V

Clutch and Transmission

Clutch

The Cadillac clutch is a dry multiple-disc clutch with eight smooth driven discs and seven driving discs faced with friction material composed largely of asbestos. The driving discs have gear teeth machined on their outer circumference to engage with teeth machined internally in the flywheel. The driven discs have gear teeth machined on their inner circumference to mesh with teeth machined on the outside of the clutch hub, which in turn drives the transmission. Except when the clutch pedal is pushed down, the clutch discs are pressed together by a spring having a pressure of 300 lbs. The driven discs then revolve with the driving discs and the engine, if running, drives the transmission.

When the clutch pedal is pushed down to disengage the clutch a forked lever presses against the clutch spring through a ball thrust bearing, releasing the discs from the pressure of the spring. The discs then separate and the driven discs rotate independently of the driving discs.

The clutch itself requires no adjustment or attention other than lubrication of the clutch thrust bearing as directed on page 45. Adjustment of the clutch release rod, however, may be necessary after the car has been driven some distance.

Adjustment of Clutch Release Rod

As described on page 15, the clutch pedal is purposely given about one inch of "lost motion." That is, the clutch does not begin to disengage until the pedal has been moved down about an inch from its released position. This lost motion is necessary in order to allow the clutch discs to come closer together as the facings are reduced in thickness. The lost motion gradually decreases as the clutch is used and eventually will be all taken up. Before this happens, the clutch release rod must be readjusted to restore the lost motion; otherwise, the clutch discs will slip and the engine will not drive the car.

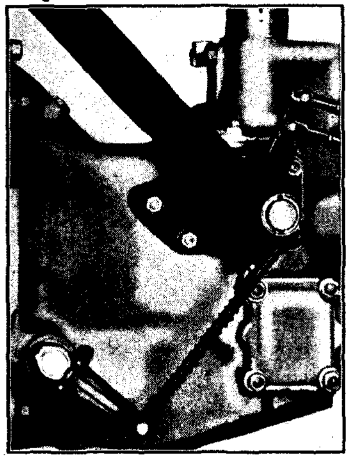

FIGURE 21
Adjustment of clutch release rod

To make the adjustment unscrew the nut "A" (Fig. 21) until the clutch pedal has a movement of one inch without starting to disengage the clutch.

The nut "A" must be turned a half-turn at a time.

Transmission

The purpose of the transmission is to provide a means for varying the ratio and direction of the rear axle speed in relation to the engine speed. Three things are accomplished by doing this: First, the engine is enabled to drive the car backwards. Second, the engine is permitted to revolve fast enough to develop the power necessary for starting and for driving the car at extremely low speeds. Third, the turning effort of the engine is multiplied so that it may be sufficient for climbing steep hills and pulling through deep sand and mud.

The Cadillac transmission is known as the selective, sliding gear type. It has three speeds forward, of which one is direct drive, and one speed in reverse. Selection of the various speeds is accomplished by movement of two shifter gears, "A" and "D," (Fig. 22) which are controlled by the transmission control lever. The positions of the gears corresponding to the five positions of the control lever as illustrated in Fig. 2 are as follows:

Neutral—When the control lever is in neutral position, the shifter gears "A" and "D" are in the positions shown in Fig. 22; that is, they are not in mesh with any of the other gears.

Low—When the control lever is moved from neutral to low, the gear "A" is moved forward into mesh with gear "R." Power is then transmitted from the clutch shaft "Z" to the transmission main shaft "C" through gears "E," "U," "R" and "A." The ratio of engine speed to propeller shaft speed in low is approximately 3 to 1.

Intermediate—When the control lever is moved from low to intermediate the gear "A" is first returned to its neutral position and gear "D" is then moved back into mesh with gear "S." Power is then transmitted through gears "E," "U," "S" and "D." The ratio of engine speed to propeller shaft speed in intermediate is approximately 1.7 to 1.

High—When the control lever is moved from intermediate to high, the gear "D" is first moved forward out of mesh with gear "S" and then farther forward until teeth cut internally in a recess in gear "D" engage teeth on the

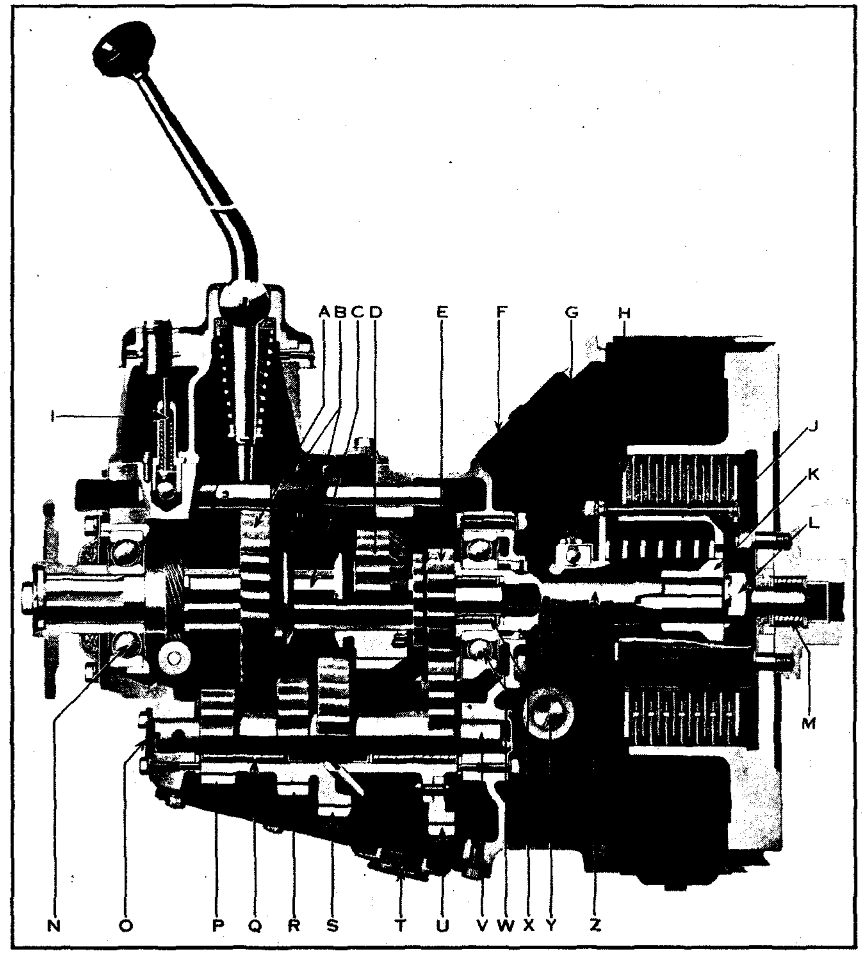

FIGURE 22. ***Sectional view of transmission***

extreme end of gear "E." The drive is then direct from the clutch shaft to the transmission main shaft without reduction.

Reverse—When the control lever is moved from neutral to low, the gear "A" is moved back into mesh with an idler gear, not shown in Fig. 22, which is at all times in mesh with gear "P." Power is then transmitted through gears "E," "U," "P," the reverse idler gear, and gear "A." The interposition of the idler gear reverses the direction of rotation. The ratio of engine speed to propeller shaft speed in reverse is approximately 3.8 to 1.

CHAPTER VI

Brakes

General Description

There are three pairs of brakes: the rear wheel external brakes, the rear wheel internal brakes, and the front wheel brakes, which are also internal. The rear wheel external brakes and the front wheel brakes are operated by the brake pedal and comprise the foot brakes. The rear wheel internal brakes are operated by the hand lever and are used principally for locking the rear wheels when the car is standing.

The purpose of the front wheel brakes is to add to the braking ability as much as is consistent with safety. It is not desirable to attempt to secure the maximum possible braking effect on the front wheels for the reason that, when a front wheel slides without rotating, it has no power to change the direction of the car.

Cadillac front wheel brakes are accordingly designed so that when the foot brakes are applied while the steering wheel is turned to the right or left, only the brake on the inside wheel is effective and the brake on the outer wheel is released, leaving the outer wheel free to rotate. It is thus impossible to lock both front wheels even on slippery pavement unless the car is moving straight ahead. If, while the car is moving straight ahead on slippery pavement, the brakes should be applied with sufficient pressure to lock both front wheels and it then becomes necessary to make a turn, the car will instantly respond because the brake on the outer wheel is automatically released as soon as the steering wheel is turned.

Adjustment

Each foot brake has provision to compensate for wear on the brake lining. The adjustment by which this compensation is effected is at the brake itself

rather than in the connections. Cadillac brakes must *not* be adjusted to compensate for wear by adjusting the pull rods or stop screws.

As described on page 16, the Cadillac two-stage brake pedal automatically notifies the driver when the foot brakes require adjustment. It is recommended that the car be taken to a Cadillac maintenance station for attention when necessity for adjustment is thus indicated.

If, however, the adjustment is neglected and as a result the pedal touches the floor boards before the brakes are fully applied, an emergency adjustment can be made by screwing down the adjusting nuts "F" (Fig. 23) one or more half-turns. The nuts "F" lock every half-turn and must be turned a half-turn at a time. The nuts "F" must not be turned down far enough to cause the brakes to heat and they must be turned down the same amount on both sides.

If adjustment of the nuts "F" is not sufficient, or if the occasion gives opportunity for a complete adjustment, this adjustment should be made as follows:

Loosen the three locking nuts "B," "D" and "N" (Fig. 23) and screw the three stop screws "A", "C" and "M" away from the brake band. Observe the clearance between those parts of the brake lining nearest the hexagonal

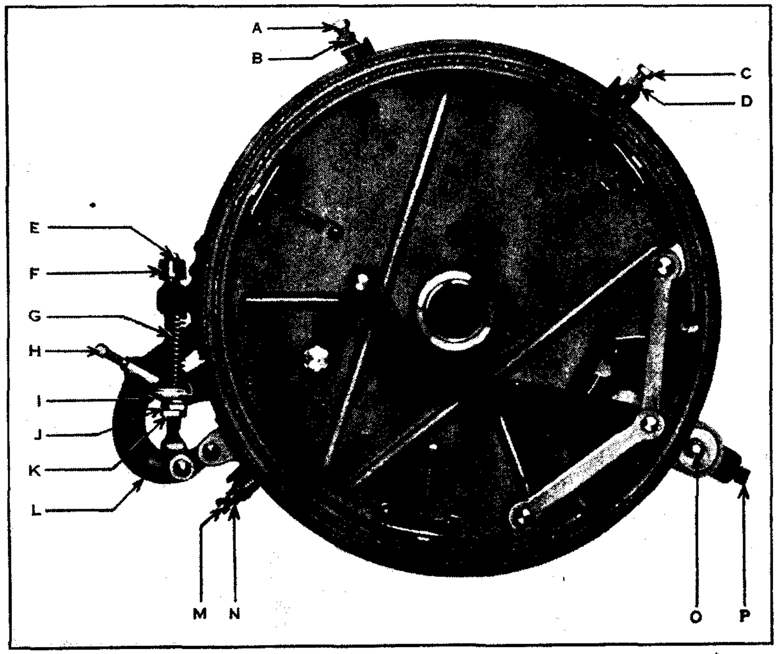

FIGURE 23. ***Rear wheel brakes***

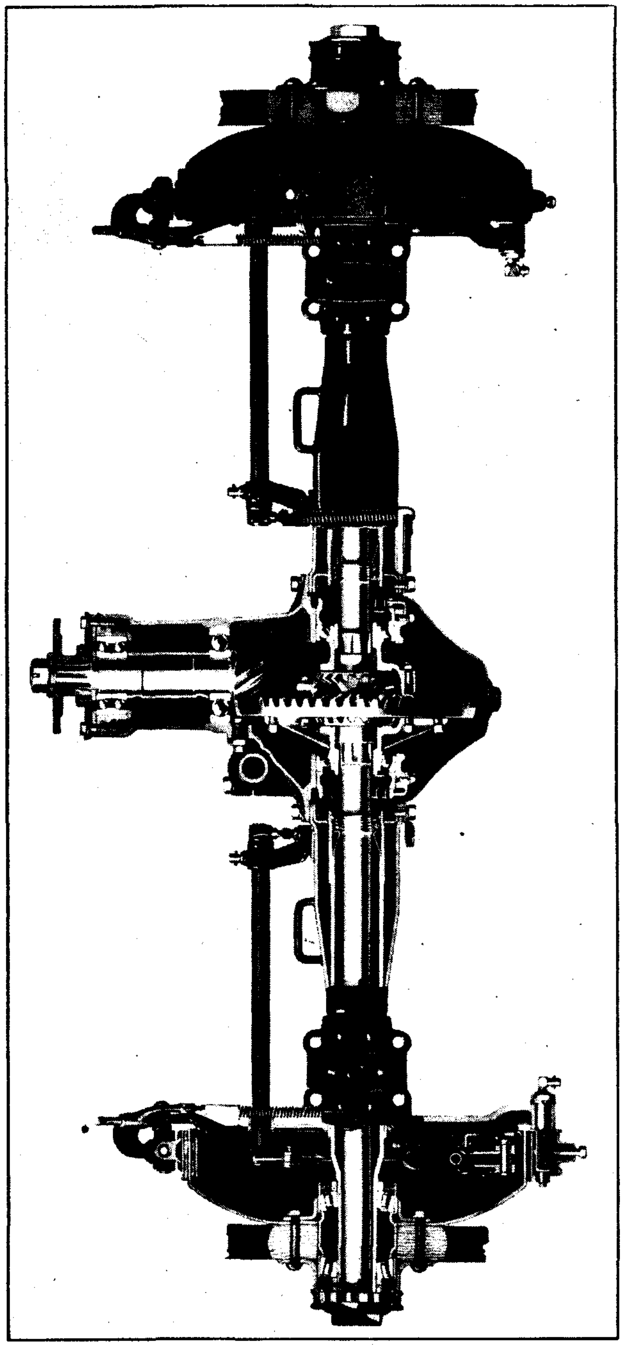

FIGURE 24. *Sectional view of rear axle*

head screw "P" and the brake drum. This clearance should be .030 to .035 inch. If the clearance is not correct, adjust the screw "P" until it is. The screw "P" is kept from turning of its own accord by a lock washer which turns with the screw and locks every half-turn. It must accordingly be turned a half-turn at a time.

Loosen the locking nuts "K" and adjust the nuts "J" and the screws "M" so that there is a uniform clearance of .030 to .035 inch between the *lower* part of the brake lining and the brake drum. To decrease the clearance between the brake lining and the drum, screw the nut "J" farther down on the yoke bolt "E."

Adjust the nuts "F" and the two stop screws "A" and "C" so that there is a uniform clearance of .030 to .035 inch between the *upper* part of the brake lining and the drum.

After making the foregoing adjustments so that there is a uniform clearance of .030 to .035 inch between the drum and the lining, check the results by applying the brakes, and measuring the travel of the upper end of the lever "L." This travel should not be less than 7/8 inch. If the end of the lever "L" travels less than 7/8 inch in moving from the released position to the applied position, readjust one or all of the nuts "F" and "J" and the screws "P," "A," "C" and "M" to increase the clearance slightly, keeping the clearance uniform at all points around the drum. Do not fail to tighten the locking nuts "B," "D," "N" and "K" when the adjustment has been made.

Do not change the adjustment of the screw "H." This screw is properly set when the car is assembled and does not require readjustment in taking up wear on the lining.

Inasmuch as the brakes are designed so that the greater proportion of the braking load is taken by the rear wheel brakes, adjustment of the front wheel brakes is usually not necessary until the rear wheel foot brakes have been adjusted several times. Before the limit of adjustment for the rear wheel foot brakes has been reached, the car should be taken to a Cadillac maintenance station for adjustment of the front wheel brakes.

Adjustment of the hand brakes is unnecessary. The hand brakes retain their effectiveness without adjustment throughout the life of the lining.

All joints in the brake connections should be oiled at regular intervals. The brakes should also be tested occasionally to be sure that they are in serviceable condition. When the brake band linings have worn so that further adjustment is impossible, they can be renewed.

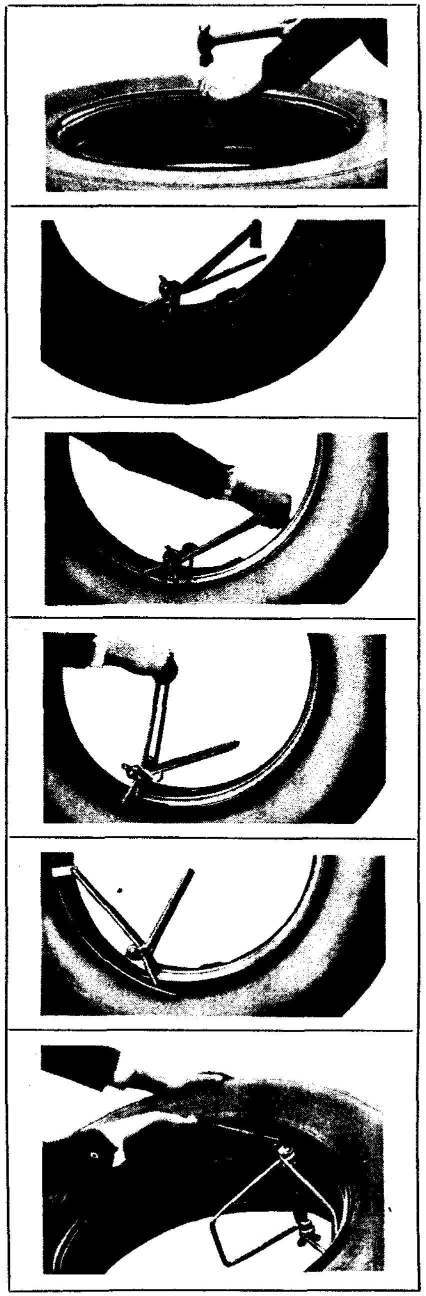

Figure 25a

Lay the tire and rim flat on the ground and drive out the locking pin, using the hammer and punch in the tool kit. *Be sure there is no air in the tire.*

Figure 25b

Apply the rim tool, which is furnished in the tool kit, as shown in the illustration. Note that there are two pairs of holes in the rim near the split and that one pair is nearer the split than the other. The short end of the tool must be inserted in the holes nearer the split and the long end in the holes farther from the split. Clamp the tool firmly in position by tightening the wing nut.

Figure 25c

Grasp the two handles and squeeze them together, spreading the ends of the rim farther apart at the split. Then pull both handles together toward the other side of the rim until one end of the rim is forced up and over the other end. If the rim does not pull over evenly on both sides a screw driver can be used to advantage to pry up the end of the rim.

Figure 25d

Release the short handle of the tool but continue pulling the long handle until it is against the rim.

Figure 25e

Engage the hook that is attached to the long handle over the edge of the rim to hold the rim in the collapsed position.

Figure 25f

Lay the rim and tire on the ground with the hook and wing nut *face down* and remove the tire from the rim by working it off first on the side where the rim is split. The handle of the large wrench is flat to serve as a prying tool.

FIGURE 25. ***Removing tire from rim***

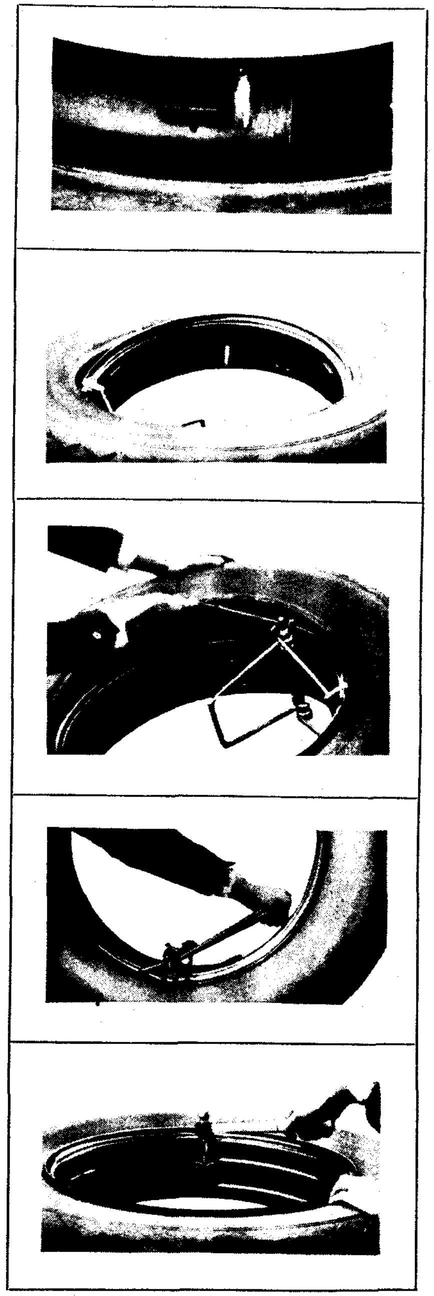

Figure 26a

Make sure that the tube flap is in place and that the valve stem passes through the holes in both ends of the flap.

Figure 26b

Lay the rim on the floor with the hook and wing nut of the tool *face up*. Insert the valve stem in the hole in the rim and work the tire well into place on each side of the valve stem.

Figure 26c

Pry the tire over the projecting end of the rim where it is split. The rest of the tire can then be pushed down into place.

Figure 26d

Release the hook from the rim and let the long handle go back until it stops. Then squeeze the two handles together until the end of the rim drops into its original position. *Do not attempt to force the long handle alone as this will only bend the tool.* If the end of the rim does not go easily into place, remove the tool and pry the end of the rim with a screw driver.

Figure 26e

Replace the pin which locks the two ends of the rim together. This is important.

FIGURE 26. ***Installing tire on rim***

CHAPTER VII

Wheels

Tires and Rims

Illustrated directions for removing a rim with tire from a wheel and installing a rim with tire on a wheel are given in Figs. 7 and 8. Directions for removing a tire from a rim and installing a tire on a rim are given in Figs. 25 and 26.

Do not under any circumstances attempt to remove a tire from a rim without deflating the tire.

Caution in Adjusting Wheel Bearings

The adjustment of wheel bearings or the removal of the wheels should not be attempted by one unfamiliar with work of this nature. It is recommended that the car be taken to a Cadillac maintenance station if possible. In any event great care must be exercised in adjusting wheel bearings not to get them tight. These bearings will revolve even when adjusted very tightly, but that condition is sure to prove disastrous. They should be adjusted so that a very slight amount of play or looseness may be discerned.

If, after a bearing has been adjusted to a point that is apparently correct, the locking device cannot be placed in position without changing the adjustment, it is far better to loosen the adjustment until it can be secured with the locking device than to tighten the bearing adjustment.

Removing Front Wheel

To remove a front wheel, first jack up the axle until the wheel is free from the ground and then proceed as follows:

Remove the hub cap by unscrewing it. Remove the cotter pin "E" (Fig. 27). Remove the lock nut "A." Remove the serrated washer "B." Remove the adjusting nut "C." The wheel may then be removed by pulling it straight off.

Installing Front Wheel and Adjusting Bearings

Before installing the wheel, make sure the bearings are clean and that they are packed in a light grease that is free from dirt and grit.

Set the wheel in place on the spindle and adjust the nut "C" (Fig. 27) very carefully, following the caution above. Install the serrated washer "B," making sure that one of the notches in the washer fits over the stud "D" on

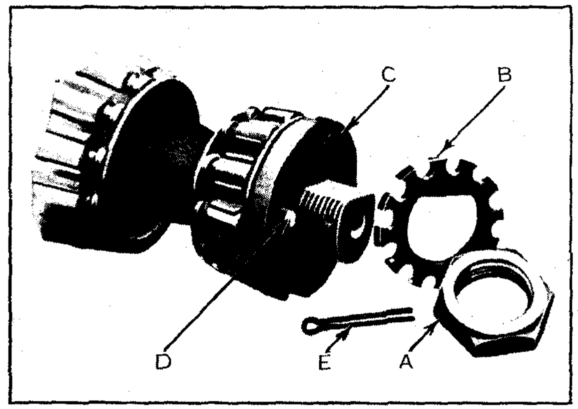

FIGURE 27. ***Front wheel bearings***

the adjusting nut. Replace the lock nut "A" and tighten it firmly, locking it with the cotter pin "E."

It is always better to adjust wheel bearings too loosely than too tightly. If after the adjustment is apparently correct, the notch in the washer "B" is not directly over the stud "D," loosen the adjustment rather than tighten it.

Removing Rear Wheel

To remove a rear wheel, first jack up the axle until the wheel is free from the ground and then proceed as follows:

Remove the hub cap "D" (Fig. 28) by unscrewing it. Remove the spring locking ring "F." Withdraw the axle shaft "E." With a screw driver or blunt

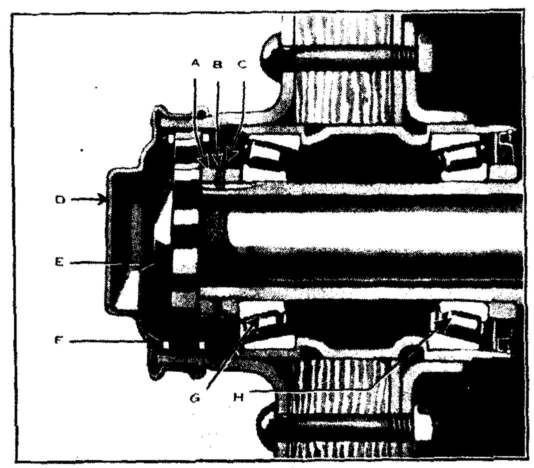

FIGURE 28. ***Sectional view of rear wheel hub, showing bearings***

tool straighten the lug of the outer lock washer "B" where it has been bent over the lock nut "A." Unscrew the lock nut "A." Remove the washers "B" and the adjusting nut "C." The wheel can then be removed by pulling it straight off.

Installing Rear Wheel and Adjusting Bearings

Before installing the wheel, make sure that the bearings are clean and packed in a light grease that is free from dirt and grit.

Set the wheel in place upon the axle and adjust the nut "C" (Fig. 28) very carefully. Install the lock washers "B," using new washers or straightening the ones removed if new ones are not available. In placing the washers in position, reverse the outer one with respect to the inner so that the lugs on one washer are opposite the spaces between the lugs on the other washer; that is, so that the lugs on the two washers are staggered. Install and tighten the lock nut "A." Next, select that lug on the inner washer that falls nearest to the center of one of the flat sides of the adjusting or inner nut, and with a screw driver or other suitable tool bend this lug over the nut. In the same way bend one of the lugs of the outer washer over one of the flat sides of the locking or outer nut. In bending the lugs of the locking washers, take care not to alter the adjustment of the inner nut or loosen the outer nut.

CHAPTER VIII

Repair Parts

Genuine Cadillac Parts

Cadillac owners are cautioned against permitting the use of other than genuine Cadillac parts in the repair of their cars. The quality of the Cadillac car is identical with the quality of its component parts, the production of which is based upon more than twenty years of experience in designing, manufacturing, and inspecting. No other individual or organization has access to the data resulting from this experience nor could they possibly have the same interest in protecting the owners of Cadillac cars.

Uniform Parts Prices

Cadillac parts are sold at uniform prices throughout the United States, and are not subject to the addition of transportation, excise or other supplementary charges. Printed price lists published by the Cadillac Motor Car Company are open to inspection by owners at any authorized Cadillac distributor's or dealer's establishment.

Ordering New Parts

With many thousands of Cadillac automobiles in use, it is obviously impractical to deal directly with each Cadillac owner. We cannot open accounts with any except regular distributors with whom annual contracts are made.

To avoid unnecessary delay and correspondence new parts should, where possible, be ordered from the distributor or dealer from whom the car was purchased or from the nearest Cadillac distributor or dealer, who carries a large stock and is generally in a position to supply a part immediately. If he cannot do so, he can order it. Where, however, conditions are such as in our judgment to warrant it, we will fill orders for parts at current list prices, f.o.b. factory, provided the order is accompanied by cash.

In ordering parts either from a Cadillac distributor or from the factory, send the engine number and the unit assembly number (see page 84) with an accurate description of the part desired, preferably accompanied by a sketch with dimensions. If this cannot be done, send the part itself properly tagged and with transportation charges prepaid. (See below under "Returning Parts.") Otherwise prompt and intelligent filling of the order will be impossible.

Our responsibility ceases in all cases, with delivery to the transportation company.

Returning Parts

In the event parts are returned, transportation charges must be prepaid or the parts cannot be accepted. They should be tagged properly with the name of the owner and the engine number of the car. A letter should be sent, giving complete instructions regarding the disposition of the parts.

Tires, Speedometer and Clock

In cases of repairs to tires, speedometers, or clocks, correspondence should be opened with the manufacturers or their representatives. If necessary the parts should be sent to them. Transportation charges should be prepaid.

CHAPTER IX

Specifications and License Data

Type of engine	8 cyl. V-type
Diameter of cylinder bore	3⅛ in.
Length of stroke	5⅛ in.
Piston displacement	314 cu. in.
Horsepower (N. A. C. C. rating)	31.25
Engine number	See below
Diameter of crankshaft main bearings	2⅜ in.
Length of crankshaft between inner ends of front and rear bearings	18⅝ in.
Exhaust valves	1 $\frac{9}{16}$ in.
Inlet valves	1 $\frac{11}{16}$ in.
Capacity of gasoline tank	20 gals.
Capacity of engine lubricating system	2 gals.
Capacity of cooling system	5½ gals.
Capacity of transmission	3 qts.
Capacity of rear axle	3½ qts.
Tires	33x6.75 (low pressure)
Wheelbase	132 in. and 138 in.
Tread	56 in.

Engine and Unit Assembly Numbers

Each Cadillac car when shipped carries an engine number which is also a serial number. This is the number to be used in filling out license and insurance applications and in general reference to the car. The engine number is stamped on the car in two places: On the name plate on the front face of the dash and on the crankcase at the base of the oil filler.

The various units such as the transmission, steering gear, etc., also carry unit assembly numbers. These are located as described below. It is important in ordering parts to give, not only the engine number of the car, but also the unit assembly number of the unit to which the part belongs.

Transmission number—on the upper surface of the boss to which the clutch and brake pedal bracket is attached.

Steering gear number—on the steering gear housing just above the grease gun connection.

Carburetor number—on the left-hand rear face of the flange by which the carburetor is attached to the intake header.

Generator number—on the left-hand side of the generator.

Starting motor number—on the left-hand side of the starter almost opposite the distributor.

Front axle number—on the upper surface of the axle I-beam at the right-hand end just above the steering stop screw.

Rear axle number—on the rear surface of the axle housing just to the right of the cover plate.

Frame number—on the upper surface of the left-hand side bar opposite the steering gear.

Index

The Cadillac Motor Car Company reserves the right without notice to make changes in design, construction and specifications

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PRINTED IN U.S.A.

CADILLAC SHOP MANUAL

1925

Diagnosis, Adjustment
Repair and Lubrication of
Cadillac V-63 Motor Cars
Including directions for Type 61

PRICE $2.00

Book Number 5759
Please refer to the above number in
writing us in regard to this manual.

Revised January, 1925

Technical Department
Cadillac Motor Car Company
Detroit, Michigan

PREFACE

The directions, suggestions and information contained in this Manual represent actual experience in the shops of the Cadillac Motor Car Company. Part One deals with diagnosis; Part Two with adjustments; Part Three with the removal, inspection and replacement of parts, and Part Four with lubrication.

The Manual is intended strictly for shop use, and has been compiled with this end in view. It will not only assist the repair man schooled in Cadillac shops, but will make it possible for the trained mechanic without previous Cadillac shop experience to determine the causes for unsatisfactory operation and to adjust, repair and lubricate Cadillac cars correctly.

It has always been the practice in the manufacture of Cadillac motor cars to machine parts to limits and to inspect parts before they are assembled into cars to make certain that they have been held to the established limits in manufacture. A result of this practice is that correct clearances between moving parts are assured.

One of the objects of this Manual is to establish similar limits for use in the inspection of parts which have seen service. These limits are supplied in Part Three under headings "Inspection." The limits named are those beyond which it is inadvisable to continue to use parts, if quietness of operation and maximum efficiency are expected in the operation of the car, but not necessarily beyond which some service, in normal use, cannot be obtained. Suitable micrometers and dial indicators are necessary in making these inspections.

In presentation and arrangement, the directions and information in this Manual have been prepared for V-63 cars. In cases where the statements made do not also apply to Type 61 cars, corresponding information for Type 61 cars is added in parentheses (   ) or under special headings. In using the Manual for Type 61 cars these parenthetical notes and special headings must be given careful attention.

To avoid constant repetition it is necessary to refer frequently to other parts of the book. In order to facilitate such reference, each section is numbered, and at the point where reference is to be made the section number preceded by the mark § is inserted in parentheses. For example, (§576) means that detailed directions for an operation just prescribed or some other information bearing on the subject under discussion is contained in that section whose heading is numbered 576. References thus indicated should always be made.

In referring to the illustrations, the number of the illustration is not repeated each time a reference letter is given. When no illustration number accompanies the letter it is the same as the number last specified.

Our Technical Department invites correspondence with shop foremen and shop superintendents on matters pertaining to the care, adjustment and repair of Cadillac motor cars. Suggestions regarding these matters are appreciated.

CADILLAC MOTOR CAR COMPANY

Detroit, Michigan.

GENERAL SUGGESTIONS

Do not use shellac on gaskets or on hose connections. Its use is unnecessary and makes practically impossible the removal of parts without injury.

Before replacing gaskets make certain that they are in good condition and that the surfaces which press against them are clean and in good condition.

In removing sprockets, gears, collars, etc., do not tap them off, unless you have no suitable puller and are unable to procure one. If you are forced to tap off parts, do so carefully, using a lead hammer or a drift of soft brass.

Use well fitting wrenches and only enough force to tighten parts properly. The amount of force required depends upon the size of the stud or cap screw and the length of the wrench. Do not tighten a nut or cap screw sufficiently to strain the parts.

Select well fitting screwdrivers in removing and replacing screws.

The replacement of parts will be facilitated if a practice is made of observing the manner in which they are assembled, before taking them apart.

If parts cannot be disassembled readily do not injure or break them by using too much force. Parts can be disassembled easily when correct methods are employed and proper tools are used.

Care should be exercised to prevent the loss or injury of parts removed.

In replacing cotter pins use new ones.

Lubricate parts which move upon one another with suitable lubricant before putting them together. This includes such parts as spring shackle bolts, brake rod pins and the like, as well as pistons, engine bearings, etc.

In cleaning metal parts, kerosene, gasoline or hot soda solution can be used, the latter being preferable because not inflammable. Ethyl gasoline, a new product of the General Motors Chemical Company, is not suitable for cleaning as it produces a smarting sensation on the skin.

Do not use waste in cleaning cylinders, pistons, bearings, gears, etc. Use cloth free from lint.

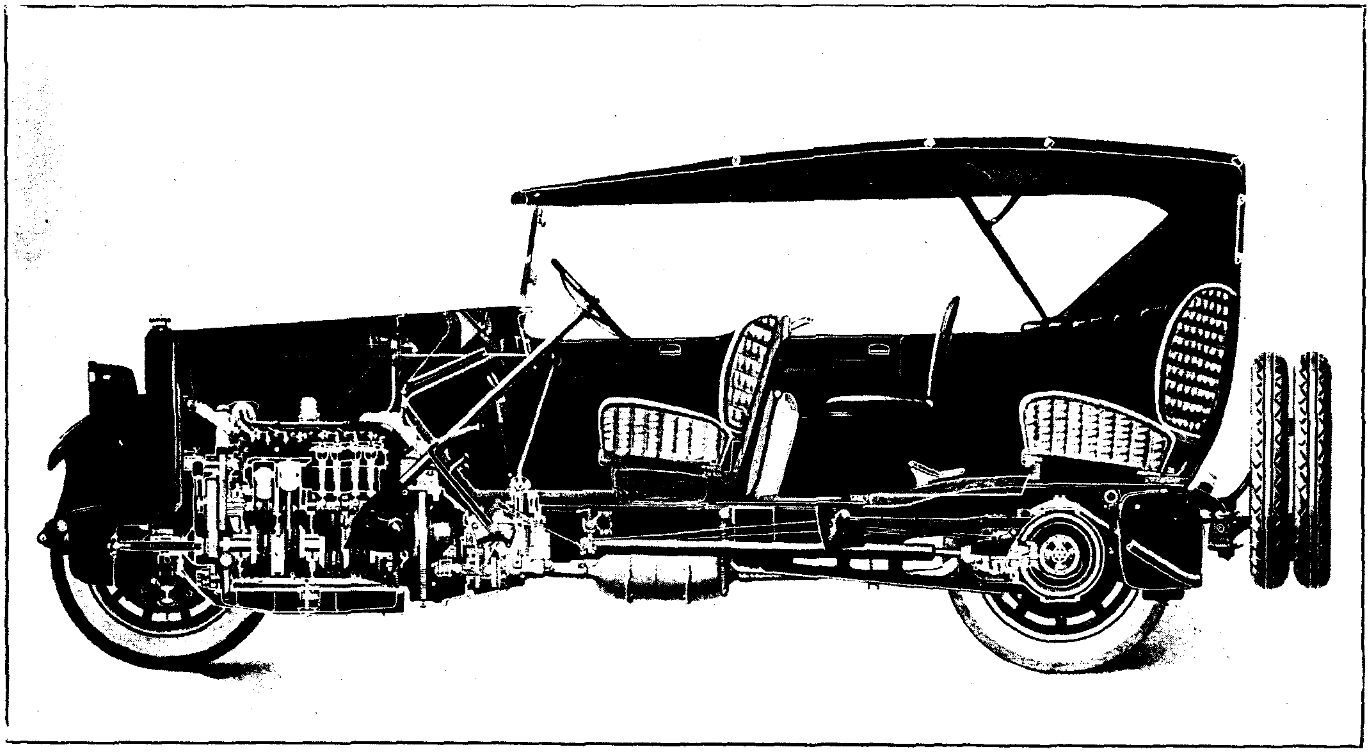

Fig. 1—Sectional View of V-63 Touring Car

GENERAL DATA

Engine

Number of cylinders	8
Bore of cylinders	3⅛ inches
Stroke	5⅛ inches
Piston displacement	314 cu. inches
Horse power (N. A. C.C. rating)	31.25

Crankshaft diameter—V-63	2⅜ inches
Crankshaft diameter—Type 61	2 inches
Valve size	1 11/16 inches
Valve lift	5/16 inch
Carburetor size	2 inches
Spark plug size	⅞ inch x 18

Engine revolutions per mile with transmission in direct drive and 33 x 5 tires.

Standard gear ratio	2620 to 2740*
Low gear ratio	2740 to 2980*
High gear ratio (special)	2420 to 2530*

*Varies with make of tire and tire inflation.

Engine Number

The number of the engine is stamped on the crankcase just back of the right-hand block of cylinders and on the name plate attached to the front face of the dash.

Gear Ratios

Axle

Standard	4.50 to 1
Low	4.91 to 1
High (special)	4.15 to 1

Transmission

High	Direct
Intermediate	58.65% of direct
Low	32.00% of direct
Reverse	26.70% of direct

Between Engine and Rear Wheels

Axle gear ratio	4.5 to 1	4.91 to 1	4.15 to 1
Transmission:			
High	4.50 to 1	4.91 to 1	4.15 to 1
Intermediate	7.673 to 1	8.372 to 1	7.076 to 1
Low	14.063 to 1	15.344 to 1	12.969 to 1
Reverse	16.854 to 1	18.390 to 1	15.543 to 1

Wheel Base

All cars . . . . . 132 inches

Tread

All cars . . . . . 56 inches

Gasoline Tank Capacity

Gallons:	
United States	20
Imperial	16.67
Liters	75.70

PART I

DIAGNOSIS

The purpose of this section of the Shop Manual is to assist the Cadillac service man to locate readily the part which requires adjustment. The possible causes for various troubles are tabulated in chart form for convenience. A service man should not be content with a remedy for the immediate trouble but should find out what causes the difficulty. For example, if timer contact points require frequent cleaning and adjusting, a diagnosis of the trouble should be made and the causes eliminated.

ENGINE

1 Engine Apparently Lacks Power

1. Engine fires irregularly. (§5).
2. Incorrect spark timing.
   - A. Incorrectly timed ignition. (§149).
   - B. Automatic spark control inoperative. (§414).
   - C. Driving with spark lever too far retarded or too far advanced.
3. Low compression. (§2).
4. Carbon in cylinders. (§7).
5. Engine overheating. (§6).
6. Imperfect fuel mixture.
   - A. Carburetor not correctly adjusted. (§§180-190).
   - B. Insufficient flow of gasoline into carburetor bowl. (§35).
   - C. High test gasoline used in summer.
   - D. Thermostats adjusted so they do not close. (§176).
   - E. Punctured thermostatic member. (§363).
7. High gear ratio which gives the impression of lack of power.
8. Large diameter tires which give the impression of lack of power.
9. Excessive frictional resistance.
   - A. Engine not properly lubricated. (§§713, 718).
   - B. Tight brakes. (§45).
10. Back pressure in mufflers—mufflers clogged with carbon.
11. Accelerator pedal does not open throttle wide—incorrect adjustment of control rods.
12. Automatic throttle valve remains closed or nearly so—automatic throttle valve shaft sticking in its bearings. (§430).

2 *Compression Low*

1. Thin oil.
   - A. Oil used has insufficient viscosity. (§§702-704).
   - B. Oil thinned by gasoline. (§70).
2. Valves not seating.
   - A. Valves timed incorrectly. (§§116-118).
   - B. Valve stems or cam slides sticking in guides. (§734).
   - C. Weak or broken valve spring. (§384).
   - D. Warped valves.
3. Valves require regrinding. (§119).
4. Worn or imperfectly fitting piston rings. (§346).
5. Loose fitting pistons, or scored cylinders or pistons. (§§322, 346).

3 *Excessive Gasoline Consumption*

1. Habits of driver.
   - A. Failure to push enriching button forward as far as possible as soon as engine is warm enough to permit it.
   - B. Running the engine more than necessary with car standing.
   - C. Car making short trips with stops between long enough to allow engine to cool.
   - D. Driving with spark lever too far advanced or too far retarded.
2. Incorrect spark timing.
   - A. Spark timed incorrectly. (§149).
   - B. Automatic spark control inoperative. (§414).
3. Soft tires.
4. Tight brakes. (§45).
5. Imperfect fuel mixture.
   - A. Carburetor not correctly adjusted. (§§180-190).
   - B. Punctured thermostatic member. (§363).
   - C. Carburetor flooding. (§29).
   - D. Thermostat valves do not close.
6. Low compression. (§2).
7. Engine firing irregularly. (§5).
8. Carbon in cylinders. (§7).
9. Engine overheating. (§6).

4 *Continued Cranking Necessary to Start Engine*

1. Habits of driver.
   - A. Attempting to start without air pressure.
   - B. Failure to prime carburetor (in cold weather).
   - C. Failure to pull back the carburetor enriching button when starting with cold engine.
   - D. Enriching button pulled too far back when starting with warm engine.
   - E. Throttle lever not in correct position.
   - F. Spark lever too far retarded (in cold weather).
   - G. High test gasoline used in summer.
2. Auxiliary air valve spring not fully compressed when enriching button is pulled back. Enriching rod not in proper adjustment. (§182).
3. Weak ignition. (§16).
4. Carburetor flooding. (§29).
5. Insufficient flow of gasoline to carburetor bowl. (§35).
6. Slow cranking. (§12).
7. Incorrect adjustment of spark plug points. (§153).
8. High test gasoline used, in summer weather.
9. Water or dirt in the gasoline.

5 *Engine Fires Irregularly*

1. Imperfect spark plugs.
   - A. Dirty spark plug cores. (§20).
   - B. Broken spark plug cores.
2. Spark plug points set incorrectly. (§153).
3. Weak ignition. (§16).
4. Dirty track in distributor. (§17).
5. Imperfect fuel mixture
   - A. Carburetor not correctly adjusted. (§§180-190).
   - B. Use of high test gasoline in summer.
   - C. Insufficient flow of gasoline into carburetor bowl. (§35).
   - D. Thermostat valves held open.
   - E. Thermostats adjusted so they do not allow valves to close. (§176).
   - F. Punctured thermostatic member. (§363).
   - G. Leaking intake manifold gasket. (§344).
   - H. Worn valve stem or valve guide. (§384).

6. Imperfect valve action.
   - A. Valves timed incorrectly. (§§116-118).
   - B. Valve stems or cam slides sticking in guides. (§734).
   - C. Weak or broken valve spring. (§384).

6 *Engine Overheats*

1. Imperfect operation of cooling system.
   - A. Accumulation of sediment in water jackets of cylinders.
   - B. Thermostat valves do not open. (§363).
   - C. Cooling liquid frozen.
   - D. Not enough liquid in cooling system.
   - E. Accumulation of mud or dirt between radiator fins.
   - F. Too much of radiator covered.
   - G. Too much alcohol in cooling liquid. (§169).
2. Late ignition.
   - A. Driving with spark too far retarded.
   - B. Timer incorrectly set. (§149).
   - C. Automatic spark control inoperative. (§414).
3. Pistons not properly lubricated. (§66).
4. Carbon in cylinders. (§7).

7 *Rapid Accumulation of Carbon in Cylinders*

1. Use of oil which has low fire and flash test. (§§702-704).
2. Rich fuel mixture.
   - A. Air valve spring incorrectly adjusted. (§183).
   - B. Flooding carburetor. (§29).
3. Driving longer than is necessary with enriching button pulled back.
4. Open thermostat.
   - A. Adjustment. (§176).
   - B. Punctured thermostatic member. (§363).
5. Excessive oil consumption. (§65).
6. Late ignition.
   - A. Driving with retarded spark.
   - B. Incorrect ignition setting. (§149).
   - C. Automatic spark control inoperative. (§414).

ELECTRICAL SYSTEM

8 *Battery Does Not Keep in Charged Condition*

1. Habits of driver.
   - A. More lights burning than are necessary when car is standing.
   - B. Car driven very little and left standing with lights burning large proportion of time.
   - C. Starter used more than is necessary.

2. Low charging rate. (§11).
3. Low acid solution level in battery. (§159).
4. Sediment in battery jars. (§164).
5. Additional electrical appliances in circuit.
6. Continued cranking necessary to start engine. (§4).

9 One Cell of Battery Regularly Requires More Water Than the Others, and Acid in That Cell Has Lower Specific Gravity

1. Leaking jar.
2. Short-circuited plates. { A. Sediment in battery jars. (§164). B. Imperfect separators.

10 Addition of Water to All Battery Cells Frequently Necessary

1. Charging rate too high for service in which car is used. (§11).
2. Excessive overcharging.
3. Short-circuited plates. { A. Sediment in battery jars. (§164). B. Imperfect separators.

11 Generator Charging Rate Too Low or Too High

1. Incorrect adjustment of generator third brush arm. (§158).

12 Starter Does Not Crank Engine, or Cranks Engine Slowly

1. Grounded motor brush does not make contact when starter pedal is pushed down due to wire from front end of generator to generator switch being drawn too tight.
2. Generator circuit does not open when starter pedal is pushed down due to bent generator switch arm.
3. Loose or corroded connections at battery terminals.
4. Imperfect motor brush contact. (§401).
5. Battery nearly or completely discharged. (§8).
6. Clutch pedal not disengaged when cranking (cold weather).
7. Starter gear hub tight on shaft as a result of lack of lubrication. (§720).
8. Incorrect adjustment of starter pedal stop.
9. Driver does not push starter pedal all the way down.
10. Grounded motor winding on armature.

13 Sparking at Generator Brushes

1. High mica on generator commutator. (§401).
2. Imperfect brush contact. (§401).
3. Insufficient spring tension on brushes. (§401).

4. Grease or dirt on commutator.
5. Brush arms binding on posts.

14 Bulbs Short Lived

1. Low voltage bulbs used. (§143).
2. Charging rate of generator too high. (§11).
3. Low acid solution level. (§159).
4. Loose or corroded connections at battery terminals or in charging circuit.
5. Short-circuited plates.
   - A. Sediment in battery jars. (§164).
   - B. Imperfect separators.
6. Excessive overcharging of battery.

15 Bulbs Dim

1. High voltage bulbs used. (§143).
2. Loose or corroded connections at battery terminals.
3. Battery nearly or completely discharged. (§8).
4. Loose connection on circuit breaker.
5. Dirt or corrosion on circuit breaker contacts.

16 No Spark or Weak Spark Between Spark Plug Points

1. Imperfect ignition coil.
   - A. Short-circuited primary or secondary winding.
   - B. Open circuit in primary or secondary winding.
   - C. Grounded primary terminals caused by improper installation of coil in bracket.
2. Timer contact points incorrectly adjusted. (§147).
3. Timer contact points dirty or pitted.
   - A. Broken down condenser. (§151).
   - B. Short-circuited resistance coil.
   - C. Timer contacts too closely adjusted. (§147).
   - D. Oil on timer contact points.
4. Loose connections or open circuit at ignition switch or at vibrating circuit breaker.
5. Dirt or corrosion on contacts of vibrating circuit breaker.
6. Leaking secondary wires.
7. Broken down condenser. (§151).
8. Storage battery discharged. (§8).
9. Dirty or cracked spark plug cores.
10. Dirty track in distributor head. (§17).
11. Grounded rotor.

17 Track in Distributor Head Requires Frequent Cleaning

1. Rough surface on rotor contact button.
2. Track in head roughened by use of sandpaper in cleaning. (§404).

18 Non-Vibrating Circuit Breaker Opens

1. Short circuit in horn, portable and tonneau lamp or cigar lighter or in circuits to these parts. (§155).

19 Vibrating Circuit Breaker Operates

1. Short circuit in head, side, instrument, or tail lamp, or in circuits to these parts. (§156).

20 Spark Plug Cores Require Frequent Cleaning

1. Too much oil passes pistons. (§65).
2. Rich fuel mixture.
   - A. Driving longer than necessary with enriching lever pulled back.
   - B. Rich carburetor adjustment. (§§180-190).
   - C. Carburetor flooding. (§29).
3. Open thermostat.
   - A. Adjustment. (§176).
   - B. Punctured thermostatic member. (§363).
4. Very low-grade gasoline used.
5. Flash and fire test of oil too low.

COOLING SYSTEM

21 Additional Cooling Liquid Frequently Necessary

1. Water pump glands leaking.
   - A. Gland nuts not tight enough. (§175).
   - B. Glands require repacking. (§175).
2. Engine overheating. (§6).
3. Leaking hose connections.
4. Liquid in condenser does not return to radiator. (§23).

22 Alcohol Fumes Escape from Condenser

1. Engine overheating. (§6).
2. Not enough liquid in condenser. (§169).

23 Liquid in Condenser Does Not Return to Radiator

1. Air leak at radiator filler cap.
   - A. Radiator cap not tightened.
   - B. Imperfect gasket in radiator cap.
   - C. Air leak around a temperature indicator or ornament in radiator cap.
   - D. Leaking connections between radiator and condenser.

GASOLINE SYSTEM

24 Gasoline Pressure Not Maintained After Engine is Started

1. Filler cap or thumb-screw on filler cap not tightened.
2. Imperfect filler cap gasket.
3. Leaking air connections.
4. Failure to screw in hand pump handle tightly after using.
5. Insufficient lubrication of air pressure pump on engine. (§67).
6. Power air pump cylinder or piston worn or cut.
7. Incorrectly adjusted air pressure regulator. (§178).
8. Leaking air pressure regulator. { A. Imperfect needle valve or seat. B. Dirt on needle valve or seat.
9. Leaking air pipe.
10. Sharp bend or dent in air or gasoline piping.
11. Pressure gauge inaccurate.
12. Leak at gasoline gauge.
13. Leak at filler joint on tank.
14. Improper seating of needle in check valve when pump cylinder or piston is worn or cut.

25 Low Gasoline Pressure Indicated When Engine is Running

See §24.

26 Gasoline Pressure Falls Off Rapidly After Engine Stops

1. Filler cap or thumb-screw on filler cap not tightened.
2. Imperfect filler cap gasket.
3. Leaking air connections.
4. Failure to screw in hand pump handle tightly after using.
5. Leaking check valve at pump.
6. Leaking air pressure regulator. { A. Imperfect needle valve or seat. B. Dirt on needle valve or seat.
7. Leaking air pipe.
8. Leak at gasoline gauge.
9. Leak at filler joint on tank.

27 High Gasoline Pressure Indicated

1. Incorrect adjustment of air pressure regulator. (§178).
2. Pressure gauge incorrect.

28 Insufficient Flow of Gasoline to Carburetor

1. Low gasoline pressure. (§25).
2. Strainer at top of tank, under front floor or at carburetor, clogged with dirt or ice. (§§179, 436).
3. Dirt or ice in settling chamber at bottom of gasoline tank. (§179).
4. Sharp bend or dent in gasoline piping.

CARBURETOR

29 Carburetor Floods

1. Dirt on needle valve or valve seat.
2. Imperfect valve or seat. (§430).
3. Valve sticking in guide.
4. Excessive gasoline pressure. (§27).
5. Float rubbing on carburetor bowl.
6. Incorrect float adjustment. (§188).
7. Bent pin in float arm.
8. Air vent hole closed between thermostat body and carburetor body.

30 Back-Firing in Carburetor

1. Very low-grade gasoline
2. Water in the gasoline.
3. Incorrect spark timing.
   - A. *Incorrectly timed ignition.* (§149).
   - B. Automatic spark advance inoperative. (§414).
   - C. Driving with spark lever retarded too far.
4. Lean fuel mixture.
   - A. Incorrect adjustment of auxiliary air valve spring. (§183).
   - B. Weak air valve spring. (§430).
   - C. Insufficient flow of gasoline into carburetor bowl. (§35).
   - D. Nozzle partly clogged.
   - E. Thermostat valves adjusted so they do not close. (§176).
   - F. Punctured thermostatic member. (§363).
5. One or more inlet valve stems or inlet cam slides sticking in guides. (§734).
6. One or more imperfect spark plug cores.
7. Valve timing incorrect as result of improper chain and sprocket assembly. (§329).
8. Throttle pump disconnected.
9. Dirty track in distributor head. (§17).
10. Improper adjustment of valves. (§§116-118).
11. Loose air vent nozzle on carburetor.
12. Accumulation of carbon in jacket of intake manifold.

31 Fuel Mixture Lean When Throttle is "Closed"

1. Incorrect adjustment of auxiliary air valve spring. (§183).
2. Weak air valve spring. (§430).
3. Insufficient flow of gasoline into carburetor bowl. (§35).
4. Nozzle partly clogged.
5. Leaking gasket between carburetor and inlet manifold or between inlet manifold and cylinder block. (§344).
6. Incorrect adjustment of enriching lever on carburetor. (§182).

32 Fuel Mixture Lean When Throttle is Partly Open

1. Incorrect adjustment of auxiliary air valve spring. (§183).
2. Weak air valve spring. (§430).
3. Insufficient flow of gasoline into carburetor bowl. (§35).
4. Nozzle partly clogged.
5. Incorrect adjustment of enriching lever on carburetor.

33 Fuel Mixture Lean When Throttle is Fully Open

1. Incorrect adjustment of auxiliary air valve spring. (§183).
2. Weak air valve spring. (§430).
3. Insufficient flow of gasoline into carburetor bowl. (§35).
4. Nozzle partly clogged.
5. Incorrect adjustment of enriching lever on carburetor.

34 Carburetor Air Valve Flutters

1. Auxiliary throttle valve shaft sticking in bearings. (§430).
2. Spring on auxiliary throttle valve broken or incorrectly adjusted. (§189).
3. Valve timing incorrect as result of improper chain and sprocket assembly. (§329).

35 Insufficient Flow of Gasoline Into Carburetor Bowl

1. Insufficient flow of gasoline to carburetor. (§28).
2. Carburetor inlet valve sticking in its guide.
3. Float rubbing on carburetor bowl due to bent float arm.
4. Bent pin in float arm.
5. Incorrect float adjustment. (§188).

CLUTCH AND TRANSMISSION

CLUTCH

36 Clutch Grabs When Engaging

1. Dry disc facings.
2. Gummy disc facings.
3. Warped plates.
4. Discs sticking in driver or on hub keys.

37 Clutch Slips

1. Incorrect adjustment of clutch pedal. (§194).
2. Driver allows foot to rest on pedal.
3. Oily disc facings.
4. Badly worn disc facings. (§193).
5. Bent or warped clutch plates.

38 Clutch Spins When Released

1. Incorrect adjustment of clutch pedal. (§194).
2. Driver does not release clutch fully.
3. Worn or dry bearing at front end of clutch connection in flywheel. (§387).
4. Gummy or sticky disc facings.
5. Discs do not slide freely on hub keys or in serrations in clutch driver. (§447).
6. Bent or warped clutch plates.
7. Thin oil in transmission. (§§706, 707).

39 Clutch Plates Rattle

1. Too much freedom between clutch plates and serrations in clutch driver or keys on clutch hub. (§447).

40 Noisy Clutch Release Ball Race

1. Worn bearing.

41 Clutch Chatters When Engaging

1. Dry clutch disc facings.
2. Glazed clutch disc facings.

TRANSMISSION

42 Noisy Gear Shifting

1. Shifting incorrectly done.
2. Clutch spins when released.
   - A. Incorrect adjustment of clutch pedal. (§194).
   - B. Operator does not release clutch fully.
   - C. Worn or dry bearing at front end of clutch connection. (§387).
   - D. Gummy or sticky disc facings.
   - E. Discs do not slide freely on hub keys or in serrations in clutch driver. (§447).
   - F. Bent or warped clutch plates.
   - G. Thin oil in transmission. (§§706, 707).
   - H. Excessive wear of discs on hub keys or in serrations in clutch driver, allowing discs to fall together.

43 Noisy Transmission Gears

1. Insufficient lubricant in transmission. (§731).
2. Unsuitable lubricant used. (§§706, 707).
3. Worn gear teeth.
4. Tire pump gears not fully disengaged.

44 Noisy Transmission Bearing

1. Insufficient lubricant in transmission. (§731).
2. Unsuitable lubricant used. (§§706, 707).
3. Dirt in bearing.
4. Worn bearing.

REAR AXLE

45 Brakes Drag When Released

1. Incorrect adjustment of bands. (§§207, 208, 210, 214, 216).
2. Bands out of true. (§§494, 524).
3. Anchor pins dry or rusty.
4. Drums on wheels out of true. (§556).
5. Rusty brake rod connections.
6. Rusty brake mechanism.
7. Releasing spring broken.
8. Yoke bolt pins tight or rusted.

46 Brakes Do Not Hold

1. Incorrect adjustment. (§§207, 208, 210, 214, 216).
2. Anchor pins dry or rusty.
3. Oily linings.
4. Lining worn down to rivets. (§§212, 213, 218).
5. Yoke bolt pins tight or rusted.

47 Brakes Noisy When Applied

1. Anchor pins dry or rusty.
2. Dry brake bands.
3. Lining worn down to rivets. (§§212, 213, 218).
4. Incorrect adjustment. (§§207, 208, 210, 214, 216).

48 Brake Bands Rattle on Rough Roads

1. Incorrect adjustment. (§§207, 208, 210, 214, 216).
2. Worn brake band guides.

49 Axle Driving Gears Noisy

1. Insufficient lubricant in axle. (§732).
2. Gears incorrectly adjusted. (§§200, 202).
3. Use of unsuitable lubricant. (§§706, 707).
4. Loose adjustment of bearings on gear mount or pinion shaft. (§§199, 201).
5. Faces of gear teeth badly worn. (§§498, 507).
6. Bearings badly worn.

50 Axle Noisy When Turning Corners Only

1. Noisy differential gears.
   - A. Insufficient lubricant in axle. (§732).
   - B. Use of unsuitable lubricant. (§§706, 707).
   - C. Worn differential gears. (§498).

51 Noisy Axle Bearing

1. Bearing too tightly adjusted. (§§199, 201).
2. Insufficient lubricant in axle. (§732).
3. Use of unsuitable lubricant. (§§706, 707).
4. Bearing worn. (§§498, 507).

52 Axle Shaft Noisy at Hub Flange

1. Rear wheel bearings loosely adjusted. (§226).
2. Bent axle shaft. (§504).
3. Bent axle housing. (§501).
4. Dry hub clutch.
5. Too much play at hub flange. (§504).

53 Oil Leaking at Rear Hub Caps

1. Too much grease in wheel bearings. (§738).
2. Unsuitable lubricant used in axle. (§§706, 707).
3. Oil level too high in axle. (§732).
4. Imperfect or worn felt oil retainers.

STEERING GEAR

54 Steering Gear Rattles

1. Too much end play in sector shaft. (§224).
2. Too much end play in steering worm. (§222).
3. Too much play between teeth of worm and sector. (§223).
4. Steering connecting rod joints loosely adjusted. (§553).

55 Excessive Play in Steering Gear

1. Too much end play in sector shaft. (§224).
2. Too much end play in steering worm. (§222).
3. Too much play between teeth of worm and sector. (§223).
4. Steering connecting rod joints loosely connected. (§553).

56 Steering Gear Turns Hard

1. Lack of lubrication. (§735).
2. Soft tires.
3. Steering gear too tightly adjusted. (§§222-224).
4. Steering connecting rod joints too tightly adjusted. (§553).
5. Dry or cut taper bushings at upper end of housing tube. (§728).
6. Spindle bolts tight or rusted.
7. Eccentric bushing dry or cut.

TIRES

57 Tires Do Not Run True

1. Rims not trued up after placed on wheels.
2. Wheels out of true. (§556).

58 Front Tires Wear Out Rapidly

1. Incorrect alignment of front wheels. (§229).
2. Loose steering connections or arms.

SPRINGS

59 Springs Squeak

1. Dry or rusty spring leaves. (§566).
2. No lubricant between spring and bolted spring clamp.
3. Insufficient lubrication of spring shackles. (§720).

60 Spring Action Stiff

1. Dry or rusty spring leaves. (§566).
2. Spring shackles adjusted too tight.

61 Springs Appear to Be Weak

1. Unusually fast driving over rough roads.
2. Heavier loads carried than car is designed for.
3. Springs weak.

LUBRICATING SYSTEM

62 No Oil Pressure Indicated on Gauge When Engine Is Running

1. Gauge incorrect. (§355).
2. Thick oil.
   - A. Cold test of oil too high. (§§702-704).
   - B. Emulsion in oil pan. (§71).
   - C. Viscosity of oil too great. (§§702-704).
3. Oil pan empty. (§714).

4. Ice in oil pan. (§69).
5. Oil pump requires priming. (§718).
6. Worn parts in oil pump. (§358).
7. Oil pressure regulator does not operate properly.
   - A. Dirt on valve or seat.
   - B. Broken or weak spring. (§366).
   - C. Imperfect valve or seat. (§366).

63 *Low Oil Pressure Indicated*

1. Thin oil.
   - A. Oil used has insufficient viscosity. (§§702-704).
   - B. Oil thinned by gasoline. (§70).
2. Oil pressure regulator does not operate properly.
   - A. Dirt on valve seat or valve.
   - B. Broken or weak valve spring (§366).
   - C. Imperfect valve or seat. (§366).
3. Incorrect adjustment of oil pressure regulator. (§718).
4. Too much oil escapes through crankshaft bearings.
   - A. Loose main or connecting rod bearings. (§§101, 102).
   - B. Excessive end play in connecting rod bearings. (§105).
   - C. Halves of main bearings not properly fitted. (§102).
5. Worn parts in oil pump. (§358).
6. Leaking oil connections in crankcase.
7. Gauge incorrect. (§355).

64 *High Oil Pressure Indicated*

1. Oil pressure regulator incorrectly adjusted. (§718).
2. Viscosity of oil too great. (§§702-704).
3. Gauge incorrect. (§355).

65 *Excessive Oil Consumption*

1. Too much oil thrown onto cylinder walls.
   - A. Incorrect adjustment of oil pressure regulator. (§718).
   - B. Loose connecting rod bearings. (§101).
   - C. Too much end play in connecting rod bearings. (§105).
   - D. Too much oil in oil pan. (§714).
   - E. Oil used has insufficient viscosity. (§§702-704).
   - F. Oil thinned by gasoline. (§70).
2. Worn or imperfectly fitting piston rings. (§346).
3. Loose fitting pistons or scored cylinders or pistons. (§§322, 346).
4. Leakage of oil through air intake port at camshaft air pump.

66 Not Enough Oil Thrown Onto Cylinder Walls

1. Incorrect adjustment of oil pressure regulator. (§718).
2. Too much oil escapes through crankshaft bearings.
   - A. Loose main bearings. (§102).
   - B. Halves of main bearings not properly fitted. (§102)
3. Worn parts in oil pump. (§358).
4. Leaky oil connection in crankcase.
5. Viscosity of oil too great. (§§702-704).

67 Insufficient Flow of Oil to Chains, Camshaft Bearings and Gasoline System Air Pump

1. High oil pressure. (§64).
2. Clogged by-pass in oil pressure regulator. (§366).
3. Worn parts in oil pump. (§358).
4. Leaking oil connections in crankcase.
5. Too much oil escapes through main crankshaft bearings.
   - A. Loose main or connecting rod bearings. (§§101, 102).
   - B. Excessive end play in connecting rod bearings. (§105).
   - C. Halves of main bearings not properly fitted. (§102).

68 Oil Indicator Does Not Operate

1. Vertical rod bent so that it does not slide freely in guide. (§355).
2. Emulsion in oil pan. (§71).
3. Leaking float.

69 Water or Ice Accumulates in Oil Pan

1. Car used in short trip service. Trips not long enough to allow engine to become thoroughly warm.
2. Failure to replace engine oil at frequent intervals. (§§715, 716).
3. Open thermostat.
   - A. Adjustment. (§176).
   - B. Punctured thermostatic member. (§363).
4. Loose fitting pistons or scored cylinders or pistons. (§§322, 346).
5. Imperfectly fitting piston rings. (§346).
6. Unsuitable engine oil used. (§§702-704).

70 Gasoline Accumulates in Oil Pan

1. Car used in short trip service. Trips not long enough to allow engine to become thoroughly warm.
2. Failure to replace engine oil at frequent intervals. (§§715, 716).

3. Driving longer than is necessary with enriching button pulled back.
4. Rich fuel mixture.
   - A. Incorrect adjustment of auxiliary air valve spring. (§183).
   - B. Flooding carburetor. (§29).
5. Open thermostat.
   - A. Adjustment. (§176).
   - B. Punctured thermostatic member. (§363).
6. Loose-fitting pistons or scored cylinders or pistons. (§§322, 346).
7. Imperfectly fitting piston rings. (§346).
8. Unsuitable engine oil used. (§§702-704).
9. Descending grades with transmission in gear, clutch engaged and ignition off.

71 Emulsion Forms in Oil Pan

1. Accumulation in oil pan of gasoline and water. (§§69, 70).

72 Oil Freezes in Oil Pan

1. Extreme cold.
2. Cold test of oil too high. (§§702-704).
3. Water mixed with oil. (§69).

PART II

ADJUSTMENTS

ENGINE

ADJUSTMENT OF CONNECTING ROD AND CRANKSHAFT BEARINGS

101 Adjustment of Connecting Rod Bearings

Remove the oil pan and baffle plate. (§354).

The caps at the lower ends of the single connecting rods are adjustable. Liners varying in thickness are placed between the caps and the rods when the engine is assembled. In V-63 engines the liners vary in thickness from .002 to .007; in Type 61 engines from .002 to .006. To readjust, *remove these liners and substitute thinner ones of the proper* thickness. Liners must be of equal thickness under each cap.

To determine the clearance in a connecting rod bearing turn the engine over by hand to bring the throw of the crank-shaft to the lower center.

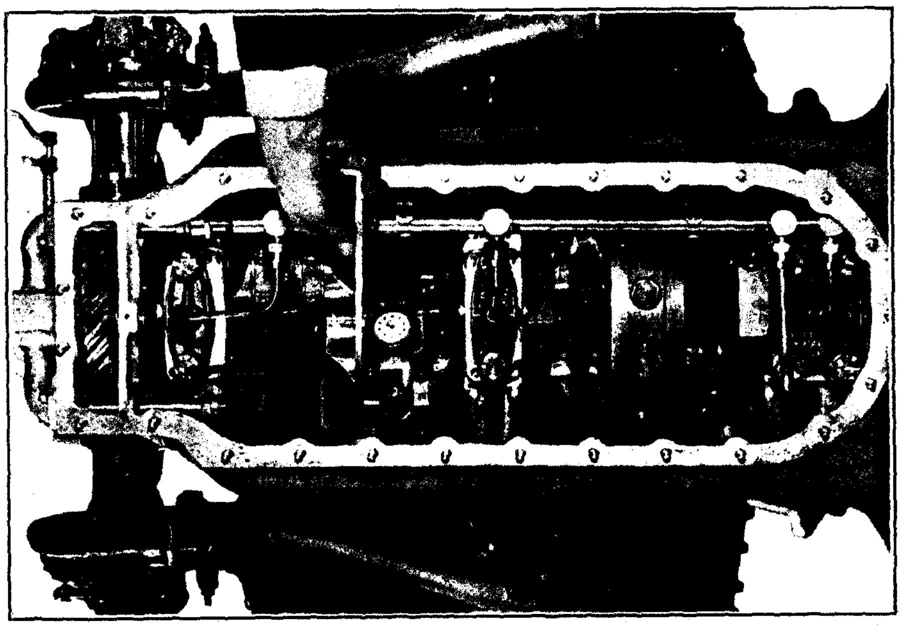

Fig. 2—Determining Clearance in Connecting Rod Bearing

Then place the indicator (tool No. 196B) in the holder (tool No. 67870) and clamp it to the forked connecting rod as shown in Fig. 2. With the bar (tool No. 57736) in position as shown, force the rod up and set the dial on the indicator at zero. Then with the bar, over the head of the straight connecting rod bolt and under a nut on a forked rod bolt force the rod down. The clearance in the bearing will be indicated on the dial.

Caution:—Place the bar on the side opposite to that to which the indicator holder is fastened. Use as much care in handling the indicator as you would in handling a fine watch.

These bearings should have from .003 inch to .004 inch play. Bearing trouble is probable if the clearance is less than .003 inch. (On Type 61 engines the play should be from .0025 inch to .0035 inch.)

The crank pin bearings in the forked connecting rods are not adjustable. If there is more than .006 inch clearance between a bearing and the crank pin, or more than .015 inch end play in the bearing, a new bearing should be substituted. (§§105-107).

102 Adjustment of Crankshaft Main Bearings

Remove the oil pan and the baffle plate. (§354).

The three main bearings are provided with liners which are clamped between the crankcase and the bearing caps.

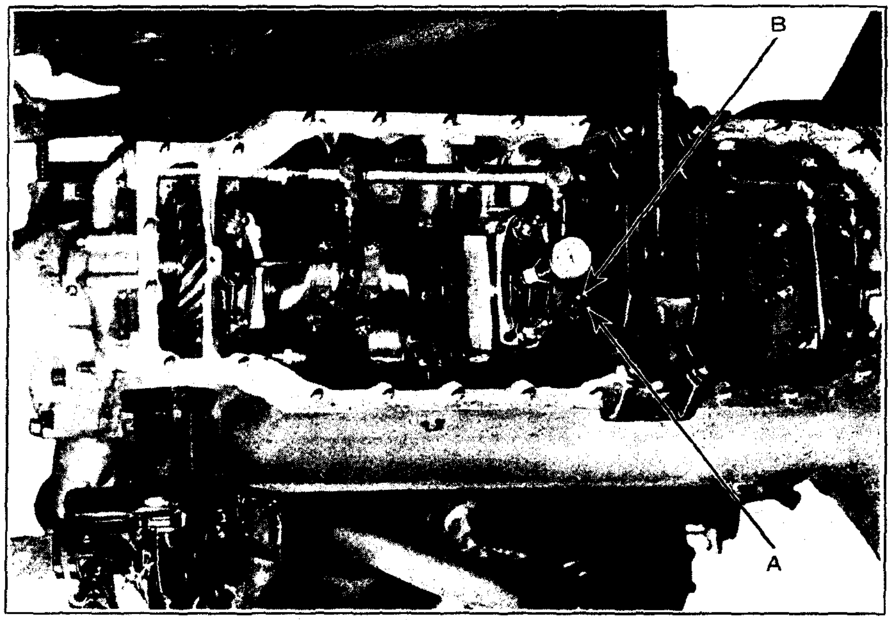

Fig. 3—Determining Clearance in Crankshaft Main Bearing

The clearance between the shaft and the bearings should be between .001 inch and .002 inch. To determine the existing clearance screw the indicator holder (tool No. 65530), on to the nipple screwed into the bearing cap and place the indicator (tool No. 196B) as shown in Fig. 3.

Turn the crankshaft so that the cheeks next to the bearing to be indicated are in the horizontal plane. Place Cadillac puller (tool No. 72631) up against the under face of the crankcase, turn the clamping screws outward and tighten the nut on each clamp. Place the arm "A" over the cheek of the crankshaft and tighten the set screw "B." Set the indicator to zero, then force the lever up and down watching the indicator hand. The bearing clearance can thus be determined. The clearance in each main bearing can be determined in like manner.

Caution:—Use as much care in handling the indicator as you would in handling a fine watch.

To tighten a main bearing, proceed as follows: Remove the oil feed pipe connecting the bearing cap with the oil manifold. Remove the aluminum bearing cap with the lower half of the bearing and the liners.

Replace the liners with liners which are less in thickness than the original liners by an amount equal to the amount of "take-up" necessary. The liners on both sides of the same bearing should be equal in thickness. Liners of the following thicknesses can be obtained from our Parts Department: .170, .172, .174, .176, .178, .180, .185 and .190.

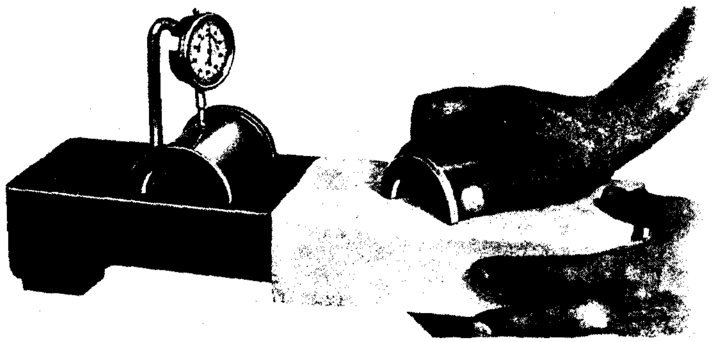

Fig. 4—Reducing Edges of Crankshaft Main Bearing

Carefully reduce the upper edges of the lower half of the bearing just enough to allow the aluminum bearing cap to clamp the new liners. This work must be done very accurately, as clearance between the halves of the bearing will cause an oil leak.

The upper edges of the lower half of the bearing may be reduced by rubbing the bearing on a piece of fine emery cloth stretched tightly over the face plate of Cadillac gauge No. 71969, as shown in Fig. 4. After the clearance in the bearing has been determined place the lower half of the bearing under the gauge as shown in Fig. 4 and sliding it back and forth, set the indicator to zero. By making tests after reducing the edges of the bearing the actual amount taken off can be determined accurately. Main engine bearings should have between .001 inch and .002 inch clearance after adjustment. (§§108, 109).

Caution:—Use care in handling the arbors and in handling the gauge not to mar the finished surfaces. Use as much care in handling the indicator as you would in handling a fine watch.

Thoroughly clean the bearing, bearing cap and liners and oil the bearing surface before replacing. Numbers on bearings and caps face to the front of the engine.

In replacing the bearing cap, tighten the bearing nuts firmly and lock with new cotter pins. Also make sure that the union nuts on the oil pipe are tightened sufficiently to prevent leakage.

If more than one bearing is removed at a time, care should be taken not to mix the liners, as they may not all be the same thickness.

After replacing the oil pan, refill it with seven quarts of suitable engine oil. Cadillac Engine Oil is recommended.

FITTING CRANK PIN BEARINGS

103 Surfaces on Crankshaft

If the crank pins of the crankshaft are scored or out of round more than .003 inch they should be dressed down before used bearings are refitted, or new bearings are installed. (§§110, 111).

104 Refitting a Used Bearing

If the babbitt is scored, rough, or shows only partial bearing on the crank pin, clean it up with a scraper. This work should be attempted only by workmen familiar with bearing scraping. The work must be done carefully to prevent an excessive flow of oil by the bearing.

If, after completing the work, the clearance between the bearing and the crank pin exceeds .006 inch, a new bearing should be substituted. The end play in a crank pin bearing should not exceed .015 inch.

In refitting a used crank pin bearing, it may be necessary to reduce the caps on the forked connecting rod to cause them to clamp the bearing tightly. The inside diameter of the hole in the rod measured lengthwise of the rod should be .002 of an inch less than the outside diameter of the surfaces of the bearing which are held in the rod. The caps can be reduced, if necessary, by rubbing them carefully on fine emery cloth stretched tightly over a machined surface plate.

105 Fitting a New Standard Size Bearing

Crank pin bearings of standard size are reamed before shipment and should not be scraped unless the bearing surface becomes injured.

If there is more than .006 inch clearance between a new standard size bearing and the crank pin, an undersize bearing should be fitted. Unreamed bearings .005 inch and .020 inch undersize are furnished by our Parts Department. The end play in a crank pin bearing should not exceed .015 inch. Side play between a single connecting rod and the shoulders on the bearing should not exceed .008 inch.

In fitting a new crank pin bearing, it may be necessary to reduce the caps on the forked connecting rod to cause them to clamp the bearing tightly, provided the caps have not previously been reduced. If it is necessary to reduce the caps, it may be done as directed in §104. If the caps of the forked rod have been previously reduced, it may be necessary in fitting the new bearing to place shims under the caps of the forked rod. In such a case, shims of the correct thickness should be used so that the inside diameter of the hole in the rod, with the caps and shims in place, will be .002 of an inch less than the outside diameter of the bearing.

106 Fitting a New Undersized Bearing

Unreamed crank pin bearings .005 inch and .020 inch undersize are furnished by our Parts Department for use where the clearance between a crank pin and a new standard size bearing exceeds .006 inch.

The desired clearance between the bearing and the crank pin is from .0015 inch to .003 inch. The clearance must in no case be less than .0015 inch or more than .006 inch.

Undersize bearings are unreamed and should be scraped or reamed. The work should be attempted only by workmen familiar with bearing scraping. Bearings can be reamed by use of the Martel reamer. (See Fig. 5.)

In fitting a new undersized bearing, the same directions should be followed in regard to fitting the bearing in the forked rod, as in §105.

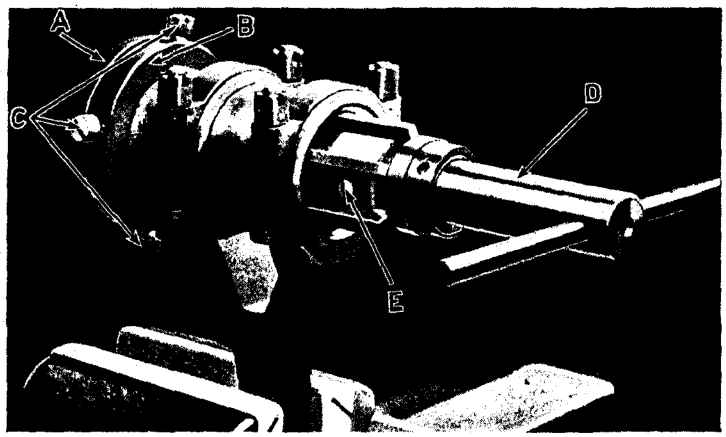

Fig. 5—Reaming Connecting Rod Bearing

107 Reaming Connecting Rod Bearings

To ream a connecting rod bearing, clamp the connecting rod into a vise protecting the rod with wood blocks or copper jaws. Set the reamer (tool No. 79255) to the proper size, assemble it upon the short shaft and place the reamer with shaft and a centering bushing into the connecting rod as shown in Fig. 5.

Hold firmly together the two portions of the centering bushing and with the 6° cutting edge of the reamer held tightly against the opposite end of the connecting rod bearing to center that end of the reamer shaft, screw the centering bushing into place. Lubricate the reamer with a good quality of lard oil and ream the bearing until the reamer strikes the centering bushing. Then remove the bushing and continue with the reaming operation.

After this work is completed the connecting rods should be aligned in accordance with directions in §369.

Caution:—Inaccurate work will result unless very great care is used in handling this tool, particularly the long bar which may be easily rendered inaccurate by rough handling. Keep all parts well oiled with a good quality of engine oil and packed in the box in which they are received.

FITTING CRANKSHAFT MAIN BEARINGS

108 Refitting a Used Bearing

If the bearing surface is rough, scored, or shows only a partial bearing on the shaft, it should be cleaned up with a scraper. This work should be attempted only by workmen who thoroughly understand bearing scraping. The work must be carefully done to prevent an excessive flow of oil by the bearing.

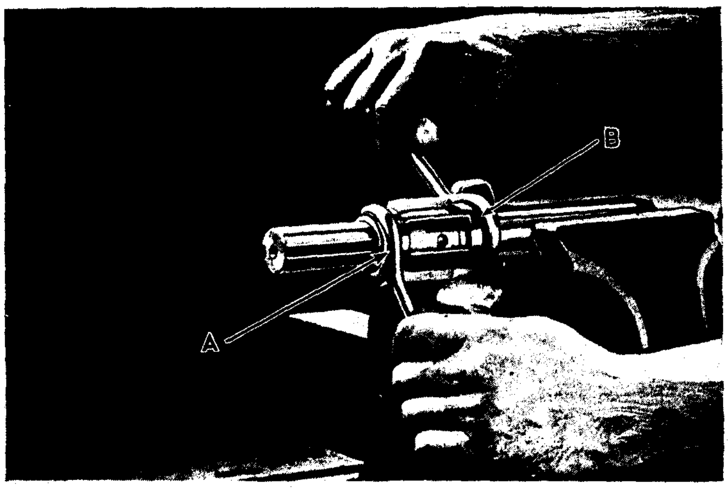

Fig. 6—Replacing Cutter in Martell Reamer

When clamped in place the clearance between a main bearing and the shaft should be from .001 inch to .002 inch.

After scraping the bearing halves reduce the edges, which come together, sufficiently to give the proper clearance between the bearing and the shaft. This may be done by rubbing the halves of the bearing over fine emery cloth stretched tightly over a surface plate as shown in Fig. 4.

Replace the liners with liners of the proper thickness. (§102).

109 Fitting New Bearings

Disassemble the engine (§§301, 302) and place the crankcase upside down upon a suitable support. Assemble the main bearings into the crankcase with the proper size liners in place. Great care should be exercised in having each half of the bearing properly fitted to the crankcase and aluminum caps before tightening down the caps.

Caution:—Do not squeeze the bearings but have them just tight enough in the case to prevent moving them endwise with a lead hammer.

After main crankshaft bearings are properly fitted in place, they should be reamed. Main bearings can be reamed by using the Martell reamer (tool No. 79255) furnished by our Parts Department, as shown in Fig. 7.

If the reamer is not fitted with cutters of the proper size replace them. To do so proceed as follows: Place the reamer upon the short shaft furnished with the tool and clamp the shaft in a vise as shown in Fig. 6. With the spanner wrench furnished loosen one of the clamping col-

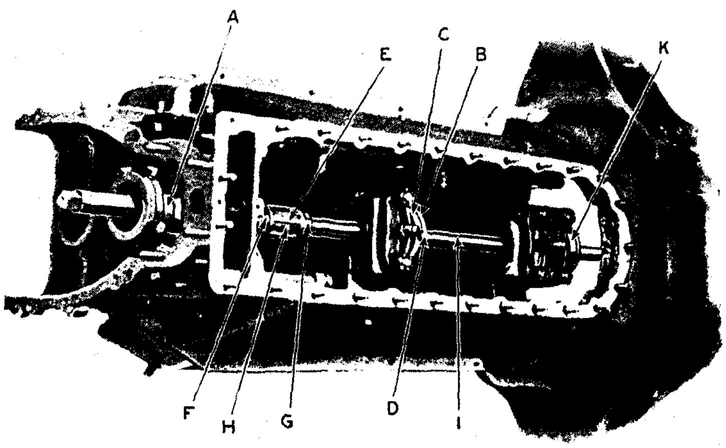

Fig. 7—Reaming Crankshaft Main Bearings

lars "A" or "B" and remove the cutters. Cutters of the correct size may be assembled into the reamer and the collar tightened. The cutters are stamped with figures from one to six. The grooves into which they fit are similarly marked. It is important that each cutter be placed in its proper groove.

After cutters of the correct size are assembled into the reamer, micrometer the crank shaft bearings and set the reamer .002 inch to .003 inch larger than the bearings. This will give them .001 inch to .002 inch clearance between the shaft and bearings after reaming is completed. To increase the size of the reamer loosen the collar "A" and tighten the collar "B." To decrease the size, loosen the collar "B" and tighten the collar "A."

With cutters of the correct size in place and the reamer set to the correct size, assemble the bar with centering bushings and reamer into the crankcase as shown in Fig. 7. Have the 6° cutting edge of the reamer face toward the forward bearing.

With the two parts of centering bushings "A," "B" and "C," fitted tightly together, screw the threaded portions tightly into the ends of the bearings as shown in Fig. 7. Have two of the set screws of the centering bushings "B," in a horizontal plane, and the other two in the vertical plane. Move the center portion of centering bushing "B," in a horizontal plane, and the other two in the vertical plane. Move the center portion of centering bushing "B" back $\frac{1}{16}$ inch to $\frac{1}{8}$ inch and adjust the set screws so that they just touch the parallel surface of the conical center.

To determine if the centering bushings have been lined up correctly pull the bar back until it just leaves the forward support and then push it forward. The bar should enter the hole without clicking. If it does not, reset the set screws of centering bushing "B." After the bar is lined up correctly lubricate the reamer with a good quality of lard oil and ream the forward bearing, continuing the reaming operation until the reamer just touches the forward centering bushing. Then remove the bushing and continue the reaming operation. After completing the work pull the reamer about one half way out of the bearing just reamed and carefully replace the centering bushing by again screwing it into place. The bar should be lubricated with a good quality of light engine oil.

Carefully remove the bar just far enough to permit turning the reamer around and then replace it. The center bearing may then be reamed in similar manner. After completing this work place the reamer between the second and third bearings and ream the rear bearing.

DRESSING DOWN CRANKSHAFT JOURNALS AND CRANKPINS

110 Crankshaft Journals

The crankshaft journals* should be smooth, free from scores, and round within .003 of an inch. If not, they should be dressed down.

This work should be attempted only by workmen who thoroughly understand work of this kind. To get the best results, the shaft should be removed from the engine and placed in a lathe or grinder. After the shaft is in proper condition, new undersize bearings should be fitted in accordance with directions in §109.

111 Crank Pin Surfaces

If the crank pin surfaces become scored, worn down or worn badly out of round they should be trued up and new undersize bearings be refitted. (§106).

*The word "journal" applies in all cases to the main bearing surfaces on the crankshaft.

Crank pins can be trued up by using the Weber crank pin returning too (tool No. 79256) furnished by our Parts Department. Complete instructions for its use are supplied with the tool.

Fit new undersize bearings after truing up the crank pins. These may be obtained from our Parts Department. Complete directions covering the fitting of new bearings will be found in §106.

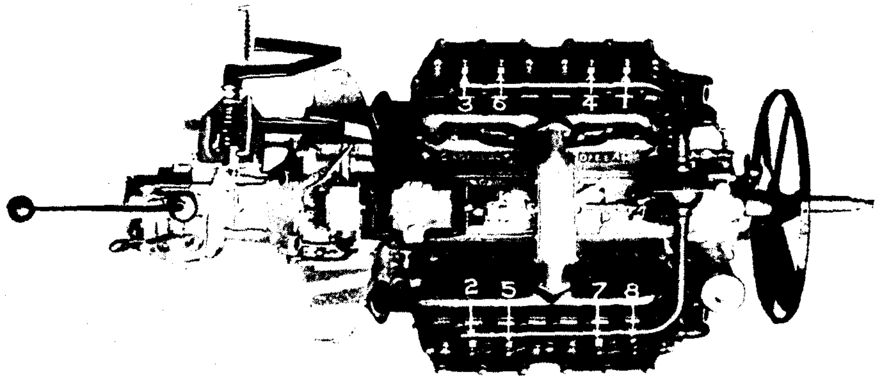

Fig. 8—V-63 Firing Order

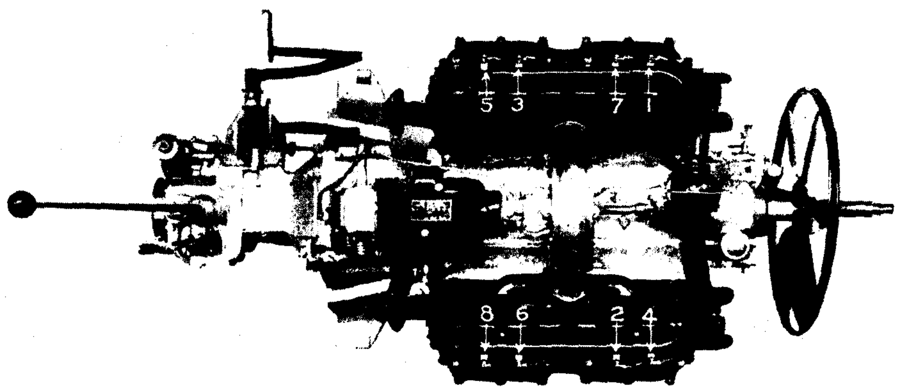

Fig. 9—Type 61 Firing Order

FIRING ORDER

112 Marks on Cylinders

The order in which the cylinders fire is indicated in Fig. 8 for V-63 engines and in Fig. 9 for Types 51-61 engines.

113 Marks on Flywheel

The flywheel marks on the first V-63 engines and on Type 61 engines are stamped on the bevelled surface on the rear face of the flywheel and are visible through the hand hole "X" Fig. 83, after removing the floor-boards and the hand hole cover. On later V-63 cars the marks are stamped on the cylindrical surface of the fly-wheel just forward of the gear teeth. These marks are visible through the inspection hole "A" (Fig. 10b) in the right hand side of the crankcase, just back of the oil pressure regulator. The cover on the inspection hole can be moved to one side after loosening the two screws.

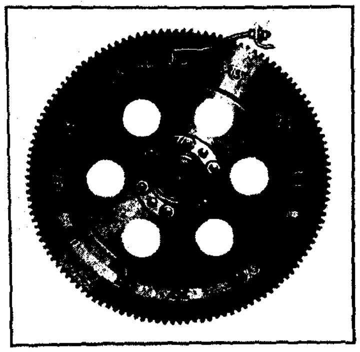

Fig. 10—Flywheel, Showing First Type Timing Marks

In order and significance, the marks are the same on all flywheels, but the letters designating the marks are slightly different. Fig. 10 shows the first type marks and Fig. 10a the second type marks. In each case the marks are arranged in four groups, each group consisting of the following marks in order.

1st Type		*2nd Type*
IN|S	Inlet valve setting	IN|S 1|5
1|5 or 1C5	Center (piston at top of stroke)	1|5 C
EX|S	Exhaust valve setting	EX|S 1|5

Each group of marks refers to two cylinders. The first type marks have the numbers of these cylinders stamped only next to the center mark of the group. On flywheels with second type marks the valve setting marks as well as the center mark are numbered.

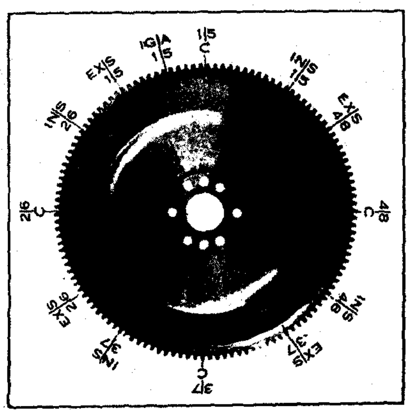

Fig. 10a—Flywheel, Showing Second Type Timing Marks

In addition to the above marks, a mark IG|A, standing for "ignition advanced," is stamped to the left of the center mark for cylinders 1 and 5. (On Type 61 engines there is an IG|A mark for each pair of cylinders.)

Complete instructions for using the "inlet setting" and "exhaust setting" marks are given in §116. The ignition timing is explained fully in §149.

FLYWHEEL POINTER

113a Adjustment of First Type Pointer

On the first V-63 and on Type 61 engines, the flywheel pointer is at the rear of the gear teeth on the flywheel and must be removed before the flywheel can be removed. In replacing it, it should be adjusted so that the tip of the pointer is exactly the same distance from each of the holes in the crankcase for the two upper transmission bolts. It is important that this adjustment be made accurately

113b Adjustment of Second Type Pointer

On later V-63 engines the flywheel pointer is in front of the flywheel on the right side and need never be disturbed. If for any reason it should be removed or its position changed, it should be readjusted as follows:

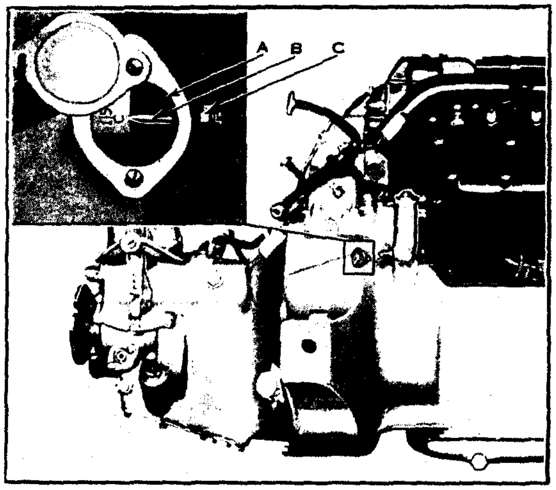

Fig. 10b—Inspection Hole and Pointer for Second Type Flywheel Timing Marks

Remove the floor boards and the hand hole cover over the clutch. Take a suitable piece of flat stock, clamp one end under one of the screws by which the hand hole cover is attached and bend the other end close to but not touching the clutch driving ring.

Remove the left cylinder head. Crank the engine in the direction in which it runs until the piston in No. 1 cylinder is some definite distance (three-fourths of an inch or one inch) from the top of the cylinder block on the up stroke. Mark the clutch ring directly opposite the improvised pointer. Crank the engine further in the direction in which it runs until the piston in No. 1 cylinder is the same distance as before from the top of the cylinder block but on the down stroke. Again mark the clutch ring opposite the pointer.

With dividers find the exact center of the distance between the two marks on the clutch ring and make a third mark. Crank the engine until this third mark is exactly opposite the pointer. If the work has been accurately done, the piston in No. 1 cylinder will then be exactly on top center.

If the tip of the pointer on the crankcase is not directly over the center mark for Nos. 1 and 5 cylinders, loosen the lock nut "C" (Fig. 10b) on

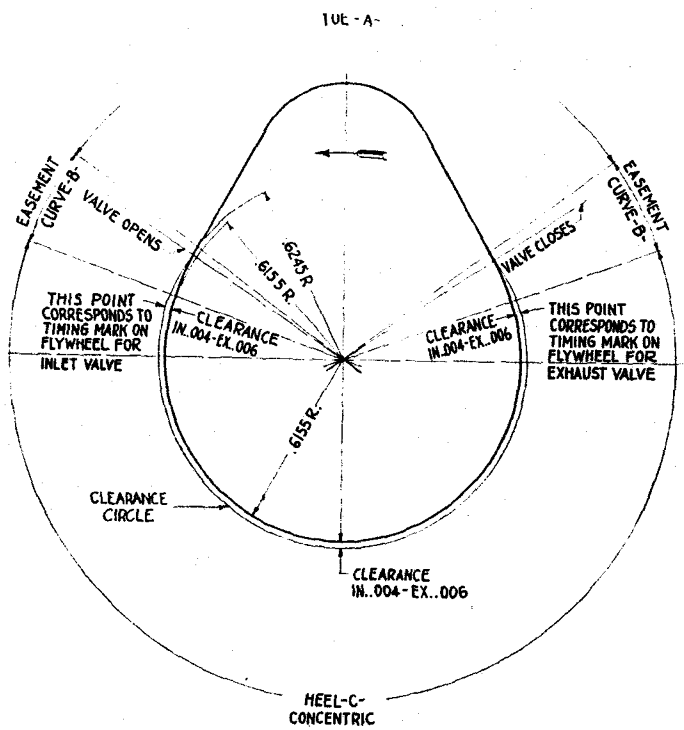

Fig. 11—V-63 Cam

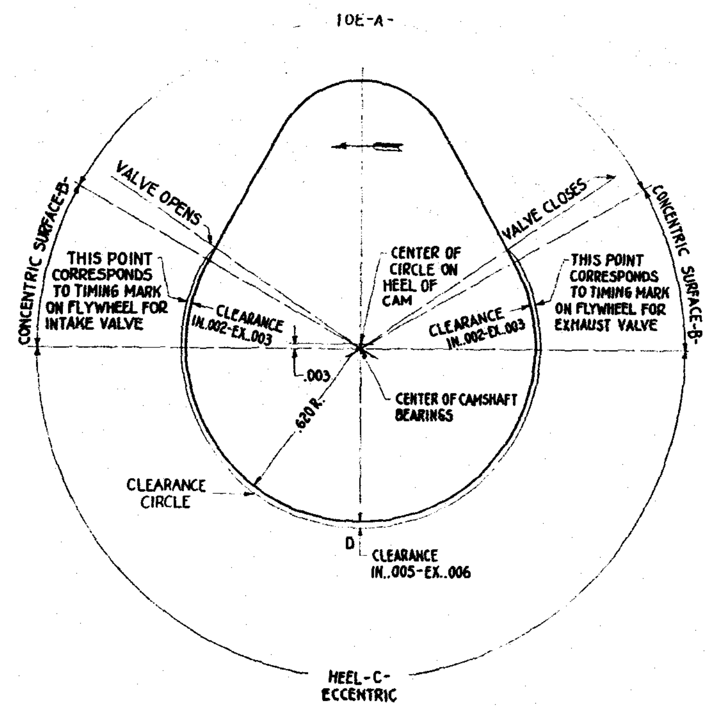

Fig. 12—Type 61 Cam

the pointer on the crankcase and turn the pointer with a screw-driver until the tip is directly over the center mark. Hold the pointer in this position and tighten the lock nut.

ENGINE VALVES

114 Shape of Cams

The shape of the cams used in poppet valve gasoline engines resembles that of a pear, the small end of the pear corresponding to the toe of the cam. When the toe of the cam is in contact with the roller, the valve is open, and when the large end or heel of the cam is in contact with the roller, the valve is closed.

While the general shape of the large part of the cam is circular it is not exactly so. Fig. 12 illustrates on an enlarged scale, the shape of the cam used in Type 61 and previous eight-cylinder engines and shows that the cam surface is made up of four parts: the toe "A", two concentric surfaces "B", and the heel "C", which is eccentric with respect to the center of the camshaft bearings. Around the heel of the cam is drawn a "clearance circle" which has such a radius that the distance between it and the cam represents the clearance between the lower end of the valve stem and the adjusting screw in the cam slide.

It is apparent from the diagram that this clearance is greatest when the roller is on the heel of the cam opposite the toe. As the cam revolves, the clearance decreases until the roller is on the short concentric surface "B." It remains constant while the roller is in contact with the concentric surface "B" but commences to decrease again as soon as the roller reaches the straight surface of the toe "A." The clearance is then quickly taken up and the valve starts to open at the point where the clearance circle meets the cam.

Fig. 11 shows the outline of the cam used in V-63 engines. As in Fig. 12, the cam surface has four divisions, but instead of the two concentric surfaces, the surfaces "B" in Fig. 11 are not circular, but have a gradually increasing radius as they approach the toe of the cam. These surfaces are called "easement curves." Fig. 11 differs from Fig. 12 also in that the heel "C" of the cam is concentric rather than eccentric with respect to the center of the camshaft bearings. It will be seen by the clearance circle in Fig. 11 that with this type of cam the cam slide clearance remains the same while the roller is on the heel "C" but that as soon as the roller reaches the easement curve the clearance starts to decrease. The clearance is completely taken up and the valve starts to open while the roller is still on the "easement curve."

115 Position of Cam for Adjustment of Cam Slide

It is wrongly assumed by many mechanics, that, because the general shape of the large part of the cam is circular, the adjustment of the cam slide clearance can be made with the roller on any part of the cam except the toe "A". It is *not* sufficient in Cadillac eight cylinder engines for the cam roller simply to be away from the toe of the cam. It is necessary that the cam roller be in contact with a definite part of the cam surface when the cam slide is being adjusted. Marks are accordingly placed on the flywheel to indicate when the rollers are in contact with the proper points on the cams. Figs. 10 and 10a show the marks on the flywheel and Figs. 11 and 12 indicate the corresponding points on the cam surface.

There is only one correct method for placing the cams of Cadillac eight-cylinder engines in position for adjustment of the cam slides and that is according to these flywheel marks as directed in §116. This applies equally to V-63 engines and previous eight cylinder engines. Time-saving methods which disregard the flywheel marks are incorrect, such as the following: adjusting both cam slides with the piston on firing center; adjusting one cam slide when the valve operated by the other cam slide is wide open; turning the crankshaft until the valve is wide open and then a quarter turn farther. These and other similar methods used by many mechanics will not give correct results.

116 Placing Cam in Position

To place a cam in position for properly adjusting the cam slide proceed as follows:

Crank the engine slowly by hand in the direction in which it runs until the piston in the cylinder in which the valve is located is at the end of the compression stroke, or in other words, on firing center. When the piston is exactly on firing center the pointer attached to the crank-case will then be directly over the mark on the flywheel indicating "center" for that cylinder.

INLET VALVE. If the valve operated by the cam slide is an inlet valve, crank the engine further by hand in the direction in which it runs until the "IN|S" of that group is directly under the pointer. It will be necessary to crank the engine nearly a complete revolution. On flywheels with second type marks (Fig. 10a), the correct IN|S is designated by the numbers of the cylinders stamped below it. On flywheels with first type marks (Fig. 10), it will be necessary to mark the IN|S with chalk in order to identify it when it appears under the pointer. When the center mark is under the pointer the correct IN|S is just to the left.

The cam is then in the correct position for adjusting the cam slide operating that inlet valve. (§§117, 118).

EXHAUST VALVE. If the valve operated by the cam slide is an exhaust valve, after cranking the engine to the proper firing center, crank it further by hand in the direction in which it runs until the next "EX|S" is under the pointer.

Then crank the engine further one complete revolution until this "EX|S" is again directly under the pointer.

The cam is then in the correct position for adjusting the cam slide operating that exhaust valve. (§§117, 118).

ALL VALVES: While the foregoing procedure is correct for an individual valve, if all sixteen cam slides are to be adjusted, the following method will save time.

Place the cam operating the inlet valve for No. 1 cylinder in position as directed in the foregoing instructions and adjust the cam slide operating that valve. Crank the engine by hand in the direction in which it runs until the next IN|S is under the pointer. This will require exactly one-quarter of a turn, or 90 degrees. Adjust the cam slide operating the inlet valve for No. 2 cylinder. Then crank the engine another quarter turn when the next IN|S mark will be under the pointer and adjust the cam slide operating the inlet valve for No. 3 cylinder. Continue in this manner from one IN|S mark to the next, cranking the engine one-quarter turn in each case, until all eight inlet cam slides have been adjusted.

When the cam slide operating the inlet valve for No. 8 cylinder has been adjusted, crank the engine further until the next EX|S mark is under the pointer. This will require approximately one-eighth of a turn. Adjust the cam slide operating the exhaust valve for No. 8 cylinder. Crank the engine one-quarter turn further when the next EX|S mark will be under the pointer. Adjust the cam slide operating the exhaust valve for No. 1 cylinder. Crank the engine one-quarter turn further when the EX|S mark for No. 2 cylinder will be under the pointer. Adjust the cam slide operating the exhaust valve for No. 2 cylinder. Continue in this manner from one EX|S mark to the next until all eight exhaust cam slides have been adjusted.

117 Cam Slide Clearance

V-63 camslides must be adjusted to different clearances from camslides on Type 61 and previous eight-cylinder engines. The reason for this is the difference in shape between the V-63 cam and the previous type of cam as shown in Figs. 11 and 12 and as explained in §114.

V-63

When the cam is in the proper position (§§115, 116), the clearance between the end of the valve stem "G" (Fig. 13) and the adjusting screw "B" in the cam slide "D" should be .004 inch for intake valves and .006 inch for exhaust valves, when the engine is cold.

Type 61 and Previous Eight Cylinder Engines

When the cam is in the proper position, the clearance between the end of the valve stem "G" and the adjusting screw "B" should be .002 inch for intake valves, and .003 inch for exhaust valves, when the engine is cold.

118 Adjustment of Cam Slide

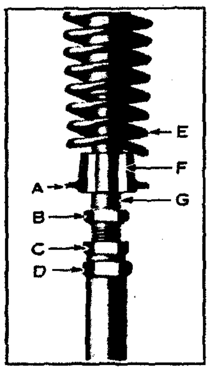

Fig. 13—Cam Slide and Adjusting Screw

To adjust a cam slide, loosen the locking nut "C" and turn the adjusting screw "B."

Tighten the locking nut "C" when the proper clearance has been obtained, taking care that in so doing the adjustment of the screw "B" is not disturbed.

Cadillac wrench No. 88745 may be used for the adjusting screw and nut. The cam slide may be held from turning by using tool No. 87964 for V-63 cars and tool No. 72843 for Type 61 and previous cars.

119 Grinding Valves

Remove the valve. (§383).

Before grinding remove carbon or rust from the valve and valve stem bushing. Do not use a reamer for this purpose. Polish the valve stem.

It is a good plan to wrap soft string around the stem of the valve near the head. This will tend to prevent the grinding compound getting into the valve guide.

In the absence of a good prepared grinding compound, make a paste of powdered glass or flour of emery, mixed with thin oil.

Place the grinding compound on that portion of the valve which bears on the valve seat. Then replace the valve, and with a screwdriver or other suitable tool, rotate it back and forth about one-third revolution, with only a slight pressure on the tool. Lift the valve occasionally and turn it to a new position. Continue the grinding operation until the valve and its seat show perfect bearing when tested with Prussian blue or pencil marks on the valve seat.

Then thoroughly wash the valve, the valve chamber and the valve guide with kerosene or gasoline. Be very careful to leave none of the grinding compound in any part of the cylinder, as it will cause serious damage if it works into the cylinder bore or other parts of the engine; also remove the string from the valve stem. Replace the valve.

After replacing the valve, retime it. (§§116-118). Retiming is necessary as the amount of clearance between the valve and the adjusting screw in the cam slide is necessarily reduced during the grinding operation.

All valve springs in one cylinder block may be lifted at once to facilitate grinding of valves by using two of Cadillac valve lifter, tool No. 85783.

ENGINE CHAINS

120 Riveting Chains

Each joint of each chain contains two pins as shown in Fig. 14: a seat pin "A," which is ribbed, and a rocker pin, "B," which is plain. If a chain is removed, care must be taken in replacing it that the joint pins are inserted as shown. If the rocker pin is inserted backward it will quickly destroy the chain. It is also necessary that the arrows stamped on the chain links point in the direction in which the chain runs.

To rivet the fanshaft driving chain, bring the ends of the chain together on one of the sprockets. The wedging action of the sprocket teeth helps to draw the ends of the chain together. From the front,

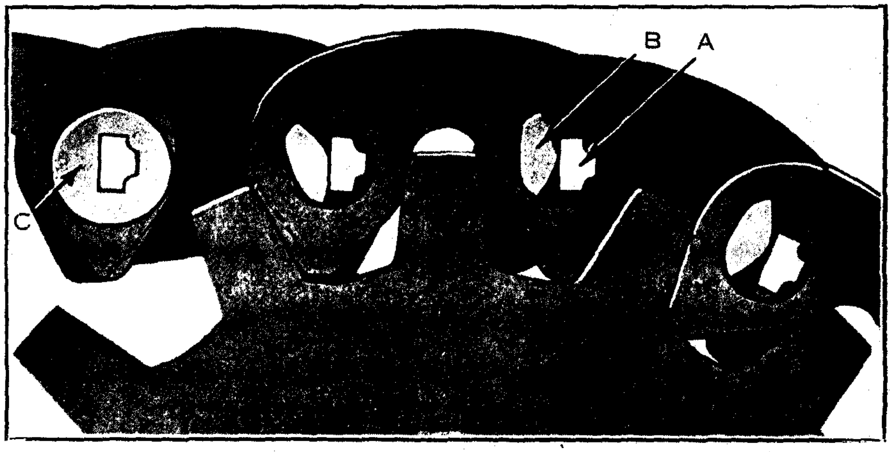

Fig. 14—Magnified View of Chain Showing Correct Positions for Rocker and Seat Pins.

insert the rocker pin and a used or extra seat pin as a temporary pin to align the links. The seat pin should be inserted to about two-thirds of its length.

Rivet the small washer "C" on one end of the new seat pin. Remove the slotted plug from the hole "U" (Fig. 68) in the rear of the fanshaft housing and turn the fanshaft so that the connection between the ends of the chain is directly opposite this hole. Insert the new seat pin from the rear through the hole in the fanshaft housing, forcing out the temporary seat pin. For this operation use Cadillac rivet inserter, tool No. 56331. In doing this be careful not to force out the rocker pin. Be sure to recover the temporary seat pin so that it will not get into the mechanism of the engine.

Place the riveting block, Cadillac tool No. 83231, back of the chain between the fanshaft housing and the inner end of the seat pin to be riveted. Place the small washer "C" on the outer end of the seat pin and force it on with Cadillac tool No. 56322. Carefully rivet over the end of the pin.

To rivet the camshaft driving chain, first make sure that the crankshaft and camshaft sprockets are in the correct relation to each other. (§329). Then bring the ends of the chain together on the upper side of the large sprocket and insert a rocker pin and a temporary seat pin, the same as directed previously for the fanshaft driving chain.

To insert the new seat pin, use the same tool, No. 56331, as for the fanshaft chain, having the ends of the chain half-way between the sprockets. In placing the washer on the pin use the same tool, No. 56322, as for the fanshaft chain, but in riveting the pin use block No. 56332 instead of No. 83231.

After riveting a seat pin, test it to see that it is not broken by applying a pair of pliers to the washer and pulling endwise.

121 Replacement of Chains

Chains must always be replaced in pairs. Do not replace one chain only. For instructions for replacing engine chains see §§328, 329.

122 Adjustment of Type 61 Chains

The frequency with which chain adjustment is necessary depends upon four things:

Use of suitable lubricant
Manipulation of carburetor enriching lever
Replacement of engine oil
Washing out of oil pan of engine.

It is a good plan to readjust the chains at the end of the first two thousand miles of use.

123 Tests for Need of Adjustment

To determine if chain adjustment is necessary oscillate the fan as far as possible without slipping the fan clutch. If the movement at the periphery of the fan exceeds 1″ adjustment is recommended. Under no conditions should the car be driven until a readjustment is made if the fan movement exceeds 2″.

124 Method of Adjustment

Turn the shaft "B" (Fig. 67) *six complete revolutions* in the clockwise direction. This will loosen the locking collar "A" screwed onto the inner end of the support "C." Turn the shaft "E" in the clockwise direction sufficiently to reduce the movement at the periphery of the fan to ⅜ inch without slipping the clutch at the fan hub. Then turn the shaft "B" in the counter-clockwise direction, thereby clamping the support "C" into place.

When chains become so badly worn that readjustment cannot be made, remove the offset link of each chain. Then loosen the locking collar "A" (Fig. 67) by turning the shaft "B" six complete revolutions. Turn the shaft "E" in the clockwise direction bringing the sprockets "L" and "N" into positions such that the chains can be replaced. Then adjust the chains as directed in the preceding paragraph.

STORAGE

125 Engine

To prepare the engine for storage proceed as follows: Start the engine, cover the radiator and run the engine until it is hot. (§191). The engine should be run at a speed which will show an ammeter reading of about 10 with all lights switched off. It usually requires from two to ten minutes to heat up the engine.

After the engine is hot, stop the flow of gasoline to the carburetor by removing the gasoline tank filler cap, thus relieving the air pressure. Immediately the engine starts to slow down from a "lean mixture" inject one-half can of clean fresh engine oil into the carburetor. This may be done easily by lifting up the cover over the air valve. This will stop the engine. Be certain there is no fire near when the filler cap is removed. Replace and tighten the cap after the engine stops and replace the screw.

Open the compression relief cocks. Inject from five to six tablespoonfuls of clean fresh engine oil into each cylinder and before closing the cocks, crank the engine three or four revolutions with the ignition switched off. This will tend to distribute the oil over the cylinder walls.

Drain the cooling system. (§172).

126 Storage Battery

(§162).

127 Tires

During winter storage it is best to remove the tires from the rims and keep the casings and tubes in a fairly warm atmosphere away from the light. It is best to inflate the tubes slightly after the tires have been removed to keep the tires in the position in which they are when inflated on the rim.

If the tires are not removed from the car, and the car is stored in a light place, it is best to cover the tires to protect them from strong light, which has a deteriorating effect on rubber.

The greatest injury that can be done to tires when the car is stored is to allow the weight of the car to rest on them. If the tires are not removed the car should be blocked up so that no weight is borne by the tires which should then be deflated partially. This will relieve the tires of all strain, so that in the spring they should be practically no worse for the winter's storage.

128 Body and Top

It is best to put the top up and cover the entire car to protect it from dust.

129 Taking the Car Out of Storage

When the car is taken out of storage and before the engine is started, drain the oil from the oil pan, remove and clean the oil pan and baffle plate and replace the oil with fresh oil. (§715).

The following instructions should be followed carefully in starting the engine:

Open the compression relief cocks and inject from five to six tablespoonfuls of clean fresh engine oil into each cylinder.

Close the cocks and with the ignition turned off, turn the engine over a few revolutions by hand. This will tend to distribute the oil over the cylinder walls.

Start the engine in the usual manner.

Immediately the engine starts push the carburetor enriching button as far forward as possible without causing the engine to stop or a material reduction in engine speed and open the throttle to a point which causes an ammeter reading of approximately 10 with all lights switched off. With the engine running inject a half canful of clean fresh engine oil into the carburetor under the cover, which is located over the auxiliary air valve.

Push the carburetor enriching button forward as far as it will go as soon as the engine is warm enough to permit it.

ELECTRICAL SYSTEM

130 General Description

The Cadillac-Delco system is the single wire, single unit system. One side of the motor generator, storage battery, lamps, horn and ignition apparatus is connected to some part of the frame of the car or engine. The other connections are made with copper wires or cables.

MOTOR GENERATOR

131 Serves Double Purpose

The motor generator serves both as a generator of current and as an electric motor for cranking the engine when starting. The principal elements of the motor generator are an armature and a field. There are two windings on the armature and two in the field—one on the armature and one on the field are used when the motor generator is used as a generator and the other windings when it is used as a motor.

132 Generator

The motor generator, when acting as a generator, is driven at engine speeds by the fanshaft which, in turn, is driven by a silent chain from the camshaft at the front end of the engine. Thus driven, it delivers electrical energy for charging the storage battery and for operating the lights, ignition apparatus and horn. To prevent the current generated from rising too high when the engine is running at high speeds, the third brush system of current regulation is employed.

133 Motor

When acting as a motor, the sole function of the motor generator is to crank the engine. In starting, the first thing the operator does is

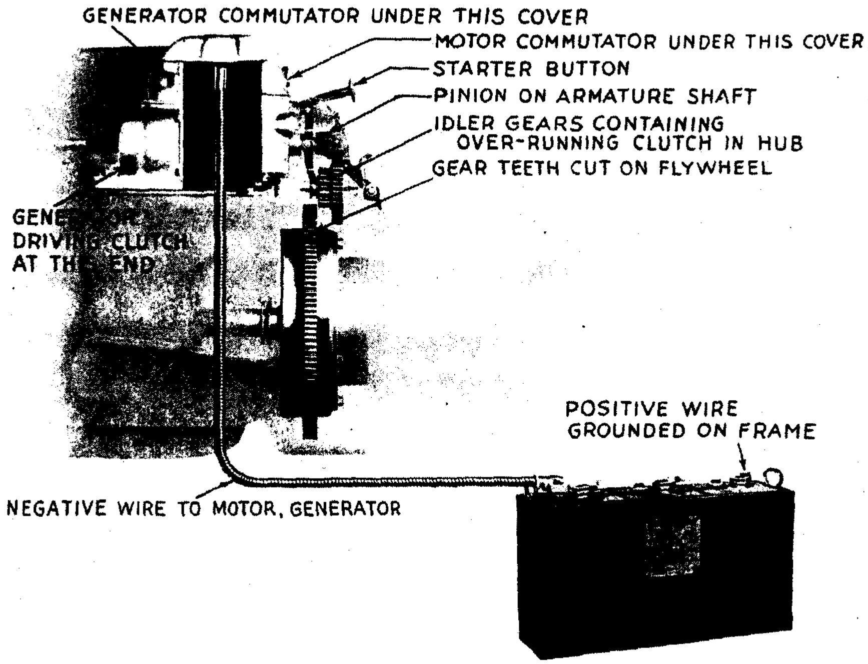

Fig. 15—Motor Generator and Starting Mechanism

to push up the ignition lever on the combination switch. This closes the ignition circuit and the circuit between the storage battery and the generator windings on the motor generator, causing the armature to revolve slowly.

A ratchet clutch in the front end of the generator allows the armature to rotate ahead of the driving shaft. The clicking noise that is heard when the ignition switch is turned on comes from this clutch.

Next the operator pushes down the starter button. The first movement causes the starter gears to mesh with the teeth on the flywheel. The probability of the ends of the teeth striking and failing to mesh is overcome by the slow rotation of the armature which began as soon as the ignition was turned on.

As the starter button is pushed further down, the circuit between the storage battery and the generator windings of the motor generator is broken. Upon the last movement of the starter button the circuit is closed between the storage battery and the motor windings on the motor generator, causing it to act as a powerful electric motor which rapidly cranks the engine.

As the gear ratio between the armature shaft and the crankshaft is approximately 25 to 1, the armature would be driven at an excessively high rate of speed after starting the engine and before the operator let the starter button back if it were not for an over-running clutch in the hub of the idler gears between the flywheel and the armature shaft. The electric motor cranks the engine through this clutch, but after the engine has started and begins to run faster than the electric motor, the clutch slips.

When the starter button is let up, as soon as the engine is running under its own power, the first movement of the button breaks the circuit between the electric motor and the storage battery, a further movement causes the starter gears to slide out of mesh and the final movement completes the circuit between the generator and the storage battery, which was broken at the generator switch (Fig. 75), when the starter button was pushed down. The engine running and the circuit being closed between the storage battery and the generator windings of the motor generator, the generation of current begins.

Caution:—The action which causes the engine to "turn over" is produced by a gear of the electric starting motor sliding into mesh with teeth on the fly-wheel of the engine. When pushing down on the starter button to throw these gears into mesh, if it should so happen that they are in just such positions that the ends of the teeth of the starter gear come against the ends of the teeth of the fly-wheel, instead of the teeth of one sliding between the teeth of the other, do not use force. Simply permit the starter button to return to the normal position and then push it down again. In the meantime, the gears will probably have changed their relative positions sufficiently to permit the teeth to mesh.

134 Fitting Motor Generator Brushes

If the brushes of the motor generator do not have a good full bearing on the commutators, the brushes should be refitted. To do so proceed as follows:

Cut a strip of number 00 sandpaper slightly wider than the brushes. Pass it between the brushes and the commutator and at least one-half way around the commutator. Draw the sandpaper back and forth with sanded side against the brushes.

Another method is by removing the end frame and placing the sandpaper around the commutator with ends just butting.

The paper can be held in place by using LePage's glue at three or four places on the commutator. Allow the glue to dry before replacing the brushes and end frame.

After the end frame has been reassembled connect the motor end to a storage battery to revolve the armature. Do not allow the armature to revolve at high speed.

When fitting motor brushes use the generator end as a motor to revolve the armature.

Ordinarily the brushes seat very quickly.

Do not use emery cloth in fitting brushes.

135 Commutators

Do not under any condition put oil of any kind on the commutators of the motor generator.

HORN

136 Description

On later V-63 cars, the horn is mounted on the intake manifold. On the remainder of the V-63 cars, and on Type 61 cars, the horn is mounted just back of the fan. The horn is operated by a switch on the steering gear. The horn is motor driven, and ordinarily requires very little attention or adjustment.

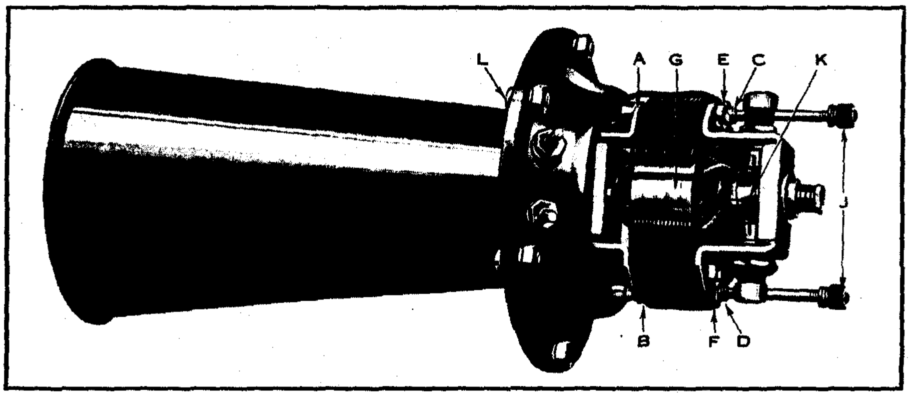

Fig. 16—Horn

Before attempting to readjust a horn, make sure that the horn requires adjustment. See that the battery is well charged, that the collar screws are tightened properly, that the commutator of the horn motor is clean, that the horn switch is making proper contact, that there are no loose or corroded connections at any point in the circuit and that there are no broken or grounded wires in the circuit.

137 Adjustment of Horn

Horns mounted on the intake manifold can be adjusted without being removed. To adjust a horn mounted on the fanshaft housing it is necessary to remove the horn which can be done after disconnecting the horn wires and removing the two screws attaching the support to the fanshaft housing. To adjust either type of horn, remove the shell enclosing the horn motor.

The adjustment consists in moving the entire motor closer to or farther away from the horn diaphragm.

If the tone of the horn lacks volume, the motor should be moved toward the diaphragm. If the tone is rough and the motor stops abruptly the motor should be moved away from the diaphragm.

To move the horn motor toward the diaphragm, turn the two nuts "A" and "B" (Fig. 16) each about one-sixth of a turn counter-clockwise (facing the horn from the front.) Then tighten the two nuts "E" and "F" by turning them in the same direction.

To move the horn motor away from the diaphragm, turn the two nuts "E" and "F" clockwise. Then tighten the two nuts "A" and "B".

It is important to turn the adjusting nuts on the two sides the same amount to insure the motor being held the same distance from the diaphragm on both sides.

Caution. Do not use pliers on the knurled nuts "J" holding the motor shell in place.

138 Cleaning and Lubricating Horn

After each 2000 miles of car operation, the commutator of the horn motor should be inspected and cleaned. If the horn is mounted on the intake manifold it is necessary only to remove the motor shell from the horn. If the horn is mounted on the fanshaft housing it will be necessary to remove the horn from the engine and the motor shell from the horn.

If the commutator appears to be dirty, it should be cleaned with a dry cloth, and this should be done with the horn motor running so that the commutator will be cleaned on all sides. If this does not make the commutator bright and clean it may be polished with very fine sandpaper (No. 000) while the horn motor is running.

Do not place oil or vaseline on the commutator or brushes. If the horn is a Kellog horn, however, the commutator may be wiped carefully with a cloth which has been moistened with light vaseline. If this is done the commutator should be wiped afterward with a clean, dry cloth.

Horns on V-63 cars are lubricated when assembled and do not require further lubrication either on the bearings or on the commutator. (Horns on Type 61 cars may be lubricated with a few drops of engine oil on the front and rear ball bearings of the armature shaft. Medium Cadillac Engine Oil is suitable for this purpose.)

Do not under any circumstances, put lubricant on the commutator of a horn.

Wipe the inside of the motor shell with a clean, dry cloth before replacing it.

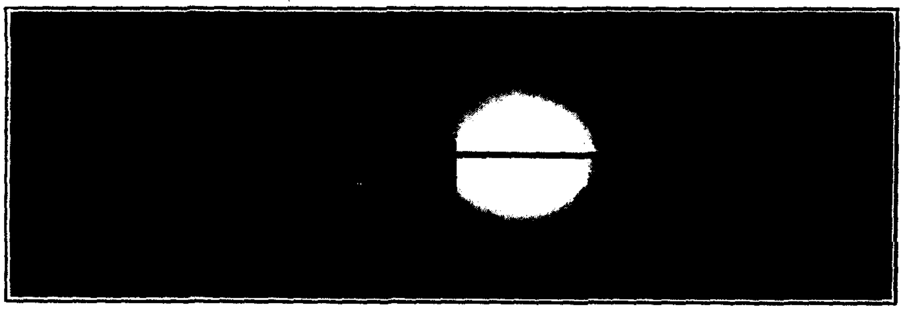

Fig. 17—Light from Right Headlamp, Lens Removed

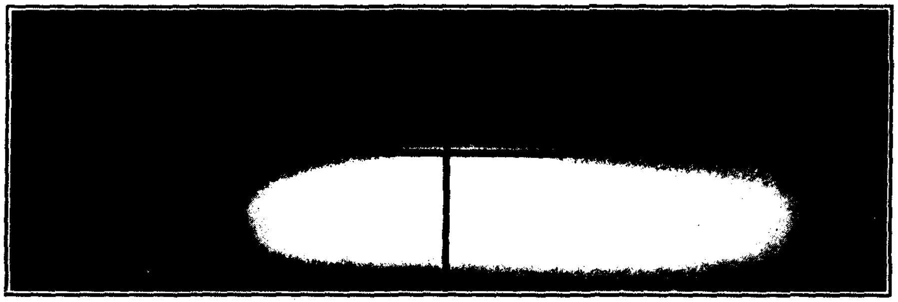

Fig. 18—Light from Right Headlamp, Lens in Place

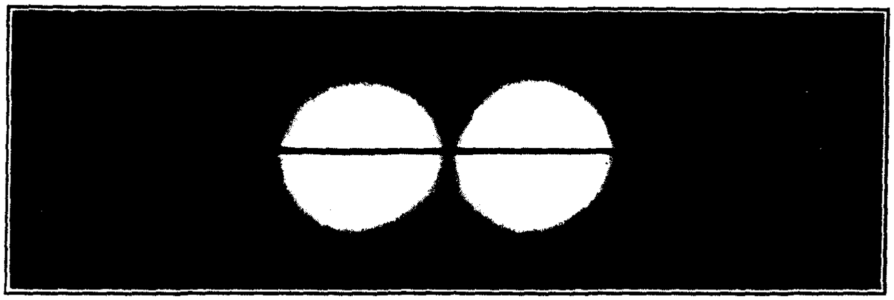

Fig. 19—Light from Both Headlamps, Lenses Removed

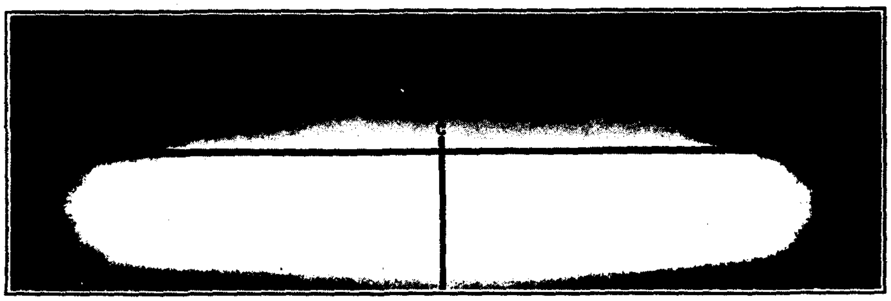

Fig. 20—Light from Both Headlamps, Lenses in Place

LAMPS

139 Tilting Head Lamp Reflectors

The reflectors in the head lamps are pivoted so that they can be tilted and are controlled by a button on the instrument board. When the road is clear and illumination of the distant road is desired, the reflectors direct the rays ahead. When a vehicle traveling in the opposite direction approaches, rays from the headlamps can be deflected further than already deflected by the lenses, increasing illumination directly in front of the car, by simply pushing forward the button and thereby tilting down the reflectors.

140 Focusing Headlamps with Bausch and Lomb Lenses

Focal adjustment of the headlamps should be made whenever a headlamp bulb is changed. To make the adjustment, place the car with its normal load on a level stretch, facing a dark wall and with the headlamps 25 feet distant from it. On the wall mark a horizontal line at the same distance above the ground as the centers of the headlamps, and a vertical line in front of the center of the automobile (Fig. 17.)

Pull the reflector control button out from the instrument board. Remove the door with lens from the headlamp to be adjusted, and cover or disconnect the other headlamp. By turning the adjusting screw "O" (Fig. 79) at the edge of the reflector toward the top, move the lamp forward or backward until the smallest circular beam of light is thrown on the wall (Fig. 17). Turning the adjusting screw clockwise moves the bulb back, turning it counter-clockwise moves the bulb forward.

141 Aiming Headlamps

When both headlamps are properly focused, note the position of the two circles of light thrown on the wall with respect to the horizontal and vertical lines. With the reflector control button pulled out, the centers of the circles of light should coincide with the horizontal line, should be the same distance apart as the centers of the headlamps, and equally distant from the vertical line (Fig. 19).

If the center of either spot of light is above or below the horizontal line, adjust the tilting reflector by means of the adjusting screw "U" (Fig. 79) at the bottom of each reflector. Turning the screw clockwise tilts the reflector down and lowers the beam of light.

If the centers of the two spots of light are not the same distance apart as the centers of the lamps, or if they are spaced unequally with respect to the vertical line, loosen the headlamp support nuts and turn the lamps until the beams are parallel and spaced equally.

With the lenses in place each lamp should produce a beam with the top edge approaching point "C" (Fig. 18). The two together should produce a beam approaching point "C" and spreading equally to the right and left of the vertical line (Fig. 20).

If the lenses for any reason are removed from the headlamp doors they should be replaced with the cylinder lines vertical. Notches in the lenses register with clips on the doors to insure correct centering of the lenses.

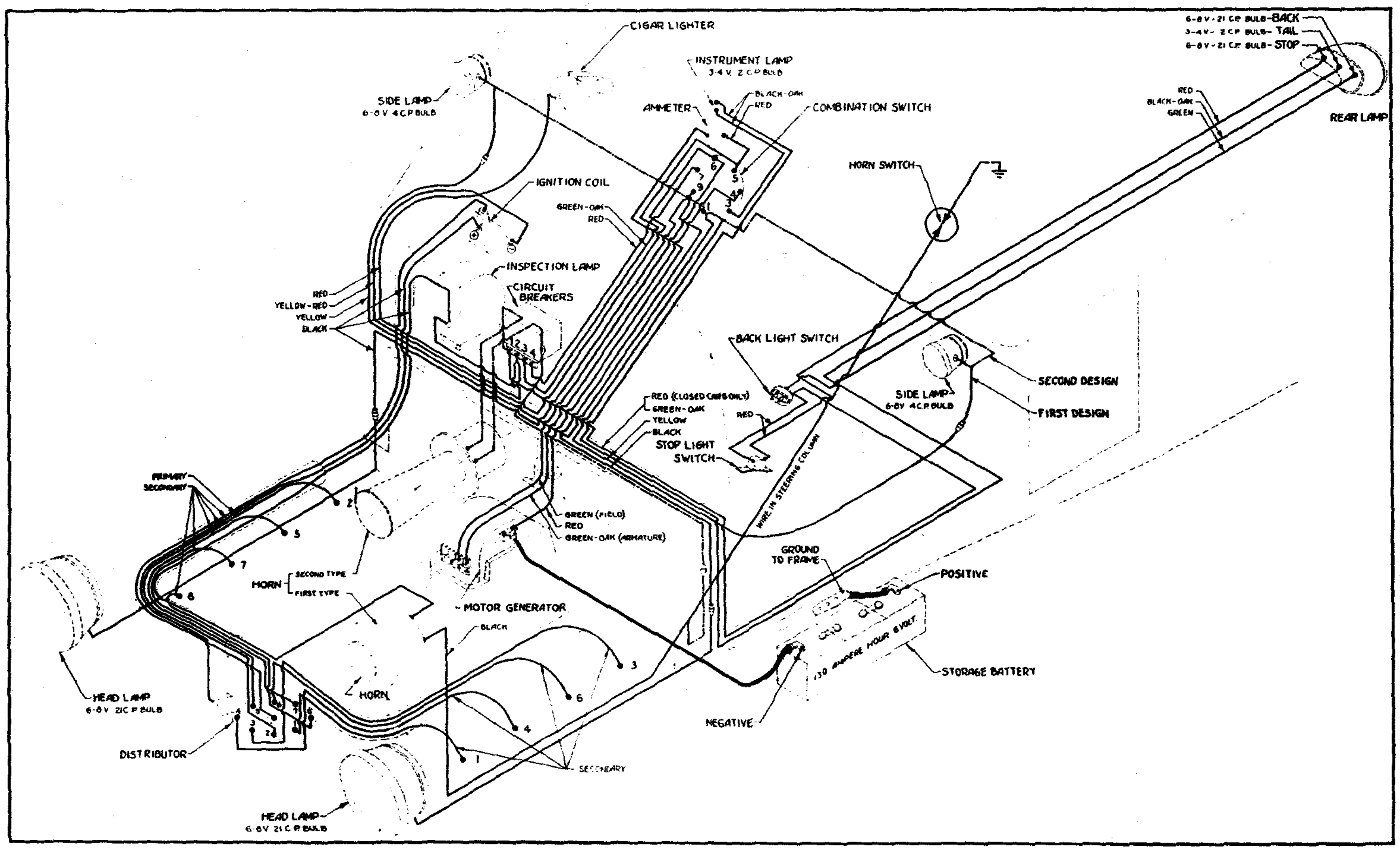

Fig. 21—V-63 Wiring Diagram—Open Cars

142 Cleaning Reflectors

The reflectors in the head and side lamps are plated with pure silver. In polishing, extreme care must be used in selecting materials which will not scratch the silver.

Powdered dry rouge and a chamois skin are recommended. If the reflectors are tarnished, moisten the rouge with alcohol, and apply with the chamois. Then polish with a dry chamois and rouge.

The chamois should be soft and must be kept free from dust. Do not use chamois used for any other purpose.

143 Lamp Bulbs

Bulbs should have the correct voltage and candle power rating. The following is a table of correct voltage and candle power ratings:

Lamps	*Voltage*	*Candle Power*
Head	8	21
Side	8	4
Instrument	4	2
Tail	4	2
Stop-light (V-63)	8	21
Back-up light (V-63)	8	21
Inspection	8	4
Dome, enclosed cars	8	4
Quarter, enclosed cars	8	2
Tonneau (Type 61)	8	2

IGNITION SYSTEM

144 General Description

The ignition system embodies the following elements: A source of current, the generator, or at low speeds, the storage battery; an ignition timer, which interrupts the low tension current at the proper instant to produce a spark in the high tension circuit; an induction coil, transforming the primary current of six volts into one of sufficient voltage to jump between the points of the spark plugs; a condenser, which assists the induction coil to raise the voltage, and which protects the contact points of the ignition timer from burning; and a high tension distributor which directs the distribution of the high tension current to the spark plugs in the respective cylinders.

145 Distributor and Timer

The distributor and timer (Fig. 78) are carried on the fanshaft housing and are driven by the fanshaft through spiral gears.

The distributor consists of a cap or stationary head of insulating material and a rotor of the same material which turns with the timer shaft. The distributor head carries one contact in the center and eight additional contacts placed at equal distances about the center. (Only two of these contacts are shown in Fig. 78.) The center contact is connected to the high tension terminal on the ignition coil. The eight remaining contacts are connected to the spark plugs in the cylinders.

The center contact is provided with a spring plunger which is in constant contact with a plate on the rotor. This plate carries a contact button at its outer end. As the rotor revolves, the contact button slides over the eight outer contacts in the distributor head, consecutively completing the high tension circuit to each of the spark plugs from the ignition coil.

The timer, by which the low tension current is interrupted at the proper time to produce the spark, is beneath the rotor. An eight lobed cam "J" (Fig. 22) on the timer shaft, operates two contact arms "C" and "O." As the cam revolves, these arms alternately complete and break the primary circuit. The cam is held in place by the lock screw "I."

Two sets of timer contact points are provided. The object is to distribute over two sets the current which would otherwise pass through one. This greatly lessens wear and burning of the points.

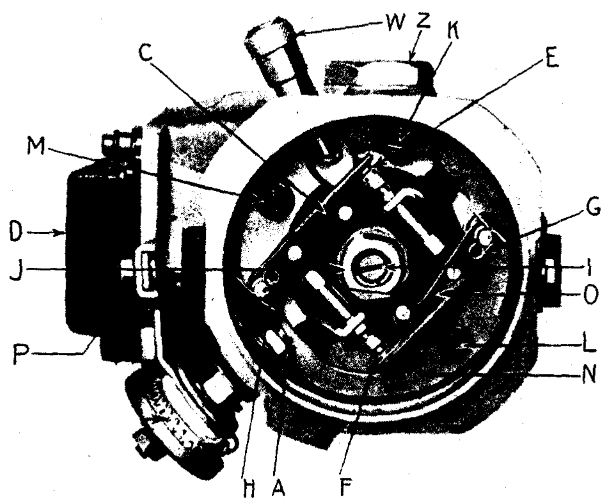

Fig. 22—Timer

The spark timing is automatically controlled by a centrifugal governor which advances or retards the position of the timer cam relative to the driving shaft, as the engine speed increases or decreases. A spark lever at the steering wheel is provided, however, by which the timing may be still further advanced or retarded. This spark lever is connected to the manual control lever at the left of the distributor housing.

146 Cleaning Distributor Rotor Button Track

If the track in the distributor head, against which the rotor button presses, requires cleaning, do not use sandpaper or emery cloth. Clean with a piece of cloth moistened with a good grade of vaseline, then polish with a dry cloth.

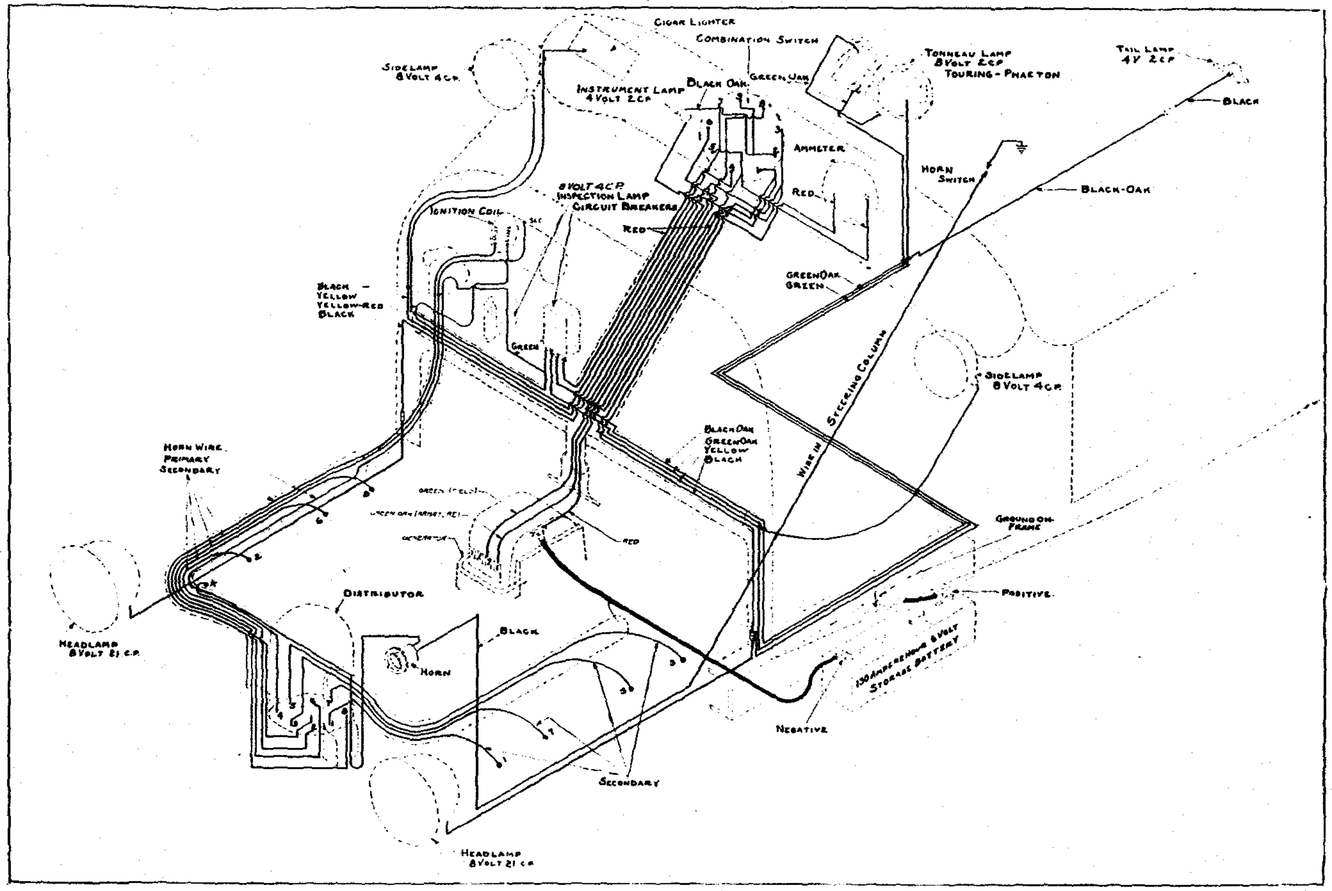

Fig. 23—Type 61 Wiring Diagram—Open Cars

147 Adjustment of Timer Contact Points

The timer contact points should be adjusted so that both sets open simultaneously and are the same distance apart when open, that is, .020 inch, if the car is new, or .015 to .018 inch if the car has been driven more than 2,000 miles.

ADJUSTMENT OF CONTACTS FOR GAP—To adjust the gaps between the contact points, remove the distributor rotor. (§406). Crank the engine by hand until one of the contact arms is directly on top of a lobe of the cam "J" (Fig. 22). Then adjust the corresponding contact points so that they stand .020 inch apart if the car is new or .015 to .018 inch if the car has been driven more than 2,000 miles. Adjust the other contact points in the same manner with the other contact arm on top of a cam lobe. Be sure that both sets of contact points are adjusted exactly alike. If the segment plate, "N" (Fig. 22), is correctly adjusted, both contact arms "O" and "C" will be directly on top of lobes of the cam "J" at the same time. If they are not, adjust the contacts for gap as directed above and adjust the segment plate "N" as directed in §148.

DO NOT FILE THE CONTACT POINTS, nor grind them without a suitable wheel and fixture. To clean the points, remove the contact arms after removing the cotter pins "H" and "G," remove the contact screws and simply rub the points over an oil stone a few times or until the points are clean and bright. Be sure the faces are at right angles to the screws and arms. Do not remove the segment plate nor loosen the screws "M," "K" and "L" in removing the contact points for this work.

It is a good plan after adjusting the timer contact points to check the ignition timing (§149), for the reason that changing the gap at the contact points also changes the timing.

ADJUSTMENT OF CONTACTS FOR SIMULTANEOUS OPENING—To determine whether the contact points open simultaneously proceed as follows: Remove the distributor rotor. (§406). Insulate the contact arm springs from the aluminum housing by inserting pieces of heavy paper or light cardboard no thicker than a common calling card between the springs and the housing. Disconnect one of the primary wires from the ignition coil on the dash and connect it to the other primary terminal on the coil.

Connect a six volt lamp to each contact arm, grounding the other terminal of each lamp.

Switch on the ignition and crank the engine slowly by hand. The two lights will be extinguished at the same instant if the contact points open simultaneously. If they do not open simultaneously and the gaps between the contact points are in correct adjustment, adjust the segment plate "N" (Fig. 22). (§148).

148 Adjustment of Segment Plate

The holes in the segment plate "N" for the three screws "M," "L" and "K" are elongated in a direction parallel to the contact arms "O" and "C." This permits adjustment of the position of the contact arms

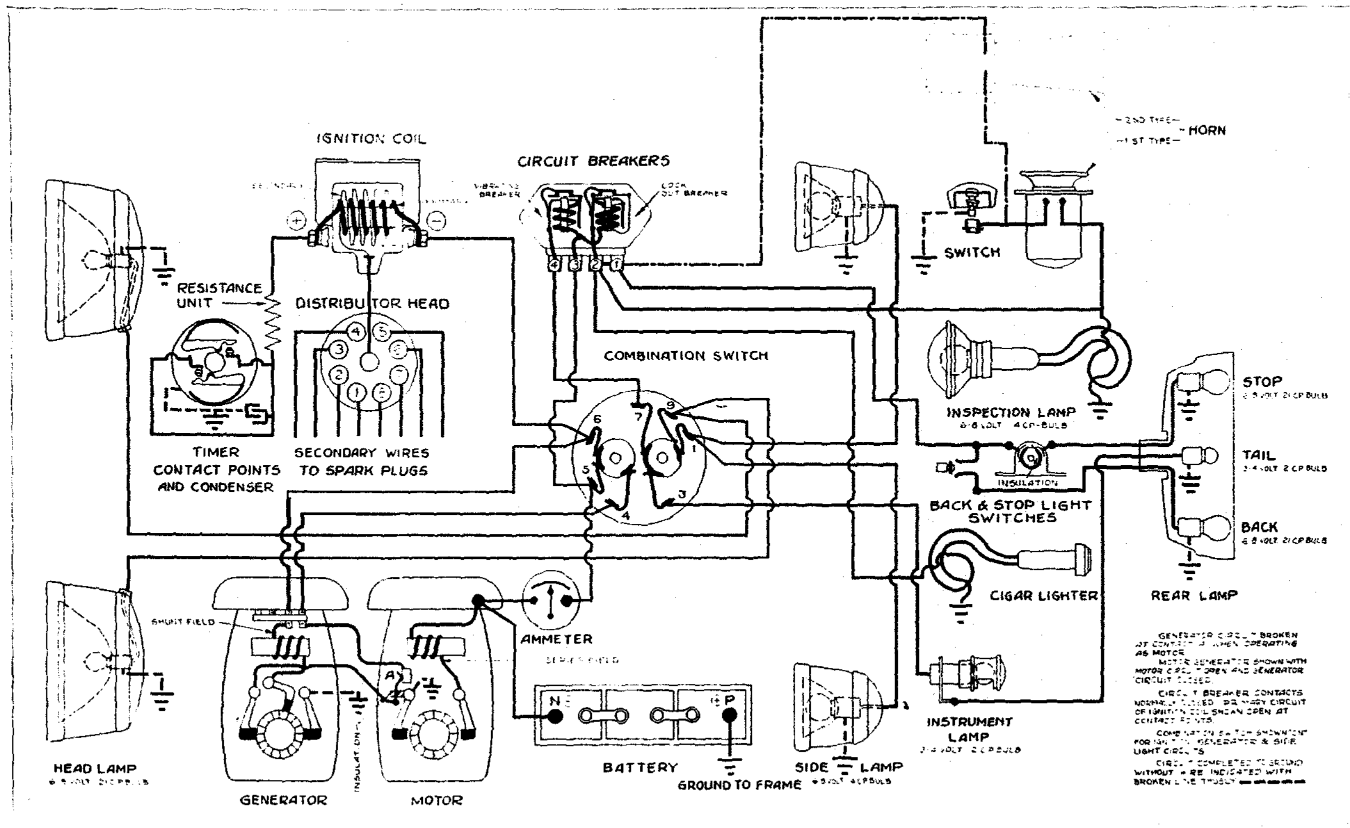

Fig. 24—V-63 Circuit Diagram: Starting, Lighting, Ignition and Horn

relative to the cam "J." This adjustment is made at the factory and the plate "N" need not be readjusted unless it has been removed or the screws "M," "L" and "K" have been loosened. The plate "N" should not be removed in removing the contact points to clean them.

If the adjustment of the segment plate has been altered proceed as follows in readjusting: Test with lamps to determine which set of contact points open first. (See under "Adjustment of Contacts for Simultaneous Opening," §147.) If the test shows that the contact points at "F" open before those at "E," loosen the three screws "M," "L" and "K" and the nut "A" and move the segment plate slightly towards the resistance unit. If the contact points at "E" open before those at "F" move the segment plate slightly away from the resistance unit. Move the segment plate only very slightly, as each change in position retards the opening on one side as much as it advances it on the other. After setting the segment plate tighten the screws and test again for simultaneous opening. Continue the adjustment of the segment plate until the test indicates simultaneous opening with both gaps correctly and equally set.

It is necessary to readjust the cam "J," as moving the segment plate affects the timing of the ignition. (§149).

149 Timing Ignition

Unless the timer contact points are in proper adjustment they should be readjusted before proceeding to time the ignition. (§147).

To time the ignition proceed as follows:

Move the spark lever to the retard position; open the compression relief cocks on the cylinder blocks and crank the engine by hand until the piston in number one cylinder is on firing center. (Number one cylinder is the one nearest the radiator in the left-hand block of cylinders.)

Next remove the distributor head, also the rotor (§406) and loosen the lock screw "I" (Fig. 22) just enough to allow the cam "J" to be turned by hand after the rotor is fitted. (The lock screw should not be loosened enough to allow the cam to turn on the shaft when the engine is cranked by hand with the rotor in place.)

Then turn the cam with a suitable wrench until the cam is in the correct position for the terminal marked "1" on the distributer head.

Caution:—If the rotor is used instead of a wrench for turning the cam extreme care should be taken to have the cam pushed down fully after removing the rotor and before tightening the lock screw.

Move the spark lever at the steering wheel to the "Advanced" position.

If the cam "J" is properly set, the contact points will just open when the mark IG|A on the flywheel (Figs. 10 and 10a) is directly under the pointer attached to the crankcase of the engine. (The letters "IG|A" stand for "Ignition Advanced.")

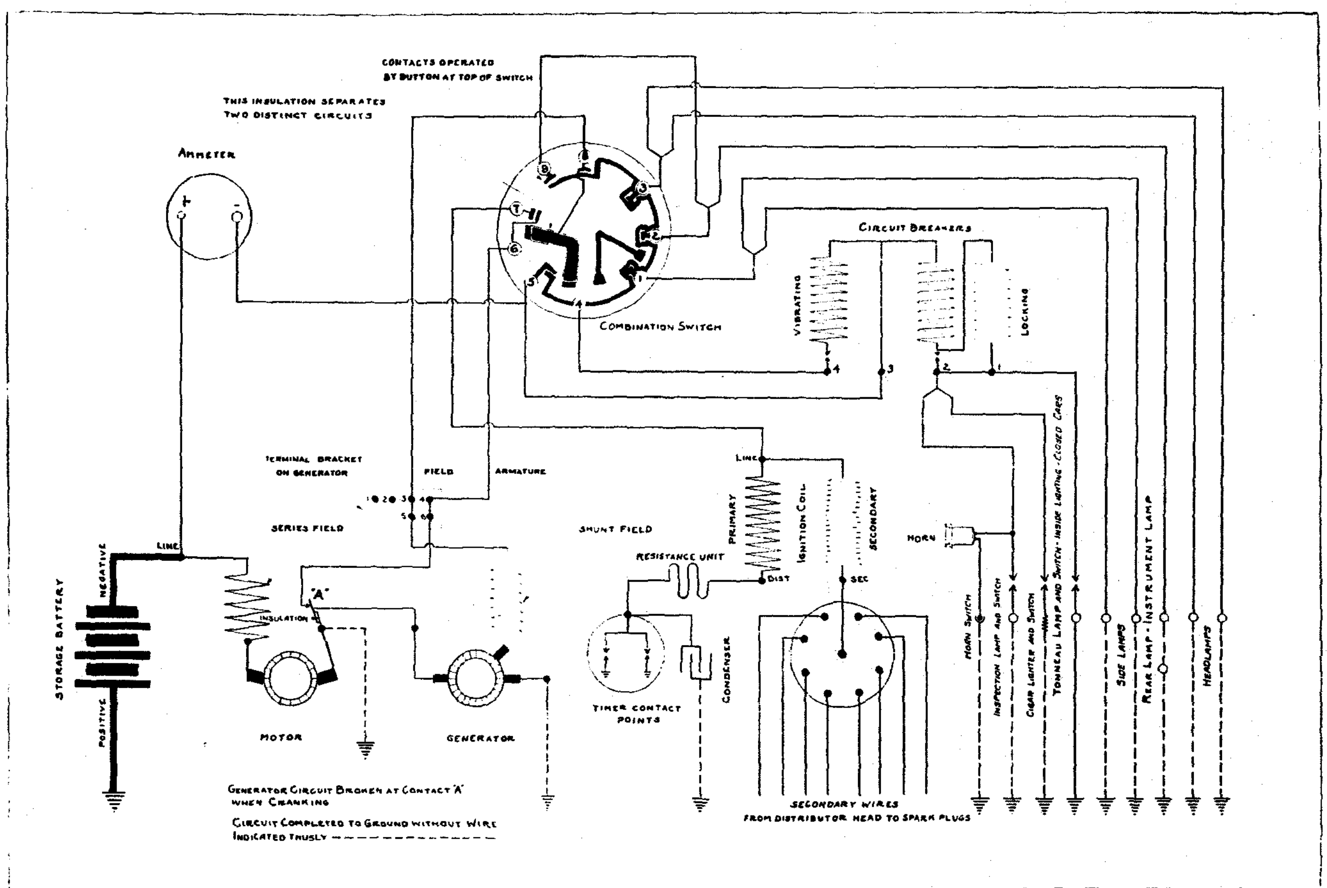

Fig. 25—Type 61 Circuit Diagram: Starting, Lighting, Ignition and Horn

Either of two methods may be used for indicating the instant the contact points open.

First Method: With the distributor head and rotor in place, switch on the ignition and hold a high tension spark plug wire about one-eighth of an inch away from the cylinder casting and crank the engine slowly by hand in the direction in which it runs. Stop cranking immediately a spark occurs between the wire and the casting. (It will be necessary to crank the engine nearly two complete revolutions before the spark occurs.)

Second Method: With the ignition switched off, connect a six volt test lamp in series between the number 3 terminal of the circuit breaker (Figs. 21, 23, 24 and 25) and the terminal "P" on the timer (Fig. 22). Disconnect one of the primary wires at the ignition coil. (This is not necessary on Type 61 cars.) If this is not done, the light will not go completely out when the timer contacts open but will merely become dim. With this method, stop cranking immediately the light is extinguished.

If the contact points open early turn the cam "J" slightly in a counter-clockwise direction to correct the adjustment. If the contact points open late, turn the cam slightly in a clockwise direction. After turning the cam "J" test the timing again and readjust if necessary.

After the adjustment has been correctly made lock the cam securely to the distributor shaft by the lock screw "I."

After locking the adjustment it is a good plan to check the timing by fully retarding the spark lever—in other words moving it to the extreme left on the sector. If the ignition is set properly the contact points will open under these conditions when the center line of the fly wheel for each cylinder is directly under the pointer attached to the crankcase or has slightly passed the pointer.

Caution:—This work must be done accurately and under no condition should the ignition be set so that the contact points open before center with the spark lever at full retard position.

150 Resistance Unit

The resistance unit is a coil of resistance wire wound on a porcelain spool as shown in Fig. 22. Under ordinary conditions it remains cool and offers little resistance to the passage of current. If for any reason the ignition circuit remains closed for any considerable length of time with the engine not running, the current passing through the coil heats the resistance wire, increasing its resistance to a point where very little current passes, and insuring against a waste of current from the battery and damage to the ignition coil and timer contacts.

Caution:—The resistance wire is of the proper length to allow not more than two or three amperes of current to flow and under no condition should it be shortened. If shortened or shorted out serious damage will result.

151 Ignition Condenser

The purpose of the condenser in the ignition system is to protect the timer contact points against the corrosive action of sparking and to utilize the tendency to spark to build up a higher voltage in the high tension circuit than would otherwise be obtained.

The ignition condenser is mounted on the right-hand side of the distributor housing in a waterproof casing "D." (See Fig. 22.) It consists of layers of tinfoil separated by sheets of paraffin paper. Alternate layers of tinfoil are connected to opposite terminals. The current does not pass through the condenser and on test the terminals should show open circuit.

There are no adjustments in connection with the condenser.

152 Ignition Coil

The ignition coil serves to transform the low voltage current in the primary circuit to a current of high voltage in the secondary circuit. The coil consists of a primary winding of coarse wire wound around an iron core in comparatively few turns, and a secondary winding of many turns of fine wire, also the necessary insulation and terminals for wiring connections. It is mounted on the inner face of the dash at right side.

153 Spark Plugs

In order to get the best results the porcelains of the spark plugs should be clean and the points should be .023 inch apart. If the points are too close, the engine will miss under a light load and when idling. If the points are too far apart, it will miss under heavy loads and when the throttle is opened quickly for acceleration.

CIRCUIT BREAKERS

154 Description

The circuit breakers are mounted on the inner face of the dash. These are protective devices which take the place of fuses.

The circuit breakers prevent the discharging of the storage battery and damage to the wiring, horn, lights or other apparatus, in case any of the circuits to or in these parts become grounded.

As long as only a normal amount of current is used by the circuits protected, the circuit breakers will not open. In the event of a ground, an abnormally heavy current is conducted through one of the circuit breakers, thus producing strong magnetism which attracts the armature and opens the contact. This cuts the flow of current.

155 Lockout Circuit Breaker

The circuit breaker protecting the horn, inspection lamp, tonneau lamp (Type 61), dome lamp, quarter lamps, stop light, backing light and cigar lighter is known as a lockout circuit breaker. In case of a ground in any of these circuits, the breaker opens and remains open until the ground is removed.

156 Vibrating Circuit Breaker

The circuit to the remainder of the lights is protected by a vibrating circuit breaker. In case of a ground in any of the circuits protected by the vibrating circuit breaker, the breaker will start to vibrate and will continue to vibrate until the ground is removed.

GENERATION OF CURRENT

157 Ammeter

When the engine is not running and the lights are turned on, the ammeter, which is located on the instrument board, indicates on the "Discharge" side of the dial the amount of current being drawn from the storage battery for this purpose. When the ignition switch is turned on the ammeter indicates, in addition, the current used in slowly rotating the armature of the motor generator. When the starter button is pushed down current is no longer required for slowly rotating the armature of the motor generator. The ammeter then indicates only the current used for the ignition and lights (if turned on). The ammeter does not indicate the amount of current used in the cranking operation.

Before the engine is running fast enough to generate sufficient current to equal the current demand, the ammeter indicates on the "Discharge" side the amount of current being drawn from the storage battery. When the engine has attained a speed sufficient to generate current to more than equal the demand, the ammeter indicates on the "Charge" side the excess current which passes to the storage battery and recharges it.

Ordinarily, with all lights switched off, sufficient current is generated to start recharging the battery when the car is operated in high gear at speeds between four and six miles per hour and, of course, at much lower speeds when the car is operated in low or intermediate gear. With all lights turned on sufficient current is generated to take care of the requirements at a speed of ten to fifteen miles per hour and at speeds greater than this the surplus current passes through the storage battery and recharges it. In other words, the ammeter indicates the rate at which the storage battery is being charged or discharged.

To determine the total output of the generator, turn off all the lights and add the amount of current used for ignition, i. e., two to three amperes, to the ammeter reading.

158 Current Regulation

The generating capacity of the generator is regulated by means of a third brush on the generator commutator. (See Fig. 74). The position of this brush relative to the other two generator brushes determines the maximum output of the generator, the length of the brush arm being adjustable. The brush arm is properly adjusted when the car is assembled and should not require readjustment unless its position is altered. To determine whether readjustment is necessary, proceed as follows:

Start the engine in the usual manner. With all the lights turned off slowly increase the speed of the engine by means of the hand throttle lever, meanwhile observing the hand of the ammeter on the instrument board. (*Do not race the engine.* There is no worse abuse, and it is unnecessary in this adjustment to run the engine faster than 1500 revolutions per minute.) The current indicated by the ammeter will increase with the speed of the engine to a point between 950 and 1200 revolutions per minute, and will then decrease. If the amount of current indicated by the ammeter at the maximum point is greater than 16 amperes (see Note), stop the engine and readjust the third brush as follows:

Remove the generator front end top cover. Loosen the two screws which hold together the two parts of the third brush arm and shorten the brush arm. After moving the third brush to an approximately correct position, press the brush down so that it makes even contact with the commutator, and hold it down while tightening the screws in the brush arm. The purpose of this is to have the curvature of the end of the brush conform as closely as possible to that of the commutator.

After setting the third brush, refit it to the commutator. (§134).

Start the engine. Again slowly accelerate the engine and check the maximum current. If it is still greater than 16 amperes, reset the third brush and sand it in again.

If the maximum current indicated by the ammeter is less than 16 amperes (see Note) and the specific gravity of the battery repeatedly shows that the battery is not being properly charged, lengthen the brush arm. Do not, however, lengthen the brush arm unless the condition of the battery makes it necessary.

Note: In exceptional cases where an unusual demand is made upon the battery, the third brush may be adjusted to give a maximum ammeter reading of more than 16. In no case, however, should the maximum ammeter reading be greater than 18 amperes.

STORAGE BATTERY

159 Adding Water to Storage Battery

The acid solution in the storage battery must cover the plates, and should be even with the bottom of the filling tubes. (See Fig. 26.) Water should be added every 500 miles or frequently enough to keep the level up to this point. *Do not add acid.*

To remove a filling plug, turn it as far as possible in the counter-clockwise direction, then lift it straight up. To replace, set the plug in place and turn it in the clock-wise direction until tight. (On Type 61 cars the arrow on the filling plug should be at right angles to the center line of the car when the plug is set in place.)

Water for filling the battery must be pure. Distilled water, melted artificial ice or fresh rain water are suitable for this purpose. If rain water is used, it should not be allowed to come in contact with any metal. It should not be caught from a metal roof or in a metal receptacle.

Never keep the water in a metal container, such as a metal bucket or can. It is best to get a bottle of distilled water from a druggist or from an ice plant. The whole point is to keep metal particles out of the battery. Spring water, well water or hydrant water from iron pipes generally contains iron and other metals in solution, which will ultimately cause trouble if used.

160 Replacing Acid Lost by Spilling

If any acid solution has been spilled or has leaked from a cell, replace the loss with freshly mixed solution and follow with an overcharge by

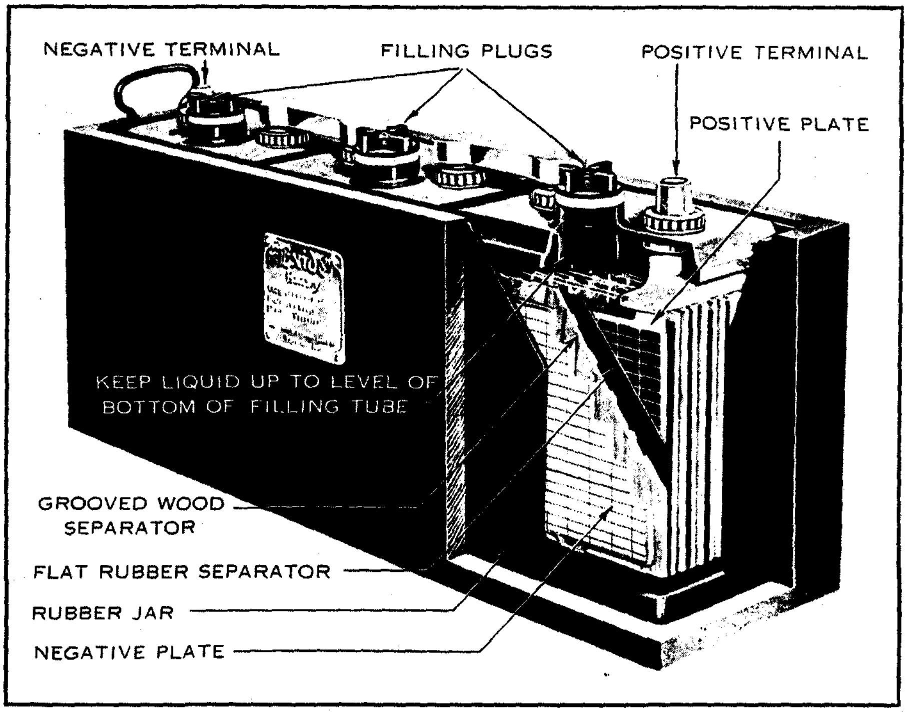

Fig. 26—Storage Battery, Sectional View

running the engine for several hours (§191) or by charging the battery from an outside source. (See Fig. 27).

The specific gravity of the acid solution used for replacing the loss should be the same as that of adjacent cells. This can be determined by the use of an hydrometer syringe.

The acid solution may be prepared by mixing chemically pure sulphuric acid, which has a specific gravity of 1.840, and distilled water. The proportion for an acid solution having a specific gravity of 1.280 is one part of chemically pure acid and three parts (by volume) of distilled water.

Caution:—The acid must always be poured slowly into the water. Do not pour the water into the chemically pure acid.

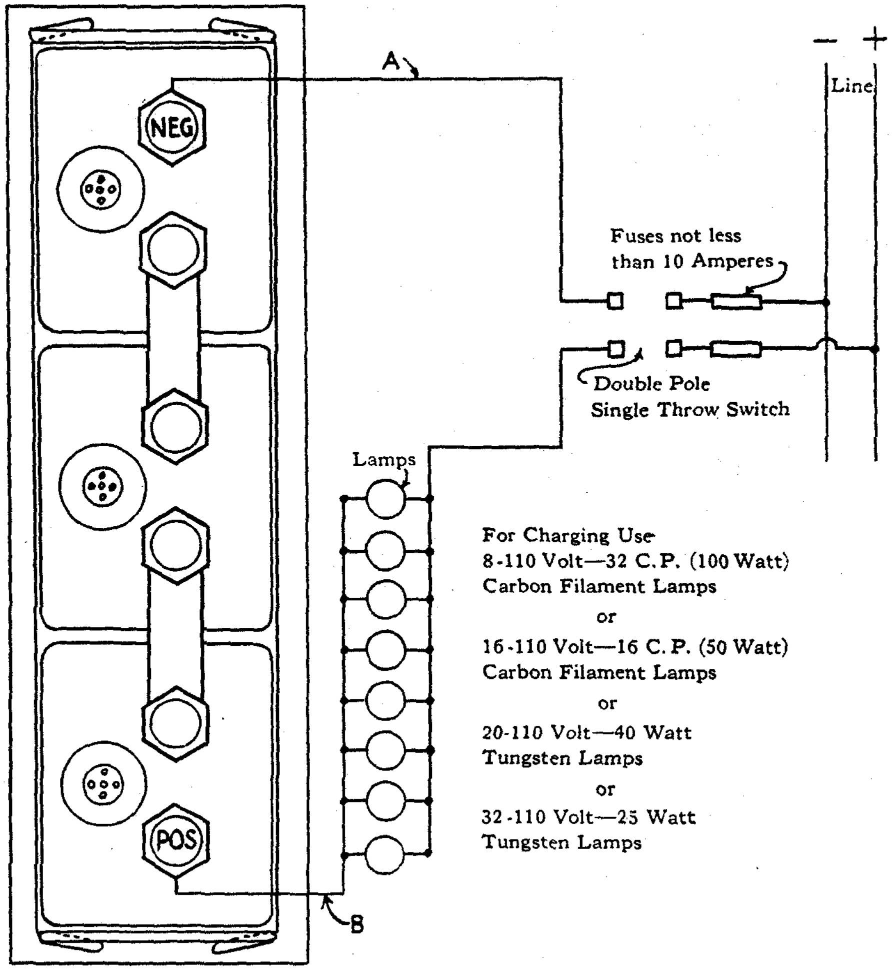

Fig. 27—Diagram of Connection for Charging Battery from 110 Volt D. C.

If, after mixing the acid solution as described above, a solution of a lower specific gravity is desired, it may be prepared by adding additional water to the mixture. But do not under any conditions pour water into the chemically pure acid.

161 Charging from an Outside Source

It is necessary that the charging be done with *direct current.* The simplest method when there is 110 or 120 volt direct current available, is to connect eight 110 volt, 32 candlepower, 100 watt carbon lamps in parallel with each other and in series with the battery to be charged, this combination giving approximately the proper charging rate—8 amperes. The positive terminal of the battery must be connected to the positive side of the charging circuit and the negative terminal to the negative side. *Very serious injury to the battery will result if connected in the reverse direction.* The terminals of the battery are stamped "Pos." and "Neg."

To determine the polarity of the charging circuit, if a suitable voltmeter is not at hand, dip the ends of the two wires "A" and "B" (Fig. 27) into a glass of water in which a teaspoonful of salt has been dissolved, care being taken to keep the wires at least an inch apart. When the current is turned on, fine bubbles of gas will be given off from the negative wire.

The diagram (Fig. 27) illustrates just how the connection should be made. The charge should be continued until all the cells have been "gassing" or bubbling freely for five hours, and there is no further rise in the voltage of the battery or specific gravity of the acid solution over the same period. A battery in good condition in a discharged state will require about ten hours of re-charging. If it has stood in a discharged condition for several weeks, it will require from twenty-five to fifty hours' charging—all depending upon the condition of the battery and the length of time it has stood discharged.

If only alternating current is available, a current rectifier must be used. Consult your city electrician regarding this matter.

Caution:—Never run the engine with the storage battery disconnected, or while it is off the car. Very serious damage to the motor generator may result from such action.

162 Preparing Battery for Storage

When a car is stored for some time the level of the acid solution should be even with the bottom of the filling tubes. (§159). If water is added it should be added just before the last time the car is used so that it will be thoroughly mixed with the acid solution. When the car is stored, the specific gravity of the acid solution should register from 1.270 to 1.290. In this condition there is no danger of the acid solution freezing during cold weather. The specific gravity of water is 1.000 and water freezes at 32 degrees F. above zero.

Unless the battery is fully charged, or nearly so, during freezing weather it is probable that the acid solution in the battery will freeze and cause extensive damage.

The following is a table of the freezing temperatures of sulphuric acid and water solutions of specific gravities from 1.050 to 1.300:

Specific Gravity (Hydrometer Reading)	Freezing Temperature (Degrees Fahr.)
1.050	+27°
1.100	+18°
1.150	+ 5°
1.164	0°
1.200	—17°
1.250	—61°
1.275 to 1.300	—90°

The battery should be charged at least once a month during the "out of service" period, either by running the engine or charging from an outside source (Fig. 27). If neither of the above is possible, the battery can be allowed to stand without charging during the winter provided the specific gravity of the acid solution registers from 1.270 to 1.290 at the time the car is laid up. Much better results and longer life from the battery will be obtained by giving the periodic charges.

The wires of the battery should be disconnected during the "out of service" period, as a slight leak in the wiring will discharge the battery.

163 Placing Battery in Service Again

Before putting the battery into service again, inspect it and add water, if necessary. In placing the battery on the car, care should be taken not to tighten the hold-down bolts too tight. If the battery has not been kept charged during the winter, it will be advisable to give it a fifty-hour charge at a four-ampere rate from an outside source before putting it into service again. Make sure that the terminals are free from corrosion and that good connections of the wires are made.

The corrosion, which is a greenish deposit, can be removed from the bolts and terminals by placing them in a solution of water and bicarbonate of soda (cooking soda).

The corrosion can be removed from the posts by saturating a piece of cloth with the solution and wiping them off. Do not allow any of the solution to get into the cells of the battery.

After the parts are free from corrosion they should be washed in warm water, and a light coat of heavy grease or vaseline applied.

If the battery has received periodic charges, it will not be necessary to give it any special attention other than to fill it to the proper height with distilled water. After the car has been driven for a number of hours, read the specific gravity of the acid solution with the hydrometer syringe. It should register from 1.270 to 1.290 if the battery is fully charged.

164 Sediment

The sediment which gradually accumulates in the bottom of the jars should be removed before it reaches the bottom of the plates, as it is very harmful to the battery. The need of cleaning may be determined by inspection. Its necessity is indicated by lack of capacity, excessive evaporation of the acid solution and excessive heating when charging. When a battery requires removal of sediment, better results follow if the work is done at a place where they are thoroughly familiar with storage battery practice.

165 Cigar Lighter

The wire to the cigar lighter is carried on a reel fastened to the front face of the instrument board. Pulling the cigar lighter out of its receptacle on the instrument board automatically operates a switch in the reel chamber by which current to the cigar lighter is controlled. Permitting the cigar lighter to return to its receptacle automatically switches off the current. It it is desired to light a pipe with the cigar lighter the shield around the heating element may be removed by turning it slightly to disengage the bayonet lock and then pulling it straight off. If the heating element should be burned out, it may be replaced in the same manner as a headlamp bulb after removing the shield.

166 Portable Lamp

The portable lamp is attached to the right hand side of the front face of the dash. The wire to the lamp is wound upon a reel. The current for the lamp is controlled by a small switch button near the lamp socket. To use the lamp, lift the right hand side of the engine hood and pull the lamp straight out from its socket. To release the reel and return the lamp to its socket, press in on the switch button until the reel is released, holding it in while the cord is rewound. (On some Type 61 cars, the reel is released for rewinding by a small lever on the dash at the side of the lamp receptacle.)

COOLING SYSTEM

167 General Description

The cooling system is of the forced circulation type. Circulation through each cylinder block is independent of that through the other, two pumps being provided.

The temperature of the liquid circulated by the pumps is under thermostatic control, the purpose of which is to permit liquid circulated through the water jackets of the cylinders to warm up to the temperature at which the engine operates best, very soon after the engine is started and to prevent the temperature dropping below this point while the engine is running.

168 Condenser

A condenser, the purpose of which is to prevent the loss of the cooling medium by evaporation, is attached at the outer right hand side of the car frame.

The operation of the condenser requires an air tight seal at the radiator filler cap. To make it possible to screw down and tighten the cap without injury to the rubber gasket, two metal washers are interposed between the head of the cap and the gasket. It is important that nothing be installed on the radiator cap which may cause an air leak or which makes necessary the elimination of the washers or cutting a hole through the gasket.

169 Anti-Freezing Solutions

In cold weather a good anti-freezing solution should be used. A solution of commercial glycerine and water is recommended of the

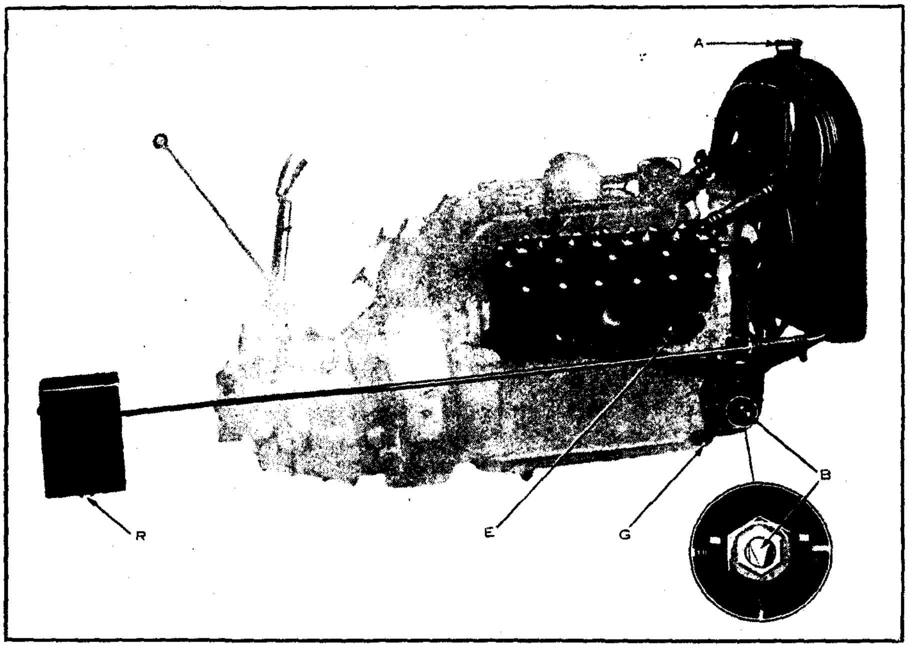

Fig. 28—Cooling System

correct proportion for the temperature experienced. The following are the freezing temperatures of glycerine and water solutions of various proportions.

Glycerine (parts by volume)	Water (parts by volume)	Freezing Temp. (degrees Fahr.)
1	3	20°
1	2	12°
1	1	0°
3	2	—4°

Do not use a solution containing calcium chloride as this is injurious to the metal parts of the cooling system.

The radiator condenser also makes it possible to use with safety an anti-freezing solution of denatured alcohol and water solutions of various proportions.

Denatured Alcohol (parts by volume)	Water (parts by volume)	Freezing Temp. (degrees Fahr.)
1	4	10°
1	3	0°
1	2	—10°
1	1	—25°

It is a good plan occasionally to draw out a sample of the solution in the radiator and to test its specific gravity with a hydrometer graduated between the limits of the above table.

Before filling the cooling system with anti-freezing solution, the condenser should be drained by removing the plug "R" (Fig. 28). If water is left in the condenser when filling the cooling system with anti-freezing solution, it may freeze before enough alcohol passes over from the radiator to lower its freezing temperature.

The capacity of the cooling system is five and one-quarter gallons. The condenser should contain an additional three quarts, making a total of six gallons.

Caution:—Do not use water in the cooling system during freezing weather. Use a good anti-freezing solution. Water will freeze even though the engine be run continuously.

FILLING AND DRAINING THE COOLING SYSTEM

170 Filling Cooling System

Fill the cooling system with water during warm weather and with a suitable anti-freezing solution during freezing weather. (§169). To fill the cooling system on V-63 cars or on Type 61 cars with second type water pumps,[1] proceed as follows:

Make sure that the cylinder drain plugs "E"[2] (Fig. 28) are tightly in place. Close the water pump drain valves "G". Turn the thermostat control shaft "B" on each water pump so that the triangular indicator on the end of the shaft points up. The shaft may be turned in either direction.

There is a drain plug "E"[2] in each cylinder block and a drain valve "G" and a thermostat control shaft "B" at each water pump. A special wrench for the drain valves "G" and the thermostat control shafts "B" is included in the tool equipment of the car.

Remove the radiator filler cap "A" and fill the cooling system to within one inch of the top of the filler.

Fill the radiator condenser (§168) with three quarts of the same liquid used to fill the radiator. This may be done by pouring the liquid slowly into the radiator filler or by removing the filler strainer and pouring the liquid directly into the overflow pipe through a small funnel. The second method is the shorter.

[1]See §174 regarding first type water pumps on Type 61 cars.

[2]On some Type 61 cars drain cocks instead of drain plugs are used at "E".

(On Type 61 cars liquid may be added directly to the condenser, if desired, after raising the floor boards and removing the condenser filling plug.)

Screw the radiator cap down tightly after replacing it. This is important because the operation of the radiator condenser depends upon a tight joint at the radiator cap.

After filling the cooling system turn the thermostat control shafts "B" so that the triangular indicators point down. These indicators should point *up* when filling the cooling system and *down* at all other times.

171 Adding Cooling Solution

If only a small amount of cooling solution is necessary to fill the system, it is necessary only to remove the radiator filler cap and pour in the required amount.

Screw down the radiator filler cap firmly after replacing it. This is necessary to insure operation of the condenser.

172 Draining Cooling System

To drain the cooling system turn the thermostat control shaft "B" (Fig. 28) on each water pump so that the triangular indicator on the end of the shaft points up. The shaft may be turned in either direction. Then open the drain valve "G" on each water pump and remove the drain plug "E"[1] on each cylinder block.

To drain the condenser remove the drain plug "R."

173 Cleaning Cooling System

The cooling system should be drained and flushed out every two or three months. This can be done in the following manner:

Run the engine with the radiator covered until the liquid in the cooling system is boiling hot.

Shut off the engine and immediately drain the cooling system.

If an alcohol anti-freezing solution is drawn off part of it may be used again if the sediment is allowed to settle. In case it is used the specific gravity should be tested with a hydrometer, after it has cooled thoroughly.

After the liquid is drained off, refill the cooling system with hot water and repeat the operations outlined above.

In cleaning the cooling system do not turn the thermostat control shafts "B" (Fig. 28) each time the cooling system is drained and refilled. After draining it the first time, leave the shafts with the indicators pointing up until the cleaning has been completed and the cooling system has been refilled with fresh liquid. Then turn the shafts so that the indicators point down.

[1]On some Type 61 cars drain cocks instead of drain plugs are used at "E".

If, in draining the second time, the water is very dirty, it may be desirable to repeat the flushing operation a third time, using a solution of sal-soda. If the sal-soda solution is used, be sure that it is drained out and the system flushed again with clear water.

The sal-soda solution should not be permitted to get onto the finish of the hood or radiator.

174 Type 61 First Type Water Pumps

The first type water pumps used on early Type 61 cars do not have the drain valve "G" or thermostat control shaft "B" (Fig. 28). Instead, these pumps have a three-way valve "P" (Fig. 30) which should be turned to "Fill," when the cooling system is being filled; to "Drain," when the cooling system is being drained, and to "Close" at all other times.

WATER PUMPS

175 Water Pump Packing Glands

To tighten the glands of the water pumps first remove the splash pan under the engine, then turn the packing glands in the direction in which the wheels rotate when the car is moving backward. Use Cadillac wrench No. 83232.

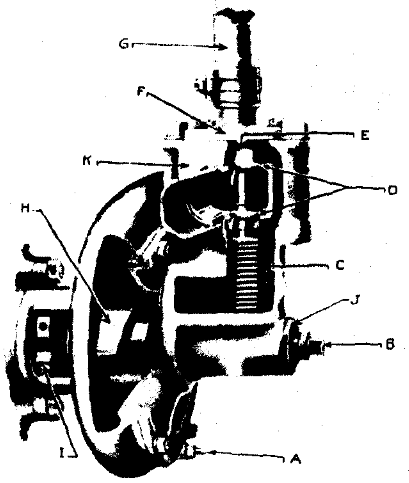

Fig. 29—Water Pump, V-63 and 2nd Type on Type 61 cars

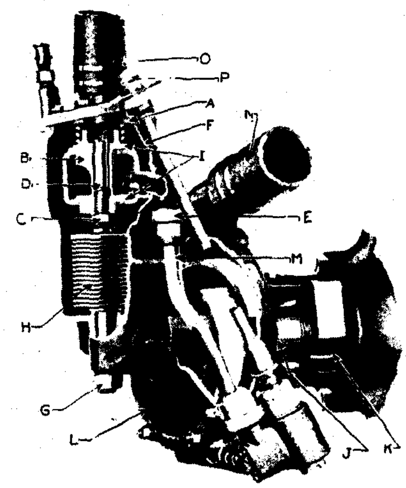

Fig. 30—Water Pump, 1st Type on Type 61 cars

To repack water pumps it is necessary first to remove them. (§360). Repack with Cadillac packing.

In tightening the glands, tighten them only sufficiently to prevent leakage. Tightening them further causes unnecessary friction on the pump shaft.

176 *Adjustment of Water Pump Valves*

The thermostat valves of water pumps on V-63 and later Type 61 engines are not adjustable. To adjust the thermostat valves of water pumps on Type 61 engines prior to engine 61-U-48, proceed as follows:

Disconnect at the water pump the hose between the pump and the cylinder head and remove the cap "A" (Fig. 30) over the valve.

Remove the spring and the valve "B." Loosen the lock nut "C." Replace the valve and screw down the adjusting screw "D" until it just touches the thermostat. Then unscrew the adjusting screw exactly three-quarters of a turn. This will give a clearance of 1/32″ between the lower end of the adjusting screw at the top of the thermostat, which is the recommended clearance.

Remove the valve again and set the lock nut "C," being careful not to alter the adjustment of the screw "D." Replace the valve, the valve spring and the cover plate "A." Be certain that the spring enters the groove in the cover plate.

RADIATOR

177 *Adjustment of Position*

The height of the radiator above the frame and its distance from the engine can be adjusted within limits. The vertical adjustment can be made by turning the nut "A" (Fig. 31) on each radiator support stud. Movement of the radiator forward or backward is provided for by making the holes in the frame larger than the nuts "A." Provision is made for locking the radiator in the desired position by the spacer "C" which has a series of notches in different locations.

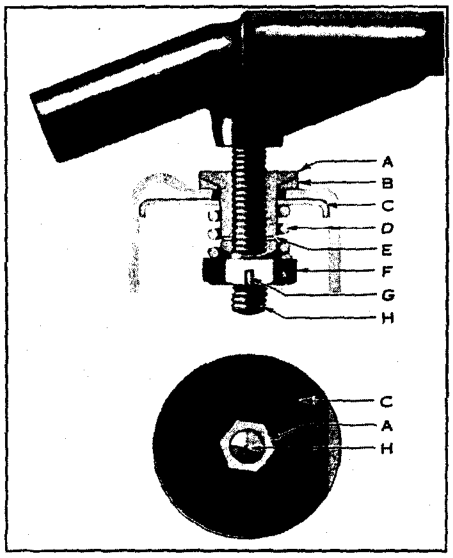

Fig. 31—Sectional View of Radiator Support. (Inset shows view from beneath with nut removed.)

To adjust the height of the radiator, proceed as follows:

Remove the cotter pin "G," the nut "F," the brass washer "E," the spring "D," and the spacer "C." If the horizontal position of the radiator is not to be changed, mark the notches of the spacer which engage the lower end of the nut "A." To lower the radiator, turn the nut "A" clockwise (looking at it from under the car.). To raise the radiator turn the adjusting nut "A" counter-clockwise.

When the radiator has been adjusted to the proper height, adjust its horizontal position if this is necessary. (See next paragraph.) If its horizontal position is satisfactory, replace the spacer "C," adjusting it so that the lower end of the nut "A" is held in the same notches of the spacer as before. Then replace the spring "D," the brass washer "E," and the nut "F." Draw the nut "F" up far enough to compress the spring slightly but not enough to close up the coils of the spring. Replace the cotter pin "G."

To move the radiator simply forward or backward, proceed the same as for raising or lowering the radiator, but do not change the adjustment of the nut "A." After removing the spacer "C", move the radiator to the desired position and replace the spacer with the lower end of the nut "A" in different notches to correspond with the new location of the radiator. Replace the spring "D," the brass washer "E" and the nut "F" in the same manner as after adjusting the height of the radiator.

GASOLINE SYSTEM

178 Pressure Relief Valve

A pressure relief valve is connected in the air line of the gasoline system for the purpose of preventing excessive pressure. It is attached to the left-hand side of the frame under the front floor boards and is adjusted to release if a pressure of 2½ pounds should be reached. As the pump at the front of the engine is designed to furnish a pressure of considerably less than 2½ pounds, it is evident that the relief valve is not intended to release under normal conditions. The relief valve is intended to operate only in case higher pressures result from the use of gasoline, such as "casing-head" gasoline, containing highly evaporative fractions.

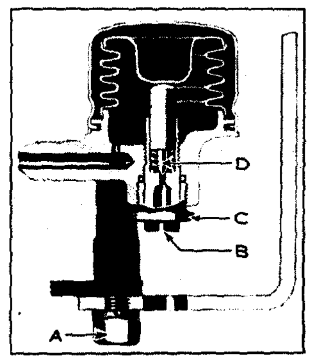

Fig. 32—Air Pressure Relief Valve, Sectional View.

If the pressure gauge on the instrument board shows a pressure of more than 2½ pounds the relief valve should be readjusted. Or, if it is found impossible to maintain sufficient pressure to insure flow of fuel to the carburetor, this condition may indicate need for readjustment of the valve.

As low pressure may also be caused by leakage of air at the gasoline tank filler cap or at the piping connections, or by the presence of dirt on the needle valve "D" (Fig. 32) or its seat, do not readjust the relief valve without making certain that the low pressure is due to the valve releasing and not to these other causes.

To adjust the pressure relief valve, loosen the hexagonal gland nut "C." Then turn the hollow, slotted screw "B" in the clockwise direction if the pressure at which the valve releases is too low; or in the counter-clockwise direction if the valve releases at too high a pressure. Tighten the gland nut "C." (On Type 61 cars the cap screw "A" must be removed and the relief valve moved away from the side bar to permit access to the screw "B" with a screw driver).

179 Settling Chambers and Strainers

The gasoline system is protected by a settling chamber at the bottom of the gasoline tank, a strainer and a settling chamber under the front floor boards, and a strainer at the carburetor. (On some Type 61 cars there is also a strainer at the top of the gasoline tank.) These settling chambers and strainers must be clean.

CARBURETOR

180 When Adjustment Should Be Made

The carburetor should not be tampered with unless it needs adjustment. Good carburetor action cannot be expected before the engine is thoroughly warmed up. This is particularly true during cold weather. Imperfect carburetor action while the engine is cold does not indicate that the carburetor requires adjustment, and carburetor adjustment should not be made under these conditions.

Before changing any of the carburetor adjustments be sure it is the carburetor which requires attention.

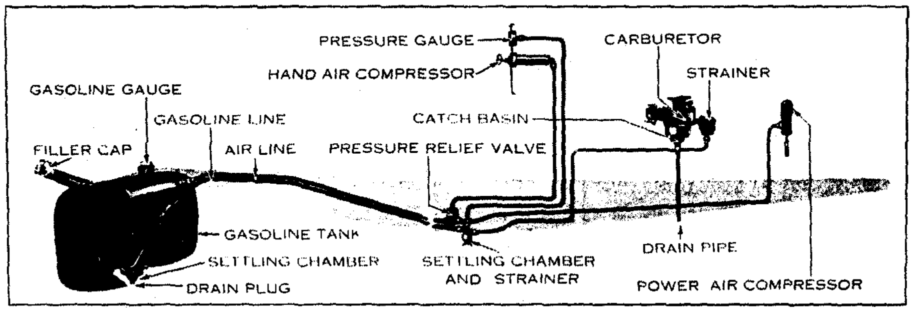

Fig. 33—V-63 Gasoline System

In adjusting the carburetor select a quiet place, for correct adjustment depends largely upon being able to detect slight changes in engine speed.

181 Adjustment of Enriching Device

Adjustment of the enriching device can be made only when the engine is not running. When the lever "B" (Fig. 34) is held forward against the stop on the carburetor body, the tip of the air valve should, at a room temperature of 65° to 85° F., have an opening of $\frac{1}{16}''$ to $\frac{1}{8}''$ when held up lightly. In making this test do not apply enough pressure to the valve in holding it up to spring the thermostatic member to which the rear end of the air valve spring is attached and against which the valve strikes when the lever is held forward.

If the opening under these conditions is more or less than the limits given, a readjustment may be made after removing the cover "P" (Fig.

37) (see below under "Caution") and loosening the two screws which hold the bracket carrying the thermostatic member. Tighten the screws after completing the adjustment.

Caution:—Care must be used in removing the cap "P" (Fig. 37) over the auxiliary air valve not to ruin the air valve spring by stretching or twisting it. Remove the spring after lifting the cover just enough to permit this. If the spring is deformed by careless removal of the cover, do not attempt to repair it, but replace it by a new spring.

The tongue "A" (Fig. 34) should stand in the center of the slot in the lever "B" when the carburetor enriching button on the instrument board is pushed forward as far as it goes. If the tongue does not stand in the center of the slot, a readjustment should be made by altering the length of the control rod attached to the lever "B".

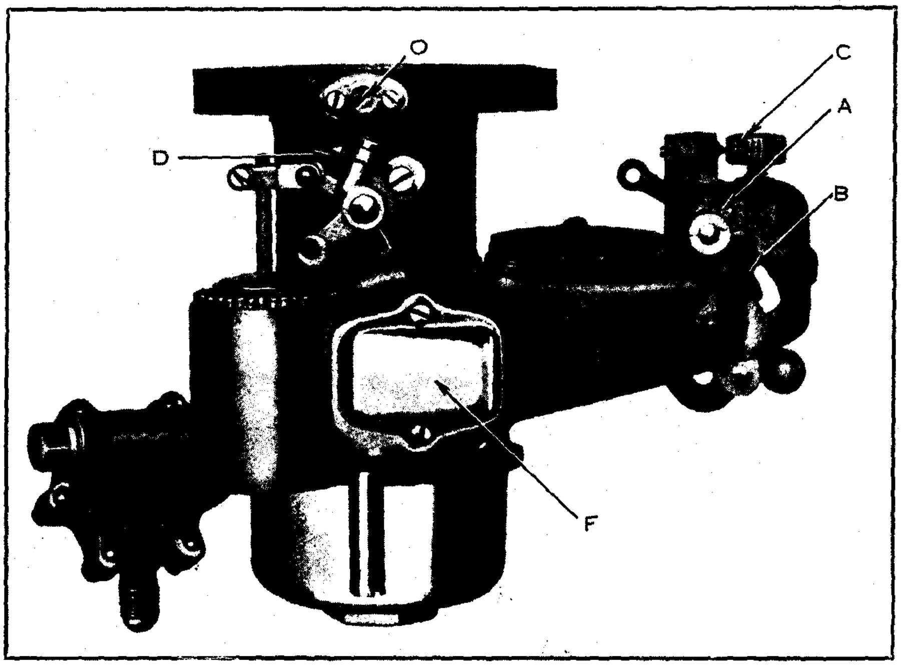

Fig. 34—Carburetor, Side View

183 Adjustment of Auxiliary Air Valve Spring

Before attempting to adjust the auxiliary air valve spring, make certain that the enriching device is in correct adjustment (§181) also make certain that the relief valve over the air valve seats properly.

The rear end of the auxiliary air valve spring is attached to a thermostatic member which automatically adjusts the spring to compensate for changes in temperature. Auxiliary air valve spring readjustment is, therefore, very rarely required when once made.

The adjustment of the auxiliary air valve spring is made by the adjusting screw "C" (Fig. 34) and in the same manner as on earlier eight-cylinder carburetors. To determine whether the spring requires readjustment and to make the readjustment, proceed as follows:

Start the engine and run it until the intake manifold is up to normal driving temperature. Place the spark lever in the fully retarded position and move the throttle lever to the "CLOSE" position. The engine speed should then be about 300 revolutions per minute. If the engine runs

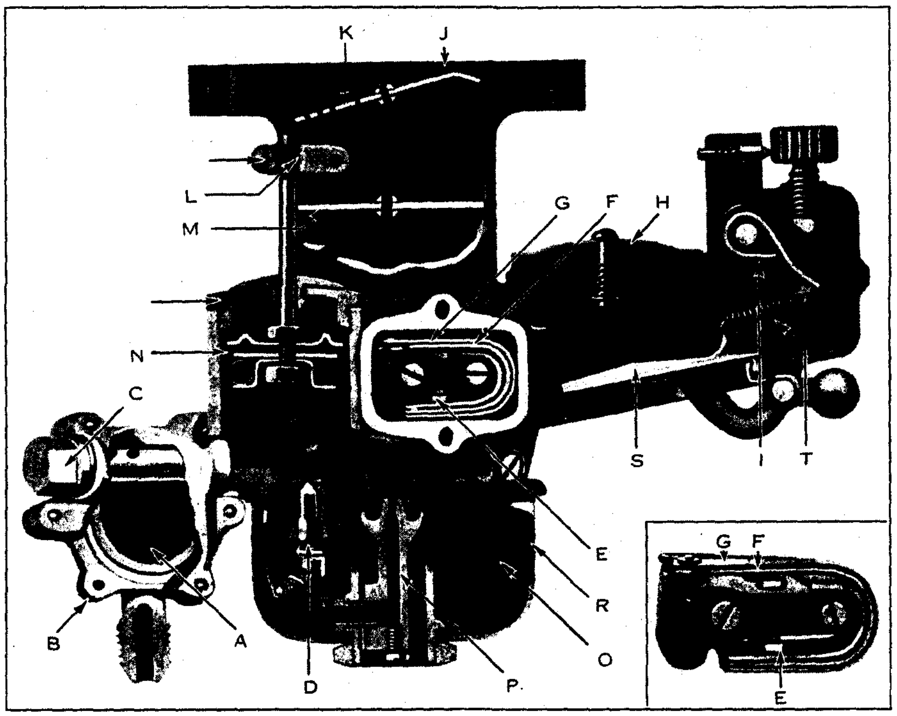

Fig. 35—Carburetor, Sectional View, Double Thermostat Type

faster than this, loosen clamp screw and unscrew the throttle stop screw "D" (Fig. 34) until the engine speed is reduced to 300 revolutions per minute. If unscrewing the stop screw "D" does not permit the throttle in the carburetor to close enough to reduce the engine speed to 300 revolutions per minute loosen the set screw in the small collar on the end of control rod running from the steering gear to the bell crank lever at the side of the starter housing. If the engine runs less than 300 revolutions per minute, move the throttle lever down until the engine speed is increased to about 300 revolutions per minute.

Then make the following test to determine the necessity for adjusting the auxiliary air valve spring:

Press down gently on the ball-shaped counterweight of the auxiliary air valve and note whether the immediate result is an increase or a decrease in engine speed. Release the counterweight and allow the engine to run a few seconds to regain its normal speed. Then press up gently on the counterweight and note the effect on the engine speed.

If the mixture is correct, the immediate result of gentle pressure up or down on the counterweight of the auxiliary air valve is a slight decrease in engine speed. If the immediate result of gentle upward pressure on the counterweight is a slight decrease in engine speed, while the result of downward pressure is an increase in engine speed, a rich mixture is indicated. If the immediate result of downward pressure is a decrease in engine speed, while the result of upward pressure is an increase of engine speed, a lean mixture is indicated.

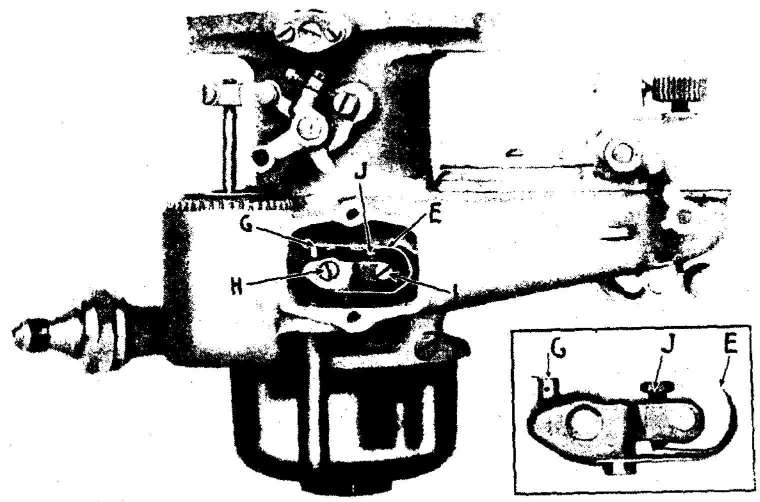

Fig. 36—Carburetor, Single Thermostat Type
(Used on early Type 61 cars)

If the above tests indicate an incorrect mixture adjust the auxiliary air valve screw "C" (Fig. 34) turning it clockwise to correct a lean mixture and counter-clockwise to correct a rich mixture. Continue to change the adjustment of the screw "C" and to test as above until a correct mixture is indicated. Do not turn the screw "C" more than a few notches at a time and not more than two notches at a time when nearing correct adjustment.

Move the throttle lever to the "CLOSE" position unless it is already in that position. The engine should now run at a speed of about 300 revolutions per minute. If it does not, change the adjustment of the throttle stop screw "D" until this speed is obtained. When the stop screw "D" has been adjusted correctly lock the adjustment and adjust the collar on the control rod from the steering gear so that the throttle in the carburetor will start to open immediately the throttle lever is moved. Test the correctness of the mixture as before, and if necessary readjust the screw "C." When the test indicates the correct mixture with the throttle lever at the "CLOSE" position and the engine running 300 revolutions per minute, adjustment of the auxiliary air valve spring is correct. The enriching device should then be readjusted. (§181).

184 Throttle Pump Control Thermostat

On V-63 and Type 61 cars, the piston of the throttle pump does not enter the gasoline as in earlier eight-cylinder carburetors, but when operated forces compressed air into the carburetor bowl above the gasoline, momentarily forcing additional gasoline through the spraying nozzle. Since good acceleration is obtained with a somewhat leaner mixture after the carburetor has become warm, a throttle pump control thermostat "G" (Fig. 35) and "E" (Fig. 36) covered by the cap "F" (Fig. 34) is provided to open a relief hole when the temperature of the carburetor reaches a predetermined point, thus providing a release for a portion of the air compressed by the pump. The result is that a lesser amount of gasoline is forced through the spraying nozzle.

185 Vent Control Thermostat

Carburetors on V-63 and later Type 61 cars are fitted with two thermostats "G" and "F" (Fig. 35) attached to the thermostat block instead of one.

The object of the second or high temperature thermostat is to open a large vent from the carburetor bowl during hot weather, this being desirable when very high test gasoline is used. On V-63 and later Type 61 cars the vent control or high temperature thermostat, is the outer one. On some of the first carburetors fitted with the vent control thermostat it is the inner one. On these carburetors the vent control thermostat covers a smaller vent than on later carburetors.

Both thermostats are properly adjusted when the carburetor is assembled at the factory and require no further attention unless tampered with. If tampered with, thermostats may be readjusted in the following manner:

186 Adjustment of Throttle Pump Control Thermostat

Throttle pump control thermostats on all V-63 and Type 61 carburetors are adjusted in the same manner and to the same temperatures. To make this adjustment proceed as follows:

Remove the thermostat with block from the carburetor body, being careful not to injure the gasket. This may be done after removing the left hand screw in the face of the thermostat block. (On early Type 61 carburetors with only one thermostat, both of the screws "H" and "I" (Fig. 36) must be removed to remove the block.) The thermostat adjustment is made by turning screw "E" (Fig. 35) or "J" (Fig. 36), which should be so adjusted that the relief vent hole is just closed at a temperature of 75° F. and just open at a temperature of 77° F. To test this, provide two dishes of water, one at a temperature of 75°

F. and the other at a temperature of 77° F. First immerse the thermostat with block in the water at 75°. When removed, the vent hole should just be closed. If it is not, readjust the screw "E" (Fig. 35) or "J" (Fig. 36) controlling the thermostat. Then immerse it in the water at 77°. The vent hole should then be just open. If it is not, readjust the screw. When the vent hole is just closed at a temperature of 75° and just open at a temperature of 77°, the adjustment is correct and should be locked by tightening the lock nut.

187 Adjustment of Vent Control Thermostat

Vent control thermostats, should be adjusted in exactly the same manner as throttle pump control thermostats, but to different temperatures.

Vent control thermostats should be so adjusted that the vent hole

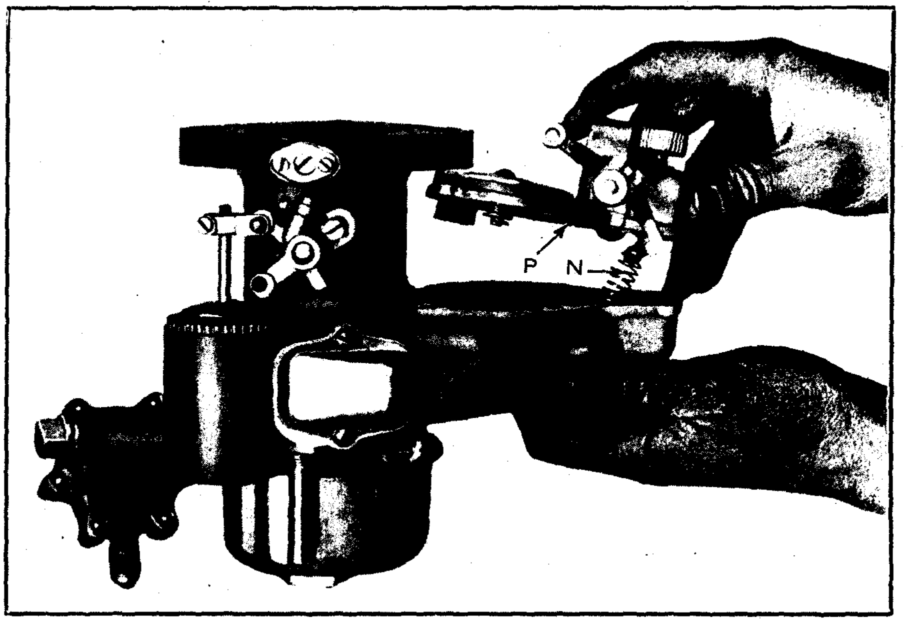

Fig. 37—Removing Auxiliary Air Valve Spring

is closed at a temperature of 130° F. and open at a temperature of 135° F. (This applies also to carburetors on which the vent control thermostat is the inner one.) If very high test gasoline is used during extremely hot summer weather it may be found desirable to change this setting to have the vent closed at 115° F. and open at 120° F.

In making these adjustments, care must be exercised to make certain that the water used is exactly at the temperatures given. This work must be done carefully and should be entrusted only to a careful workman. The efficient operation of the carburetor depends considerably upon the skill used in making these adjustments.

If the gasket between the block and the carburetor is damaged in removal, replace it by a new one. There should be no possible chance for a leak around the vent passage.

188 Adjustment of Float

This adjustment is correctly made when the carburetor is assembled at the factory and should not soon require readjustment unless tampered with. The adjustment may be checked as follows:

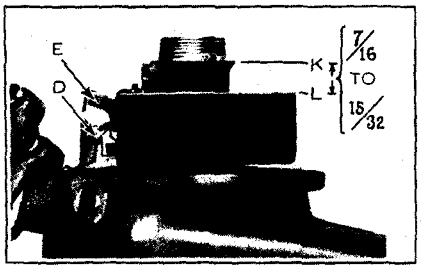

Fig. 38—Carburetor Float Setting

After removing the carburetor (§428) remove the carburetor bowl, invert the carburetor and remove the small cork gasket against which the carburetor bowl presses. Take a measurement from the flange "K" (Fig. 38) to the top edge of the float "L" at a point diametrically opposite the needle valve. This measurement should be from $\frac{7}{16}''$ to $\frac{15}{32}''$. Correction of the float level may be made by springing the hinge bracket slightly.

189 Adjustment of Automatic Throttle

The adjustment of the automatic throttle is made in the same manner as with the earliest type of eight-cylinder carburetor. To determine if the spring which controls the automatic throttle is in proper adjustment and to make the adjustment, proceed as follows:

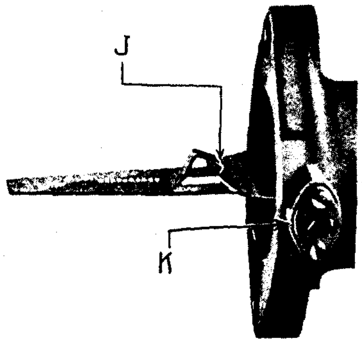

Fig. 39—Testing Spring of Carburetor Automatic Throttle

Remove the carburetor from the intake manifold. Cadillac tool No. 76037 should be used in making this adjustment.

Attach the tool "J" (Fig. 39) to the automatic throttle and hold the carburetor in the horizontal position as shown, *note the position* which the throttle disc assumes. The disc should assume the horizontal position, the weight of the tool opening the automatic throttle to within $\frac{1}{32}''$ of the stop pin. If it does not and you are sure that the throttle shaft is free in its bearings, slightly loosen the screws on the plate "K" (Fig. 39) and turn the large adjusting cap. Turning the cap in a clockwise direction increases the tension of the spring and turning it in a counterclockwise direction decreases the tension. Retighten the screws holding the plate "K" after making the adjustment.

190 Throttle Pump Adjusting Screw

This adjustment is provided to make it possible to lessen the effect of the throttle pump which may sometimes be found desirable during warm weather, also during cold weather if high test gasoline is used.

Unscrewing the adjusting screw "R" (Fig. 40) opens a by-pass in the passage between the throttle pump and the throttle pump control thermostat. At all temperatures with carburetors having the throttle pump control thermostat only and at ordinary temperatures with carburetors having the vent control thermostat the pressure of the air above the gasoline in the carburetor bowl is thus lessened at the moment of acceleration and less gasoline is forced through the spraying nozzle as a result. On carburetors with the vent control, pressure is relieved at high temperature by the operation of the high temperature thermostat.

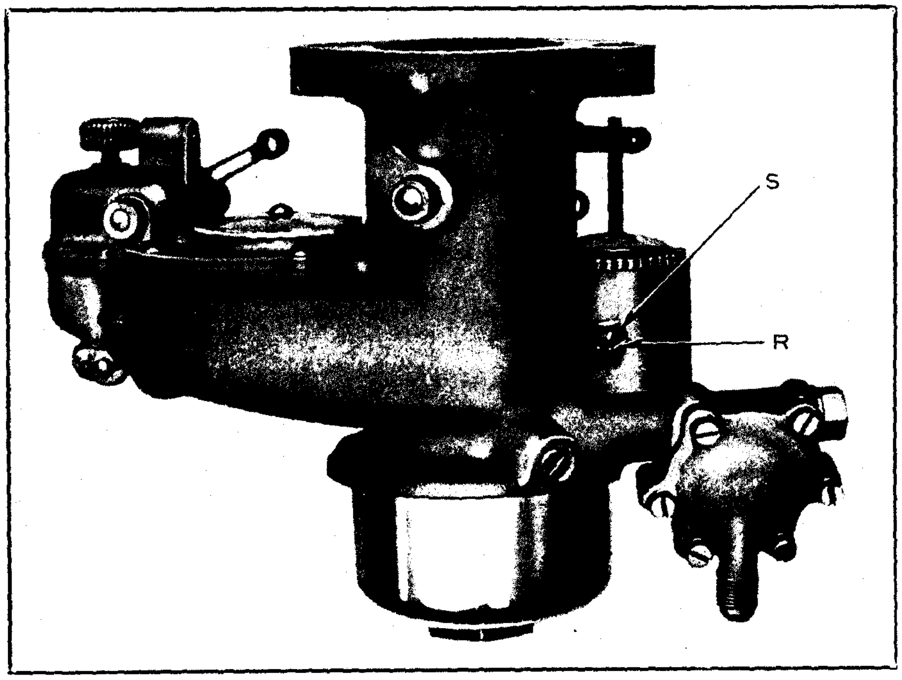

Fig. 40—Throttle Pump Adjusting Screw

Seven turns of the adjusting screw "R" in the counter-clockwise direction fully opens the by-pass. The amount of opening required depends upon the quality of the gasoline and atmospheric temperature. Ordinarily it is necessary to unscrew the adjustment not more than two or three turns if adjustment is required.

After making the adjustment, lock it with the lock nut "S."

191 Personal Danger of Running Engine in Closed Garage

Carbon monoxide, a deadly poisonous gas, is present in the exhaust of gasoline engines. Increasing the proportion of gasoline to air in the mixture fed to the engine, in other words, enriching it, increases the amount of carbon monoxide given off.

The presence of carbon monoxide makes it very dangerous to run the engine while the car is in a small, closed garage. If the doors and windows are open the danger is lessened, but it is far safer, particularly if an adjustment of the carburetor is being made, to run the car into the open.

Serious personal injury may be caused by the presence of carbon monoxide in a garage if the percentage of it in the air is greater than a very small fraction of one per cent. Unconsciousness may result without warning. It is reported that no indication of danger is given by personal discomfort until too late. Deaths resulting from the presence of carbon monoxide in garages have been reported.

CLUTCH AND TRANSMISSION

CLUTCH

192 General Description

The main clutch is of the multiple disc dry-plate type. The eight driving discs (Fig. 83) are covered on both sides with a friction material, composed largely of asbestos, and are driven by gear teeth in the clutch ring which is bolted to the engine flywheel.

The nine driven discs are not covered. These discs are carried on the clutch hub and drive it through six keys on the hub. The clutch hub is splined to the transmission shaft.

When the clutch is engaged by allowing the clutch pedal to come towards you, the spring forces all of the discs together. The resulting friction between the discs drives the transmission shaft and the car, when the transmission control lever is in other than the neutral position.

There are no adjustments on the clutch proper. The clutch pedal should be adjusted occasionally to compensate for wear on the facings of the clutch discs. This adjustment is explained in §194.

193 Relining Clutch Discs

Remove the clutch discs in accordance with the directions in §446.

Determine the amount of clearance between the teeth of the discs and the teeth of the clutch ring. If the clearance is .010 inch or more, new discs should be substituted.

With pliers or a sharp cold chisel and a hammer remove the used linings. Care must be exercised not to spring the discs in removing the linings.

After removing the lining determine if the discs are warped or sprung by laying them face down on a surface plate. If they are warped or sprung they should not be used again.

Cadillac clutch disc lining is supplied with the holes punched for the rivets. Suitable rivets are supplied. It is recommended that Cadillac lining and rivets be used.

Do not have the lining nearer than one-sixteenth of an inch from the bottom of the teeth on the periphery of the discs nor allow it to extend over the inner edge of the discs.

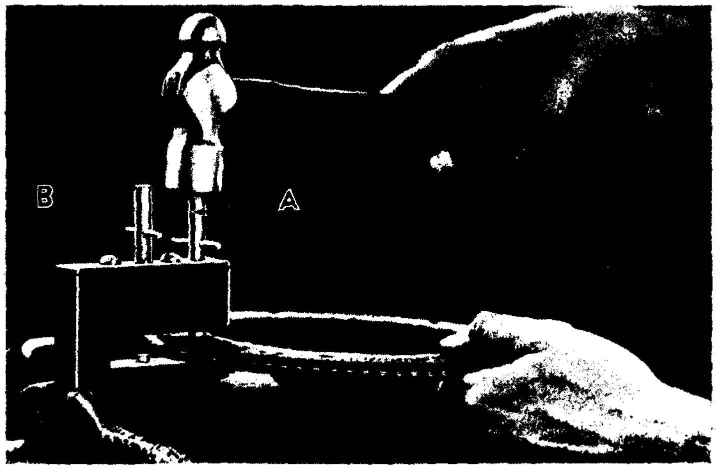

Fig. 41—Clutch Disc Relining Tool

Do not have all rivet heads on one side of the disc. Alternate them. Rivets should be headed over and well drawn in so that they are at least one thirty-second of an inch below the surface of the lining.

The clutch rivets may be set by using Cadillac riveter, tool No. 71975, as shown in Fig. 41.

When using this tool insert the brass tube rivets through the holes in the clutch discs and facings, alternating the rivet heads. Place the disc with facings into the tool as shown in Fig. 41 so that the punch "A" enters one of the rivets. Tap the punch firmly then move the disc under the punch "B," and complete the riveting. Set each rivet in a similar manner. After completing the work, smooth down the new facings with a press or a steel block and hammer.

CLUTCH PEDAL

194 Adjustment of Clutch Pedal Clearance

If the clutch pedal strikes the stop screw before the clutch is fully engaged, readjustment should be made.

Remove the pin "T" (Fig. 42) and unscrew the yoke "S," which is threaded on the rod "O," so that when the pin "T" is replaced the clutch pedal has a movement back and forth of one and one-quarter inches without starting to release the clutch. Secure the pin "T" with a cotter pin and tighten the lock nut "R."

195 Adjustment of Clutch Pedal Stop

The clutch pedal stop screw "N" (Fig. 42) is adjusted when the car is assembled and requires no further attention. When in proper adjustment the stop screw "N," should hold the pedal arm "U" so that the lower edge of the pedal pad is from 5½ inches to 5¾ inches (5 to 5¼ on Type 61) away from the toe board, measured in a line perpendicular to the toe board. In this position there should not be less than ⅜ of an inch clearance between the pedal arm "U" and the under side of the toe board at any point. If the adjustment has been changed, it may be readjusted in the following manner:

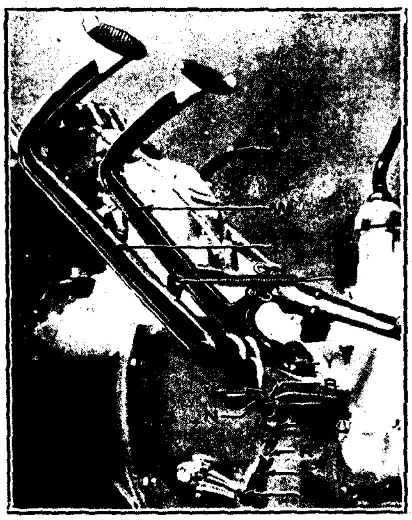
Fig. 42—Clutch Control

Remove the pin "T" from the yoke "S," loosen the lock nut "V" and adjust the stop screw "N" so that the pedal arm "U" is held in the position described in the preceding paragraph when the pin "Y" is against the stop screw. Tighten the lock nut "V."

Then adjust the yoke "S" so that when the pin "T" is replaced the clutch pedal has a movement back and forth of one and one-quarter inches without starting to release the clutch. Secure the pin "T" with a cotter pin and tighten the lock nut "R."

TRANSMISSION

196 General Construction

The transmission is of the selective type of sliding gear. It provides for three speeds forward and one reverse. The gear changes are accomplished by the movement of the control lever.

The teeth of the driving gear "A" (Fig. 83) are cut on the large end of the clutch connection shaft "B" which revolves on annular ball bearings "C" and "D," and which turns with the crankshaft of the engine when the clutch is engaged, at which time the bearing "D" is inoperative. The gear "A" is in constant mesh with the jackshaft gear "E." The jackshaft gears "E," "F," "G" and "H" revolve together on two Hyatt high-duty flexible roller bearings "I" on a stationary shaft "J." The roller bearings "I" are lubricated by oil forced through the tube "K" which revolves with the gear "F."

The main transmission shaft "L," which is coupled to the forward universal joint, is splined and carries two sliding gears "M" and "N." The shaft "L" is supported by an annular ball bearing "O" at the rear end, and at the front end by a-roller bearing "P" which is housed in the rear end of the clutch connection shaft "B."

REAR AXLE

197 Provision for Adjustment

Type 61 and early V-63 rear axles, which are equipped with roller bearings for the pinion and ring gear, have two sets of adjustments, the distinction between which must be clearly understood before any attempt at adjustment is made. One set of adjustments is provided for taking up end play in the pinion and ring gear bearings and the other set is for moving the pinion in or out and the ring gear to the right or left.

The pinion and ring gear bearings are correctly adjusted when the car is assembled but after a few thousand miles it may be found that the bearings "E" and "F" (Figs. 43b and 43c), which take the end thrust of the gears, have become more permanently seated, causing end play in the pinion shaft "D" and side play in the gear mount "B." When this condition exists, axle gear noise will result. As a precaution, therefore, the bearings "E" and "F" should be readjusted at the end of the first 2000 miles.

If the pinion and ring gear bearings are kept in proper adjustment, it is seldom necessary to readjust the positions of the ring gear and pinion. On the other hand, if the gears are allowed to run for any length of time with end play in either the pinion bearings or the ring gear bearings the tooth surfaces are likely to be so badly worn that no adjustment can be made which will give correct tooth contact. In any event the pinion and ring gear bearings on the roller bearing type axle should be properly adjusted before any attempt is made to adjust the positions of the pinion or ring gear.

Late V-63 rear axles, which are equipped with ball bearings, do not require an adjustment for taking up play in the bearings. These axles require only adjustments for moving the pinion in or out and the ring gear to the right or left.

198 Adjustment of Pinion and Ring Gear Bearings on Type 61 and Early V-63 Rear Axles (Roller Bearing Type)

Do not attempt to detect end play in the pinion or ring gear bearings by prying the pinion or gear mount back and forth. The end play might be insufficient to detect in this manner and still be enough to injure the tooth surfaces of the gears.

Adjustment of Pinion Bearings

To adjust the pinion bearings, proceed as follows:

Remove the long clamping bolt "V" (Fig. 43b) on the pinion cage and remove the locking key which holds the shell "G" (Figs. 43b and 43c) in place. Turn the shell "G" clockwise as far as it will go, using spanner wrench No. 79249, and applying as much pressure as can be applied by hand with this wrench. When the pinion shell "G" has been drawn up tight, back it off a minimum of two notches and a maximum of three notches. (If, with two notches, the pinion shaft is not free, the pinion shell should be backed off three notches. In no case should the pinion shell

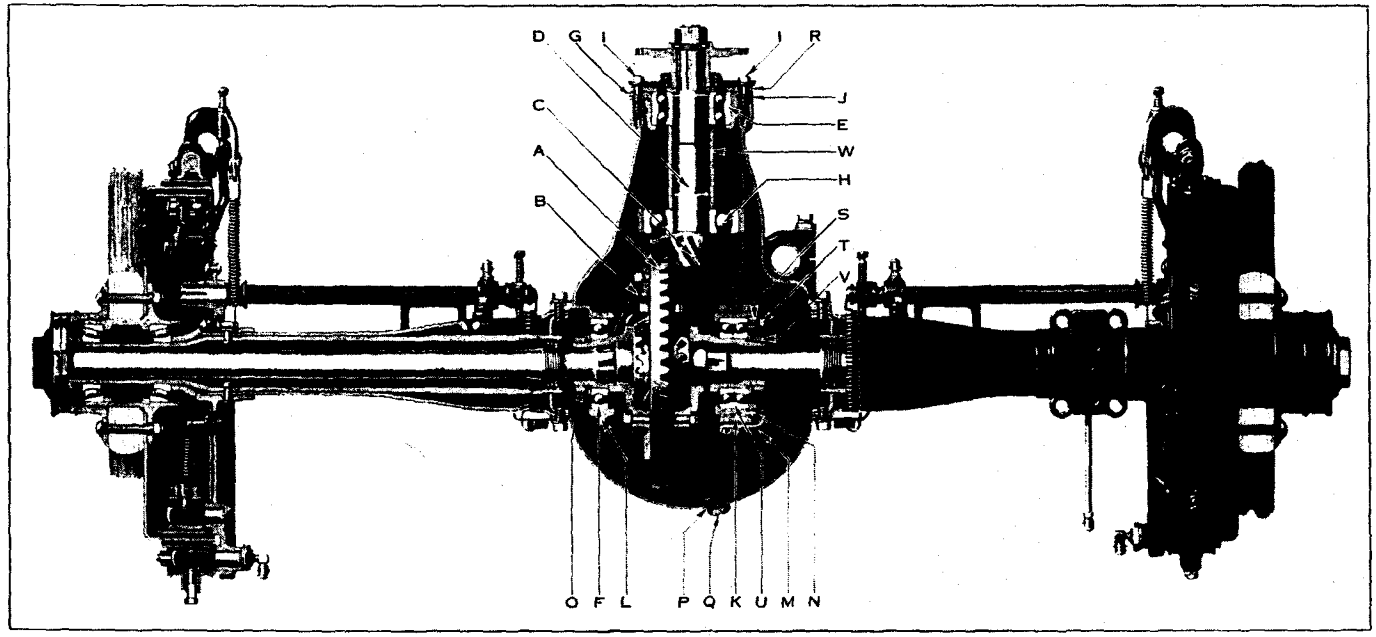

Fig. 43a—V-63 Ball Bearing Type Rear Axle

be backed off more than three notches even though the pinion shaft does not turn freely, as the tightness is probably due to the felt packing.) When the pinion shell has been properly adjusted, insert the locking key and replace and tighten the clamping bolt "V."

Adjustment of Ring Gear Bearings

The ring gear bearings may be adjusted, after draining the lubricant and removing the rear cover, by turning either the right-hand bearing adjusting nut "N" (Figs. 43b and 43c) or the left-hand bearing adjusting nut "O." Since the thrust comes on the left-hand bearing "F," it is *usually possible to take up the end play by adjusting the left-hand nut.* However, extreme care must be taken in adjusting the left-hand nut that the ring gear does not bind on the pinion. As the nut is tightened, the ring gear should be tested to see that it is still free. If the ring gear binds on the pinion before the nut is fully tightened, do not turn the left-hand nut farther but take up the remainder of the end play by turning the right-hand nut, first tightening the screws in the left-hand bearing cap.

Before turning either of the adjusting nuts, remove the cotter pin which locks the key "M" or "L" and swing the key back out of the slot in the adjusting nut. Remove the wire which locks the screws in the cap "K" and loosen the screws just enough to permit turning the adjusting nut. Special socket wrench No. 83236* should be used for turning the cap screws. (The screws in the cap on the adjusting nut which is *not* being adjusted should be clamped tight while the other nut is being adjusted.) *To take up the end play, turn the adjusting nut* as far as it will go using tool No. 72799 and applying as much pressure as can be applied with this tool by hand. After the nut has been drawn tight, back it off a minimum of one and one-half notches and a maximum of two and one-half notches. Tighten the clamp screws in the cap "K" but do not replace the key "L" or "M" until all adjustments have been completed.

199 Adjustment of Ring Gear and Pinion for Position

Neither the ring gear nor the pinion should be moved without knowing in which direction they should be moved. This *cannot* be determined by observing whether the heel ends of the teeth on the pinion are flush with those on the ring gear. It can be determined only by measuring the backlash and taking the tooth impression with red lead as directed *in §201. While it is true that the pinion and gear are so machined that* when they make proper contact the teeth on the pinion and ring gear will be approximately flush, this condition is only a starting for point setting new gears and must not be used as a test in readjusting gears. The gear and pinion positions are likely to be more nearly correct as they are than with the ends of the teeth flush.

On the roller bearing type axle, movement of the pinion in or out or of the ring gear to the right or left should not be attempted until the

*The following special tools mentioned in §§197-201 are being shipped to distributors. Dealers should order from their respective distributors. Tool No. 91221—Crank for turning rear axle pinion shaft; Tool No. 91222—Tool for forcing pinion cage out of differential carrier; Tool No. 91220—Indicator holder for determining backlash in rear axle gears; Tool No. 91671—Spanner wrench for gear mount bearing adjusting nut. Tool No. 83236 is the wrench already in use for the torque arm support bolt nut.

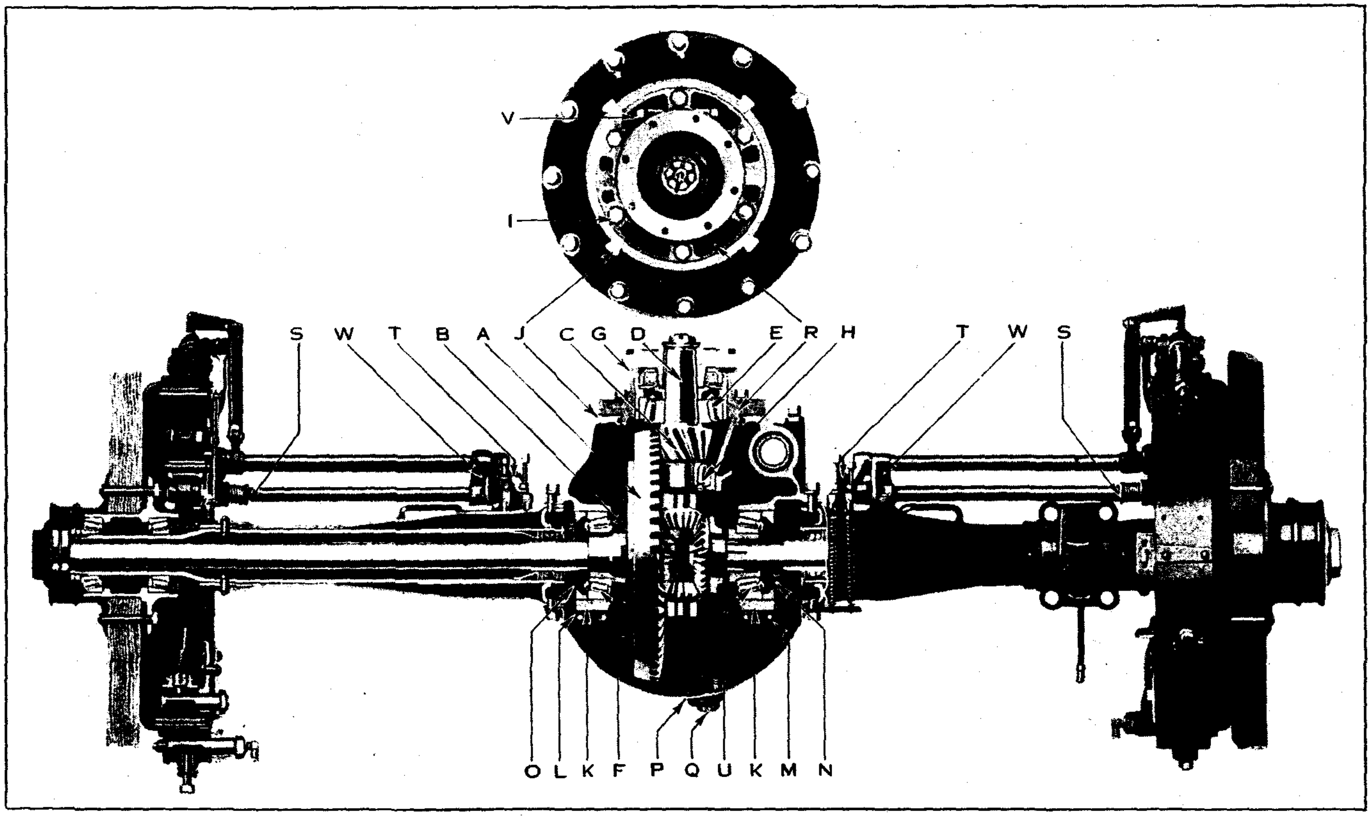

Fig. 43b—V-63 and Late Type 61 Rear Axle (roller bearing type)

pinion bearings and the ring gear bearings have been properly adjusted as directed in §198 under "Adjustment of Pinion and Ring Gear Bearings." The adjustments provided on this type axle for moving the pinion and ring gear are such that it is not necessary to readjust the bearings after moving the pinion or ring gear.

Adjustment of Pinion on Late V-63 Rear Axles (Ball Bearing Type)

To move the pinion in or out on the ball bearing type axle proceed as follows:

Remove the six screws "I" (Fig. 43a), in the plate over the pinion front bearing. By means of tool No. 91222,* force the bearing retainer out of the differential carrier about $\frac{1}{16}$ of an inch or enough to permit removing the shims. Do not use a cold chisel or screw driver for this purpose. Remove the shims "J" by pulling out the two halves. Measure the thickness of the shims with micrometers and if the pinion is to be moved in, substitute shims of less thickness or remove one of the shims from each side. If the pinion is to be moved out, substitute shims of greater thickness or insert an additional shim on each side. These shims must be changed only in pairs, the shims of each pair being of the same thickness. Shims are supplied in the following thicknesses: .010, .015, and .035.

Replace and tighten all six of the screws "I" before taking the tooth impression again.

Adjustment of Pinion on Late Type 61 and Early V-63 Rear Axles (Roller Bearing Type)

To move the pinion in or out on V-63 or late Type 61 roller bearing type axles proceed as follows:

Remove the six screws "I" (Fig. 43b) in the pinion cage flange. By means of tool No. 91222* force the pinion cage out of the differential carrier about $\frac{1}{16}$ of an inch to permit removing the shims. Do not use a cold chisel or screw driver for this purpose. Remove the shims by pulling out the two halves. Measure the thickness of the shims with micrometers, and if the pinion is to be moved in, substitute shims of less thickness or remove one of the shims from each side. If the pinion is to be moved out, substitute shims of greater thickness or insert an additional shim in each side. These shims must be changed only in pairs, the shims of each pair being of the same thickness. Shims are supplied in the following thicknesses: .010, .015, and .035 inches.

Replace and tighten all six screws in the flange of the pinion cage before taking the tooth impression again.

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*See foot-note on page 87.

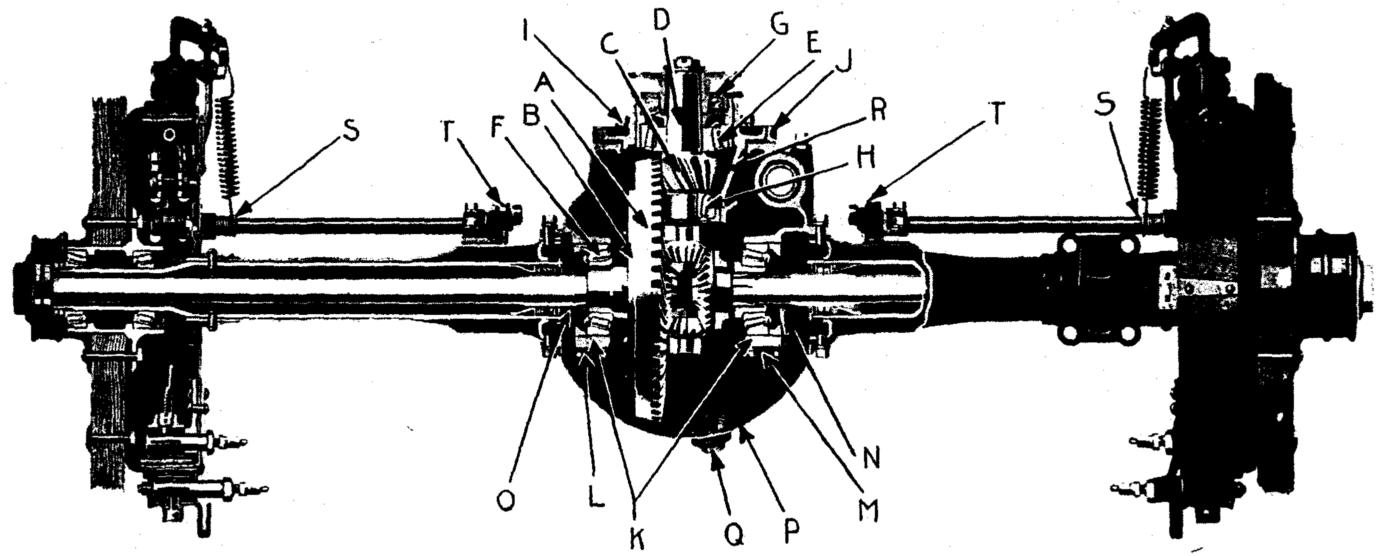


Fig. 43c—Early Type 61 Rear Axle (roller bearing type)

Adjustment of Pinion on Early Type 61 Rear Axles (Roller Bearing Type)

To move the pinion in or out on early Type 61 rear axles, proceed as follows:

Loosen the six screws "I" (Fig. 43c). Turn the adjusting ring "J," moving the pinion in the desired direction. Clockwise rotation of the locking ring moves the pinion out and counter-clockwise rotation moves the pinion in. Spanner wrench No. 81846 is for use in making this adjustment. Tighten the six screws "I" before taking the tooth impression again.

Adjustment of Ring Gear on Late V-63 Rear Axles (Ball Bearing Type)

To move the ring gear to the right or left on the ball bearing type axle, proceed as follows:

After draining the lubricant and removing the rear cover, remove the wires which lock the screws in the cap "K" (Fig. 43a). Remove the cotter pin which locks the key "M" and swing the key "M" out of the slot in the adjusting nut "N." Loosen the cap screws in the adjusting nut cap "K" just enough to permit turning the adjusting nut "N." To move the ring gear to the right, turn the adjusting nut "N" counter-clockwise (looking toward the nut from the right.) To move the ring gear to the left, turn the adjusting nut "N" clockwise. Spanner wrench No. 91671* should be used to turn the nut "N." Tighten the cap screws in the cap "K" before taking the tooth impression again.

Adjustment of Ring Gear on Type 61 and Early V-63 Axles (Roller Bearing Type)

To move the ring gear to the right or left on the roller bearing type axle, proceed as follows:

Loosen the cap screws in the adjusting nut caps "K" (Figs. 43b and 43c) just enough to permit turning the adjusting nuts "N" and "O." (The keys "L" and "M" will already be out of the slots in the adjusting nuts.) To move the ring gear to the right, back off the right-hand bearing adjusting nut a definite number of notches, and then turn the left-hand bearing adjusting nut the same number of notches in the same direction. To move the ring gear to the left, first back off the left-hand bearing adjusting nut a definite number of notches and then turn the right-hand bearing adjusting nut the same number of notches in the same direction. Tighten the screws in the caps "K" before taking the tooth impression again.

200 Backlash

The teeth on the pinion and ring gear are so machined that when they make proper contact there will be from .006 to .012 inch backlash. To measure the amount of backlash an indicator is absolutely necessary. Backlash cannot be accurately judged by "feel."

*See foot-note on page 87.

Dial indicator No. 196-B* should be used to measure the backlash and should be attached with holder No. 91220* designed for the purpose. If the differential carrier is detached from the axle housing as is recommended, the indicator should be fastened to the differential carrier as shown in Fig. 44a. If the differential carrier is not detached from the axle housing the indicator may be fastened to the axle housing as shown in Fig. 44b.

Fig. 44a—Backlash Indicator Attached to Differential Carrier

On roller bearing axles, backlash should not be measured until the pinion and ring gear bearings have been adjusted and the screws on the ring gear bearing caps have been tightened. If there is end play in the pinion or ring gear bearings the backlash measurement will mean nothing.

To measure the backlash attach the indicator either to the differential carrier (Fig. 44a) or to the axle housing (Fig. 44b) and adjust the indicator so that the stem rests against the back of one of the ring gear teeth. Be sure that the indicator does not touch the gear at any other point. With the pinion held firmly from turning,turn the ring gear by hand back and forth as far as the backlash permits. The amount of the movement of the ring gear is the amount of backlash and will be shown on the indicator dial in thousandths of an inch.

Backlash is not materially affected by movement of the pinion in or out. It is greatly affected by movement of the ring gear to the right or left. *Turning the adjusting nuts one notch increases or decreases the backlash approximately .002 inch.*

The backlash should be measured before the tooth impression is first taken and after each movement of the ring gear or pinion. Correction of the backlash by movement of the ring gear should be made only as directed in §202 under "Order of Procedure."

201 Tooth Impression

The purpose of taking the tooth impression is to determine whether or not the ring gear and pinion are in the proper positions with respect

*Dial indicator No. 196-B is the indicator used to determine clearances in crankshaft and connecting rod bearings. See foot-note on page 87 regarding tool No. 91220.

to each other, and, if they are not, to determine in which direction they should be moved to obtain proper tooth contact. It is, in fact, the only way to determine whether the gears make proper contact.

Taking the tooth impression consists in painting the teeth on the ring gear with a thin paste of red lead and oil, and then turning the pinion shaft while applying a load on the ring gear. Where the teeth make contact with each other the red lead will be rubbed off and the contact will be distinctly visible.

Nothing but red lead is suitable for taking the tooth impression. White lead should never be used and Prussian blue cannot be used satisfactorily. Powdered red lead should be mixed with ordinary engine oil to form a thin paste, which should be applied with a paint brush.

In turning the pinion shaft to make the tooth impression, a power testing stand is desirable although not essential. In the absence of a power testing stand, satisfactory results can be obtained by using a crank (tool No. 91221*) to turn the pinion shaft, and inserting a piece of hard wood between the ring gear and the differential carrier to serve as a brake. It is important that as heavy a load be applied as possible. The pinion shaft should be turned about 25 revolutions forward and then the same number of revolutions in the reverse direction.

Impressions of correct and incorrect tooth contact are shown in Figs. 45 and 46. While these diagrams are not reproductions of actual gear teeth, they represent clearly the positions of the contact area.

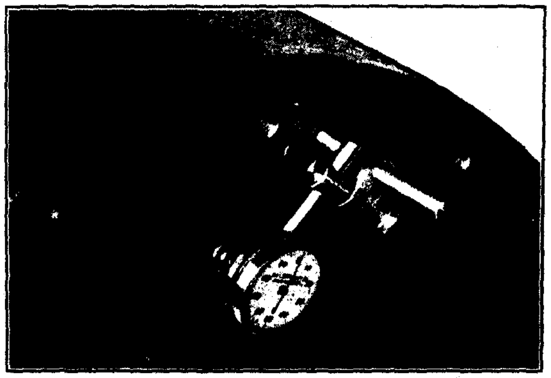
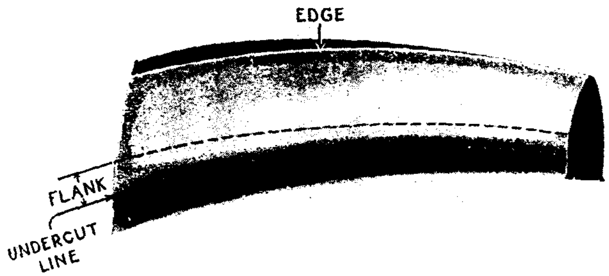


Fig. 44b—Backlash Indicator Attached to Rear Axle Housing

201a Interpretation of Tooth Impression

There are two things to be considered in observing a tooth impression: the location of the tooth contact with respect to the depth of the tooth, called the "profile contact," and the location of the tooth contact with respect to the length of the tooth, called the "lengthwise contact."

*See foot-note on page 87.



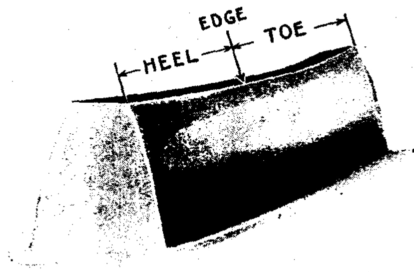
Pinion in correct position.

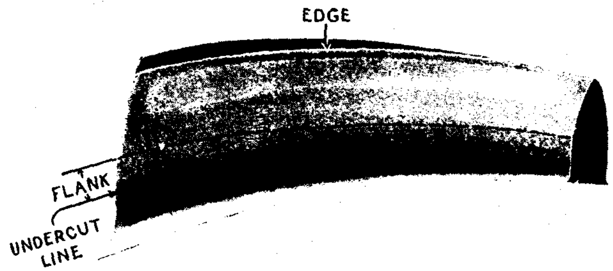
a

Pinion: Contact extends uniformly from edge to undercut line.

b

Ring Gear: Contact uniform throughout area.





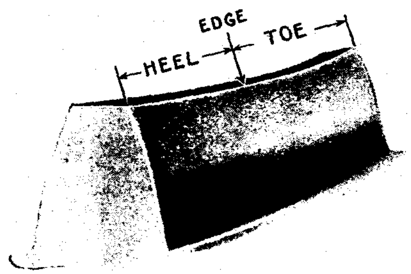
Pinion too far toward center of ring gear—move pinion out.

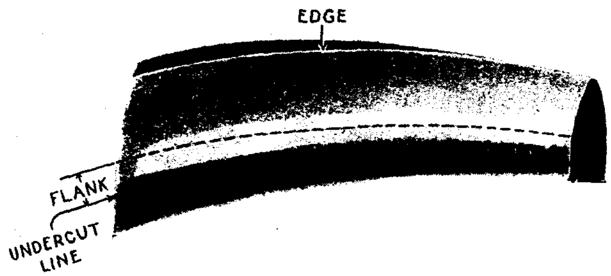
c

Pinion: Contact too close to edge.

d

Ring Gear: Heavy contact too far down flank.





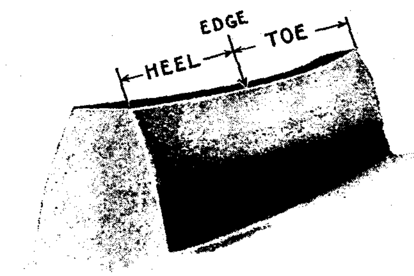
Pinion too far from center of ring gear—move pinion in.

e

Pinion: Contact too far down on flank.

f

Ring Gear: Heavy contact too close to edge.



(91C)

Fig. 45—Profile Contact on Pinion (left) and Ring Gear (right). (Driving side of tooth shown.)

NOTE: On V-63 and late Type 61 axles with large inspection hole, judge the profile contact by the pinion tooth impression as shown on the left. On early Type 61 axles, on which the pinion tooth impression cannot be observed, judge by the ring gear tooth impression as shown on the right.

The *profile contact* is changed whenever the pinion is moved in or out, the effect on the ring gear teeth being opposite to the effect on the pinion teeth. The profile contact is not materially affected by movement of the ring gear to the right or left.

The *lengthwise contact* is changed whenever the ring gear is moved to the right or left. The lengthwise contact is not materially affected by movement of the pinion in or out.

The following four rules therefore describe the effect on the tooth impression of the four possible movements of the ring gear and pinion:

(1) Moving the *pinion in* moves the profile contact on the pinion toward the edge of the tooth and the profile contact on the ring gear toward the flank of the tooth. (See Fig. 45, c and d).

(2) Moving the *pinion out* moves the profile contact on the pinion toward the flank of the tooth and the profile contact on the ring gear toward the edge of the tooth. (See Fig. 45, e and f).

(3) Moving the *ring gear* to the *right* moves the lengthwise contact toward the toe of the tooth. (See Fig. 46b.)

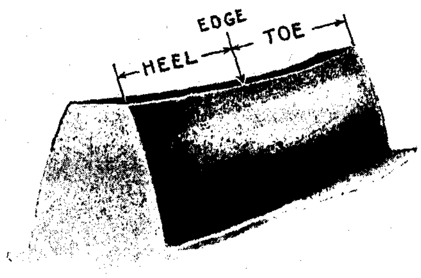
(4) Moving the *ring gear* to the *left* moves the lengthwise contact toward the heel of the tooth. (See Fig. 46c.)

The ideal or theoretical *profile contact* on the *pinion tooth* extends from the edge of the tooth to the undercut line as shown in Fig. 45a and is heaviest in the center of this area. If the contact, although showing from the edge to the undercut line, is decidedly heavier toward the edge or toward the flank, the pinion is only slightly out of position. If the contact is narrow and located near the edge as in Fig. 45c, or on the flank as in Fig. 45e, the pinion is likely to be very much out of position.

The theoretical *profile contact* on the *ring gear tooth* is similar to that on the pinion and is shown in Fig. 45b. Movement of the pinion, however, does not have as pronounced an effect on the ring gear as on the pinion. The same setting of the pinion which would cause the profile contact on the pinion to appear as in Fig. 45c or Fig. 45e would not materially change the area of the contact on the ring gear but would produce a decidedly heavier contact away from the edge as in Fig. 45d or toward the edge as in Fig. 45f.

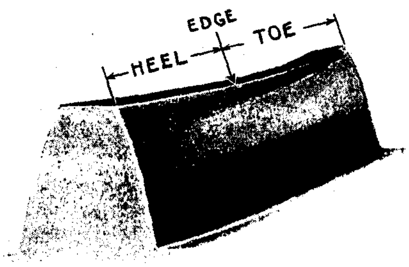
The ideal *lengthwise contact* is in general equally distant from the end of the tooth as in Fig. 46a. On the driving side of the tooth, however, it is better to have the tooth contact toward the toe rather than toward the heel, and on the coasting side toward the heel rather than toward the toe.

It is possible to use the tooth impression either on the pinion or on the ring gear as the guide to movement of the pinion. Because of the greater curvature of the pinion teeth, however, they are much more sensitive to change in profile contact than are the ring gear teeth. On V-63 and later Type 61 rear axles which have the large inspection hole, the profile contact on the pinion should therefore be observed. On early Type 61 axles which do not permit observation of the tooth impression on the pinion, it is necessary to observe the profile contact on the ring gear teeth. Lengthwise contact should be observed on the ring gear rather than on the pinion on all types of axle.



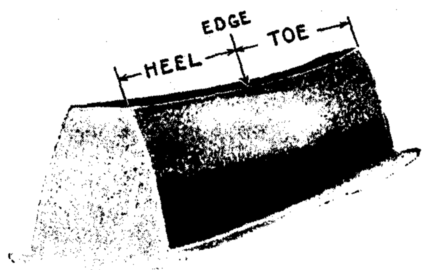
a

*Ring gear in correct position.
Contact in center of tooth
or slightly toward toe.*



b

*Ring gear too far toward center of pinion
—move ring gear to left. Contact too
far toward toe of tooth.*



c

*Ring gear too far from center of pinion
—move ring gear to right. Contact too
far toward heel of tooth.*

Fig. 46—Lengthwise Contact on Ring Gear.
(Driving side of tooth shown.)

202 Order of Procedure

In the foregoing the various elements of gear adjustment have been discussed without regard to their order in the actual work. It is important that the steps proceed in a definite manner. The following is the order of procedure for making the complete adjustment.

1. Drain the lubricant and remove the rear cover.

2. Remove the rear axle drive shafts. (§503).

3. Disconnect the front end of the torque arm by removing the nut on the lower end of the torque arm hanger.

4. Disconnect the rear universal joint flange from the pinion shaft flange. Do not let the joint drop on the floor.

5. Remove the screws which fasten the differential carrier to the rear axle housing and remove the differential carrier assembly with torque arm attached. Place the assembly on a bench where there is good light, holding it by clamping the torque arm in a vise.

Note: If preferred, the differential carrier can be left attached to the axle and the axle removed as a unit and placed on a stand. Removal of the differential carrier assembly, however, is recommended. Do not attempt to adjust the gears under the car. The gears cannot be thoroughly cleaned nor the tooth impression properly observed.

6. Clean all traces of lubricant from the ring gear and as far as possible from the pinion using a brush and gasoline.

7. Clamp the indicator holder in position and adjust the indicator as directed in §200 under "Backlash."

8. Prepare a thin paste of red lead and oil as directed in § 201 under "Tooth Impression" and provide a paint brush for applying it.

9. If the axle is of the roller bearing type, adjust the pinion and ring gear bearings as directed in §198 under "Adjustment of Pinion and Ring Gear Bearings." The tooth impression cannot be properly interpreted if there is end play in the bearings.

These preliminary steps having been taken, the following is the recommended procedure for adjusting the ring gear and pinion positions:

10. Measure the backlash between the pinion and ring gear with the indicator. (See §200 under "Backlash.")

11. If the backlash is less than .006 of an inch, move the ring gear toward the left. If the backlash is more than .012 of an inch, move the ring gear toward the right. When the backlash is within the limits of .006 and .012 of an inch, proceed with the next step.

12. Paint the teeth of the ring gear with the red lead and take the tooth impression as directed in §201 under "Tooth Impression."

13. With the aid of an electric light, observe the profile contact on the driving side of the pinion teeth. (If the axle is an early Type 61 axle see paragraph 13a.) If the contact extends from the edge to the undercut line and is heaviest in the center of this area as in Fig. 45a, the pinion need not be moved. If the tooth contact is toward the edge

of the tooth as in Fig. 45c, the pinion should be moved out. If the tooth contact is toward the flank as in Fig. 45e, the pinion should be moved in. (See §201a under "Interpretation of Tooth Impression.")

13a. If the axle is an early Type 61 axle observe the profile contact on the ring gear teeth. If the contact covers the area shown in Fig. 45b and is uniform throughout this area or heaviest in the center of the area the pinion need not be moved. If the heaviest contact is toward the edge of the tooth as in Fig. 45f, even though there is some contact over the entire area, the pinion should be moved in. If the heaviest contact is away from the edge as in Fig. 45d, the pinion should be moved out.

14. Having determined in which direction the pinion should be moved, if at all, move the pinion as directed in §199 under "Adjustment of Ring Gear and Pinion for Position."

15. Measure the backlash between the pinion and ring gear.
16. Take the tooth impression with red lead.
17. Observe the profile contact on the pinion tooth as in paragraph 13 or on the ring gear tooth as in paragraph 13a.

18. Repeat the operations in paragraphs 14 to 17 until the tooth contact is as near the theoretical condition shown in Figs. 45a and 45b as possible.

19. Observe the profile contact on the coasting side of the pinion teeth if the axle is a late Type 61 or V-63 axle or of the ring gear teeth if the axle is an early Type 61. The profile contact on the coasting side should be the same as on the driving side. If it is not, a slight readjustment might be made if doing so does not change the profile contact too much on the driving side. The same rules hold for changing the profile contact on the coasting side as on the driving side.

20. Observe the lengthwise contact on the driving side of the ring gear tooth. If the tooth contact is distributed equally between the toe and heel as shown in Fig. 46a, or slightly toward the toe, the ring gear will not need to be moved. If the tooth contact is decidedly toward the toe as in Fig. 46b, the ring gear should be moved to the left. If the tooth contact is toward the heel as in Fig. 46c, the ring gear should be moved to the right.

21. Keeping in mind the backlash as last measured, move the ring gear in the proper direction as indicated by the tooth contact, but do not move it so far that the limits of backlash (.006—.012) will be exceeded.

22. Measure the backlash.
23. Take the tooth impression.
24. Observe the lengthwise contact on the ring gear tooth.
25. Repeat the operations in paragraphs 21 to 24 until the lengthwise contact is as near the theoretical condition as possible, or until, in the effort to obtain correct tooth contact, the backlash has been increased or decreased to the limit.

26. Observe the lengthwise contact on the coasting side of the ring gear teeth. If the foregoing adjustments have been properly made, and if the tooth surfaces have not been injured by running the gears with

improper adjustment, the lengthwise contact on the coasting side of the driving gear teeth should be centrally located between the heel and the toe, or should be slightly toward the heel. If the tooth contact should be toward the toe, or decidedly toward the heel, the gears will likely be noisy on the coast. In this event, the ring gear might be moved slightly to improve the contact, provided doing so does not increase or decrease the backlash beyond the recommended limits, nor materially alter the tooth contact on the driving side. It is ordinarily more satisfactory to adjust for the proper condition on the driving side than on the coasting side.

Gears which cannot be made to show proper tooth contact on both driving and coasting sides, or which cannot be made to show good contact on either side without excessive backlash, have probably been damaged by running under improper adjustment. Such gears cannot be adjusted to give quiet operation.

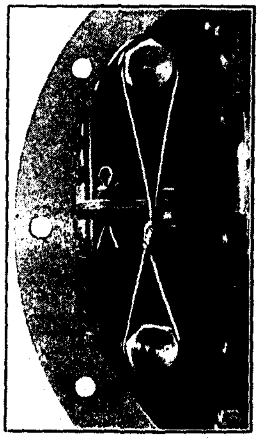


Fig. 47—Correct Method of Wiring Ring Gear Bearing Cap Screws

27. When the adjustment has been completed, tighten the screws in the ring gear bearing caps and lock them with No. 14 soft annealed iron wire. Make sure that the wire is threaded through the screw heads in the proper direction. Fig. 47 shows the proper manner for wiring the screw heads.

28. Engage the locking keys with the notches in the adjusting nuts and lock them with cotter pins.

29. It is a good plan before installing the differential carrier in the axle housing to examine the packing in the inner ends of the axle sleeves and to replace it if necessary.

30. Install the differential carrier assembly by reversing the order of the operations in paragraphs to 1 to 5. In connecting the front end of the torque arm, do not fail to lock the nut on the hanger with a cotter pin. In installing the axle shafts, observe that the shafts are marked "R" and "L" and be sure that they are installed in their proper places.

UNIVERSAL JOINTS

203 Description

The tubular drive shaft that transmits the power of the engine from the transmission to the rear axle is fitted with a universal joint at each end.

The purpose of the joints is to provide a flexible drive, which is made necessary by the constantly changing alignment due to the play of the springs.

The general arrangement of the joints is shown in Fig. 84. The joints differ only in that the forward joint, which is attached to the transmission shaft, is provided with a sliding connection, or slip sleeve, "K," while the rear joint is welded to the drive shaft. A sliding connection is necessary to take care of the endwise motion of the drive shaft due to variation in the distance between the transmission and the rear axle caused by the action of the springs.

The joints are protected by an inner housing "D" and an outer housing "C," both of pressed steel. The inner housing is bolted to the flange and the outer housing fits over the end of the inner housing and is held in place and kept tight by means of a spring. The packing "H" is for the purpose of preventing grease from working out and dirt from getting in.

TORQUE ARM

204 Adjustment of Torque Arm Support Bolt

The bolt at the front end of the torque arm, which connects the torque arm support to the cross member of the frame, is adjustable. Loosen the jam nut with wrench No. 83236 and tighten up the bolt with wrench No. 83237. Tighten the jam nut when adjustment of the bolt is completed.

V-63 FOUR WHEEL BRAKES

205 General Description

There are three pairs of brakes on V-63 cars: the rear wheel external brakes, the rear wheel internal brakes, and the front wheel internal brakes. The rear wheel external brakes and the front wheel brakes are operated by the brake pedal and are used for regular service. The rear wheel internal brakes are operated by a hand lever and are used principally for locking the rear wheels when the car is standing. The hand brakes are entirely independent of the foot brakes and comprise a complete reserve braking system.

The purpose of the front wheel brakes is to add to the braking ability as much as is consistent with safety. It is not desirable to attempt to secure the maximum possible braking effect on the front wheels for the reason that when a front wheel slides without rotating it has no power to change the direction of the car. The driver of a car with both front wheels locked has therefore no control over its direction particularly in rounding slippery corners.

The Cadillac front wheel brakes are accordingly designed so that, when the foot brakes are applied while the steering wheel is turned to right or left, only the brake on the inner wheel is effective and the outer wheel is left free to rotate. This feature also provides that, if the brakes are applied with sufficient pressure to lock both front wheels while moving straight ahead on a slippery road, and the steering wheel is then turned to right or left, the brake on the outer wheel will automatically release and the wheel will turn freely, giving it ability to steer the car.

The combination in the foot braking system of internal brakes on the front wheels with external brakes on the rear wheels neutralizes the effect of heated brake drums. It is well known that the heat generated by the friction of the brake lining on the brake drums expands the drums, decreasing the clearance slightly if the brakes are external and increasing the clearance slightly if the brakes are internal. In the V-63 four-wheel brakes these two opposite effects neutralize each other through the division bar to which the brake pedal is connected. The pedal movement consequently does not change, the division bar merely taking a slightly different position when the brake drums are hot.

206 Brake Adjustment

A four-wheel braking system cannot be adjusted in the same manner as one with rear wheel brakes only. While the adjustment of Cadillac four-wheel brakes is not difficult, it must be done according to a definite method.

This method is described in the following pages. It has been developed after months of experience with experimental cars covering many thousands of miles.

No mechanic, no matter how familiar with the brakes on Cadillac cars of previous types, should attempt to adjust the brakes of a V-63 car without first studying and then carefully following these directions.

Adjustment to compensate for wear on the lining should NOT be made by means of the brake rods or stop screws. Provision is made in each brake for its adjustment to compensate for wear on the lining. The rods and stop screws are correctly adjusted when the car is assembled and unless tampered with do not require readjustment. If readjustment is necessary it should be made before adjusting the brakes themselves. Instructions are given in §§209, 211, 211c and 211e. If readjustment of the stop screws or rods is not necessary proceed directly with the instructions in §§207, 208, 210, 211a, 211b, or 211d.

The foot brakes are designed so that the greater portion of braking load is taken by the rear wheel brakes. The rear wheel foot brakes can accordingly be adjusted several times before it will be necessary to make any adjustment of the front wheel brakes.

Before attempting to make any brake adjustment make sure that all joints work freely and none of the connections bind. Make sure also that the brake bands are circular and conform to the shape of the drums. Bands which are not properly shaped cannot be properly adjusted.

In raising the front or rear axle for adjustment of the brakes, the axle rather than the frame should be lifted so that the axle may be in its normal position with respect to the frame while the brakes are being adjusted.

Each brake drum is provided with a removable inspection hole cover for adjustment of the internal brakes. This cover (shown at "F," Figs. 48, 49, 52a, and 52b) can be removed by taking out the screw "H" and sliding the cover away from the center of the wheel.

In adjusting the threaded yokes on the ends of the various brake rods, always make sure that the rod enters far enough into the yoke to hold securely.

The special adjusting drum, Cadillac tool No. 49839, is for use in adjusting both front and rear wheel brakes. When used for the front wheel brakes an adapting sleeve, tool No. 87981, must be used with this drum.

V-63 FOOT BRAKES — SECOND TYPE

(Engine Number 63-H-1501 and after)

207 Adjustment of Rear Wheel Foot Brakes (External)

Observe the clearance between those parts of the brake lining nearest the screw "A" (Fig. 48) and the brake drum. This clearance should be .030 to .035 of an inch. If the clearance is not correct adjust the screw

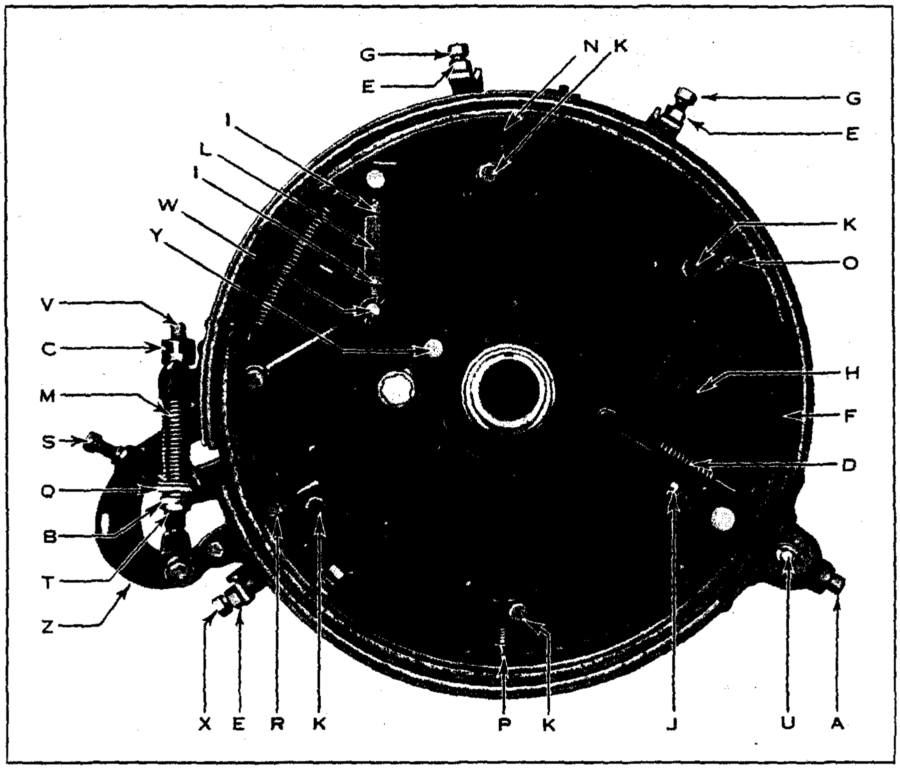


Fig. 48.—V-63 Rear Wheel Brakes (L. H.)
(Second Type)

"A" until it is. The screw "A" is kept from turning of its own accord by a locking device which locks every half-turn. It must accordingly be turned a half-turn at a time.

Observe whether the eye-bolt "Q" is at right angles to the yoke bolt "V." If it is not, loosen the nut on the eye-bolt "Q" and straighten it.

Loosen the locking nuts "T" and "E" and adjust the nut "B" and the screw "X" so that there is a uniform clearance of .030 to .035 of an inch between the brake lining and the *lower* part of the drum.

Then adjust the nut "C" and the two stop screws "G" so that there is a uniform clearance of .030 to .035 of an inch between the brake lining and the *upper* part of the drum. The nut "C" locks every half-turn and must be turned a half-turn at a time.

After making the foregoing adjustments so that there is a uniform clearance of .030 to .035 of an inch between the lining and the drum, check the results by applying the brakes and measuring the travel of the pin in the upper end of the lever "Z." This travel should not be less than 7/8 of an inch. If the pin in the upper end of the lever "Z" travels

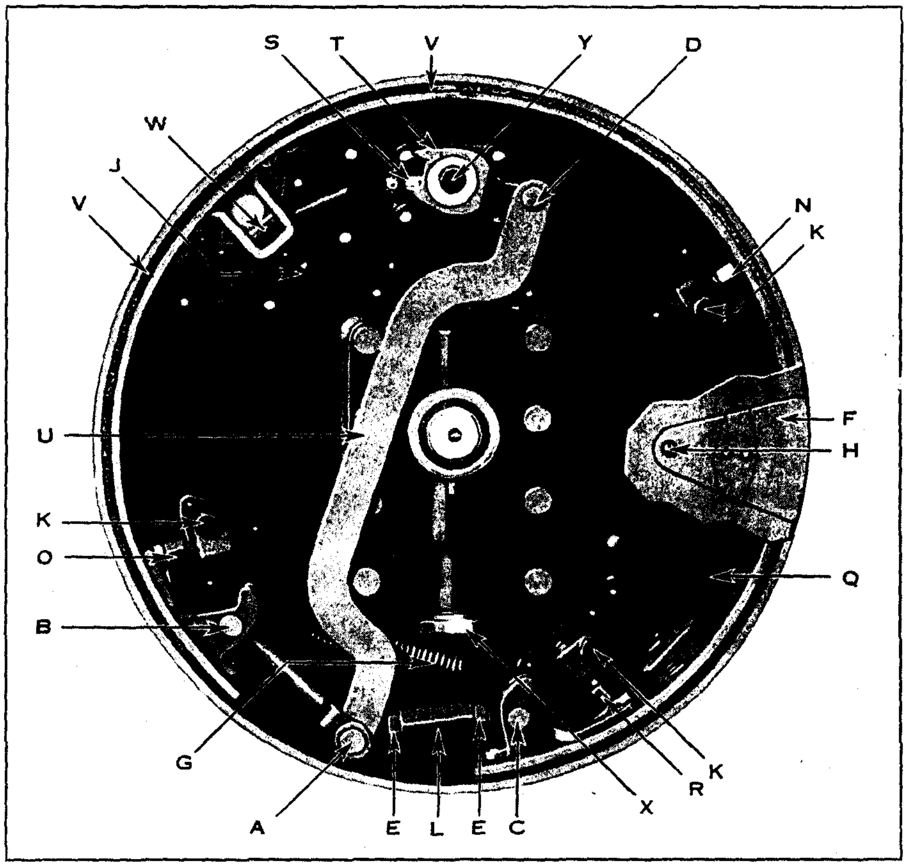


Fig. 49.—V-63 Front Wheel Brakes (L. H.)
(Second Type)

less than 7/8 of an inch in moving from the released position to the applied position, readjust one or all of the nuts "C" and "B" and the screws "A," "G" and "X" to increase the clearance slightly, keeping the clearance uniform at all points around the drum.

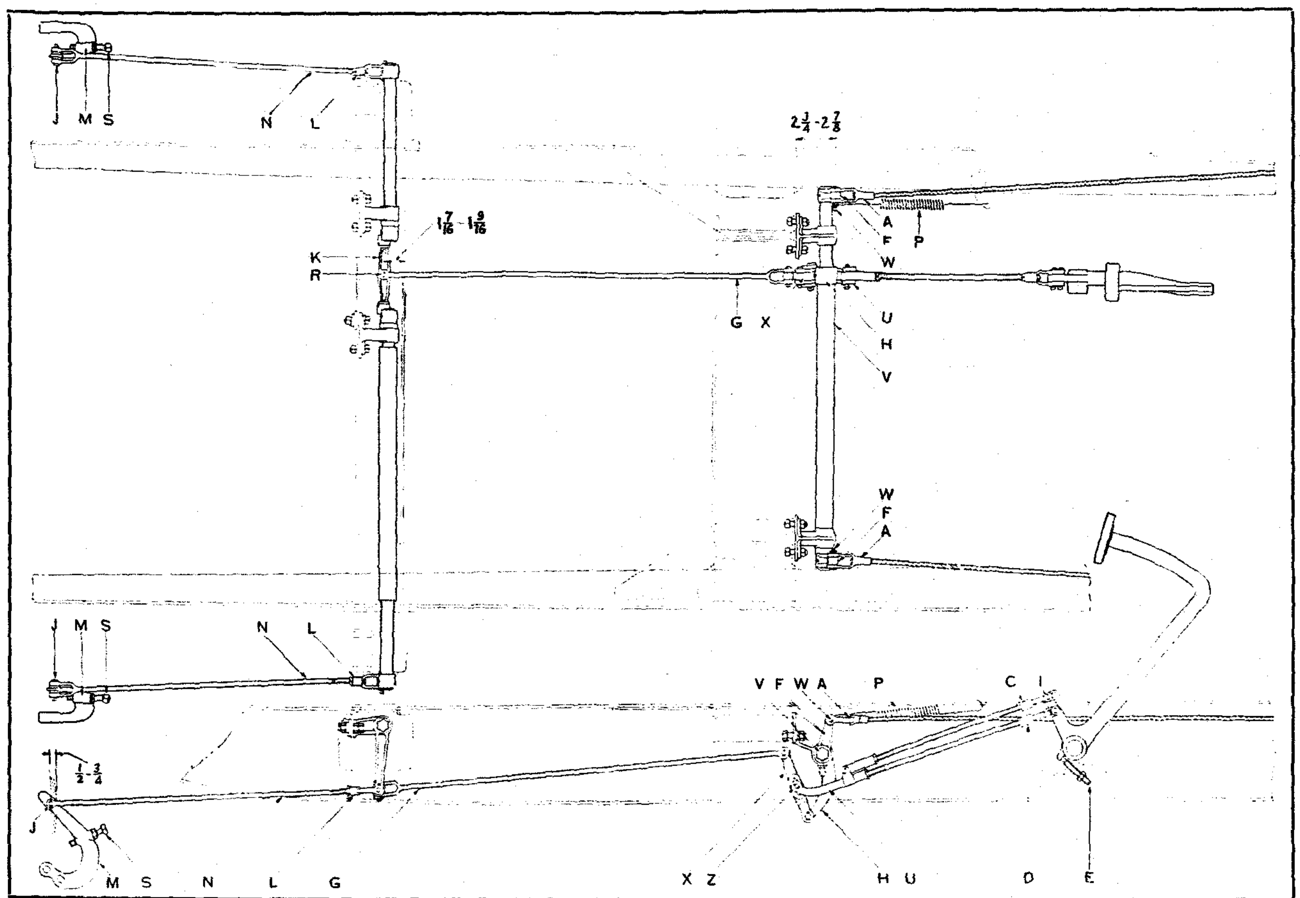


Fig. 50.—V-63 Foot Brake Rods to Rear Wheel Brakes
(Second Type)

Do not change the adjustment of the stop screw "S." The screw "S" is not intended for adjustment to take up wear on the brake lining. It should be touched only when it is necessary to set the brake rods. (§ 209.)

The last inspection after the adjustment has been completed and checked should consist in trying the locking nuts "T" and "E" to make sure they have been tightened.

208 Adjustment of Front Wheel Brakes

Raise the front axle so that both wheels can be rotated by hand. Turn the steering wheel so that the front wheels are directed straight ahead.

Remove each inspection hole cover "F" (Fig. 49) and observe the clearance between the brake drum and the brake lining at the two points "V." This clearance should be .025 of an inch. While ordinarily resetting is not necessary, if the clearance at "V" is incorrect, it should be corrected as follows: Remove the wheel and the screw "J." Then either remove one of the shims "W" or replace it with a shim of different thickness, so that when the screw "J" is replaced and drawn up tight and the wheel is installed, there will be .025 of an inch clearance at the points "V." Be sure to replace the cotter pin in the screw "J."

When the clearance at "V" has been checked and corrected,* if necessary, loosen the locking nuts "E" and the locking screws "K." Adjust the turnbuckle "L" and the stop screws "O," "R" and "N" so that with the brakes released and the lever "T" against the stop "S," there is a uniform clearance of .025 between the brake drum and the lining. The turnbuckle "L" has right-hand threads at one end and left-hand threads at the other.

After making the foregoing adjustments on both front brakes, the brakes should be tested for equal action. The front wheel brakes cannot be provided with a mechanical equalizer because it is necessary in turning corners for the right- and left-hand brakes to be applied unequally. To obtain equal braking effect when the car is moving straight ahead, the brakes must be adjusted as nearly alike as possible.

Apply the brake pedal, therefore, holding it with as steady a pressure as possible, while the retarding effect on one front wheel is compared with that on the other. If the effect is not the same on both wheels readjust the turnbuckles "L," and, if necessary, the stop screws "O," "R" and "N." The correction should be made partly by taking up the adjustment on one brake and partly by letting it off on the other. If the first adjustment has been correctly made to give both brakes the same clearance, very little, if any, readjustment will be necessary.

As described in § 205, the front wheel brakes are designed so that when the steering wheel is turned to the extreme right or left, the brake on the outer wheel will be automatically released. After the brakes have been adjusted for equal action with the front wheels straight ahead, they should therefore be checked for the extreme steering positions. To do this, first make sure that the front axle stop screws are correctly adjusted. (§ 219.)

*It is also advisable to make certain that the nut on the inner end of the anchor pin is tight. If the nut is not tight see if the anchor pin has turned and if it has, reset it. In any event draw the nut as tight as possible.

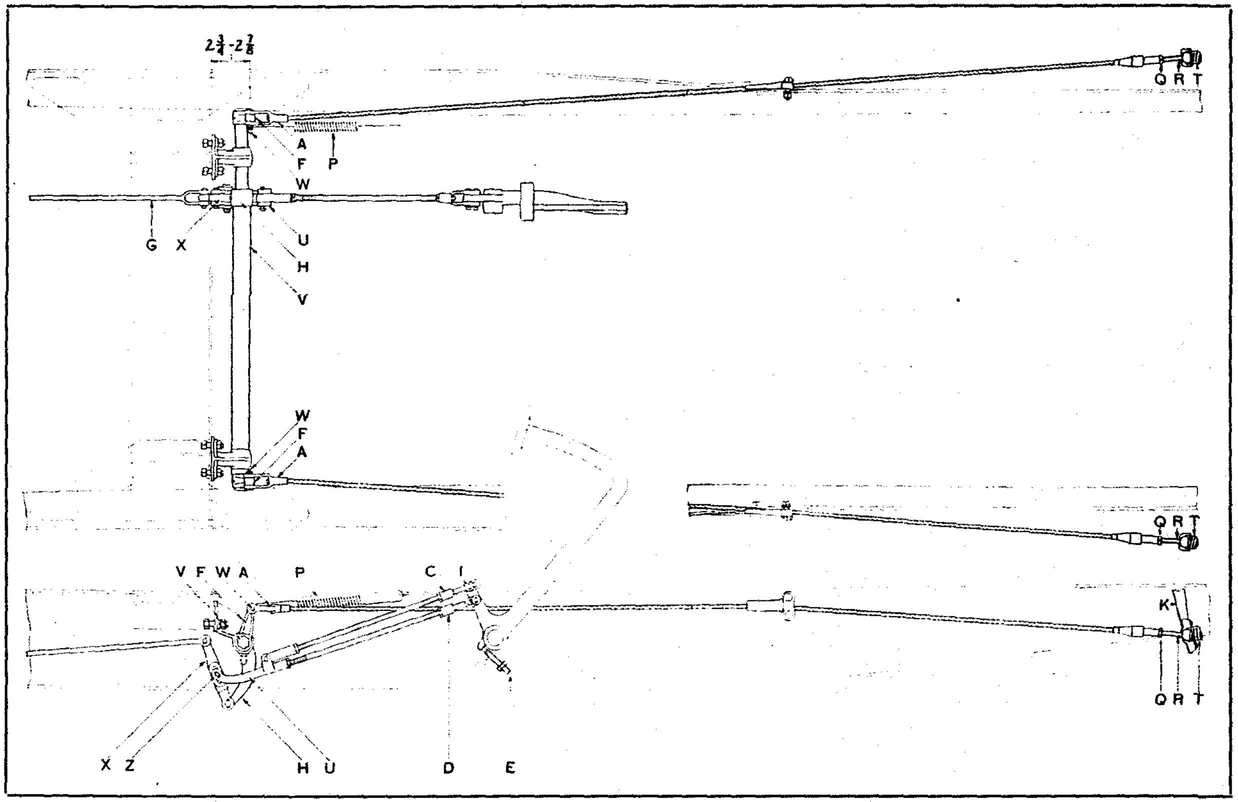


Fig. 51—V-63 Foot Brake Cables to Front Wheel Brakes (Second Type)

With the front axle stop screws correctly adjusted, turn the steering wheel first to the extreme right and then to the extreme left. In each case the outer wheel should turn freely when the brakes are fully applied and there should be a barely perceptible braking effect on the inner wheel when the brakes are released. If the correct clearance has been maintained in the original adjustment no readjustment will be found necessary. If these conditions are not met, a slight readjustment of the turnbuckles "L" should be made, turning both right- and left-hand turnbuckles the same amount.

The last inspection before the covers "F" are replaced should consist in trying the locking nuts "E" and the locking screws "K" to make sure they have been tightened.

209 Adjustment of Foot Brake Stop Screws and Rods

To determine whether readjustment of the stop screws on the rear wheel brakes at "S" (Figs. 48 and 50) is necessary, disconnect the yokes "C" and "D" from the brake pedal, make sure that the stop screws "S" are against their stops, and measure the distance between the center of each pin "J" (Fig. 50) in the upper end of the lever "M" and the nearest point on the outside of the machined surface of the brake drum. This distance should be ½ to ¾ of an inch as shown in Fig. 50.

If the center of either of the pins "J" is more than ¾ or less than ½ of an inch to the rear of the outside of the brake drum, readjust the stop screws "S" until the correct measurement is obtained on both sides.

With the stop screws "S" adjusted as just described and resting against the stops, the equalizer bar "K" should be parallel to the frame cross member and the center of the pin "R" in the rear end of the rod "G" should stand $1\frac{7}{16}$ to $1\frac{9}{16}$ inches back of the front face of the cross member. If these conditions are not met, adjust the yokes "L" at the front ends of the rods "N" until they are.

The division bar "X" is provided with three holes for the pin "Z" in the yoke "U." It is recommended that the pin "Z" be placed in the middle hole in the bar "X" as this division of braking effect between front and rear brakes is ordinarily found most satisfactory. If more braking effect is desired on the front wheels and less on the rear wheels, the pin "Z" can be placed in the lowest hole. If less braking effect is desired on the front wheels and more on the rear wheels the pin "Z" can be placed in the uppermost hole.

Make sure that the pedal stop screw "E" is properly adjusted. The upper edge of the pedal arm should be held approximately ¼ of an inch from the bottom of the channel or groove which is cut in the under side of the lower toe board. Readjust the stop screw "E," if necessary, to hold the pedal in this position.

Connect the lower yoke "D" and adjust it so that the centers of the pins "W" in the levers "F" stand 2¾ to 2⅞ inches in front of the front face of the center cross member. Unscrewing the yoke "D" moves the levers "F" forward while screwing the yoke "D" farther on the rod moves the levers "F" toward the rear.

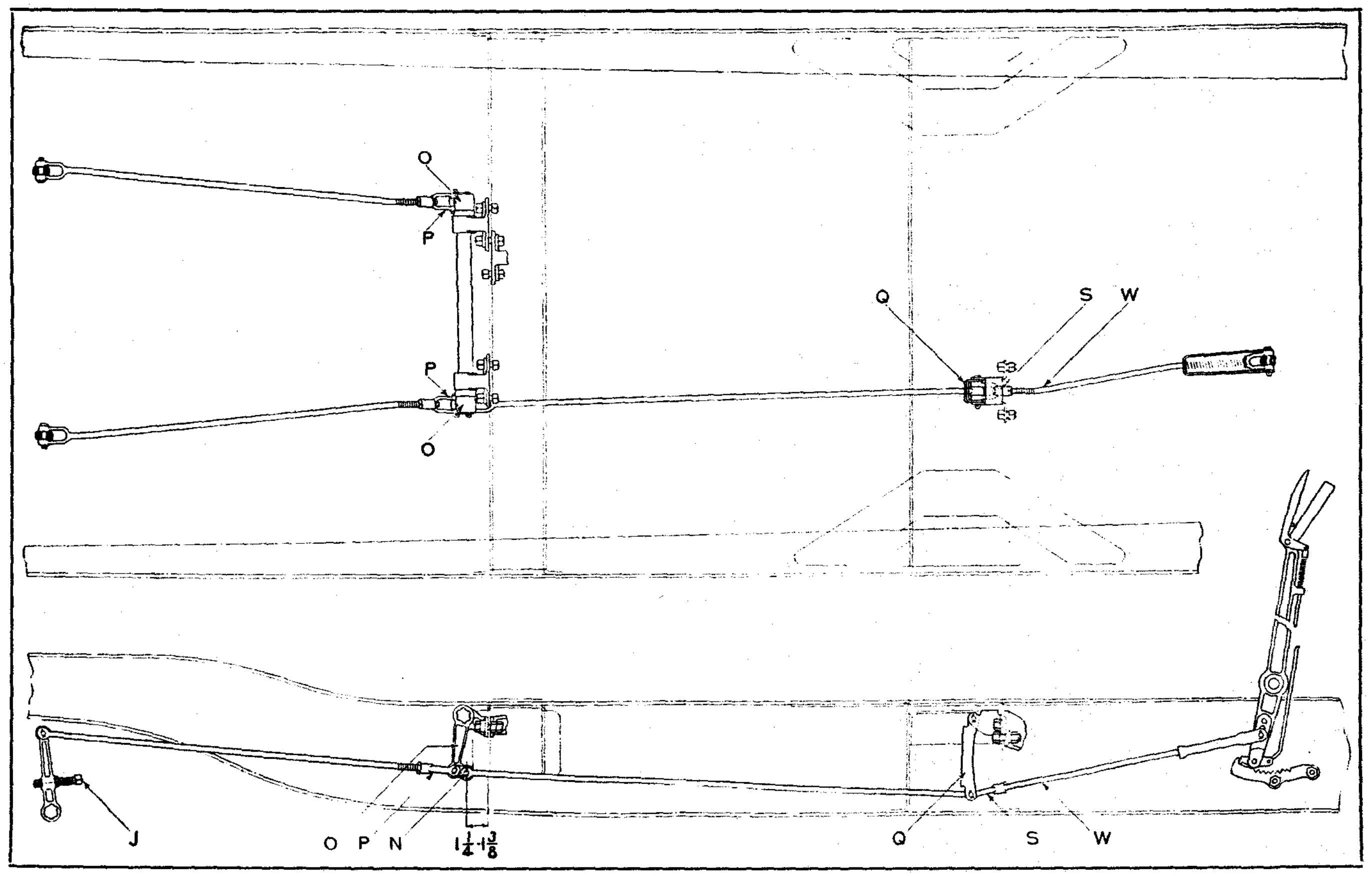


Fig. 52—V-63 Hand Brake Rods
(Second Type)

Connect the upper yoke "C" to the brake pedal and adjust it so that, when the pedal pad is depressed to a position 1 to 1½ inches from the toe boards, the pin "I" just touches the front end of the slot in the yoke "C" and begins to take the pull.*

Then adjust the front brake cables by proceeding as follows:

Raise the front axle so that both front wheels can be rotated by hand. Turn the steering wheel so that the front wheels are directed straight ahead. Remove each inspection hole cover "F" (Fig. 49) and make certain that the lever "T" is against the stop "S."

Remove the caps "T" (Fig. 51) on the levers "K" at the front ends of the foot brake cables and loosen the locking nuts "Q" on the studs "R." Adjust the studs "R," which are slotted at the front end, so that the slack in the cables is just taken up, making sure that the levers "T" are still held against the stops "S."

V-63 HAND BRAKES — SECOND TYPE

(Engine Number 63-H-1501 and after)

210 Adjustment of Hand Brakes (Rear Internal)

Raise the rear axle so that both rear wheels can be rotated by hand. Remove each inspection hole cover "F" (Fig. 48) and observe the clearance between those parts of the brake lining nearest the screw "J" and the brake drum. This clearance should be .025 of an inch. If the clearance is not correct readjust the screw "J" until the correct clearance is obtained. Do not fail to lock the screw "J" with a cotter pin.

Rotate the wheel until the inspection hole is opposite the turnbuckle "L," which has right-hand threads at one end and left-hand threads at the other. Adjust the turnbuckle "L" and the stop screws "O," "R," "N" and "P" so that when the brake is released there is a uniform clearance of .025 of an inch at all points between the lining and the drum. The locking nuts "I" and the locking screws "K" must be loosened before turning the turnbuckle "L" or the screws "O," "R," "N" and "P."

When the foregoing adjustments have been made on each brake, the brakes must be tested for equal action as the hand brakes are not mechanically equalized. Apply the hand brake lever and compare the braking effect on one wheel with that on the other. If it is not the same on both wheels, readjust the turnbuckles "L" and, if necessary, the stop screws "O," "R," "N" and "P". The correction should be made partly by

*The purpose of connecting the brake pedal rod to the pedal at two points "C" and "D" is to provide easily operated brakes for normal use without necessitating early readjustment to prevent the pedal pad from touching the toe boards.

The yokes "C" and "D" are adjusted so that during the first few inches of pedal travel the yoke "D" transmits the pull, the pin in the yoke "C" being free in its slot. The short lever arm between the yoke "D" and the pedal shaft gives the mechanical advantage necessary to permit the brakes to be operated with light foot pressure.

As the brake lining wears, the pedal must be pushed farther down to apply the brakes. When the pedal pad is within about 1½ inches of the toe boards, the pin in the yoke "C" overtakes the end of the slot and during the rest of the pedal travel the brakes are applied through the yoke "C." The longer lever arm between yoke "C" and the pedal shaft reduces the rate of pedal travel and the brakes can be used for a considerably longer time before the pedal will touch the toe boards, than would be the case if there were only the one connection at "D." Naturally, after the yoke "C" takes effect greater pressure is required to operate the brakes but they can be operated until the pedal pad actually touches the toe board. Readjustment should be made before this.

If an owner insists that the brakes always operate with the least possible effort, this can be assured by readjusting the brakes before the lining has worn enough to permit the yoke "C" to take effect.

taking up the adjustment on one brake and partly by letting if off on the other. If the adjustment has been correctly made to give the same clearance at both brakes, very little if any readjustment will be necessary.

The last inspection before the covers "F" are replaced should consist in trying the locking nuts "I" and the locking screws "K" to make sure they have been tightened.

211 Adjustment of Hand Brake Stop Screws and Rods (Rear Internal)

Raise the rear axle so that boht wheels can be rotated by hand. Remove each inspection hole cover "F" (Fig. 48).

With the brakes released and the stop screws "J" (Fig. 52) resting against the rear axle, measure the distance between the center of each

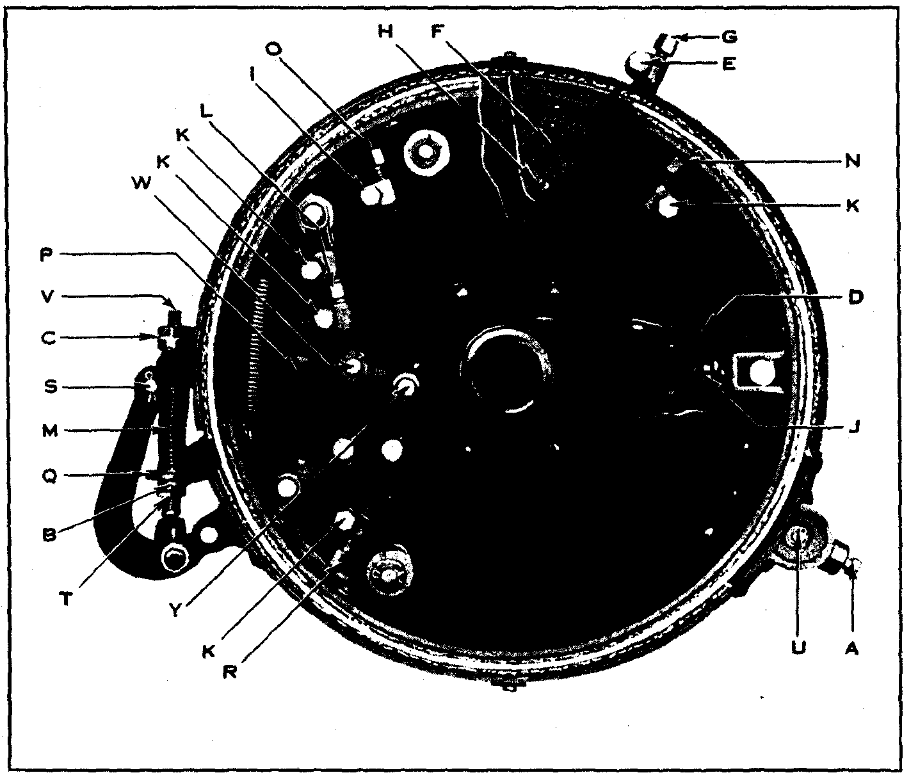


***Fig. 52a—Rear Wheel Brakes** (**L. H.**)*
*(**First Type**)*

pin "W" (Fig. 48) and the inside of the brake drum. This distance should be $3\frac{1}{2}$ to $3\frac{5}{8}$ inches.

If the center of either of the pins "W" is more than $3\frac{5}{8}$ or less than $3\frac{1}{2}$ inches from the inside of the brake drum, disconnect the yokes "P" (Fig. 52) from the levers "O" and readjust the stop screws "J" until the correct measurement is obtained at each brake.

Disconnect the yoke "S" from the lever "Q." Then, with the stop screws "J" correctly adjusted and resting against the axle housing, connect the yokes "P" again to the levers "O" adjusting them so that the pin "N" in the right-hand lever "O" stands 1¼ to 1⅜ back of the rear face of the cross member. The hand brakes are not equalized and the levers "O" are pinned to the same cross shaft so that the yokes "P" must be adjusted together keeping both stop screws against the axle housing.

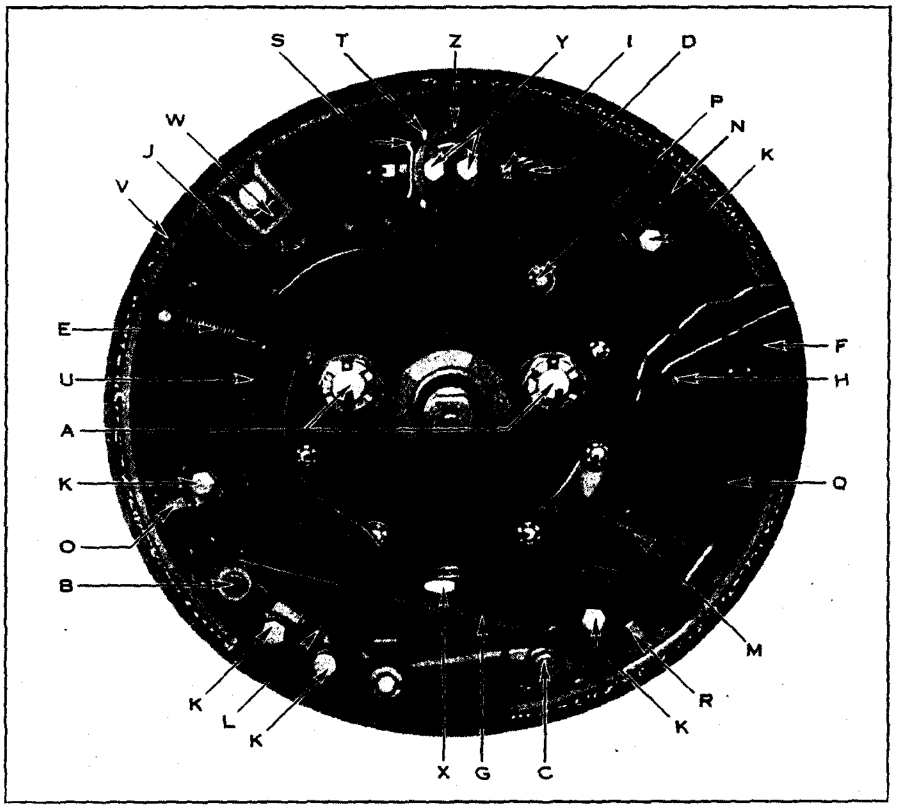


Fig. 52b—V-63 Front Wheel Brake (L. H.)
(First Type)

Connect the yoke "S" to the lever "Q" adjusting it so that, when the pawl at the lower end of the hand brake lever is against the stop on the ratchet, the pin in the brake lever will stand just away from the front end of the slot in the yoke on the front end of the rod "W."

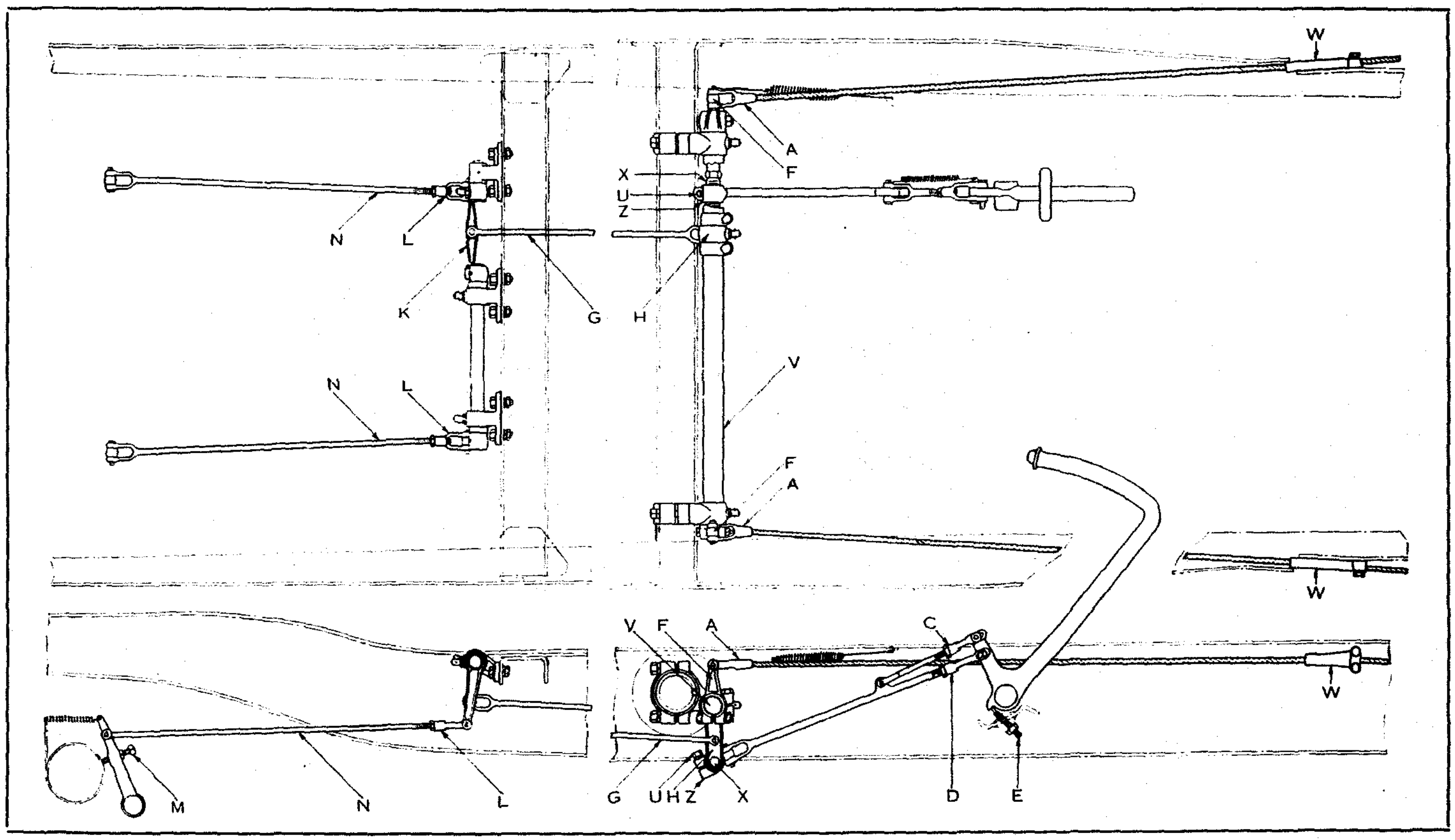


Fig. 52c—V-63 Foot Brake Rods to Rear Wheel Brakes
(First Type)

V-63 FOOT BRAKES — FIRST TYPE

(Before Engine Number 63-H-1501)

211a Adjustment of Rear Wheel Foot Brakes (External)

Observe the clearance between those parts of the brake lining nearest the screw "A" (Fig. 52a) and the brake drum. This clearance should be .030 to .035 of an inch. If the clearance is not correct adjust the screw "A" until it is. The screw "A" is kept from turning of its own accord by a locking device which locks every half-turn. It must accordingly be turned a half-turn at a time.

Observe whether the eye-bolt "Q" is at right angles to the yoke bolt "V." If it is not, loosen the nut on the eye-bolt "Q" and straighten it.

Loosen the locking nut "T" and adjust the nut "B" so that there is a uniform clearance of .030 to .035 of an inch between the brake lining and the *lower* part of the drum.

Then adjust the nut "C" and the stop screw "G" so that there is a uniform clearance of .030 to .035 of an inch between the brake lining and the *upper* part of the drum. The locking screw "E" must be loosened before the stop screw "G" can be turned. The nut "C" locks every half-turn and must be turned a half-turn at a time.

After making the foregoing adjustments so that there is a uniform clearance of .030 to .035 of an inch between the lining and the drum, check the results by applying the brakes and measuring the travel of the pin "S." This travel should not be less than ¾ of an inch. If the pin "S" travels less than ¾ of an inch in moving from the released position to the applied position, readjust one or all of the nuts "C" and "B" and the screws "A" and "G" to increase the clearance slightly, keeping the clearance uniform at all points around the drum.

The last inspection after the adjustment has been completed and checked should consist in trying the locking nuts "T" and "E" to make sure they have been tightened.

211b Adjustment of Front Wheel Brakes

Raise the front axle so that both wheels can be rotated by hand. Turn the steering wheel so that the front wheels are directed straight ahead.

Remove each inspection hole cover "F" (Fig. 52b) and observe the clearance between the brake drum and the brake lining at the point "V." This clearance should be .025 of an inch. While ordinarily resetting is not necessary, if the clearance at "V" is incorrect it should be corrected as follows: Remove the wheel and the screw "J." Then either remove one of the shims "W" or replace it with a shim of different thickness, so that when the screw "J" is replaced and drawn up tight and the wheel is installed, there will be .025 of an inch clearance at "V." Be sure to replace the cotter pin in the screw "J."

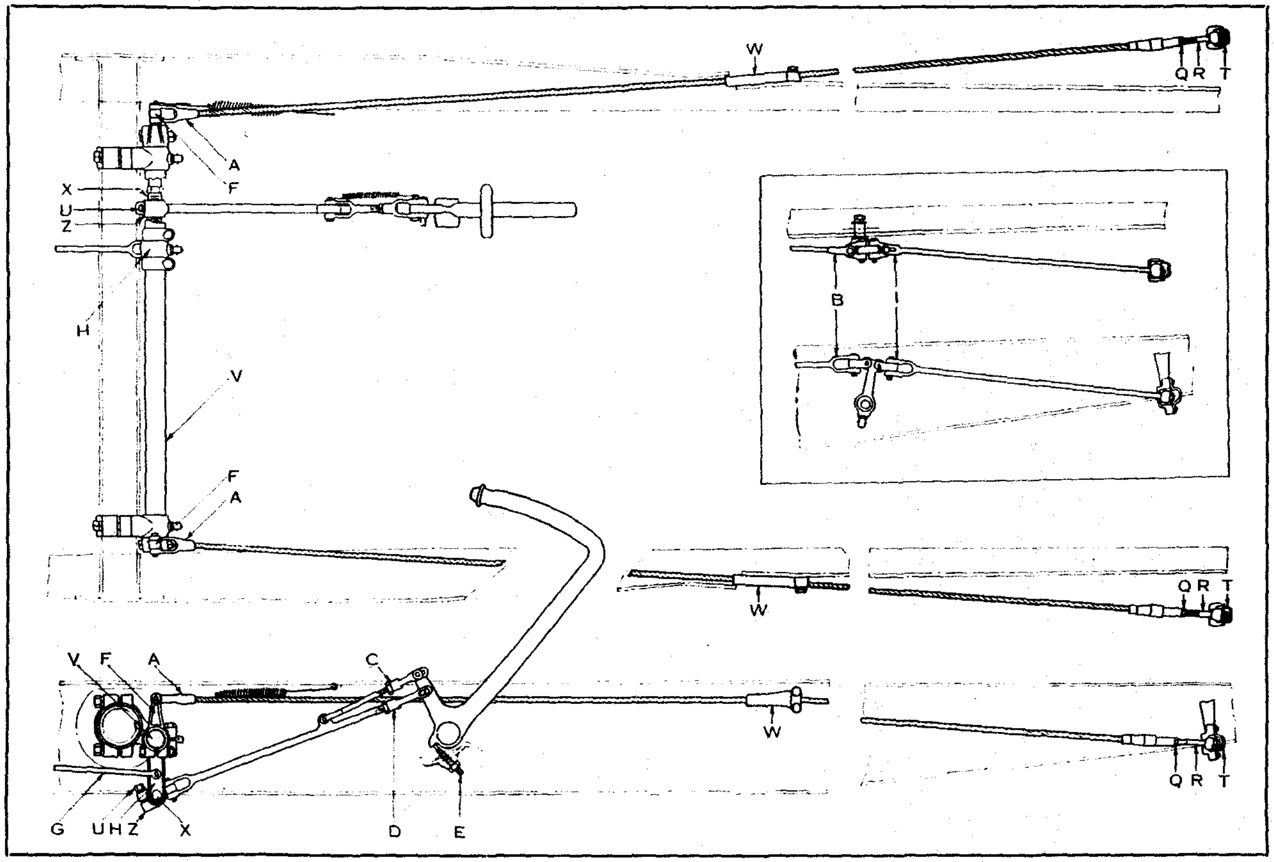


Fig. 52d—V-63 Foot Brake Cables to Front Wheel Brakes
(First Type. Inset shows rods used on early V-63 cars)

When the clearance at "V" has been checked and corrected,* if necessary, loosen the locking screws "K." Adjust the screw "L" and the stop screws "O," "R" and "N" so that with the brakes released and the stop "S" against the bearing "T," there is a uniform clearance of .025 between each brake drum and the lining. The locking screws "K" must be loosened before turning the screws "L," "O," "R" and "N". The screw "L" has right-hand threads on one end and left-hand threads on the other.

After making the foregoing adjustments on both front brakes, the brakes should be tested for equal action. The front wheel brakes cannot be provided with a mechanical equalizer because it is necessary in turning corners for the right and left brakes to be applied unequally. To obtain equal braking effect when the car is moving straight ahead, the brakes must be adjusted as nearly alike as possible.

Apply the brake pedal, therefore, holding it with as steady a pressure as possible, while the retarding effect on one front wheel is compared with that on the other. If the effect is not the same on both wheels readjust the screws "L," and, if necessary, the stop screws "O," "R" and "N." The correction should be made partly by taking up the adjustment on one brake and partly by letting it off on the other. If the first adjustment has been correctly made to give both brakes the same clearance, very little, if any, readjustment will be necessary.

As described in §205, the front wheel brakes are designed so that, when the steering wheel is turned to the extreme right or left, the brake on the outer wheel will be automatically released. After the brakes have been adjusted for equal action with the front wheels straight ahead, they should therefore be checked for the extreme steering positions. To do this, first make sure that the front axle stop screws are correctly adjusted. (§219.)

With the front axle stop screws correctly adjusted, turn the steering wheel first to the extreme right and then to the extreme left. In each case the outer wheel should turn freely when the brakes are fully applied and there should be a barely perceptible braking effect on the inner wheel when the brakes are released. If the correct clearance has been maintained in the original adjustment no readjustment will be found necessary. If these conditions are not met a slight readjustment of the screws "L" should be made, turning both right- and left-hand screws the same amount.

The last inspection before the covers "F" are replaced should consist in trying the locking screws "K" to make sure they have been tightened.

211c Adjustment of Foot Brake Stop Screws and Rods

To determine whether readjustment of the stop screws on the rear wheel brakes at "M" (Fig. 52e) is necessary, disconnect the yokes "C" and "D" from the brake pedal, make sure that the stop screws "M" are against the rear axle housing, and measure the distance between the center of each pin "S" (Fig. 52a) and the nearest point on the outside of the machined surface of the brake drum. This distance should be $1\frac{3}{4}$ to $2\frac{1}{4}$ inches.

*See foot-note on page 97.

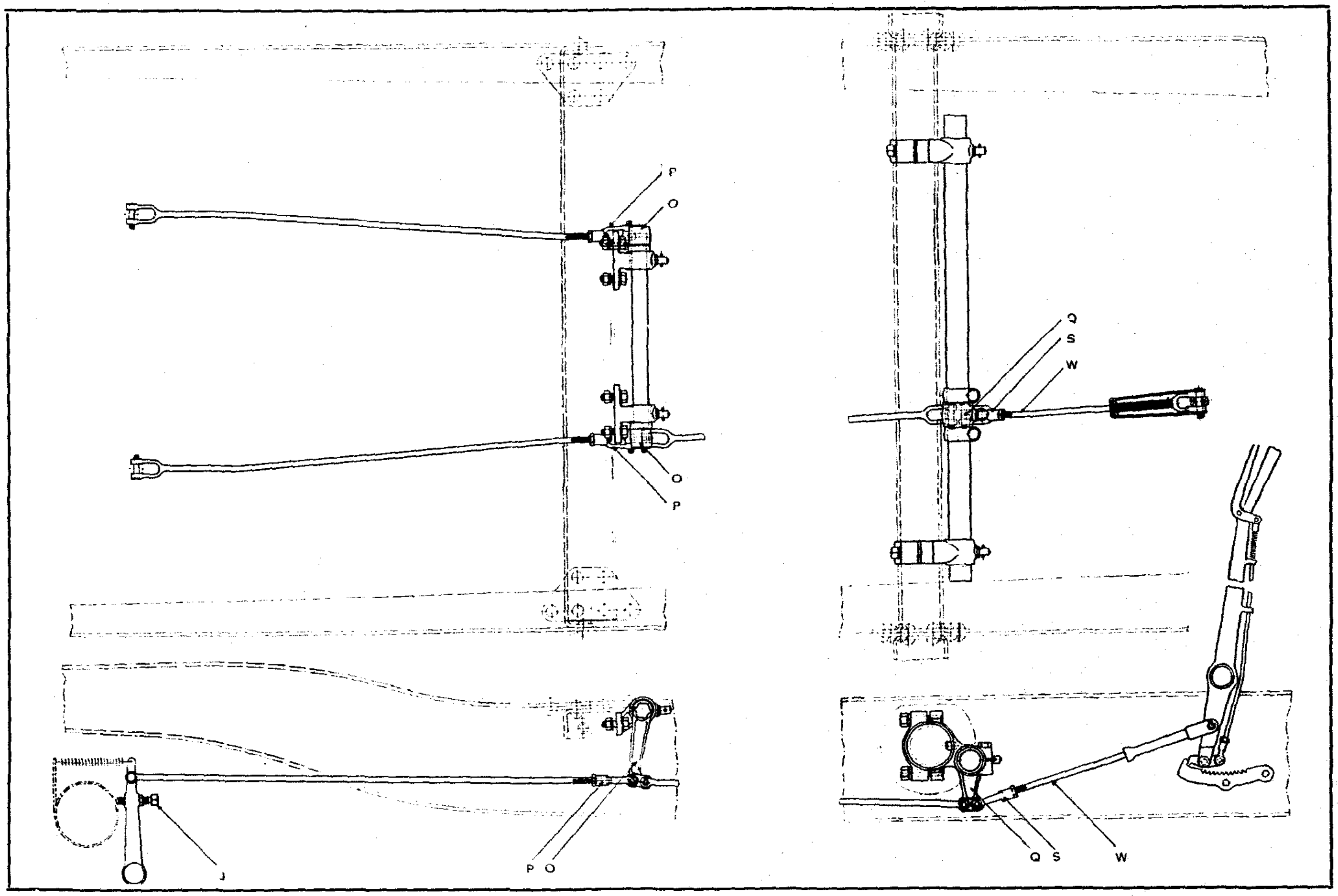


Fig. 52e—V-63 Hand Brake Rods
(First Type)

If the center of either of the pins "S" (Fig. 52a) is more than 2¼ or less than 1¾ inches from the brake drum, readjust the stop screws "M" (Fig. 52c) until the correct measurement is obtained on both sides.

With the stop screws "M" adjusted as just described and resting against the rear axle housing, the equalizer bar "K" should be parallel to the frame cross member and the center of the pin in the rear end of the rod "G" should stand 1⅞ to 2 inches back of the front face of the cross member. If these conditions are not met, adjust the yokes "L" at the front ends of the rods "N" until they are.

Make sure that the eye "Z," which is adjustable on the division bar "X," is in the correct position. The left end of the eye "Z" should be even with the left end of the thread on the division bar. This adjustment can be made by loosening the clamping screw "V" and turning the division bar "X" with a wrench.

Make sure that the pedal stop screw "E" is properly adjusted. The upper edge of the pedal arm should be held approximately ¼ of an inch from the bottom of the channel[1] or groove which is cut in the under side of the lower toe board. Readjust the stop screw "E," if necessary, to hold the pedal in this position described.

Connect the lower yoke "D" and adjust it so that the centers of the pins in the levers "F" stand ⅝ to ¾ of an inch ahead of a vertical line through the center of the shaft "V." Unscrewing the yoke "D" moves the levers "F" forward while screwing the yoke "D" farther on the rod, moves them back.

Connect the upper yoke "C" to the brake pedal and adjust it so that, when the pedal pad is depressed to a position 1 to 1½ inches from the two boards, the pin in the yoke just touches the front end of the slot and begins to take the pull.

Then adjust the front brake cables by proceeding as follows:

Raise the front axle so that both front wheels can be rotated by hand. Turn the steering wheel so that the front wheels are directed straight ahead. Remove each inspection hole cover "F" (Fig. 52b) and make certain that the stop "S" is against the bearing "T."

Remove the caps "T" (Fig. 52d) on the levers at the front ends of the foot brake cables and loosen the locking nuts "Q" on the studs "R." Adjust the studs "R," which are slotted at the front end, so that the slack in the cable[2] is just taken up, making sure that the stops "S" (Fig. 52b) are still held against the bearings "T."

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[1]The toe boards of the first V-63 cars were not grooved. A groove should be cut in these toe boards, 1 5/16 inches wide and tapering in depth from ⅜ of an inch at the upper edge to nothing at the lower edge of the board.

[2]On the first V-63 cars rods are used instead of cables to connect the levers "F" to the front wheel brakes. The condition which should exist on these cars is as follows: With both of the stops "S" (Fig. 52b) against their respective bearings "T," the pins in the slotted yokes "I" (Fig. 52d) should be at the rear ends of the slots. Adjustment to obtain this condition should be made with one or the other of the yokes "A" except on a few of the very first cars which have the adjustable yoke at "B" instead of "A."

V-63 HAND BRAKES — FIRST TYPE
(Before Engine Number 63-11-1501)

211d Adjustment of Hand Brakes (Rear Internal)

Raise the rear axle so that both rear wheels can be rotated by hand. Remove each inspection hole cover "F" (Fig. 52a) and observe the clearance between those parts of the brake lining nearest the screw "J" and the brake drum. This clearance should be .025 of an inch. If the clearance is not correct readjust the screw "J" until the correct clearance is obtained. Do not fail to lock the screw "J" with a cotter pin.

Rotate the wheel until the inspection hole is opposite the screw "L," which has right-hand threads on one end and left-hand threads on the other. Adjust the screw "L" and the stop screws "O," "R," and "N" so that when the brake is released there is a uniform clearance of .025 of an inch at all points between the lining and the drum. The locking screws "K" must be loosened before turning the screws "L," "O," "R" and "N."

When the foregoing adjustments have been made on each brake, the brakes must be tested for equal action as the hand brakes are not mechanically equalized. Apply the hand brake lever and compare the braking effect on one wheel with that on the other. If it is not the same on both wheels, readjust the screws "L" and, if necessary, the stop screws "O," "R," and "N." The correction should be made partly by taking up the adjustment on one brake and partly by letting it off on the other. If the adjustment has been correctly made to give the same clearance at both brakes, very little, if any readjustment will be necessary.

The last inspection before the covers "F" are replaced should consist in trying the locking screws "K" to make sure they have been tightened.

211e Adjustment of Hand Brake Stop Screws and Rods (Rear Internal)

Raise the rear axle so that both wheels can be rotated by hand. Remove each inspection hole cover "F" (Fig. 52a).

With the brakes released and the stop screws "J" (Fig. 52e) resting against the rear axle, measure the distance between the center of each pin "W" (Fig. 52a) and the inside of the brake drum. This distance should be approximately 4 inches.

If the center of either of the pins "W" is more than 4⅛ or less than 3⅞ inches from the inside of the brake drum, disconnect the yokes "P" (Fig. 52e) from the levers "O," and readjust the stop screws "J" until the correct measurement is obtained at each brake.

Disconnect the yoke "S" from the lever "Q." Then, with the stop screws "J" correctly adjusted and resting against the axle housing, connect the yokes "P" again to the levers "O" adjusting them so that the centers of the pins in the yokes "P" stand ⅞ of an inch to 1 inch in front of the front face of the cross member. The hand brakes are not equalized and the levers "O" are pinned to the same cross shaft so that the yokes "P" must be adjusted together keeping both stop screws against the axle housing.

Connect the yoke "S" to the lever "Q" adjusting it so that, when the pawl at the lower end of the hand brake lever is against the stop on the ratchet, the pin in the brake lever will stand just away from the front end of the slot in the yoke on the front end of the rod "W."

RELINING BRAKES

212 Brake Lining

It is recommended that all brake lining for replacement on Cadillac cars be purchased from us. Brake lining shipped from the Cadillac factory undergoes a more rigid inspection than that procurable elsewhere.

In the case of V-63 front wheel brakes suitable lining cannot be procured from any other source. The lining used on the front wheel brakes is a highly compressed, specially heat-treated lining, curved in manufacture to fit Cadillac brake drums. Any other lining will not give satisfactory results.

213 Riveting Lining to Band

To reline the brakes, it is necessary to remove the brake bands. (§§492, 493, 523).

After removing the old lining, clamp the new lining in place on the brake band, making sure that it fits the band snugly. The lining supplied for the front wheel brakes is in three pieces of equal length, two of which should be placed with their ends flush with the ends of the band. The third piece of lining should overlap equally the group of rivet holes which are drilled for it in the band. These holes are located so that the third piece of lining is not equally spaced with respect to the other pieces.

The lining for the rear wheel external brakes on V-63 cars is in two pieces of unequal length. The longer piece should be placed on the upper part of the band and the shorter piece on the lower part.

With the lining in place on the band, drill the holes for the rivets, using the band as a templet. Countersink the holes to a depth equal to approximately one-half of the thickness of the lining.

Hollow copper rivets are recommended. The rivets should be inserted from the lined side of the band. Be careful in riveting not to spring the band out of shape. A good plan is to rest the rivet head on a punch clamped in a vise rather than on a broad flat surface.

Replace the brake band on the axle, and with the adjusting drum, Cadillac tool No. 49839, make sure that the band is properly formed and concentric.

Adjust the brakes in accordance with the directions in §§207, 208 and 210.

TYPE 61 BRAKES

FOOT BRAKES (EXTERNAL)

214 Ordinary Adjustment

Provision is made in each brake for its adjustment. Do not attempt to adjust the brakes by the pull rods. The brakes cannot be properly adjusted in this manner. To adjust each foot brake, proceed as follows:

Remove the cotter pin in the adjusting screw "A," (Fig. 53) and turn the screw "A" until that part of the brake band lining opposite the screw just clears the drum. Adjust the two nuts "B" on the yoke bolt so that the lower part of the brake band lining just clears the drum.

Then adjust the nut "C" on the upper end of the yoke bolt so that the lever "D" is brought into the position shown in Fig. 53 when the brake is fully applied—i. e., so that the lower edge of the pin "T" and the upper edge of the pin "S" are tangent to an imaginary horizontal line shown at "X." Cadillac drum, tool No. 49839, is for use when making this adjustment with wheel removed.

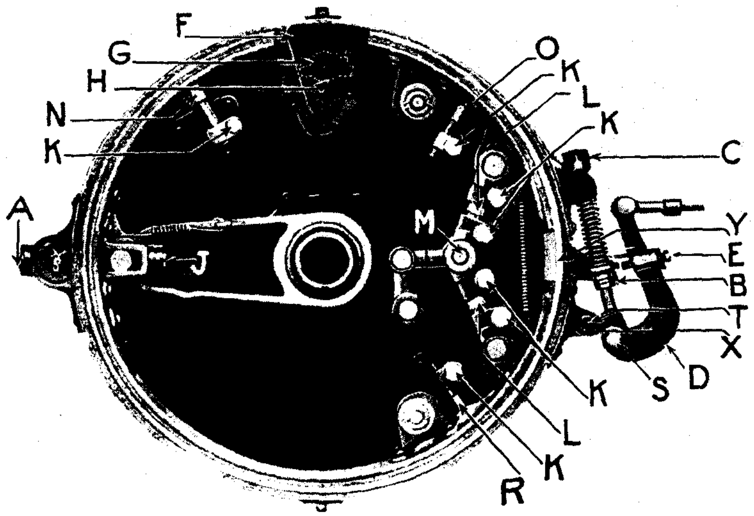

Fig. 53—Type 61 Internal and External Brakes (R. H.)

215 Adjustment of Stop Screws

The position of the stop screw "E" (Fig. 53) is adjusted when the car is assembled and requires no further attention unless its adjustment is altered. Adjustment for wear on the lining should be made as described above by the nuts "A," "B," and "C"; the stop screw "E" should not be adjusted to compensate for wear. If the stop screw "E" should be moved from its original position, it may be readjusted in the following manner:

First adjust the brake as explained above so that the lever "D" (Fig. 53) is in the correct position when fully applied. Then release the brake. Remove the pin "A" in the yoke "B" (Fig. 54). Then adjust the stop screw "E" (Fig. 53) and the nuts "B" so that the upper and lower parts of the brake band lining clear the drum by one thirty-second of an inch.

Then pull the rod "H" (Fig. 54) forward until the pin in the equalizing bar is $\frac{3}{16}$ inch from the rear end of the slot in the yoke on the end of the rod "H." Holding the rod "H" in this position, adjust the yoke "B" and the stop screw "C" so that when the pin "A" is replaced the brake pedal arm "U" is held three-eighths of an inch away from the under side of the toe board and the pin in the equalizing bar is $\frac{3}{16}$ inch from the rear end of the slot in the yoke on the end of the rod "H."

After the adjustments are completed, be sure to lock all adjusting screws and nuts and to insert and spread all cotter pins.

HAND BRAKES (INTERNAL)

216 Ordinary Adjustment

Provision is made in each brake for its adjustment. Do not attempt to adjust the brakes by the pull rods. The brakes cannot be properly adjusted in this manner. To adjust each hand brake proceed as follows:

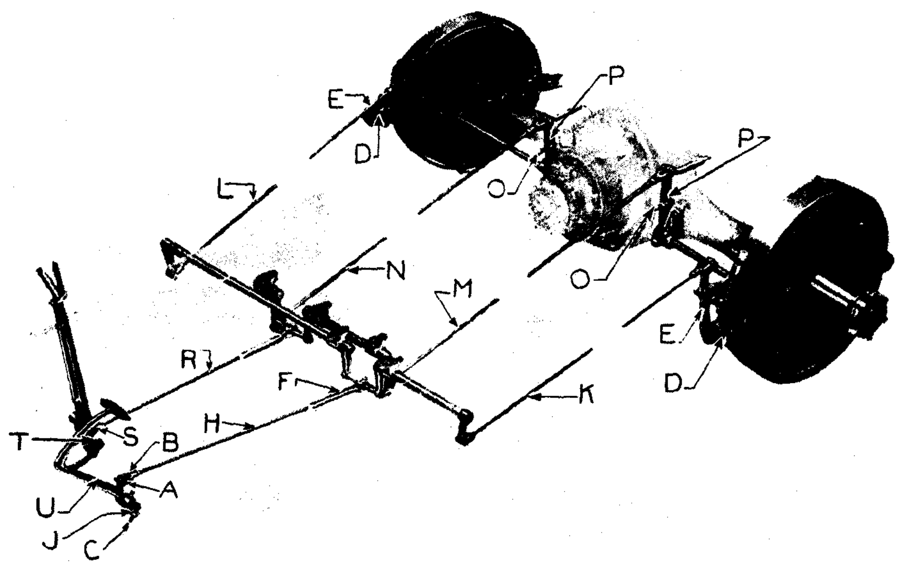

Fig. 54—Type 61 Brake Rods

Place a jack under the rear axle housing and raise the axle so that the wheel can be turned by hand. Remove hub cap and draw out axle shaft free of wheel hub, allowing wheel to turn free. Remove the cover "F" (Fig. 53) this may be done by loosening the lock nut "G" and turning the bolt to the left about one-quarter of a turn, which releases the clamping bar "H."

Rotate the wheel until the opening gives access to the screw "J." Turn the screw "J" until that part of the brake band lining opposite the screw just clears the drum.

Rotate the wheel and through the opening loosen the seven locking screws "K." Then adjust the stop screw "N" and stop screw "O" until the upper part of the brake band lining clears the drum by one thirty-second of an inch.

Turn the two adjusting screws "L" which have right hand threads on one end and left hand threads on the other until the lower part of the brake band lining clears the drum by one thirty-second of an inch.

The screws "L" should be turned equally and in the same direction.

When the brake is fully applied the center of pin "M" should stand three and three-sixteenths inches to three and one-quarter inches away from the inside of the brake drum at "Y."

Adjust the stop screw "R" so that the head of the screw just touches the inside of the brake band. Tighten the seven locking screws "K" and replace the cover "F."

Replace axle shaft and hub cap.

217 Adjustment of Stop Screws

The stop screw "O" (Fig. 54) is adjusted when the car is assembled, and requires no further attention unless its adjustment is altered. Adjustment for wear on the linings should be made, as described in §216, by the screws "J," "L" and "R" (Fig. 53); the stop screw "O" (Fig. 54) should not be adjusted to compensate for wear. If the original adjustment of the stop screw "O" has been altered, it may be readjusted in the following manner:

First, adjust the brake, as described in §216, by the screws "J" and "L" (Fig. 53) but screw the stop screws "O," "R" and "N" away from the brake band.

Then remove the pin "T" in the yoke "S" (Fig. 54) and adjust the stop screw "O" so that when the brake is released the center of the pin "M" (Fig. 53) stands three and nine-sixteenths inches away from the inside of the brake drum.

Adjust the stop screws "R" and "O" so that the upper and lower parts of the brake band are equidistant from the brake drum. Adjust the stop screw "N" so that the head of the screw just touches the inside of the brake band. Tighten the seven locking screws "K" and replace the cover "F."

Then adjust the yoke "S" (Fig. 54) so that when the pin "T" is replaced the upper end of the handle on the hand brake lever may be moved back one and one-quarter inches from its extreme forward position without moving the rods "M" and "N."

After the adjustments are completed, be sure to lock all adjusting screws and nuts and to insert and spread all cotter pins.

218 Relining Brakes

Type 61 brakes may be relined in the same manner as V-63 rear wheel brakes. (§§212, 213).

FRONT AXLE AND STEERING GEAR

FRONT AXLE

219 Spindle Arm Stop Screws

The stop screws "X" (Fig. 92) and "H" (Fig. 98) are for the purpose of limiting the angle at which the front wheels can be turned. The stop screw at the right end of the axle limits the angle to which the wheels can be turned to the right. The stop screw at the left end of the axle

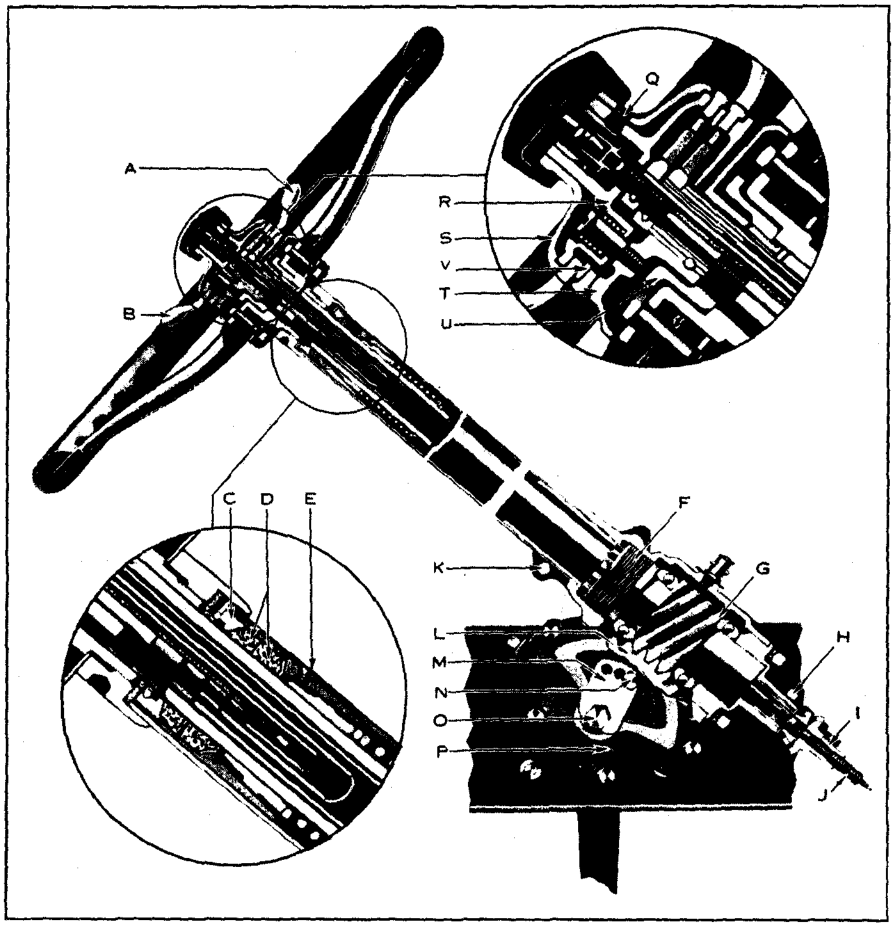

Fig. 55—Steering Gear, Sectional View

limits the angle at which the wheels can be turned to the left. (On Type 61 cars the stop screws are vice-versa, i. e., the stop screw at the right end of the axle limits the angle to which the wheels can be turned to the left, etc.)

The stop screws are adjustable and should be so set that the wheels are permitted to turn to as great an angle as possible, yet preventing the tires from rubbing on the side springs or the steering connecting rod on the left side.

220 Adjustment of V-63 Spindle Bearing

To adjust a V-63 spindle bearing, proceed as follows:

Remove the wheel. (§227).

Remove the three springs "E," "G" and "M" (Fig. 49).

Remove the clevis pins "B," "C" and "D" and remove the link "U" with the toggle.

Disconnect the brake yoke guide "F" (Fig. 92) from the frame of the car by removing the nut "L" and tapping out the pivot "K."

Remove the eight bolts "P" (Fig. 49) by which the brake dust shield is fastened to the spindle. The top of the dust shield with brake band attached may then be tilted toward the frame of the car so as to permit removal of the cap "N" (Fig. 92) by unscrewing it.

Tighten the adjusting nut "O" until all bearing play is taken up. Then back it off just enough to free the adjustment. (§231).

Replace the cap "N," drawing it down tight on the bearing cup "R." This is important because the cap "N" locks the bearing cup "R" in place. Replace the dust shield on the spindle and be sure to tighten and cotter pin all of the nuts "P" (Fig. 49). Make sure the dust shield is true with the spindle by testing it in accordance with the instructions in §521. Replace the link "U" and springs "E," "G" and "M."

Connect the brake yoke guide to the frame by replacing the pivot "K" (Fig. 92) in the socket on the side bar. The small pin "J" in the socket must line up with the slot in the shank of the pivot.

Before replacing the wheel, check the adjustment of the brakes. (§208).

221 Adjustment of Type 61 Spindle Bearing

The bushing "G" (Fig. 98) is pressed into the axle forging. If there is too much end play in the bearing "D" draw up on the adjusting nut "B," pulling the bushing "G" up against the under side of the spindle. Then back off the adjusting nut "B" just enough to free the adjustment. (§231).

STEERING GEAR

222 Adjustment of Worm Thrust Bearings

To take up the end play in the worm "G" (Fig. 55) remove the two screws "B" and lock plate "C" (Fig. 56). Then with a screw-driver or something else suitable, screw down the adjusting collar "F" (Fig. 55) which can be seen through the hole from which the lock plate "C" (Fig. 56) was removed, until the proper adjustment is made. Replace the lock plate "C" and the screws "B."

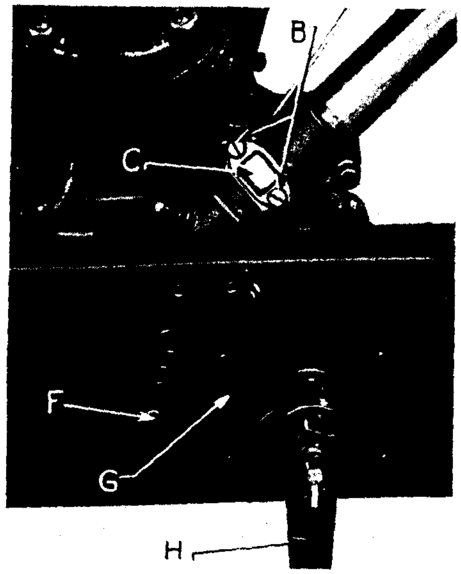

Fig. 56—Steering Gear Housing and Arm

223 Adjustment of Worm and Sector

An adjustment is provided for taking up wear on the teeth of the worm "G" and sector "L" (Fig. 55). The sector "L" has its bearing in an eccentric steel bushing. Wear can be taken up by turning this bushing so that it throws the sector towards the worm.

To do this proceed as follows: First turn the steering wheel so that the front wheels point straight ahead. Remove the locking screw "F" (Fig. 56). As the bushing is assembled at the factory it is necessary to move the arm "G" down to tighten the adjustment.

If the wear on the teeth of the worm sector is very great, it will be necessary to remove the steering arm "H" and to place the arm "G" in a different position on the hexagonal end of the eccentric bushing in order to bring the arm "G" in position so that it can be locked by the screw "F."

After the adjustment is made properly be sure that the lock screw "F" is replaced and properly tightened.

224 Adjustment of Sector Shaft

An adjustment is provided on the inner face of the steering gear housing for taking up end-play in the sector shaft.

To make this adjustment remove the locking arm "M" (Fig. 55) and turn the adjusting screw "O" in until the proper adjustment is made.

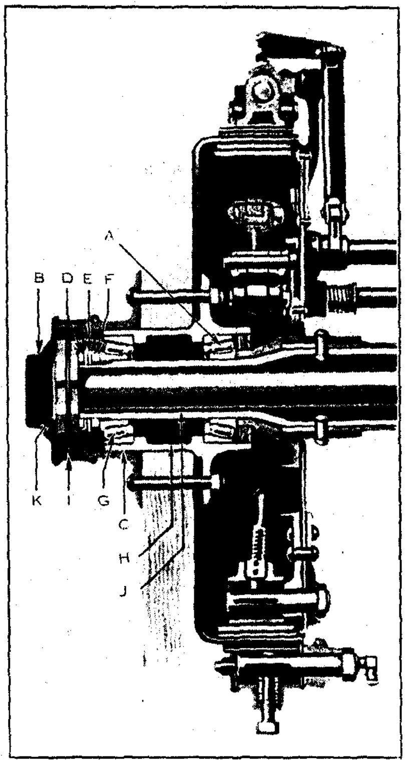

Fig. 57—Sectional View of Rear Hub, Showing Bearings

after which the locking arm "M" should be replaced and the lock screw, "N," replaced and tightened.

Caution:—Do not turn the steering gear when the car is standing. This is not only unnecessary but is also bad practice.

WHEELS

225 Removing Rear Wheel

Jack up the axle so that the wheel will clear the floor.

Remove the hub cap "B" (Fig. 57) by unscrewing it. (On some Type 61 cars the rear wheels hubs are provided with lubricators which must be removed before the hub caps can be unscrewed.)

Remove the spring locking ring "I."

Withdraw the axle shaft "K."

With a screw driver or blunt tool straighten the lug of the outer lock washer "E" which has been bent over the lock nut "D." (On Type 61 and early V-63 cars a single grooved lock washer is used.) Remove the lock nut "D," both lock washers "E" and the adjusting nut "F." The wheel can then be taken off.

226 Replacing Rear Wheel and Adjusting Bearings

Before replacing the wheel, see that the bearings "A" and "G" are clean and filled with light grease which is free from dirt and grit.

In replacing the wheel, set the adjusting nut "F" very carefully. (§231). Before replacing the lock washers "E," straighten them or use new ones. Place both washers in position, reversing the outer one with respect to the inner so that the lugs on one washer are opposite the spaces between the lugs on the other washer, that is, so that the lugs on the two washers are staggered. Install and tighten the lock nut "D." Next select that lug on the inner washer which falls nearest to the center of one of the flat sides of the adjusting nut and with a screw driver or other suitable tool bend this lug over the nut. In the same way bend one of the lugs of the outer washer over one of the flat sides of the locking nut. In bending the lugs of the locking washers, take care not to alter the adjustment of the inner nut nor loosen the outer nut. (On Type 61 or early V-63 cars the single grooved lock washer used at "E" must be expanded with an offset chisel or swedge at two or more points opposite flat sides of the nuts "D" and "F." Care should be taken in doing this not to loosen either nut.)

227 *Removing Front Wheel*

Jack up the axle until the wheel is free from the ground. Remove the hub cap by unscrewing it. Remove the cotter pin "E" (Fig. 58). Remove the lock nut "A." Remove the washer "B." Remove the adjusting nut "C." The wheel may now be removed.

Before replacing the wheel, see that the bearings are clean and that they are filled with a thin grease. Be sure that the grease is free from dirt and grit.

(On Type 61 cars in order to remove the inner bearing from a front wheel hub it is necessary to remove the retainer "T" (Fig. 98). This can be done after taking out the screw and the lock wire. In replacing the retainer "T," screw it in until the outer surface is flush with the inner surface of the hub.)

228 *Replacing Front Wheel and Adjusting Bearings*

In replacing the wheel, adjust the nut "C" (Fig. 58) very carefully. (§231). Replace washer "B," being sure that one of the holes in the washer fits over the stud "D." Replace the lock nut "A" and tighten carefully. Replace the cotter pin.

It is better to adjust the wheel bearings a little too loose than tight. If, after the adjustment is apparently correct, a hole in the washer "B" is not directly over the stud "D," it is best to loosen the adjustment rather than to tighten it.

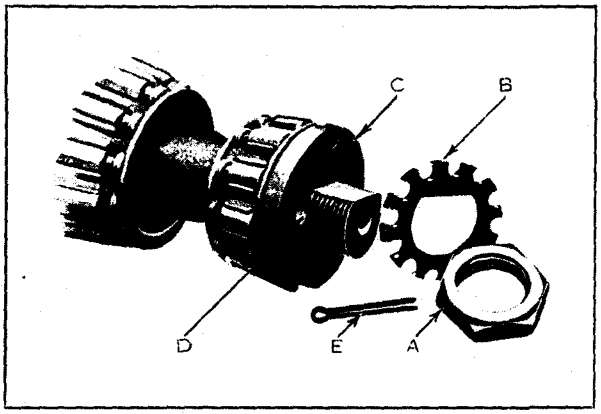

Fig. 58—Front Wheel Bearings and Adjusting Nuts

229 *Alignment of Front Wheels*

The front wheels should toe in not less than $\frac{1}{4}$ inch nor more than $\frac{3}{8}$ inch in the diameter of the wheel, taking measurements at the wheel felloe on a horizontal line passing through the wheel center. Under no condition should the wheels toe out. Adjustment for aligning the front wheels is provided by the threaded yokes on the ends of the parallel rod. One turn of either yoke will produce a difference in toe-in of approximately $\frac{1}{8}$ inch. ($\frac{3}{16}$ on Type 61).

If one full turn of one yoke is not sufficient for the desired adjustment the opposite yoke should be adjusted a full turn. Any further adjustment necessary should be made by turning the two yokes alternately. If the wheels are badly out of alignment the parallel rod and steering arms should be checked by the dimensions in Figs. 87, 88 and 91.

In no case should a yoke be unscrewed from the parallel rod so far that the rod extends into the yoke less than one inch.

If the left yoke (except on Type 61 cars) is adjusted do not fail to replace the key which locks this yoke from turning.

The front wheels camber about one and one-half inches, that is, the measurement between the wheels at the top should be approximately one and one-half inches greater than the corresponding measurement diametrically opposite at the bottom of the wheels.

BENT PARTS

230 Caution in Straightening

Modern automobile construction demands the use of the highest grades of alloy steels. A great advantage of alloy steels is that by properly heating and cooling and re-heating such steels great strength and durability are obtained. However, heat treatment must be given with full and accurate knowledge of the contents of the steel, which cannot be obtained in the ordinary repair shop. Therefore, if any part is heated outside of this factory for the purpose of straightening or for other purposes, the part at once loses the advantage which the original heat treatment gave it.

WHEEL AND SPINDLE BEARINGS

231 Caution in Adjusting

When adjusting wheel and spindle bearings, great care must be exercised not to get them tight. These bearings will revolve even when adjusted very tightly, but that condition is sure to prove disastrous. They should be adjusted so that a very slight amount of play or looseness may be discerned.

If, after a bearing has been adjusted to a point that is apparently correct, the locking device cannot be placed in position without changing the adjustment, it is far better to loosen the adjustment until it can be secured with the locking device than to tighten the bearing adjustment.

Rear axle differential and pinion bearings should be adjusted in strict accordance with instructions in §§ 199 and 201.

CARE OF THE FINISH

232 Care When Car is New

The finish of an automobile requires more careful and frequent attention when the car is new than when it is older and the varnish is harder. Particular care should be taken to keep mud from the body and hood of the car while new.

Never permit mud to remain on the finish over night or long enough to dry. If it is not possible to wash the car thoroughly before putting it away for the night, flush it off and then thoroughly wash the car the next morning. Mud permitted to remain on the car until it has dried, is not only difficult to remove but stains and dulls the finish.

233 *Washing the Car*

Use clean water and plenty of it. Do not use water containing alkali. In parts of the country where the regular water supply contains alkali use rain water. Do not use hot water, as it destroys the lustre. The temperature of the water should be between 40 and 60 degrees Fahrenheit. Do not wash the hood while it is hot. The effect on the finish is the same as washing it with hot water. Unless the hood is allowed to cool before washing, the lustre will soon disappear.

If a hose is used in washing, do not have water pressure greater than will carry the water 6 inches beyond the end of the hose. Water under higher pressure drives the grit and dirt into the varnish. It is best not to use a nozzle.

Start at one of the front wheels, first going over the underside of the fender, the wheel and the chassis nearby, with water flowing gently from the hose. This will flush off most of the mud and dirt.

If it is necessary to use soap to remove road oil from the underside of the fenders or machine oil or grease from the chassis, use a little good automobile soap dissolved in a pail of water and apply the soapy solution with a sponge. Do not let this soapy solution remain on the finish more that two or three minutes but immediately wash it off thoroughly with a good soft carriage sponge. Then proceed to wash the under surfaces of the remaining fenders, the wheels and the remainder of the chassis in a similar manner.

When the washing of the chassis is completed begin at the front of the car and with the water running gently from the hose, flow on the body, hood and upper surfaces of the fenders. This will soften the accumulation of road dirt and remove most of it. Then go over the car again and remove all dirt by rubbing lightly with a soft wool sponge, which is used exclusively for the body, hood and upper surfaces of the fenders. At the same time, apply gently from a hose an abundance of water. Rinse the sponge frequently in clean water to remove any grit. After the washing is completed squeeze the sponge as dry as possible and pick up all water from crevices.

Then thoroughly wet a clean soft chamois, wring it as dry as possible, and dry the finish. Rinse the chamois and wring it out frequently. Do not rub the finish or apply more pressure than is necessary to dry off the water. Water evaporates quickly and leaves the finish in good condition.

If it is desired to chamois the wheels and chassis, wet the parts with clean water if they have become dry, and then wipe them. Use a separate chamois for the chassis. Do not use on the body a chamois that has been used on the chassis or wheels.

Do not use soap, gasoline, kerosene or anything of this nature on the finish. Such ingredients attack the varnish.

Do not clean the glass with preparations which may contain harmful ingredients. Use only cleaning compounds which are known to have no destructive effects on highly polished glass.

DOOR BUMPERS

234 Adjustment

On the center pillar of each door is a self-adjusting wedge support which prevents vertical play in the door. Near the top and bottom of each door are rubber bumpers which prevent side play.

On open cars, the rubber bumpers are adjustable. To adjust these simply turn the screw which is in the hole at one side of the bumper. Turning the screw clock-wise draws the bumper out.

On closed cars the rubber bumpers are not adjustable but can be replaced when worn.

(To adjust the door bumpers on Type 61 open cars, loosen the wood screw fastening the bumper to the door frame and pull the rubber out part way. The rubber is slotted where the screw passes through to permit this. Close the door slowly until the latch just catches. As it closes, the door will force the rubber into place and at the instant the latch catches, the rubber will be exactly in the proper position. Open the door and tighten the wood screw until the rubber is clamped firmly.)

TIRE HOLDER

235 Mounting Tires

The tire holder is designed to carry two standard size tires inflated on rims.

To remove the tire with rim, remove the cap from the lock at the center of the clamp and unlock it. Then unscrew the clamp as far as it will go. The tire then may be removed.

To put a tire on the holder proceed in the reverse manner.

When mounting two tires on the tire holder, the clamping or locking rings should face each other to prevent theft of the tires by removing them from the rims. If mounting one tire on the tire holder, the clamping or locking ring should face to the front or toward the body.

Care should be exercised not to permit the inner tire to strike the body of the car when removing or replacing it.

CURTAINS

236 Storage of Curtains

The side curtains for open cars are carried in an envelope provided with cloth partitions to prevent the curtains from rubbing and chafing. All curtains are tagged to facilitate attaching.

In the touring car the curtains are stowed under the front seat. In the phaeton the curtains are stowed in a compartment provided in the back of the front seat and which opens in the tonneau. The roadster has a parcel compartment just back of the seat in which the curtains are stowed.

Before the curtains are stowed away they should be dry and clean.

237 Curtain Fasteners

The curtains are held in place with fasteners which become locked on three sides when snapped into place and must be lifted on the side which is not locked in order to release them. This side is indicated by a small projection on the fastener as shown by the arrow (Fig. 59). This type of fastener cannot be released by lifting it at any other side.

Fig. 59
Curtain Fastener

SPEEDOMETER AND CLOCK

238 Speedometer

The speedometer registers the speed at which the car is traveling, the total number of miles traveled, and the trip mileage. The total mileage cannot be reset but the trip mileage can be reset to zero.

An automobile repairman should never be permitted to attempt to adjust or repair the speedometer head or to replace the glass. This work can be done only by men experienced in speedometer work and only with special machinery and tools.

If the speedometer head is removed, handle it with the same care that you would a fine watch. The speedometer head may easily be damaged by rough handling.

239 Clock

Clocks on both V-63 and Type 61 cars have eight-day movements and are wound and set in the same manner as any stem-winding watch. The winding and setting stem is on the under side of the clock just back of the instrument board.

WINDSHIELD

240 Adjustment of Sections

Under ordinary conditions, sufficient ventilation in the front compartment is obtained through the cowl ventilator. Additional ventilation for warmer weather is provided for by the adjustable upper and lower sections of the windshield.

241 Open Cars

To secure greater ventilation in the front compartment of open cars, the lower section of the windshield should be tilted in. The thumb screws half way up the windshield standards must be loosened before the lower section can be moved and should be tightened afterwards. If still greater ventilation is desired, the upper section may be tilted toward the driver.

The rubber strip between the windshield glasses must be removed before either the upper or lower section of the shield is tilted inward.

242 V-63 Closed Cars

To secure greater ventilation in the front compartment of V-63 closed cars, the upper edge of the lower section of the windshield should be tilted outward. To do this, loosen the thumb screws at the side, lift the handles until the lower edge clears the weather strip on the cowl, and then push outward. Tighten the thumb screws when the windshield is in the open position.

243 Type 61 Closed Cars

The lower section of the windshield on Type 61 closed cars can be tilted inward for increased ventilation, similar to the windshield on open cars. To do this, loosen the thumb screws at the ends of the lower section, lift the handles until the lower edge clears the weather strip on the cowl, and then pull backward until the notches on the brackets at the ends of the windshield engage with the supports on the body. Tighten the thumb screws when the windshield is in the tilted position.

The upper section of the windshield on Type 61 closed cars can be tilted inward slightly for still greater ventilation.

244 Inclement Weather

The normal position of the windshield for inclement weather is with the upper and lower sections closed, and with the removable rubber strip between the glasses. If rain or snow should freeze on the glass, making it impossible to clean it with the windshield wiper, the upper section may be tilted out at a slight angle. This is known as the rain vision position.

COLD WEATHER SUGGESTIONS

245 Starting in Intermediate or High Gear

Starting in intermediate or high gear should not be done at any time, but this is particularly unfair to a cold engine, as it necessitates a further opening of the throttle than is necessary when starting on low gear, with the probability of a "pop back" in the carburetor.

246 Cold Test of Engine Oil

Use oil having a low cold test. In other words, use oil which flows freely at low temperature. (§§702-704).

247 Frequent Changing of Oil

Water and gasoline may accumulate in the crank case of the engine during cold weather. It is necessary, therefore, to drain the oil frequently and replace it. (§716). If water and gasoline are permitted to accumulate in the crank case, serious damage to the engine may result.

248 Strainers in Gasoline System

It may be found necessary to remove the strainers in the gasoline line more frequently during cold weather in order to prevent an accumulation of water at these points which would freeze and prevent the gasoline from flowing to the carburetor. (§179).

OPERATION OF ENGINE

249 General Principle

The production of power by the engine may be described briefly as follows:

Gasoline is forced by air pressure from the tank to the carburetor. At the carburetor the gasoline is mixed with air in the proper proportion, forming an explosive vapor or gas. The gas is drawn through the intake manifold and inlet valves into the cylinders of the engine, where it is compressed and ignited by electric sparks, the pressure of the resulting explosions producing the power.

The quantity of gas supplied to the engine is regulated by a throttle valve at the carburetor which is operated by means of the throttle lever at the steering wheel or by the accelerator button at the right of the brake pedal.

250 Four-Cycle Engine

The engine is of the four-cycle type, that is, there are four movements or strokes of each piston and two revolutions of the flywheel to complete each power-producing stroke. The four strokes of the cycle each have a different function and follow one another in the same order as follows:

Suction Stroke. The suction stroke commences with the piston at its highest point in the cylinder and with the inlet and exhaust valves closed. Immediately the piston starts to descend the inlet valve opens and through this valve a charge of gas from the carburetor is drawn into the space above the piston.

Compression Stroke. As the piston starts upward again after completing the suction stroke, the inlet valve closes. As there is then no escape for the gas in the cylinder, it is compressed, the maximum compression being reached when the piston is at the top of its stroke.

Power Stroke. At the completion of the compression stroke, the spark takes place at the spark plug, igniting the compressed charge of gas.

The heat resulting from the rapid combustion causes the pressure of the confined gas to rise almost instantaneously to several times its pressure before the explosion. This pressure exerted on the piston forces down the piston and produces the impulse which is transmitted by the connecting rod to the crankshaft, causing it to rotate.

Exhaust Stroke. Just before the piston reaches the end of the power stroke, the exhaust valve opens. It remains open as the piston travels upward again on the exhaust stroke, driving the burned gas out from the cylinders. By the time the piston has reached its highest point it has forced out the burned gas and the exhaust valve closes. Having completed the four strokes, the piston is now ready to draw in a new charge and to repeat the cycle.

The same cycle of events takes place in all of the cylinders but no two pistons are at the same point in the cycle at the same time. In the Cadillac eight cylinder V-type engine, the impulses in the eight cylinders are so timed that a power stroke is begun every quarter turn of the crankshaft. In other words, the crankshaft receives four overlapping impulses every revolution.

PART III

REMOVAL, INSPECTION AND REPLACEMENT

ENGINE

301 Removal

Remove the spark control rod connecting the arm on the steering gear to the arm on the cross shaft at the rear of the radiator.

Remove the hood shelves and radiator splash shield mouldings. (On Type 61 cars the hood shelf and radiator splash shield moulding are in one piece.)

Remove the radiator splash shield.

Remove the splash shield under the engine.

Remove the radiator. (§425).

Remove the narrow splash shield just back of the cross member under the radiator.

Disconnect one of the cables from the storage battery and place a block of wood under it to prevent it touching the terminal on the battery.

Remove the top cover plate from the generator.

Disconnect the large cable at the generator, also the three smaller wires.

Remove the floor boards.

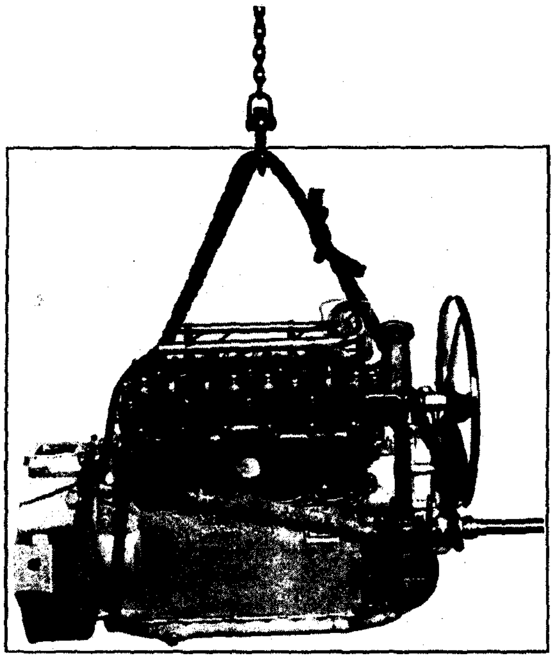

Fig. 60—Position of Rope in Lifting Engine from Frame

Remove the transmission. (If the body is off, do not remove the transmission from the engine.) (§479).

Disconnect from the front face of the dash the flexible tube which runs to the right-hand high tension conduit. Disconnect the low tension and high tension wires from the coil and remove these wires through the hole in the dash. On cars which have the horn mounted on the fanshaft housing, also disconnect the horn wire from the inspection lamp.

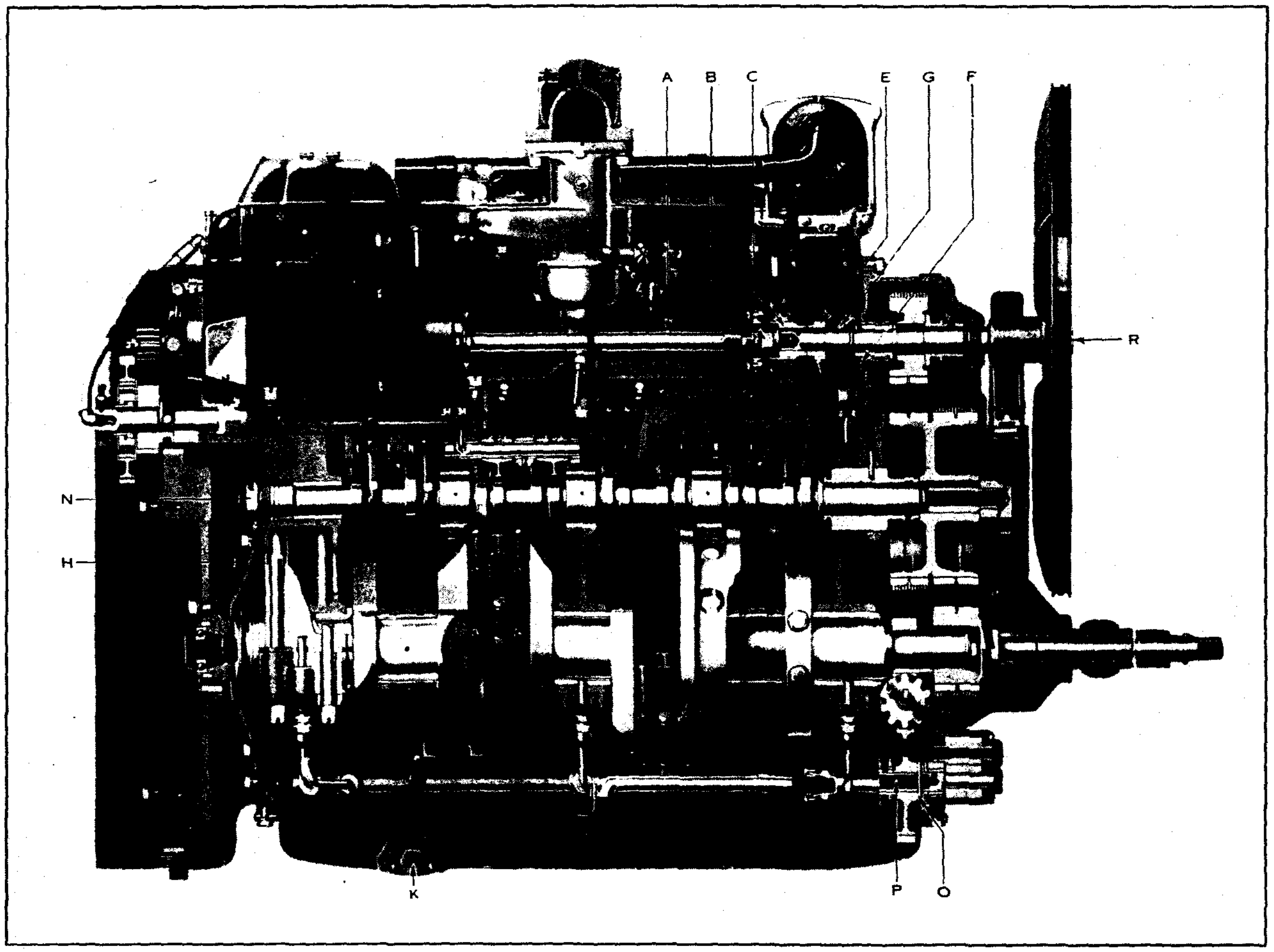

Fig. 61—Sectional View (Longitudinal) of V-63 Engine

On cars which have the horn mounted on the intake manifold, disconnect the horn wires from the horn.

Remove the enriching rod running from the dash to the carburetor.

Remove the carburetor rod running from the steering gear to the engine.

Remove, from the body of the car, the pipe which leads from the strainer under the front floor, also remove the pipe which leads from the pressure relief valve under the front floor.

Remove the air pipe between the pressure relief valve and the power compressor at the front end of the engine, also the pipe between the settling chamber and the carburetor.

Disconnect the pipe from the oil pressure regulator.

Disconnect the steering gear bracket from the instrument board.

Remove the water pump on the left side of the engine. (§360.)

Remove the left front fender or make suitable provision for protecting it from injury. (§573).

Remove the intake manifold with carburetor.

Remove the motor generator. (§397).

Remove the starter gear housing. The housing may be lifted off after removing the six cap screws and two dowel pins and disconnecting the control rods.

Remove the screws which fasten the exhaust manifolds to the engine, loosen the clamp screws at the front ends of the mufflers and remove the exhaust manifolds and muffler pipes together.

Remove the cap screws which hold the cap of the front engine support.

Remove the cotter pins and nuts from the two large bolts which hold the rear engine supports to the frame.

Remove the two large bolts using wrench No. 72836. To facilitate their removal, jack up the rear of the engine just enough to relieve the bolts of the weight of the engine.

With a suitable chain-fall attached to a stout rope placed around the engine as shown in Fig. 60, lift out the engine carefully.

(On Type 61 cars the engine may also be removed, without removing the motor generator, by removing both rear fenders, loosening the nuts on the two rear body bolts, removing the remaining body bolts and jacking the front end of the body up about eight inches.)

302 Dissassembly

Remove the engine. (§301).

Wash off the engine and transmission.

Remove the transmission if not removed before removing the engine. (§479).

Remove the right water pump. (§360).

Remove the drive shaft for the water pumps. (§377).

Remove the drain plug from the oil pan and drain out the oil.

Remove the oil pan and the baffle plate. (§354).

Remove the front cover plate. (§348).

Remove the oil pump. (§357).

Remove the spiral gear and the shaft which drives the oil pump. (§333.)

Remove the fan. (§330).

Remove the camshaft and fanshaft driving chains. (§328).

Remove the four cap screws which hold the brackets for the high tension conduits. (On Type 61 engines these brackets are held by four of the cylinder head nuts.) Remove the distributor head and the low tension wire and remove the conduits with brackets, wires and head.

Remove the distributor rotor. This may be done by lifting it straight up. If the rotor sticks on the shaft, force it off with two small screw-drivers. The rotor is recessed on the under side at two points to receive screw-drivers in removing. Lift both sides evenly and carefully.

Remove the fanshaft and fanshaft housing. (§§318, 339).

Remove the oil leads and manifold from the crankcase.

Remove the connecting rods and pistons. (§368).

Remove the oil pressure regulator.

Remove the cylinder blocks. (§321).

Remove the rocker arm plate. (§351).

Remove the set screw in the top of the crankcase which holds the front camshaft bearing and remove the camshaft with front bearing and sprocket by pulling straight forward. (§371).

(In removing the camshaft of Type 61 engines there is no set screw to be removed but the lock nut on the rear of the eccentric bearing must be removed by turning the locking worm clockwise. In pulling out the shaft this lock nut must be held clear of the cams and bearings on the shaft.)

Remove the flywheel. (§386).

Remove the crankshaft. (§374).

303 Inspection

Inspect each part in accordance with the directions in this book under the appropriate heading.

304 Reassembly and Replacement

In reassembling and replacing the engine, reverse the operations under "Disassembly" and "Removal."

After tightening the nuts on the large bolts which hold the rear end of the engine to the frame, loosen them one notch and replace the cotter pins.

ROCKER ARMS AND SHAFTS

305 Removal

Remove the rocker arm plate. (§351). Loosen the set screws holding the rocker arm shafts in place. Mark each rocker arm to be removed so it can be put back as originally assembled.

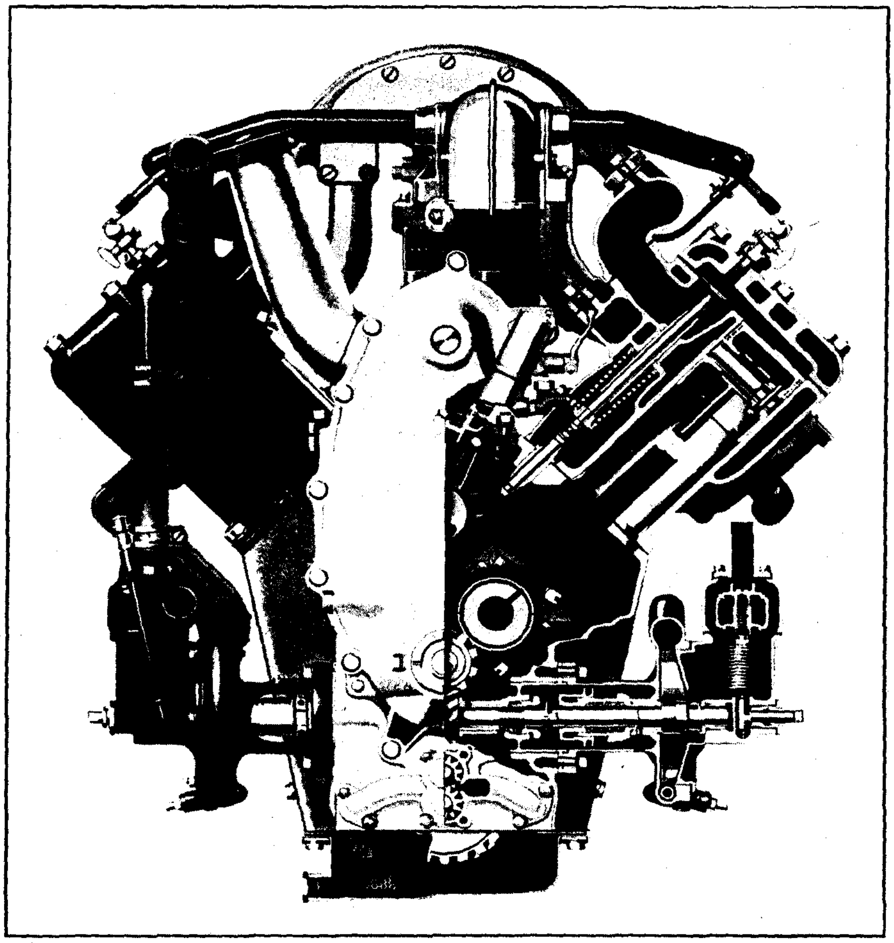

Fig. 62—Front View of V-63 Engine with One Half Sectioned

Remove the rocker arm shafts by screwing a cap screw into the threaded end of the shaft, clamping the head of the screw in a vise and pulling on the cover plate. (On Type 61 cars the shafts are not threaded and must be removed by tapping them out.)

306 *Disassembly*

The rocker arm bushing may be removed by pressing it out.

To remove the roller pin, drill into the riveted end of the pin with a $\frac{3}{16}$ inch drill and tap the pin out. The roller and the hardened steel sleeve on which it turns may then be removed.

(On Type 61 rocker arms, the roller pin may be pressed out after removing one of the cotter pins. Care should be taken not to spring the arms.)

307 *Inspection*

Clean all parts but do not allow the rocker arm bushings to remain in contact with gasoline or kerosene. These bushings, which are porous, should not be allowed to absorb other liquids than lubricating oil.

Inspection of Rocker Arms and Shafts—It is recommended that rocker arm rollers and pins be inspected without disassembling as a new roller pin is necessary if the roller pin is removed. (Type 61 rocker arms should be disassembled for inspection.)

The clearance between a rocker arm roller and the steel sleeve (pin on Type 61) upon which it rotates should not exceed .003 inch.

The outer circumference of the rollers should be true within .0015 inch.

The clearance between a rocker arm bushing and the shaft should not exceed .004 inch.

Rocker arm shafts should be a light press fit into the bronze bushings which receive them.

All bearing surfaces should be smooth.

Oil holes are not necessary in the rocker arm bushings in V-63 engines. These bushings are made of a porous metal which absorbs and distributes to the bearing surface any oil coming in contact with the outer surface of the bushing.

Inspection of Other Parts—Inspect the cams. They should be smooth and show practically no wear.

308 *Replacement*

V-63 rocker arm bushings should not be reamed. They should be pressed into the arm with Cadillac tool No. 89077. This tool has a pilot the outside diameter of which determines the size of the hole in the bushing after assembly.

Rocker arm pins, sleeves and rollers should be well lubricated before assembling. In assembling, use a new roller pin in each arm and peen over the end of the pin carefully with a ball peen hammer. (On Type 61 rocker arms a new pin is not necessary unless the clearance between the pin and the roller exceeds .003). The rollers should rotate freely after assembly.

In replacing rocker arms, reverse the operations under "Removal."

CRANKSHAFT COUNTERWEIGHTS

309 Removal

The large counterweights must be removed before removing the connecting rods or pistons. It is not necessary to remove the small counterweights except when removing the crankshaft.

To remove a counterweight, proceed as follows:

Remove the oil pan and baffle plate. (§354).

Open the compression relief cocks.

Remove the cotter pins locking the two cap screws by which the counterweight is attached to the crankshaft.

Unscrew the cap screws by which the counterweight is attached to the crankshaft, using Cadillac special wrench, tool No. 89025, with socket No. 89026 for the large counterweights and socket No. 89027 for the small counterweights. The counterweight may then be removed.

310 Inspection

Make sure the dowel pin is in place in each weight.

The threads on the cap screws and the threads in the holes in the cheeks of the crankshaft should be in good condition.

311 Replacement

To replace a counterweight, reverse the operations under "Removal."

Counterweights must be assembled only on the crankshaft with which they were originally balanced. Each weight has the number of this crankshaft stamped on it and must be used with no other crankshaft. If any counterweight of one shaft is interchanged with the counterweight of another shaft, the original balance and smooth running of the engine will be destroyed.

The counterweights of a crankshaft are also not interchangeable with each other. To insure that each counterweight is replaced only in its correct position, the location for the dowel pin is different for each of the four weights. Before attempting to attach a counterweight, note the location of the dowel pin and select the correct location for the counterweight on the crankshaft. The small counterweights are attached to the end cheeks and the large counterweights to the cheeks second from the ends.

Make sure before starting the screws that the counterweight is seated firmly in place; otherwise, the screws are likely to start with crossed threads. In tightening the screws, tighten them as firmly as is possible by hand, using special socket wrench, tool No. 89025.

In locking the screws after they are tightened, use only new cotter pins of the correct size and length.

In the large counterweights of early V-63 engines and in the small counterweights of all V-63 engines there are two cotter pin holes for each screw, the two holes being at an angle of 30° to each other. If a cotter pin cannot be inserted in either hole, tighten the screw to bring one of the flat sides parallel to one of the holes. Do not loosen the screw.

In later V-63 engines the screws by which the large counterweights are attached have twelve radial slots to receive the end of a cotter pin inserted through a hole in the flange of the counterweight from the inner side. If after the screw is tightened a cotter pin cannot be inserted in this hole, tighten the screw until one of the slots is opposite the hole. Do not loosen the screw.

Make sure that the end of each cotter pin is spread.

CRANK PIN BEARINGS

312 Removal

Remove the oil pan and the baffle plate. (§354).

Remove the oil suction pipe and any of the main bearing oil leads which are in the way.

Remove the large counterweight next to the crank pin bearing to be removed. (§309).

Open the compression relief cocks.

Remove the cotter pins and the two nuts from the cap of the straight connecting rod.

Remove the cap, being careful not to mix the liners.

Remove the cotter pins and the four nuts from the caps of the forked connecting rod and remove the caps.

Remove the rod with piston. Care must be exercised not to damage the piston in removing it. Do not allow the skirt of the piston to fall against the connecting rod. Do not allow the halves of the crank pin bearing to drop.

Remove the halves of the bearing.

313 Inspection

Inspection of Bearing—Clean the bearing and wipe it off with a cloth. In handling, be careful not to drop it or spring or mar it in any other way.

Inspect the bearing metal. If it is cracked, or cut so that it cannot be cleaned up with a scraper, without increasing the clearance between the bearing and crank pin to more than .006 inch, a new bearing should be substituted. (§§103-107).

To insure against excessive oil consumption, smoking at the exhaust, the rapid formation of carbon in the cylinders, and noisy operation, the clearance between a crank pin bearing, when clamped in the rod, and the crank pin should not exceed .006 inch. End play in a crank pin bearing should not exceed .015 inch. There is no adjustment on crank pin bearings. Crank pin bearings .005 inch and .020 inch undersize are furnished by our Parts Department.

Inspect the dowel pin holes in the bearing. The clearance between the pin holes and the pins should not exceed .002 inch.

Examine the oil holes in the bearing, cleaning them out if obstructed.

Inspection of Other Parts—Inspect the crank pin. The crank pin should be round within .003 inch and free from scores; if it is not, it should be dressed down. (§111). A new undersize bearing should be fitted if there is more than .006 inch clearance between the pin and bearing after the work is completed. (§106).

Examine the oil hole in the crank pin, cleaning it out if obstructed.

Inspect the pistons and piston rings in accordance with the directions in §346. If wear on a piston seems to indicate that the rod is sprung or twisted, test it for alignment. (§369).

Inspect the cylinder bores. Cylinder bores should be round within .002 inch and free from scores.

314 Replacement

With a cloth wipe off the halves of the bearing and well lubricate the bearing surfaces with engine oil of a suitable quality before replacing these parts.

In replacing, reverse operations under "Removal."

Care should be exercised that the dowel pins in the caps of the forked rod are in the pin holes in the bearing, before tightening the cap nuts. The bearing must be clamped properly in the forked rod. If necessary, reduce the caps of the rod as directed in §104.

Be sure to replace the connecting rods as originally assembled in the engine. (§370).

In replacing counterweights make sure that the number stamped on each weight is the same as the number stamped on the cheeks of the crankshaft. It is of vital importance that the counterweights of different engines be not interchanged. (§311).

In adjusting the straight connecting rod follow the directions in §101.

Before replacing the baffle plate and oil pan, check carefully the points enumerated in §370.

After replacing the oil pan refill it with seven quarts of suitable engine oil. Cadillac Engine Oil is recommended.

MAIN BEARINGS

315 Removal

Remove the oil pan and the baffle plate. (§354).

Remove the pipe between the main bearing cap and the oil feeder pipe.

Remove the cotter pins and nuts from the main bearing cap. Wrench No. 71970 is for use with the main bearing cap nut.

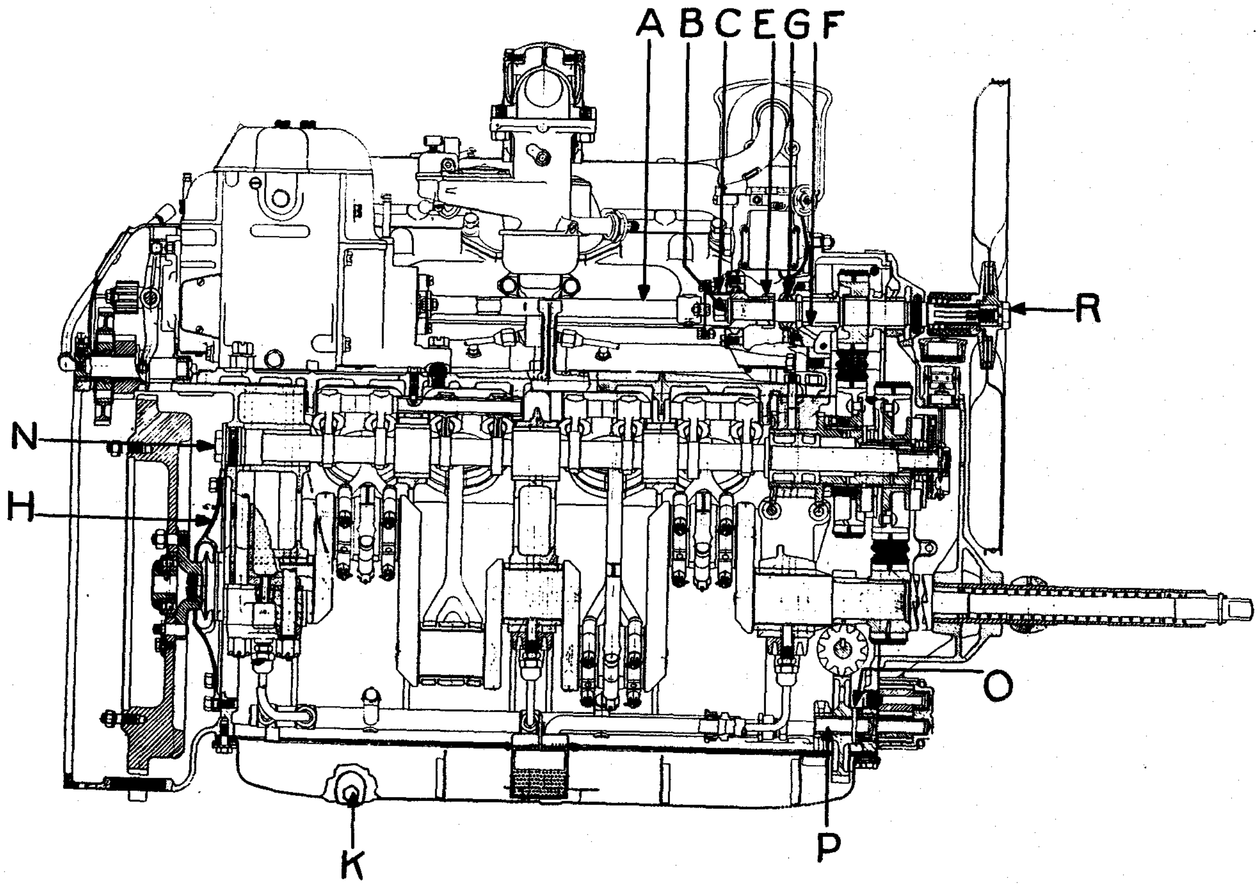

Fig. 63—Sectional View (Longitudinal) of Type 61 Engine

Remove the bearing cap with the lower half of the bearing. If more than one bearing is to be removed at a time, it is best to first remove the connecting rods (§368) to insure against springing them, should one end of the crankshaft drop lower than the other. Also support the crankshaft to prevent it dropping, which might injure it.

Care must be exercised not to mix the liners.

The upper half of the bearing can be removed by rotating it.

316 Inspection

Inspection of Bearing—Clean the bearing and wipe it off with a cloth.

In handling the bearing be careful not to drop it or spring or mar it in any other way.

Carefully inspect the babbitt. If it is cracked, or cut so that it cannot be easily cleaned up with a scraper, replacement of the bearing should be made. (§109).

The end thrust of the crankshaft is taken by the rear main bearing.

The shaft should have no more than .020 inch end play.

Inspection of Other Parts—Inspect the main bearing surfaces of the crankshaft. If any of them are out of round more than .003 inch, or scored, the shaft should be dressed down and the bearings refitted. (§110).

317 Replacement

The bearings, liners and bearing cap should be carefully wiped off and the bearing surfaces lubricated with a good grade of engine oil before replacement is made.

In replacing, reverse operations under "Removal."

The bearings are numbered on one end. The one nearest the radiator is stamped "1," the center bearing "2," and the rear bearing "3." In replacing have the numbered ends toward the radiator.

In readjusting main bearings follow the directions in §102.

Before replacing the baffle plate and oil pan, check carefully the points enumerated in §370.

After replacing the oil pan refill it with seven quarts of suitable engine oil. Cadillac Engine Oil is recommended.

If after starting the engine it is found that the pressure gauge does not register pressure, stop the engine at once and prime the oil pump. (§718).

FANSHAFT

318 Removal

Remove the fan. (§330).

Remove the carburetor. (§428).

Remove the generator drive shaft "A" (Figs. 61 and 63.)

Remove the large cap screw "B."

Remove the coupling "C" by use of Cadillac puller, tool No. 71955.

Remove the distributor and timer. (§409).

Remove the small spiral gear "E." Use Cadillac puller No. 83221.

Remove the front cover plate. (§348).

Remove the fan drive chain by cutting off the riveted head of one of the seat pins and remove the seat and rocker pins (Fig. 14).

The chain and fan shaft can then be removed.

319 *Inspection*

Clean all parts.

Inspection of Fanshaft and Bearings—Inspect the bronze bearing in the fanshaft housing.

Inspect the oil drain hole "F" and felt washer "G" (Figs. 61 and 63) and clean out the hole if obstructed.

320 *Replacement*

In replacing, reverse operations under "Removal."

All parts should be clean, and bearings well lubricated with a good grade of engine oil before replacement is made.

It is necessary to retime the ignition (§149) after replacing the distributor housing. Also put four ounces of number two grease into the distributor housing. This may be done after removing the breather "Z" (Fig. 78).

CYLINDER BLOCKS

321 *Removal*

Drain the cooling system. (§172).

Remove the connecting rods and pistons. (§368). It is possible to remove the cylinder block without first removing the connecting rods and pistons; to prevent damage to these parts, however, it is recommended that they be removed.

Remove the hose connections from the cylinder blocks.

Disconnect the high tension wires from the spark plugs, and remove the conduit brackets. Remove the forward end of the conduit from the aluminum cap by removing the two screws holding the bracket on the end of the conduit to the cap. Lay the conduit with wires back out of the way.

Remove the intake manifold. (§342).

Disconnect the exhaust pipe from the exhaust manifold by removing the two bolts or remove the exhaust manifold from the cylinder block, leaving it attached to the exhaust pipe.

Remove the large threaded dowel pin at each end of the cylinder block by placing a spring washer over the pin large enough to permit the pin to be pulled through it, and screwing down and tightening one of the cylinder hold down nuts.

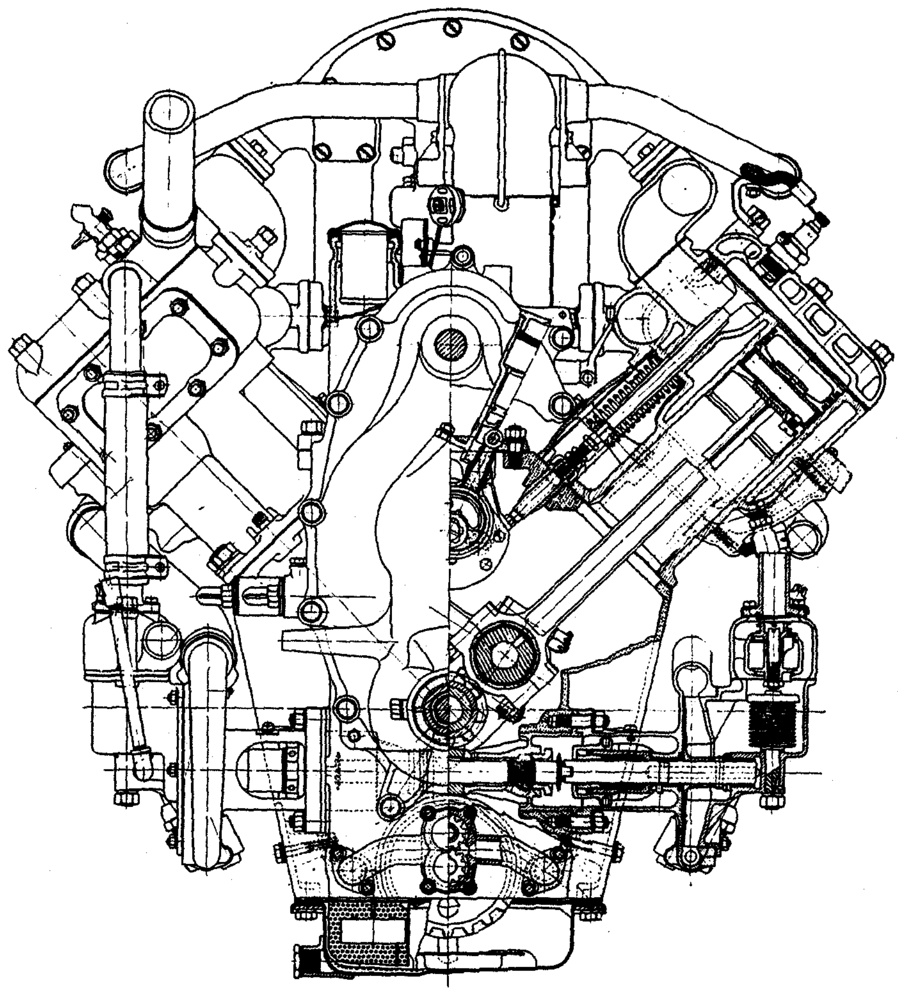

Fig. 64—Front View of Type 61 Engine with One Half Sectioned

(On Type 61 cars, remove the exhaust valves from the end cylinders. (§383). This will facilitate the removal of the end hold down nuts on the inner row.)

Remove the cylinder hold down nuts.

The cylinder block can now be removed.

322 *Inspection*

Inspection of Cylinder Block and Valves—Remove the large cover plate at each end of the cylinder block and wash out the water jacket. Replace the end covers, making sure that the gaskets are in good condition, and clean the cylinder block.

Examine all cylinder bores. Cylinder bores should be free from scores and should be round within .002 inch.

To test cylinder bores for size and parallelism use Cadillac indicator and master ring, tool No. 71967, as shown in Figs. 65 and 66.

To use this indicator proceed as follows:

With a cloth free from lint soaked in kerosene carefully clean out the cylinder bore and wipe dry. Wipe out the master ring and wipe off the shoe which holds the indicator. Then set the indicator with shoe into the master ring as shown in Fig. 65 and turn the face of the indicator so that the hand points to zero. This will set the indicator to the mean standard size, which is 3.126 inch. Standard size Cadillac cylinders in manufacture are ground to the following limits: 3.125 inch to 3.127 inch. Set the indicator with shoe into cylinder bore as shown in Fig. 66 and with a bent rod fitted into the hole drilled in the shoe, move the indicator back and forth. The size of the cylinder bore and any variation in size between the upper and lower end may thus be determined.

Caution:—Use great care in handling the master ring and indicator. These parts may easily be rendered inaccurate.

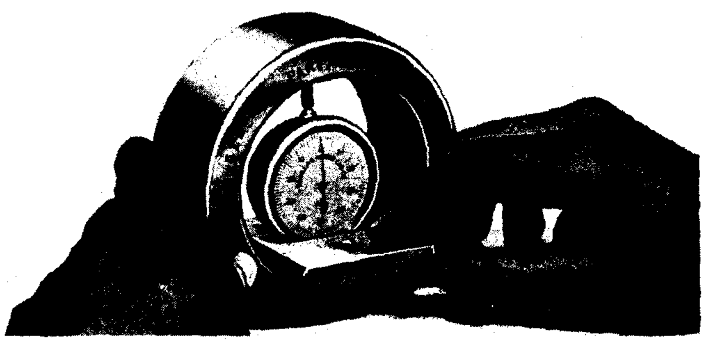

Fig. 65—Setting Cylinder Indicator with Master Ring.

Note:—The above tool cannot be used for testing first oversize cylinders 3.141 inch to 3.143 inch or second oversize cylinders 3.156 inch to 3.158 inch.

There should be no more than .007 inch clearance between a cylinder bore and that part of the piston below the lower piston ring.

Inspect the valve seats, as well as the surfaces of the valves which contact with the seats. This may be done by forcing open the valves by hand. At the same time note if the valve stems work freely in their guides; if not, the valves should be removed and the stems and guides cleaned and lubricated.

Determine the clearance between the valve stems and the bushings in the cylinder blocks. This should not exceed .004 inch.

If a valve or seat is pitted or if it appears that the valve has been leaking, the valve should be reground. (§119). If valve seats require reseating, use Cadillac reseater tool No. 79964.

Inspection of Other Parts—Inspect the pistons and piston rings. (§346). If the wear on a piston seems to indicate that the rod is sprung or twisted, test the rod for alignment. (§369).

Inspect the crank pin bearings. (§313).

Inspect the crank pins. Crank pins should be round within .003 inch and free from scores; if not, they should be dressed down. (§111). A new undersize bearing should be fitted if there is more than .006 inch between a pin and bearing after the work is completed. (§106).

323 Replacement

Make sure that the cylinders and the pistons are free from carbon. Carbon can be removed with a soft iron scraper.

In replacing, reverse operations under "Removal."

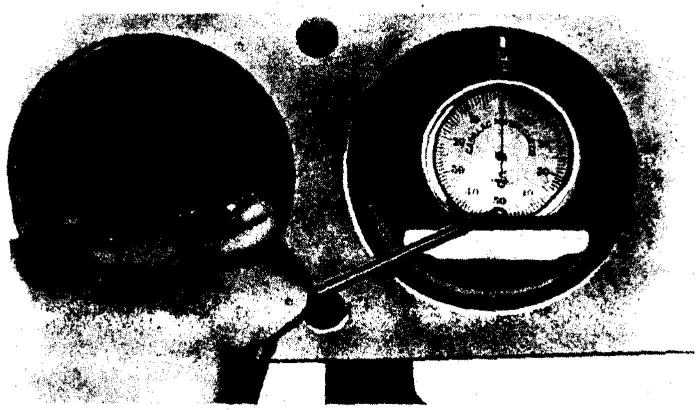

Fig. 66—Indicating Cylinder Bore.

If a new cylinder block is installed it will be necessary to ream the dowel pin holes. With the block in place use a number 8 standard taper reamer, being careful to catch all chips from the under side. Ream only enough to clean up the holes.

Care should be exercised that the dowel pins in the forked rod caps are in the pin holes in the bearings before tightening the cap nuts. The bearing must be clamped tightly in the forked rod. If necessary, reduce the caps of the rod as directed in §104.

Be sure to replace the connecting rods as originally assembled in the engine. (§370).

In replacing counterweights make sure that the number stamped on each weight is the same as that stamped on the cheeks of the crankshaft.

It is of vital importance that the counterweights of different engines be not interchanged. (§311).

In adjusting the straight connecting rods follow the directions in §101.

Before replacing the baffle plate and oil pan, check carefully the points enumerated in §370.

After replacing the oil pan, refill with seven quarts of engine oil of a suitable quality. Cadillac Engine Oil is recommended.

CRANKCASE

324 Removal

Remove and disassemble the engine. (§§301, 302).

325 Inspection

Clean all parts.

INSPECTION OF CRANKCASE—Examine the casting carefully and inspect all machined surfaces.

Examine the bearings for the camshaft. There should be no more than .005 inch clearance between the bearings and the shaft. The bearings should be free from scores. If it is necessary to replace one of the bronze bearings tap it out carefully and carefully tap in the new bearing. Cadillac tool, No. 72407 can be used for this purpose. If it is necessary to replace the rear bearing it will be necessary to first remove the cap "N" (Figs. 61 and 63). The bearing may then be tapped out from the rear.

Make certain that all crankcase studs are tight in the aluminum and that they are screwed in as far as they should go.

INSPECTION OF OTHER PARTS—Inspect all parts in accordance with directions in this book.

326 Replacement

After inspecting all parts, reassemble and replace the engine. (§304).

ENGINE CHAINS

327 Description of Type 61 Adjusting Mechanism

On Type 61 engines the camshaft sprockets "N" and "L" (Fig. 67) are not integral nor do they have their bearing upon the camshaft as in V-63 engines. The camshaft sprockets have their bearings and rotate upon eccentric surfaces "H" and "F" of the support "C."

The support "C" is clamped into the crankcase by the locking collar "A". The camshaft "J" rotates in bearings carried in the support "C."

Shafts "E" and "B" fitted with worm gears "I" and "G" meshing with teeth cut upon the flange "D" of the support "C" and with teeth cut upon the collar "A" serve as means whereby the collar "A" may be loosened or tightened and the support "C" turned.

Turning the support "C" by the shaft "E," which may be done after the collar "A" is loosened by turning the shaft "B" in a clockwise direction, raises the sprocket "N" and lowers the sprocket "L" as these sprockets have their bearing upon eccentric surfaces of the support "C." In other words, the center distances are increased between the crankshaft sprocket "T" and the camshaft sprocket "N" and between the fan sprocket "S" and the camshaft sprocket "L." The chains are thus tightened.

The camshaft sprocket "N" is driven from the crankshaft sprocket "T" by the chain "K." The camshaft sprocket "L" is driven from the camshaft sprocket "N" by a universal cross "M" through lugs on the inner surfaces of these sprockets. The camshaft "J" is driven by the

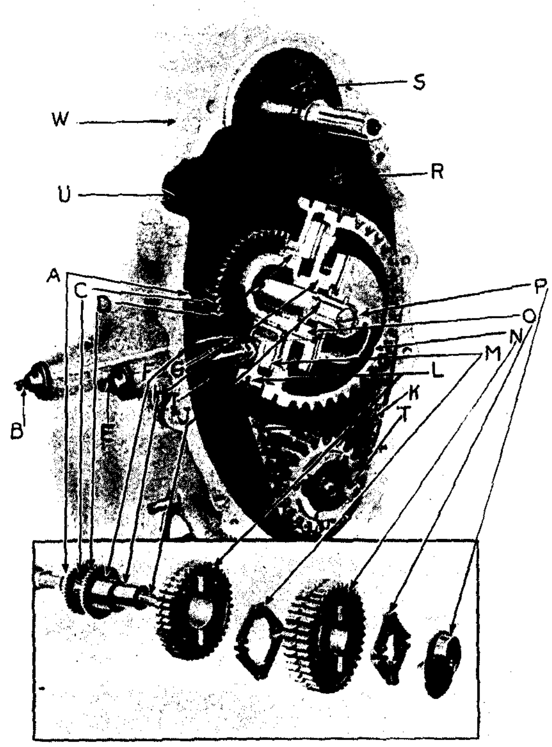

Fig. 67—Type 61 Chain Adjustment

camshaft sprocket "N" through the universal cross "O" and the driver "P." The fanshaft sprocket "S" is driven from the camshaft sprocket "L" by the chain "R."

328 *Removal*

Remove the front cover plate. (§348).

To remove the camshaft driving chain, cut off the riveted head on one of the seat pins and remove the seat and rocker pins. (See Fig. 14).

In cutting off the seat pin use a thin chisel with a long point and hold a heavy piece of brass under the end of the pin to prevent the chisel from slipping and damaging the chain. The camshaft driving chain can then be removed.

To remove the fanshaft driving chain first remove the camshaft driving chain. Then cut off the riveted head of one of the seat pins in the fanshaft driving chain. Turn the sprockets until this pin is opposite the hole "U" (Figs. 67 and 68) in the fanshaft housing, remove the plug from the hole and drive the seat pin out through the hole.

(On Type 61 engines the fanshaft driving chain can be removed without removing a seat pin by proceeding as follows: Remove the camshaft driving chain as previously directed. Then remove the camshaft driver "P" (Fig. 67) by driving out the taper pin and using puller No. 83234. Remove the camshaft sprocket "N" and the crosses "M" and "O." Remove the fanshaft sprocket at the same time pulling off the camshaft sprocket "L." On early Type 61 engines the fanshaft sprocket and shaft are splined. On some Type 61 engines the fanshaft sprocket is fastened to the fanshaft by four screws. The remaining Type 61 engines are similar to V-63 engines and have a key for the fanshaft sprocket.)

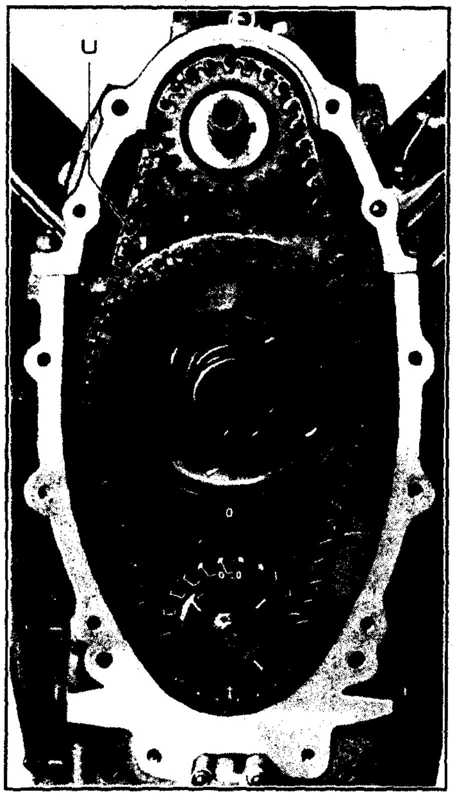

Fig. 68—V-63 Engine Chains

329 Replacement

If the fanshaft chain has been removed, replace it before replacing the camshaft chain. In reassembling, reverse the operations under "Removal," and rivet in accordance with the instructions in §120.

In replacing the camshaft driving chain care must be exercised that the chain is so placed on the sprockets that the valve timing is correct.

One tooth of the camshaft sprocket is marked with an "O" and two adjacent teeth of the crankshaft sprocket are also marked each with an "O" (See Fig. 68). In placing the chain in position the marked tooth on the camshaft sprocket should face directly opposite the space between the marked teeth on the crankshaft sprocket.

(On Type 61 engines only one tooth of the crankshaft sprocket is marked with an "O." This tooth should face directly opposite the correspondingly marked tooth on the camshaft sprocket.)

FAN

330 *Removal*

Remove the radiator. (§425).

Remove the screw "R" (Figs. 61 and 63), which has a right hand thread.

The fan with hub can now be removed by pulling it straight forward.

331 *Inspection*

Inspection of Fan—After cleaning the fan inspect the surfaces against which the friction discs press, also the rivets at the rim of the fan and at the center.

After the fan is put back and the engine is started, note if the fan runs true. If it does not it should be trued up.

332 *Replacement*

In replacing the fan reverse the operations under "Removal."

Be sure and have the fan with the blades facing in the proper direction. The straight edges of the blades should be toward the radiator.

SPIRAL GEAR FOR OIL PUMP DRIVE

333 *Removal*

Remove the oil pan and the baffle plate. (§354).

Remove the oil pump. (§357).

Determine the amount of clearance between the teeth of the gear to be removed and those of the gear with which it meshes. (§334).

Remove the taper pin "O," (Figs. 61 and 63).

Remove the shaft "P." To do so tap it forward carefully.

334 *Inspection*

Clean all parts.

There should be no more than .018 inch clearance between the teeth of the gear just removed and those of the gear with which it meshes. The bearing surfaces of the drive shaft, and those of the bushings in which it rotates should be free from scores. There should be no more than .004 inch between the shaft and bushings. If necessary to replace either bushing drive it out carefully. Unless very great care is exercised in removing and replacing, there is a possibility of cracking the aluminum.

Examine the oil holes to each bushing. Clean out if obstructed.

Examine the faces of the thrust washer. They should be free from scores.

The gear should have no more than .008 inch end play.

335 *Replacement*

In replacing, reverse the operations under "Removal."

After replacing the oil pan, refill with seven quarts of engine oil of a suitable quality. Cadillac Engine Oil is recommended.

If, after starting the engine, it is found that the pressure gauge does not register pressure, stop the engine at once and prime the oil pump. (§718).

CYLINDER HEADS

336 Removal

Drain the cooling system. (§172).

Remove the hose connections from the cylinder head.

Disconnect the high tension wires from the spark plugs.

(On Type 61 engines, remove the conduit brackets from the cylinder head. Remove the forward end of the conduit from the aluminum cap by removing the two screws holding the bracket at the end of the conduit to the cap. Lay the conduit with wires back out of the way.)

Remove the spark plugs. Remove the twenty nuts by which the cylinder head is held to the block.

Remove the cylinder head and the gasket.

337 Inspection

INSPECTION OF HEAD AND GASKET—Inspect the machined surfaces of the cylinder head. Inspect the gasket. Do not use the gasket again unless you are sure it is in condition for further use. Ordinarily a gasket may be used several times unless it is injured in removing.

INSPECTION OF OTHER PARTS—Inspect the cylinder bores. Cylinder bores should be free from scores.

Examine the machined face of the cylinder which presses against the gasket.

338 Replacement

With a soft iron scraper remove all carbon from the cylinder head, cylinder and piston heads.

Before replacing gaskets coat them with heavy cup grease. After replacing the head, screw on the twenty hold-down nuts by hand. Then begin with the center nut in the middle row, work towards the ends, tightening the nuts lightly with a wrench. Then do the same with the nuts on the inner row, and finally with those on the outer row. After all nuts are tightened lightly, go over them again, tightening them firmly.

In refilling the cooling system follow the directions in §170.

FANSHAFT HOUSING

339 Removal

Remove the fan. (§330).

Remove the distributor and timer. (§409).

Remove the fanshaft. (§318).

Remove the two dowel pins which locate the fanshaft housing on the crankcase. To remove the dowel pins place spring washers over the pins large enough to permit the pins to be pulled through them, and screw on and tighten $\frac{5}{16}$ inch x 18 nuts.

Loosen the cap screw at the left rear corner of the fanshaft housing and remove the other three cap screws by which the fanshaft housing is held to the crankcase.

The housing can now be removed.

340 Inspection

Clean all parts.

INSPECTION OF FANSHAFT HOUSING—Examine the machined surfaces of the housing. Also examine the casting.

INSPECTION OF OTHER PARTS—Inspect the fanshaft and fanshaft bushings. (§319).

341 Replacement

In replacing, reverse the operations under "Removal."

After replacing the distributor and timer, retime the ignition and place four ounces of Cadillac Distributor Grease in the housing. The grease may be put in after removing the breather "Z" (Fig. 78.)

INTAKE MANIFOLD

342 Removal

Disconnect the tube to the automatic windshield cleaner.

If the horn is mounted on the intake manifold, remove the headlamp operating rod between the instrument board and the radiator.

Remove the two cap screws holding the carburetor to the manifold.

Remove the two cap screws holding each intake manifold flange to the cylinder block.

The intake manifold can now be removed.

343 Inspection

CLEANING INTAKE MANIFOLD—If the horn is mounted on the intake manifold, remove it. Remove the manifold jacket cover plates and clean out the carbon deposit from the inside of the hot air jacket. Use a wire brush or other suitable tool.

INSPECTION OF INTAKE MANIFOLD—After cleaning the manifold inspect the finished surfaces against which the carburetor and cylinder blocks are bolted. The surfaces must be in good condition and perfectly flat to prevent air leaks at these points. Inspect the hot air jacket.

INSPECTION OF OTHER PARTS—Inspect the surface of the carburetor and the surface of the cylinder blocks which bolt against the manifold. These surfaces must be in good condition and perfectly flat.

344 Replacement

In replacing the intake manifold, reverse the operations under "Removal." Make sure that all gaskets are in good condition, also that the cap screws holding the manifold to the cylinder blocks and the carburetor to the manifold are drawn down together and well tightened to prevent air leaks.

PISTON, WRIST PIN AND PISTON RINGS

345 Removal

Remove the connecting rod with piston from the engine. (§368).

If more than one piston is to be removed, mark each one with its number before it is removed from the connecting rod.

The wrist pin can be removed after the small set screw in the wrist pin support is removed.

The piston rings can be removed with hack saw blades as shown in Fig. 69. The teeth should be ground from the saw blades to prevent injury to the piston and rings. Care must be used in removing the rings not to strain them.

346 Inspection

Clean all parts.

Inspection of Wrist Pin—There should be no more than .003 inch clearance between the wrist pin and the bushing and no more than .0015 inch clearance between the wrist pin and the piston.

Inspection of Piston and Rings—Pistons should be free from scores and round within .002 inch. The difference in width between the piston rings and the grooves should not exceed .003 inch.

Piston pins should have no more than .0015 inch clearance in the piston.

There should be no more than .007 inch clearance between the cylinder and the skirt of the piston and no more than .025 inch clearance between the ends of the rings when the piston is in place in the cylinder.

Inspection of Other Parts—If wear on a piston seems to indicate that the connecting rod is sprung or twisted, test the rod for alignment. (§369).

Inspect the wrist pin bushings. (§369).

Inspect the crank pin bearing. (§313).

Inspect the crank pin. The crank pin should be round within .003 inch and free from scores; if it is not, it should be dressed down. (§111).

A new standard or undersize bearing should be fitted if there is more than .006 inch clearance between the pin and the bearing after the work is completed. (§106).

Inspect the cylinder bores. Cylinder bores should be round within .002 inch and free from scores.

346a Selection of New Pistons and Connecting Rods

In replacing reciprocating parts, selection for weight is essential for the preservation of the original balance and smooth running of the engine. As the principles by which V-63 and Type 61 engines are balanced differ, it is necessary to select new pistons and connecting rods for V-63 engines in a different manner from those for Type 61 engines.

In assembling V-63 engines at the factory, pistons and connecting rods are selected of such weights that the total weight of the piston and rod assembly for each pair of opposite cylinders is within $\frac{1}{8}$ of an ounce of a definite fixed amount from which the compensator weights are calculated. This amount is 8 pounds and $\frac{25}{32}$ ounces and includes, besides the two rods and two pistons, the connecting rod bearings, cotter pins, piston rings, wrist pins, and wrist pin locking screws. In the selection of new pistons and connecting rods for replacement, it is important to maintain this *uniform total weight* of the assembly, rather than to attempt to obtain uniform individual weights for all parts of the same kind. Obviously, to maintain this total weight of the assembly, it is necessary in installing a single new rod or piston to select one having a weight as close as possible to that of the replaced part.

In assembling Type 61 engines, pistons and connecting rods were selected for *individual weight*, so that each piston weighed within $\frac{1}{6}$ of an ounce of every other piston in the same engine. Similarly, all forked connecting rods of a Type 61 engine weighed within $\frac{1}{6}$ of an ounce of each other and all straight rods of an engine weighed within $\frac{1}{6}$ of an ounce of each other. Selection of new pistons and connecting rods for replacement in Type 61 engines should be made accordingly.

In checking the weight of pistons and connecting rods, a high-grade scale should be used which can be read accurately to the limits mentioned in the preceding paragraphs.

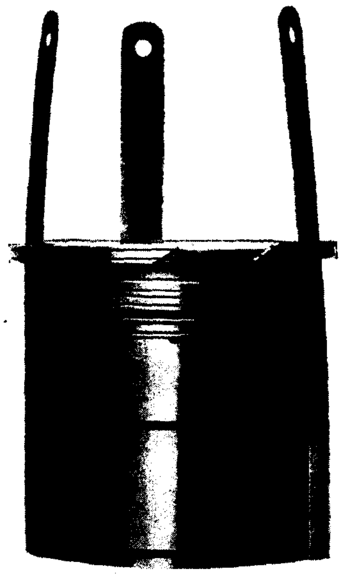

Fig. 69—Removing Piston Rings

347 Replacement

With a scraper clean the carbon from the piston head and rings. A piece of heavy twine or a twisted strip of cloth can be used to clean the ring grooves.

Clean all parts carefully and lubricate all bearing surfaces with engine oil of suitable quality.

In replacing, reverse the operations under "Removal."

In assembling the piston on the connecting rod, place the wrist pin support with the screw next to the side of the rod which has the longer wrist pin boss.

Care should be exercised that the dowel pins in the forked rod caps are in the pin holes in the bearing before tightening the cap nuts. The bearing must be clamped properly in the forked rod. If necessary, reduce the caps of the forked rod as directed in §104.

Be sure to replace the connecting rods as originally assembled in the engine. (§370).

In replacing counterweights, make sure that the number stamped on each weight is the same as that stamped on the cheeks of the crankshaft. It is of vital importance that the counterweights of different engines be not interchanged. (§311).

In adjusting the straight connecting rod follow directions in §101.

Before replacing the baffle plate and oil pan, check carefully the points enumerated in §370.

After replacing the oil pan, refill it with seven quarts of engine oil of a suitable quality. Cadillac Engine Oil is recommended.

FRONT COVER PLATE

348 *Removal*

Remove the radiator. (§425).

Remove the hood shelves and radiator splash shield mouldings. (On Type 61 cars the hood shelf and splash shield moulding is in one piece.) Remove the splash pan at the front of the radiator.

Remove the splash pan under the engine.

Remove the fan. (§330).

Remove the air compressor cylinder and piston from the front cover plate. To remove the cylinder, first disconnect the air pipe, then remove the two small hold-down nuts. To remove the piston, crank the engine over by hand until the piston is at the top of its stroke, then move it forward.

Remove the cap of the front engine support.

Remove the floor board just back of the transmission control lever. If this is not done, the plate in the floor board may be cracked when the front end of the engine is raised.

Jack up the front end of the engine about four inches.

Remove the two dowel pins which position the cover plate on the crankcase. These pins may be removed by placing over them spring washers large enough to permit the pins to be pulled through, then screwing on and tightening $\frac{3}{8}$ inch x 16 nuts.

Mark the twelve cap screws holding the cover plate in place and remove the screws.

Remove the cover plate.

349 *Inspection*

Clean the cover plate with kerosene or gasoline.

Carefully inspect all machined surfaces, also the gasket between the plate and crankcase.

Make sure that the starting shaft works freely in its bearings.

350 Replacement

In replacing, reverse the operations under "Removal."

Be certain that the twelve cap screws which hold the cover plate to the crankcase are replaced as originally assembled.

ROCKER ARM PLATE

351 Removal

Remove the intake manifold with carburetor. (§§342,428). It is unnecessary, however, to remove the carburetor from the manifold, or to drop the drain pocket located under the carburetor.

Remove the motor generator. (§397).

Remove the distributor and timer. (§409).

Remove the oil level indicator dial. This may be done after the two small cap screws holding it to the cover plate are removed.

Drain the oil pan by removing the drain plug "K" (Figs. 61 and 63). It is not absolutely necessary to drain the oil pan, but doing so allows the float and float tube to drop, reducing the amount exposed above the cover plate. This is desirable as there is less likelihood of damaging the tube.

Remove the small red ball at the top end of the indicator tube. This may be done by tapping lightly upon the under side of the ball.

Remove the carburetor drain pipe and drain pocket. (On Type 61 engines there are two drain pipes.)

Remove the nuts holding the rocker arm plate to the crankcase, also the threaded dowel pin at each end of the plate. To remove a threaded dowel pin, place over it a spring washer large enough to permit the pin to be pulled through it, then screw on and tighten a $\frac{5}{16}$ inch x 18 nut.

Remove the cylinder heads. (§336).

Raise all sixteen valves and hold them in the raised position. This may be done with four Cadillac valve-lifters, tool No. 85783. If these tools are not at hand remove all sixteen valves. (§383).

Remove the clamps holding the cam slide bushings in place and raise the cam slides and bushings.

The rocker arm plate can be removed by lifting it straight up and at the same time cranking the engine over very slowly. Both ends of the cover plate must be lifted evenly.

352 Inspection

Clean all parts.

Inspection of Rocker Arm Plate—Inspect the rocker arm plate. Test with a straight edge the machined surfaces which bolt against the crankcase.

The bronze bushings in which the rocker arm shafts are held should be tight in the aluminum.

Inspection of Other Parts—Inspect the rocker arms and rocker arm shafts. (§307).

Inspect the cams. They should show practically no wear.

353 Replacement

Make sure that the gasket between the plate and crankcase is in good condition.

In replacing, reverse the operations under "Removal."

After replacing the distributor and timer, retime the ignition (§149), and put four ounces of Cadillac Distributor Grease or No. 2 cup grease into the distributor housing. This may be done after removing the breather "Z" (Fig. 78).

Refill the oil pan with seven quarts of suitable engine oil after replacing it. Cadillac Engine Oil is recommended.

OIL PAN AND BAFFLE PLATE

354 Removal

Remove the splash pan under the engine.

Drain the oil pan. This is done by removing the plug "K" (Figs. 61 and 63).

Remove the twenty-seven nuts holding the oil pan to the crankcase, and remove the oil pan, being careful not to injure the cork gasket between the oil pan and the baffle plate.

Remove the oil float with the tube to which it is soldered. The small red ball at the upper end of the float tube will prevent the tube dropping down. The ball may be removed, however, by pushing the float up an inch or so and pulling it down, repeating the operation until the ball is forced off.

Remove the baffle plate, being careful not to injure the cork gasket between the baffle plate and crankcase.

355 Inspection

Inspection of Oil Pan and Baffle Plate—Clean the oil pan and baffle plate. Make a careful inspection of these parts, also of the cork gaskets. The oil pan should be free from dents. The surface which presses against the gasket must be in good condition.

The screen of the baffle plate must be free from injury.

Inspection of Other Parts—Make sure that the unions are tight on all of the oil pipes inside of the crankcase. To determine this try them with a wrench.

Determine if the float contains oil. If it does it may be repaired by soldering it after the oil has been drained out.

If the float tube is bent in removing, straighten it before replacing.

356 *Replacement*

In replacing, reverse the operations under "Removal."

(On Type 61 engines, to replace the red ball on the upper end of the indicator tube, it is necessary to remove the oil indicator, which can be done by removing the two screws. The red ball is a taper fit on the oil tube and should be tapped in place lightly.)

After replacing the oil pan, refill it with seven quarts of suitable engine oil. Cadillac Engine Oil is recommended.

If after starting the engine it is found that the oil pressure gauge does not register pressure, stop the engine at once and prime the oil pump. (§718).

OIL PUMP

357 *Removal*

Remove the splash pan under the engine.

Wash off the pump and the front end of the engine around the pump.

Remove the two small nuts on each pump flange and the four small nuts by which the body of the pump is held to the front cover plate.

Remove the pump by pulling it straight forward. The pump will come off easily if both ends are removed evenly. Remove the lower gear from the oil pump drive shaft.

358 *Inspection*

Clean all parts and inspect the pump body and elbows.

There should be no more than .004 inch clearance between the teeth of the pump gears and the pump body, no more than .004 inch clearance between the bearings at each end of the pump gears and the bushings in which they operate, and no more than .006 inch end play in the pump gears when the pump is bolted in place on the front cover plate.

359 *Replacement*

In replacing, reverse the operations under "Removal," first making sure that all gaskets are in good condition, also that the surfaces which press against these gaskets are clean. Line up the pump to make sure that the spiral gear for the pump drive turns freely.

If Cadillac made gaskets are not procurable make gaskets of paper .009 inch to .011 inch in thickness. If the gaskets are too thick, too much end play in the pump gears will be permitted resulting in a less efficient pump. All three gaskets must be made of paper of equal thickness.

If after starting the engine it is found that the pressure gauge does not register pressure, stop the engine at once and prime the oil pump. (§718).

WATER PUMPS

360 Removal of Pump

Drain the cooling system. (§172).

Remove the splash pan under the engine.

Disconnect at the water pump all hose connections.

Remove the two nuts which hold the pump to the crankcase.

The pump can now be removed. Remove both sides evenly.

361 Removal of Pump Impeller

Remove the pump. (§360).

(On early Type 61 pumps, disconnect the pipe "M" (Fig. 30).

Remove the pump cover.

The impeller with shaft may then be removed. The pump shaft is held to the pump impeller by a taper pin. The shaft may be forced out of the impeller with a press after the pin is removed.

362 Removal of Thermostat or Thermostat Valve

Remove the thermostat housing cap "F" (Fig. 29).

Remove the large brass nut "J" and the shaft "B."

Remove the thermostat valve body "K" with valve and thermostat intact.

With a screw-driver remove the slotted locking nut "E" and unscrew the valve "D" from the thermostat, holding the stem of the thermostat with a wrench placed just above the thermostat. The thermostat can then be removed.

Be careful not to injure the thermostatic member. Do not force the nut "E" or valve "D" without a wrench on the thermostat stem *above* the thermostat.

First Type 61 Cars

On early Type 61 cars proceed as follows in removing a thermostat:

Remove the pump. (§360).

Disconnect the thermostat drain pipe nut "E" (Fig. 30).

Remove the thermostat valve body "F."

Remove the nut "G."

The thermostat can then be removed.

To remove a thermostat valve on an early Type 61 car proceed as fol ows:

Drain the cooling system (§172).

Disconnect at the water pump, the hose connection "O," (Fig. 30) and the copper pipe "M."

Remove the thermostat housing cap "A."

Remove the spring.

The valve may then be removed.

363 Inspection

Test the thermostatic member. To do so proceed as follows:

Place the thermostat in water at a temperature of between 165° and 170° Fahrenheit. A first class thermometer should be used in determining the temperature of the water.

Under these conditions the thermostatic member should elongate from $\frac{3}{16}''$ to $\frac{1}{4}''$ in 15 to 30 seconds.

Inspect the valves "D" (Fig. 29) and "I" (Fig. 30) and the valve seats. Remove any rust or scale which has accumulated and regrind the valves if necessary.

The pump impeller and the bushings in which it operates, should be free from scores. The clearance between the shaft and either bushing should not exceed .006 inch. If it is necessary to remove the bushing which has the packing gland on its outer end, drive it out with a soft brass drift, after first driving out the $\frac{5}{16}$ inch x $\frac{3}{16}$ inch brass pin "J." (Fig. 30). The bushing in the pump cover may be removed by pulling it out. This bushing is not pinned.

The pump impeller should have no more than .010 inch clearance in the pump body with the pump cover in place.

Examine the packing in the gland "I" (Fig. 29) and "K" (Fig. 30). If it is necessary to repack the gland follow the directions in §175.

364 Replacement

In replacing, reverse the operations under "Removal."

Be careful not to interchange the right and left impellers. The proper impeller may be identified by reference to Fig. 29 which shows the left pump and impeller.

OIL PRESSURE REGULATOR

365 Removal

Remove the oil pipe from the regulator by unscrewing the union.

Remove the four one-fourth inch nuts and washers holding the regulator to the crank case and remove the regulator.

Unscrew the cap from the regulator and remove the spring and ball.

366 Inspection

Clean all parts.

Examine the ball. It should be clean and free from pits.

Examine the ball seat. The seat should be free from pits. It can be removed from the housing by driving it out carefully from the bottom.

Examine the one-sixteenth inch by-pass hole "D" in the housing. (See Fig. 106.) The by-pass has an outlet in the hole through which oil passes to the pressure gauge pipe. The by-pass should be cleaned if obstructed.

The valve spring should have a free length of $2\frac{7}{16}$ inches and should support a load of between $6\frac{1}{2}$ and $7\frac{1}{2}$ pounds when compressed to $1\frac{3}{4}$ inches.

The surfaces of the housing which bolt against the crankcase should be in good condition.

367 Replacement

In replacing, reverse the operations under "Removal."

If the regulator is in proper adjustment after installation the pressure gauge on the instrument board will indicate a pressure of between five and seven pounds when the engine is warm, idling at approximately 300 revolutions per minute, and the oil in the engine is of a suitable quality and fresh. Cadillac Engine Oil is recommended. If a higher or lower oil pressure is indicated, readjustment should be made in accordance with the directions in §718.

CONNECTING RODS

368 Removal

Remove the oil pan and the baffle plate. (§354).

Open the compression relief cocks.

If all of the connecting rods are to be removed, remove both of the large counterweights. In any case, remove the large counterweight next to each rod to be removed. (§309). It is not necessary to remove the small counterweights. (Type 61 crankshafts are not fitted with counterweights.)

Remove the cotter pins and the two nuts from the cap of the straight connecting rod. Remove the cap, being careful not to mix the liners.

Remove the rod and piston. Care must be exercised not to damage the piston in removing it. Do not allow the skirt of the piston to fall against the connecting rod.

Remove the cotter pins and the two nuts from each cap of the forked connecting rod and remove the caps. Wrench No. 72813 is for use with the nuts on the forked connecting rods.

Remove the rod and piston, being careful not to damage the piston or to allow the halves of the connecting rod bearing to drop.

Remove the bearing halves.

Mark each piston with the number of the cylinder from which it was taken.

Remove the pistons from the connecting rods. This can be done by first removing the small set screw in the piston pin boss and pushing out the pin by hand.

369 Inspection

Clean all parts removed.

Inspection of Rods—The wrist pin bushing should be free from scores. There should be no more than .003 inch clearance between the pin and the bushing. If it is necessary to replace the bushing proceed as follows: With a press force out the used bushing and force in the new one, being sure that the oil holes line up. Be careful not to spring the rod. Then ream the new bushing, using a three-fourths inch reamer. The size of the bushing when reamed should be between .7495 inch and .7502 inch. The rod should be tested for alignment after the bushing is in place and reamed.

Cadillac gauge No. 71969 as shown in Fig 70 can be used for this purpose.

To align the rod clamp the arbor into the lower bearing and with the hand lightly force an arbor of the correct size into the upper bearing. With the indicator in place on the gauge, set the connecting rod with arbor into the gauge as shown in Fig. 70, first making certain that the arbor and the bearing surfaces of the gauge are clean. Each end of the small arbor should rest squarely upon the machined surfaces of the gauge; if they do not, remove the rod from the gauge and spring it lightly until they do. Then move the small end of the connecting rod up and down and watch the indicator. Set the indicator to zero by turning the dial. Remove the connecting rod with arbors and set it back in the gauge upside down. Move the small end of the rod as before and watch the indicator. If the hand does not indicate zero, remove the connecting rod and spring it lightly. Continue in this manner until the arbors are parallel.

The bearing at the lower end of the forked connecting rod must be clamped properly in the rod. To cause this, the diameter of that portion of the bearing which is held in the rod must be .002 inch greater than the rod diameter, taken lengthwise of the rod. If the bearing is not clamped, the caps on the rod may be reduced by rubbing them carefully over fine emery cloth stretched tightly over a machined surface plate. (§104).

The bearings in the upper and lower ends of the rods should be parallel and in the same plane.

To test the forked rod for alignment proceed as previously directed for the single connecting rod, with the lower bearing clamped in place. If the arbor is not a tight fit in the lower bearing, use a new bearing.

Inspect the crank pin. The crank pin should be round within .003 inch and free from scores; if it is not it should be dressed down. (§111). A new undersize bearing should be fitted if there is more than .006 inch clearance between the used bearing and pin, after the work is completed. (§106).

Inspect the pistons and the piston rings in accordance with the directions in §346.

Inspect the wrist pins. (§346).

Inspect the cylinder bores. They should be round within .002 inch and free from scores.

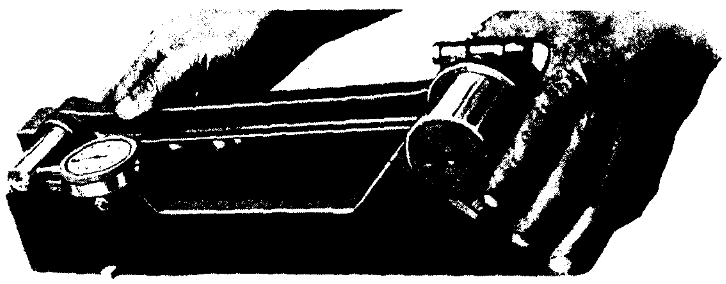

Fig. 70—Testing Connecting Rod for Alignment.

370 Replacement

In replacing pistons or connecting rods with new parts be sure and select the parts for weight in accordance with the directions in §346a.

With a cloth carefully wipe off the pistons, connecting rods, and bearings and lubricate the bearing surfaces with engine oil of a suitable quality.

In replacing, reverse the operations under "Removal."

In assembling the pistons on the connecting rods, place the wrist pin support with the screw next to the side of the rod which has the longer wrist pin boss.

In assembling the crank pin bearings in the forked rods, place the bearing so that, when the rod is correctly assembled in the engine, the number on the end of the bearing will face toward the rear and so that the edges of the halves of the bearing will be horizontal when the piston attached to the rod is on top or bottom center. Be sure that the dowel pins in the forked rod caps are in the pin holes in the crank pin bearing before the cap nuts are tightened. Be sure that the bearing is clamped properly in the rod. (§104).

Connecting rod caps, bolts and nuts should be replaced in accordance with the numbers stamped on them. All nuts and bolts and both bearing caps on the forked rods are numbered. The cap and one bolt and nut of each straight rod are numbered.

In assembling the connecting rods in the engine, be sure that the rods are placed as originally assembled. The forked rods should be on the left side of the engine or on the side with the oil manifold. The longer wrist pin boss should face toward the nearest main bearing. Each rod is numbered on the channel section to indicate the cylinder to which it belongs. The two No. 1 rods should go in the cylinders nearest the radiator; the No. 2 rods in the cylinders just back of these, etc. The numbers on the rods will face downward if the rods are assembled correctly.

In replacing the counterweights on the crankshaft be sure that the number stamped on each weight is the same as the number stamped on the cheeks of the crankshaft. It is of vital importance that the counterweights of different engines be not interchanged. (§311).

In adjusting the straight connecting rod caps on the outside of the crank pin bearings, follow the directions in §101.

Before replacing the baffle plate and oil pan, it is a good plan to check the entire assembly by the following list:

1. All forked rods on left side of engine (side with oil manifold).
2. Wrist pin set screws toward longer wrist pin boss on rod.
3. Longer wrist pin bosses on rods toward nearest main bearing.
4. Numbers on rods facing downward.
5. Numbers on rods corresponding to numbers of cylinders.
6. Edges of halves of crank pin bearings horizontal.
7. Numbers on counterweights corresponding to number on crankshaft.
8. Cotter pins in all connecting rod and main bearing nuts.
9. Cotter pins in all counterweights.

After replacing the oil pan, refill it with seven quarts of suitable engine oil. Cadillac Engine Oil is recommended.

CAMSHAFT

371 Removal

Remove the camshaft and fanshaft driving chains. (§328).

Remove the carburetor. (§428).

Remove the generator drive shaft "A" (Figs. 61 and 63).

Disconnect the timer control rod.

Remove the two cap screws which hold the brackets for the left-hand high tension conduit to the cylinder block. (On Type 61 engines these brackets are held by cylinder head nuts.) Loosen the small screws in the brackets which hold the right-hand conduit. Remove the distributor head and the low tension wire and lift the left-hand conduit with wires and head over to the right side.

Remove the distributor rotor. This may be done by lifting it straight up. If the rotor sticks on the shaft, force it off with two small screw drivers. The rotor is recessed on the under side at two points to receive screw drivers in removing. Lift both sides of the rotor evenly and lift it carefully.

Loosen the cap screw on the left rear corner of the fanshaft housing and remove the remaining three cap screws.

Remove the fanshaft housing with the distributor and timer attached.

Remove the rocker arm plate. (§351).

Remove the long set screw in the top of the crankcase which locks the front camshaft bearing. Remove the camshaft with sprocket by pulling the camshaft straight forward. If the sprocket is to be removed from the camshaft, use Cadillac puller No. 85799.

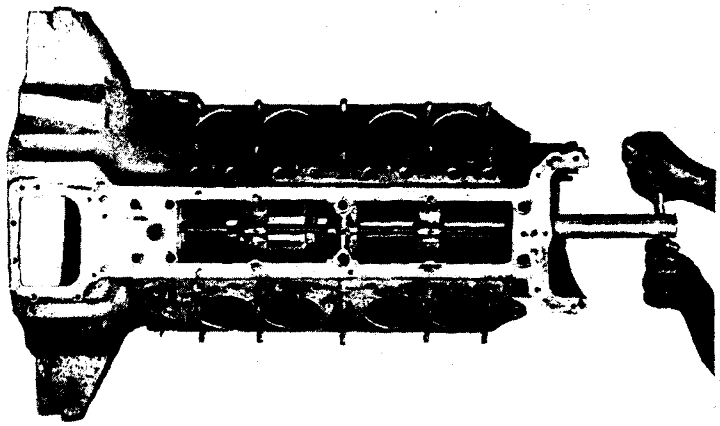

Fig. 71—Removing Camshaft Bearing

(On Type 61 cars there is no set screw to be removed, but the lock nut on the rear of the eccentric bearing must be removed by turning the locking worm in the clockwise direction. In pulling out the camshaft and eccentric bearing the lock nut must be held clear of the cams and bearings on the camshaft.)

The three center camshaft bearings can be removed or replaced with Cadillac tool No. 72407.

To remove a camshaft bearing place the large casting against the web of the crankcase as shown in Fig. 71. With the smaller washer in place against the edge of the bearing, screw on and tighten the nut, using the long socket wrench.

To replace a bearing reverse the casting and with either the larger or smaller washer in place, screw up on the nut. It is well to lubricate the new bushing before putting it in.

372 Inspection

INSPECTION OF CAMSHAFT—Clean the shaft and wipe it off with a cloth.

Inspect the oil hole in the shaft, cleaning it out if necessary.

Inspect the cams carefullly. They should show practically no wear.

All bearing surfaces of the camshaft should be round within .003 inch and free from scores. The clearance between the camshaft and the bearings should not exceed .005 inch.

INSPECTION OF OTHER PARTS—Inspect the camshaft bearings in the crankcase. The bearing surfaces should be free from scores. If it is necessary to replace one of the three center bearings, Cadillac tool No. 72407 can be used for this purpose. If it is necessary to replace the rear bearing, first remove the flywheel (§386), then remove the cap "N" (Figs. 61 and 63). The bearing may then be driven out from the rear.

Inspect the rocker arms and rocker arm shafts. (§307).

373 Replacement

In replacing, reverse the operations under "Removal."

In replacing the sprocket on the camshaft, use pusher No. 85797.

(When replacing the camshaft driver on Type 61 engines use Cadillac pusher No. 83233.)

Be sure to replace the camshaft driving chain correctly. (§329).

CRANKSHAFT

374 Removal

Remove the rocker arm plate (§351).

Remove the camshaft driving chain. (§328).

Remove the flywheel. (§386).

Remove the cover "H" (Figs. 61 and 63), at the rear end of the crankcase.

Remove all four of the counterweights. (§309).

Remove the connecting rods and pistons. (§368).

Determine the amount of clearance between the teeth of the spiral gear on the crankshaft and those of the gear with which it meshes. (§375).

Remove the main bearings, being careful that the shaft does not drop. (§315).

Carefully tap up the main bearing bolts until their lower ends are flush with the machined surfaces against which the liners are held.

The crankshaft can now be removed.

375 Inspection

Inspection of Crankshaft—Remove the screw plugs by unscrewing them with a large screw driver and clean out the oil ways thoroughly. Replace the plugs and tighten, locking them by making a fairly light punch mark between the shaft and each screw.

Wash the shaft with gasoline or kerosene and inspect all bearing surfaces. If any of the bearing surfaces are cut, or out of round more than .003 inch they should be dressed down. (§§110, 111). If after dressing down a crank pin, there is more than .006 inch clearance between the pin and the crank pin bearing, a new standard or undersize bearing should be fitted. (§§105, 106).

End play in a crank pin bearing should not exceed .015 inch. The clearance between a crank pin bearing and the crank pin should not exceed .006 inch. There is no adjustment on crank pin bearings. Crank pin bearings .005 and .020 inch undersize are furnished by our Parts Department.

The end thrust of the crankshaft is taken by the rear main bearing. The crankshaft should have no more than .020 inch end play in this bearing.

Place the shaft on lathe centers. It should run out of true no more than .004 inch at the center bearing.

Inspection of Other Parts—Examine the oil hole in the spiral gear on the crankshaft. Clean out if obstructed.

Inspect the main and crank pin bearings. (§§313, 316).

Inspect the pistons and piston rings. (§346). If the wear on a piston seems to indicate that the rod is sprung or twisted, test the rod for alignment. (§369).

Inspect the cylinder bores. They should be round within .002 inch and free from scores. (§322).

When the crankshaft is in place there should be no more than .018 inch clearance between the teeth of spiral gear on the shaft and those of the gear with which it meshes.

Inspect the camshaft and fanshaft driving chains and sprockets.

Inspect the flywheel. (§387).

Inspect the annular ball bearing at the rear end of the crankshaft. The races should rotate smoothly and quietly and have no more than .015 inch end play.

376 Replacement

Before replacing the shaft, wipe it off with a cloth and lubricate the bearing surfaces with engine oil of a suitable quality.

In replacing, reverse the operations under "Removal."

The main bearings are numbered on one end. The bearing nearest to the radiator is stamped "1," the center bearing "2" and the rear bearing "3." In replacing, have the numbered ends toward the radiator.

In adjusting the main bearings follow the directions in §102.

In assembling and replacing the pistons and connecting rods, follow carefully the directions in §370.

In adjusting the straight connecting rods, follow the directions in §101.

Before replacing the baffle plate and oil pan, check the points enumerated in §370.

After replacing the oil pan refill it with seven quarts of suitable engine oil. Cadillac Engine Oil is recommended.

If after starting the engine it is found that the pressure gauge does not register pressure, stop the engine at once and prime the oil pump. This may be done by disconnecting the oil pipe from the oil pressure regulator and forcing two to three gunfuls of clean engine oil into the regulator. Connect the pipe and tighten the union before starting the engine.

DRIVE SHAFT FOR WATER PUMPS

377 *Removal*

Remove the splash pan under the engine.

Drain the cooling system. (§172)

Remove the oil pan and the baffle plate. (§354).

Determine the amount of clearance between the teeth of the gear on the drive shaft for the water pumps and those of the gears with which it meshes. (§378).

Remove the right hand water pump. (§360).

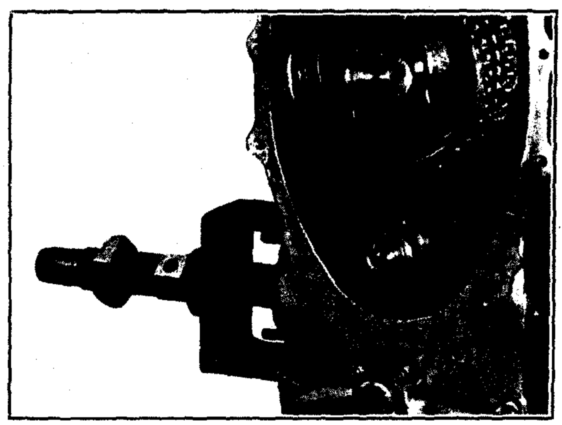

Fig. 72—Removing Water Pump Drive Shaft Bearing

Remove the packing nut. Place the Cadillac puller, tool No. 66869, in position as shown in Fig. 72, screwing the threaded portion well into the bearing to be removed and screw up and tighten the large nut. The right hand bushing has a left hand thread while the left hand bushing has a right hand thread. There is a right hand thread on one end of the tool and a left hand thread on the other for the removal of either bushing.

Remove the drive shaft with gear and thrust bearing.

The remaining drive shaft bushing can be removed by use of the same tool, No. 66869, if desired, after removing the remaining water pump.

378 Inspection

Clean all parts.

Inspection of Drive Shaft, Gear, Bushings and Thrust Bearing—The drive shaft and the bushings in which it rotates should be free from scores. There should be no more than .006 inch clearance between the shaft and bushings.

Inspect the balls of the thrust bearing and the surfaces of the thrust washers. The balls should be free from pits and in good condition. The surfaces of the washers should be free from pits and worn no more than .006 inch where the balls contact with them. If these parts are worn or pitted they may be reversed and used again.

There should be no more than .018 inch clearance between the teeth of the gear and those of the gears with which it meshes. If it is necessary to remove the gear from the shaft do so with a press. Be sure in pressing on the gear that it stands exactly in the center of the shaft.

Inspection of Other Parts—Examine the packing in the glands of the water pumps before replacing the pumps. (§175)

379 Replacement

In replacing, reverse the operations under "Removal."

Be sure that the spiral grooves on the ends of the drive shaft lead in the correct direction. The right-hand thread should be on the right-hand side and the left-hand thread on the left-hand side. On some cars only the left end of the shaft is grooved.

With the bushings in place the drive shaft should have no less than .002 inch end play and no more than .005 inch.

CAM SLIDES AND GUIDES

380 Removal

Remove the valve over the cam slide and guide to be removed. (§383). The cam slide may then be lifted out.

Remove the clamp which holds the guide for the cam slide and remove the guide.

The guide may be removed by the use of Cadillac puller, tool No. 72394, as shown in Fig. 73.

Insert the part "A" (Fig. 73) in the cam slide guide, force it to one side of the guide and insert the locking wire "B." With a bar under the hook "C" the guide can be removed.

381 Inspection

INSPECTION OF CAM SLIDE AND GUIDE—There should be no more than .004 inch clearance between a cam slide and the guide in which it operates.

The upper face of the head of the cam slide adjusting screw should show very little wear.

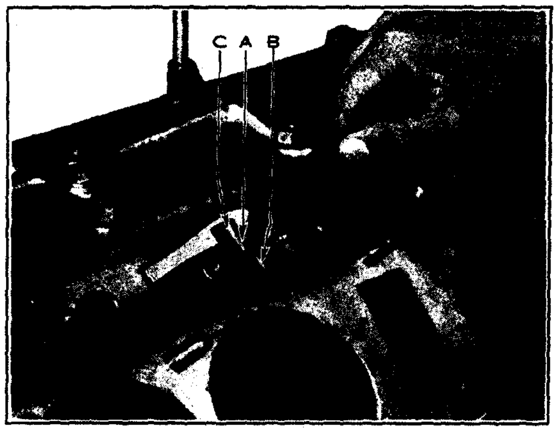

Fig. 73—Removing Cam Slide Guide

INSPECTION OF OTHER PARTS—Inspect the valves in accordance with directions in this book. (§384).

382 Replacement

In replacing, reverse operations under "Removal."

Adjust the cam slides in accordance with the directions in §§115-118.

VALVES AND VALVE SPRINGS

383 Removal

Remove the cylinder head. (§336).

Remove the carburetor. (§428).

Remove the valve cover plate.

Force up washer "A," (Fig. 13), by use of Cadillac valve lifter, tool No. 65201, then remove the split collar "F." Let the washer "A" down carefully and both sides evenly.

If four valves next to each other are to be removed at one time, all four washers "A" may be lifted together by using tool No. 85783.

384 Inspection

Clean all parts.

INSPECTION OF VALVES—Clean the valve seat in the cylinder block, and the bushing in which the valve stem operates. Tool No. 84924 can be used advantageously in cleaning valve stem bushings. Any carbon on the valve stem, or in the bushing should be removed.

There should be no more than .004 inch clearance between a valve stem and the valve stem bushing.

Inspect the valve seat in the cylinder block and the surface of the valve which bears on the seat. If the valve or valve seat is pitted or if it appears that the valve has been leaking it should be reground. (§119).

Inspect the valve spring. The conical valve springs used on later V-63 engines should have a free length of approximately $4\frac{1}{8}$ inches and a minimum pressure of 72 pounds when compressed to 3 inches. The cylindrical valve springs used on Type 61 and early V-63 engines should have a minimum free length of $4\frac{3}{4}$ inches and a minimum pressure of 90 pounds when compressed to 3 inches.

385 *Replacement*

In replacing, reverse the operations under "Removal."

Adjustment of the cam slides should be checked up after replacement of valves is made. (§§115-118).

FLYWHEEL

386 *Removal*

Remove the transmission. (§479).

If the flywheel has the first type timing marks (§113), remove the flywheel pointer.

Remove the six seven-sixteenths inch nuts which hold the flywheel to the crankshaft, and remove the dowel pin clips, felt washer retainer, steel washer, felt washer and two paper gaskets. (On Type 61 engines the dowel pin clips are held by two $\frac{5}{16}$-inch cap crews which must be removed.)

Remove the dowel pins. This may be done by placing spring washers over them large enough to permit the pins to be pulled through them and screwing on and tightening two of the nuts which hold the flywheel.

The flywheel can now be removed.

387 *Inspection*

INSPECTION OF FLYWHEEL—Make an inspection of the teeth on the flywheel. If the teeth are burred somewhat on the ends, smooth them up with a mill file.

INSPECTION OF OTHER PARTS—Clean the annular ball bearing at the rear end of the crankshaft. Inspect this bearing by rotating the inner race and by noting the amount of end play in the race. The race should rotate smoothly and quietly and should have no more than .015 inch end play. The bearing is a close fit in the crankshaft and may be removed either with a suitable puller, or by suitably bent pries.

388 *Replacement*

Before replacing the felt washer soak it in lubricating oil of a good quality, and fill the space between the races of the bearing with No. 2 cup grease or Cadillac Distributer Grease.

Have the piston in No. 1 cylinder on firing center before replacing the flywheel. Then replace the flywheel, having the 1-5 center mark at the top if the flywheel has the first type marks, or opposite the pointer, if the flywheel marks are of the second type.

If the flywheel pointer was removed (§386), replace and adjust it as directed in §113a.

On later V-63 engines, if the clutch driving ring is removed from the flywheel, care must be taken to replace it in its original position relative to the flywheel, because the ring and flywheel are balanced as a unit. The zero mark on the rim of the clutch driving ring must be opposite the corresponding mark on the flywheel. If there are no zero marks on the ring and flywheel, these parts were balanced individually as was the practice on previous cars.

ELECTRICAL SYSTEM

CIRCUIT BREAKERS

389 Inspection

The lock-out circuit breaker protects the circuits to the horn, inspection lamp, tonneau-lamp, cigar lighter, stop light and backing light. It should remain closed under a load of 25 amperes, but should open and remain open under a load of 30 amperes or more. The vibrating breaker protecting circuits to the remainder of the lamps, should remain closed under a 25 ampere load, but should vibrate under a load of 30 amperes or more.

The lock-out circuit breaker can be tested by disconnecting the feed wire to the portable lamp, connecting it to one wire from a rheostat, and connecting the other wire from the rheostat to the frame of the car. The vibrating circuit breaker can be tested by disconnecting one of the headlamp wires, connecting it to one wire from a rehostat, connecting the other wire from the rheostat to the frame of the car and turning on the headlamps at the switch.

Gradually decrease the resistance of the rheostat watching the ammeter on the instrument board to determine the amount of current flowing when the circuit breaker operates.

Do not increase the current to more than 30 amperes. This is the limit of the capacity of the ammeter and a heavier load may injure it.

If either circuit breaker operates under a load of less than 25 amperes or refuses to operate under a load of 30 amperes, it is recommended that it be replaced and returned to the factory for adjustment.

390 Removal

Disconnect at the storage battery one of the large cables and block it up to prevent it touching the terminal of the storage battery.

Mark the four wires on the circuit breakers so that they may be replaced as originally assembled. Loosen the nuts on the four terminals and remove the wires.

Remove the bolts which hold the circuit breakers to the dash.

391 Replacement

In replacing the circuit breakers make sure that the four wires are replaced as originally assembled, that the terminals on the wires and on the circuit breakers are clean and that all connections are well tightened.

MOTOR GENERATOR

392 *Testing the Motor Generator.* (*On Car.*)

Test the generator field windings and the generator armature windings for short circuit, open circuit or ground by turning on ignition and observing the operation of the armature. If there is no short circuit, open circuit or ground in the generator field windings, the armature will rotate at between 175 and 300 revolutions per minute. The speed

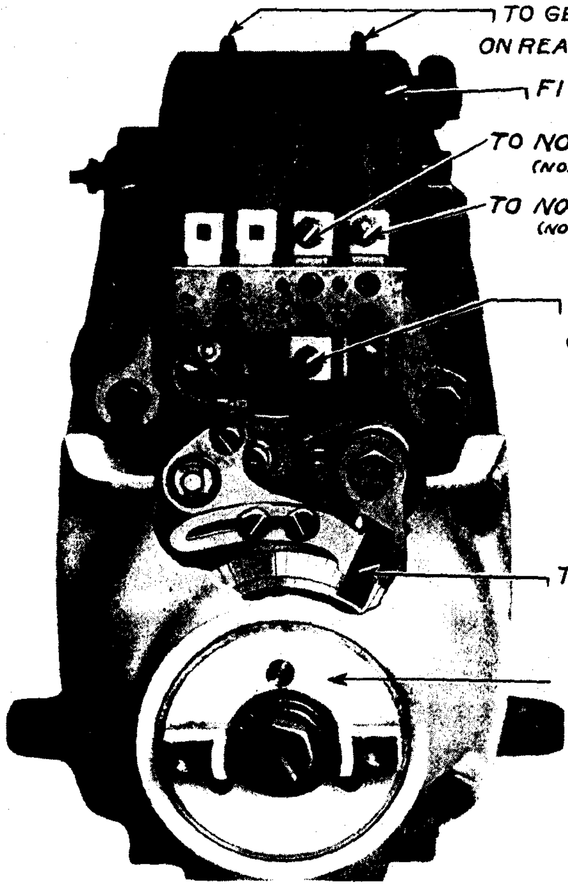

Fig. 74—Motor Generator, Front View

at which the armature should rotate depends upon the state of charge of the storage battery. If there is a short circuit, open circuit, or ground in the generator armature windings, the armature will fail to rotate or, if it rotates, will do so with a jerky motion.

Test the motor field circuit and the motor armature circuit by turning on ignition, pushing down on the starter pedal and immediately switching off the ignition. Before making this test be sure that the battery is in a charged condition, the motor commutator is clean, the brushes bear properly on the commutator, and that all electrical connections are tight. If the engine turns freely, the motor generator should crank it over at approximately 90 revolutions per minute.

To determine if either generator bearing is noisy, remove the generator drive shaft, and turn on ignition.

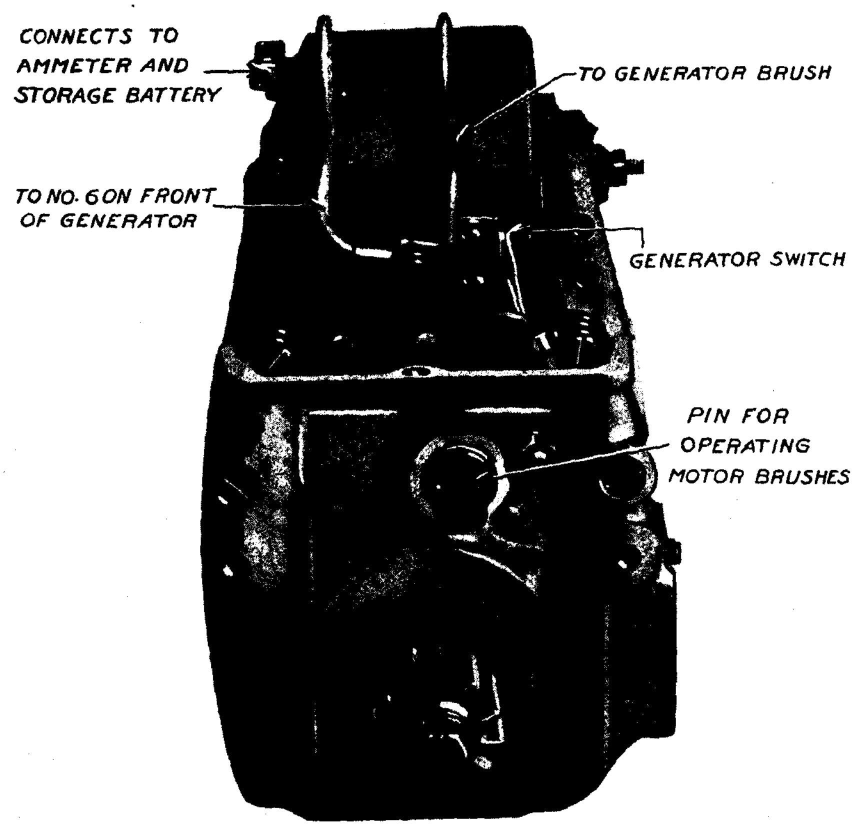

Fig. 75—Motor Generator, Rear View.

393 *Testing the Motor Generator.* (*Off Car.*)

If the motor generator is not on the car the foregoing tests may be made by connecting one wire from a charged six-volt storage battery to No. 4 terminal on the motor generator (Figs. 24 and 25), connecting together terminals No. 3 and No. 4 and connecting the other wire from the battery to the frame of the generator. Test the generator windings with the motor brushes lifted. Test the motor windings with the motor brushes against the commutator and the generator switch open. Operated as a motor, the armature should rotate at high speed.

394 Removal and Disassembly of Driving Clutch

The driving clutch may be removed without removing the generator from the engine.

Remove the carburetor. (§428).

Remove the generator drive shaft.

Remove the large cap screw in the end of the armature shaft and with Cadillac puller, No. 83227, remove the complete clutch.

The clutch may be disassembled by removing the locking wire in the space "B" (Fig. 76.) The ends of the wire come together at a recess "A." The wire can be removed by picking out one end of it with a sharp pointed instrument and then removing the entire wire. In replacing the wire make sure that the ends come together at the recess "A."

395 Removal of Generator Brushes

The brushes which bear on the generator commutator may be removed without removing the generator from the car. To remove these brushes proceed as follows:

Remove the large cable from the storage battery and block it up with a piece of dry wood to prevent it touching the terminal of the battery.

Disconnect the copper strip running from the field coil to the rear of the shunt field connection terminal. (See Fig. 74.)

Disconnect, at the terminal on the field coil, the wire from the third brush arm.

Remove the two cap screws holding the terminal bracket and the brush arm bracket in place, and remove the terminal bracket and brush arm bracket with brushes.

396 Removal of Motor Brushes

To remove the brushes which bear on the motor commutator, remove the generator in accordance with the directions in §397 and remove the rear end housing as directed in §399. The remaining motor brush can then be removed.

397 Removal of Motor Generator

Disconnect from the storage battery one of the large cables and block it up with a dry piece of wood to prevent it touching the terminal of the battery.

Remove the top cover plate from the motor generator and disconnect the large cable and the three small wires.

Remove the carburetor. (§428).

Remove the generator drive shaft.

Remove the two filister-head screws holding the motor generator to the starter gear housing.

Remove the three large cap screws which hold the motor generator to the rocker arm plate and remove the motor generator. Exercise care in removing not to drop the brush control pin. (See Fig. 75.)

398 Removal of Front Bearing

Remove the motor generator. (§397).

Remove the driving clutch. (§394).

Remove the four cap screws holding the aluminum front housing in place and remove the housing.

To remove the ball bearing from the housing, first remove the four machine screws which hold the bearing retainer in place, then tap out the bearing.

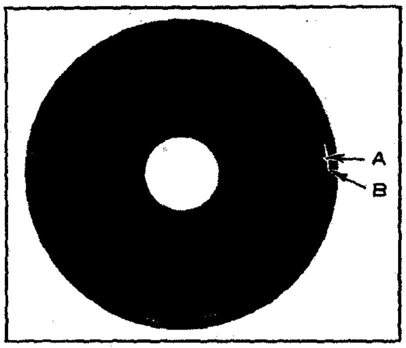

Fig. 76—Motor Generator Driving Clutch, Rear View

399 Removal of Rear Bearing

Remove the motor generator as directed in §397.

Remove the left-hand motor brush arm. This is the one which is not attached to the rear end housing.

Remove the screw and lock washer from the rear end of the armature shaft and pull off the pinion and large spacer.

Remove the four cap screws holding the rear end housing in place, and remove the housing.

Remove the four small machine screws which hold the bearing retainer to the housing and remove the retainer.

The mounting for the bearing can be removed by tapping it out through the two small holes provided.

400 Removal of Field Coils

Remove the motor generator in accordance with the directions in §397.

Remove the rear end housing with armature as directed in §399.

Remove the front housing with bearing.

Remove the terminal bracket and the brush arm brackets.

The coils can now be removed after taking out the small filister head screw in the right side of the generator frame and the long bolt which passes through the coils and holds the two sides of the frame together.

401 Inspection

Examine the commutators. Burnt or blackened segments of the generator commutator indicate high mica, a short circuit, ground, open circuit or insufficient spring tension on the brushes. If the commutators require it, place the armature between lathe centers and turn them down. Turn off no more than is necessary to clean up the commutators. If the mica between the segments of the generator commutator is above the surface against which the brushes press, or $\frac{1}{64}$ inch or less below, cut the mica down so that it is $\frac{1}{32}$ inch below the surface. Use a hacksaw blade ground off on the sides of the teeth so that it will cut a slot between the segments, very slightly wider than the mica. Remove the sharp edges on the segments with a fine three-cornered file but do no more than take off the sharp edges.

Examine the insulators on the terminal board, particularly the one which holds terminals Nos. 4 and 6. (Fig. 74).

Inspect the ball bearings. The races of the ball bearings should rotate smoothly and quietly and should have no more than .005 inch radial play and no more than .015 inch end-play. (Some Type 61 motor generators have a roller bearing at the rear end. The roller bearings should have no more than .005 inch radial play. The rolls should be free from pits and not chipped on the ends.)

The generator and motor brushes should have a good bearing on the commutators; if not, they should be refitted. (§134).

The tension of the coil springs on the brush arms should be sufficient to cause a brush pressure of between twenty-five and thirty ounces on the generator commutator, and between thirty and thirty-six ounces on the motor commutator. The pressure between the third brush and the generator commutator should be sixteen to twenty ounces.

402 Replacement

Make certain that all connections are clean and well tightened.

Before replacing either bearing, fill it well with light cup grease.

The third brush should be so adjusted that the maximum output of the generator is eighteen amperes, which is equivalent to an ammeter reading of sixteen amperes when current for ignition is deducted. (§158).

DISTRIBUTOR HEAD

403 Removal

Remove the aluminum cap covering the distributor head. The cap may be removed by lifting it straight up after the two small screws are removed which hold each conduit bracket to the cap and the bail over the top of the cap is pushed to one side.

Press back the spring clamps on the side of the distributor head.

Remove the distributor head by lifting it straight up and then to one side. Be careful not to catch the rotor button, and thus injure the rotor button spring.

If it is desired to remove the distributor head from the high tension wires, unscrew the nine terminals.

404 Inspection

INSPECTION OF DISTRIBUTOR HEAD—Clean the head with gasoline and wipe it off with a clean cloth.

The track against which the rotor button presses should be smooth and clean. Clean with a piece of cloth moistened with vaseline, then polish with a dry cloth. Do not use sand-paper, emery cloth, or anything of that nature.

Make sure that the contact in the center of the head works freely in its guide.

INSPECTION OF OTHER PARTS—Inspect the rotor button and rotor button spring. (§407).

405 Replacement

In replacing, reverse the operations under "Removal."

DISTRIBUTOR ROTOR

406 Removal

Remove the distributor head. (§403).

Remove the rotor by lifting it straight up. If the rotor sticks on the shaft it may be forced off by the use of two small screw-drivers. The rotor is recessed on the under side at two points to receive screw-drivers in removing. Lift both sides evenly and carefully.

407 Inspection

INSPECTION OF ROTOR—The upper face of the rotor button should be smooth and clean. If it is necessary to clean it use an oil stone.

Inspect the rotor spring for tension. In replacing the spring make sure that it bottoms in the hole which receives it, otherwise the resulting increased pressure will cause cutting in the distributor head. Under a pressure of between five and ten ounces the rotor button flange should just rest on the rotor.

INSPECTION OF OTHER PARTS—Inspect the distributor head. (§404).

Inspect the timer contact points. If they are burned or pitted or out of adjustment, see §147.

408 Replacement

To replace the rotor, reverse the operations under "Removal," first making sure that the shaft over which the rotor sets, as well as the hole in the rotor which receives the shaft, is clean.

Make sure that the cam which operates the contact arms is down tight against the shoulder on which it rests. If it is not, the rotor will be raised higher than it should be with the possibility of damaging the distributor head.

If the rotor fits tightly, tap it lightly at the center with the wooden end of a screw-driver.

DISTRIBUTOR AND TIMER

409 Removal

Remove the carburetor. (§428).

Remove the generator shaft "A" (Figs. 61 and 63).

Remove the coupling "C" from the rear end of the fanshaft. To do so first remove the large cap screw "B," then remove the coupling with Cadillac puller, No. 71955, as shown in Fig. 77.

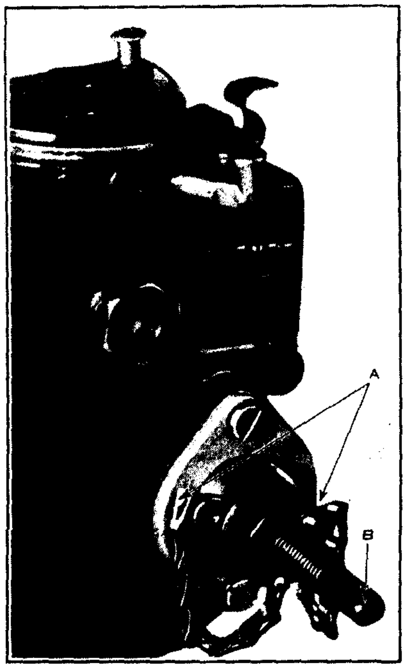

Fig. 77—Removing Fan Shaft Coupling

Remove the two cap screws which hold the brackets of the left-hand high tension conduit. (On Type 61 cars the high tension conduit brackets are held by cylinder head nuts.) Loosen the small screws in the brackets which hold the right-hand conduit. Remove the distributor head and the low tension wire and lift the left-hand conduit with wires and head over to the right side.

Remove the distributor rotor. This may be done by lifting it straight up. If the rotor sticks on the shaft, force it off with two small screw drivers. The rotor is recessed on the under side at two points to receive drivers in removing. Lift both sides of the rotor evenly and lift it carefully.

Remove the dowel pin "X" (Fig. 78) by tapping it out from the front.

Remove the spark control rod.

Remove the two bolts, nut and two cap screws which hold the distributor and timer to the fanshaft housing.

The distributor and timer may now be removed by tapping it lightly. As the dowel pin "Y" is still in position, care must be exercised to remove both sides evenly.

410 *Removal of Lower Bearing*

Remove the rotor.

Remove the nut "A" (Fig. 22), the resistance unit, and the condenser "D."

Remove the oiler "W."

Remove the screws "K" "L" and "M." With a screw driver or a knife blade start the contact-arm spring out of the recess in the housing. Lift out the segment plate "N."

Remove the headless screw in the yoke "F" (Fig. 78) and remove the yoke and shaft to which it is attached.

Remove the plate "B."

Remove the locking washer "H."

Remove the distributor shaft complete with ball bearings by lifting it out through the top of the housing.

The bushing "C" can now be removed by tapping it out carefully.

411 *Removal of Upper (Ball) Bearing*

Remove the distributor shaft as directed in §410.

Loosen the lock screw "I" and remove the cam "J" (Figs. 22 and 78).

Remove the locking washer and lift out the two steel washers and the felt washer.

Remove the ball bearing by tapping it off carefully.

412 *Removal of Gear*

Remove the distributor shaft complete in accordance with the directions in §410.

Remove the screw "P" (Fig. 78) and tap out the straight pin "R"

Remove the locking washer and the collar "T."

Remove the locking washer held to the spiral gear "O" by the screws "V". The gear with sleeve can now be removed from the shaft. The gear is held to the sleeve by a taper pin.

413 *Removal of Spring*

Remove the distributor shaft as directed in §410.

Remove the gear as directed in §412.

Remove the pin "N" (Fig. 78).

Remove the two large headed screws holding the automatic advance weight.

Remove the sleeve below the spring.

Remove the spring.

414 Inspection

Check up the amount of side play in the annular ball bearing "A," also in the plain bearing "C." The side play in the ball bearing should not exceed .003 inch. The side play in the plain bearing should not exceed .004 inch.

The ball bearing should rotate smoothly and quietly.

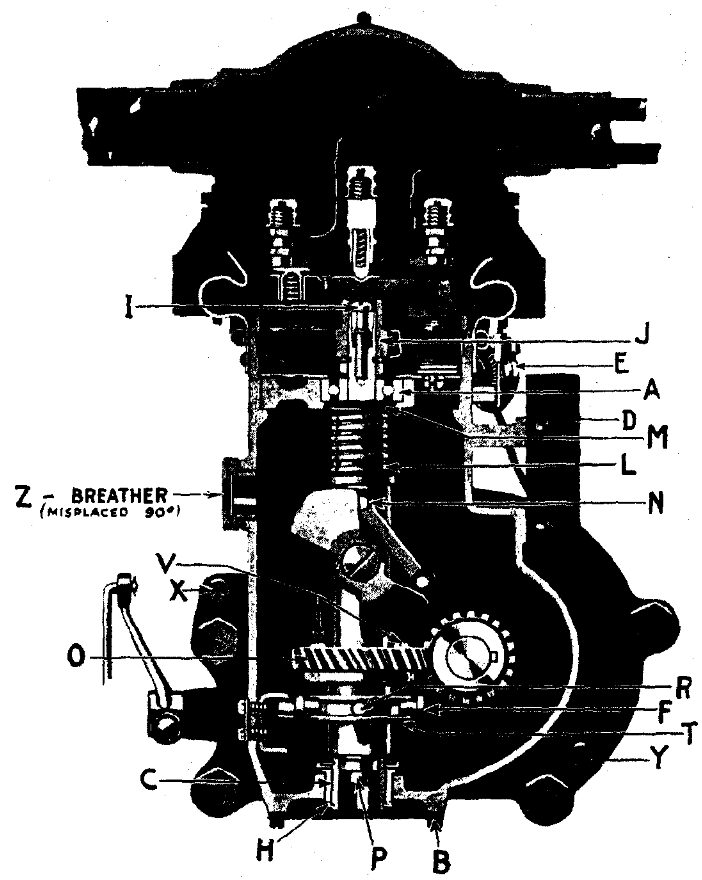

Fig. 78—Distributor and Timer, Sectional View.

Examine the spring. The dimensions to which the spring should compress under various loads are given in the following table:

Length of Spring	Load	Length of Spring	Load
$1\frac{3}{16}$	0	$\frac{11}{16}$	3 lbs. 15 oz.
$1\frac{1}{16}$	1 lb.	$\frac{9}{16}$	5 lbs. 1 oz.
$\frac{15}{16}$	1 lb. 13½ oz.	$\frac{7}{16}$	6 lbs. 7 oz.
$\frac{13}{16}$	2 lbs. 14 oz.		

Distributors stamped with a date previous to July 8, 1922, or distributors installed on engines numbered 61-W-1 to 61-W-88 inclusive were originally assembled with a somewhat lighter spring. Any springs on these distributors testing below the above specifications should be replaced.

Examine the teeth of the gear "O" and those of the gear with which it meshes.

Examine the timer contact points. They should be clean, fit squarely against each other and be in proper adjustment. (§147).

The tension of the springs on the contact arms should be great enough to cause a pressure of eighteen to twenty ounces between the contact points.

INSPECTION OF OTHER PARTS—Inspect the distributor rotor. (§407).

Inspect the distributor head. (§404).

415 Replacement

To replace, reverse the operations under "Removal," being careful to replace in their proper positions all the small insulating bushings and washers. After replacing the segment plate "N" (Fig. 22,) and before tightening the screws "M," "L" and "K" and the nut "A", adjust the segment plate as accurately as possible by the eye, so that the contact arms are directly opposite lobes of the cam "J" at the same time. Then test for simultaneous opening of the contact points (§147) and adjust the segment plate in accordance with the directions in §148.

After replacing the distributor and timer remove the breather "Z" (Fig. 78.) and place four ounces of Cadillac Distributor Grease in the housing.

Retime the ignition in accordance with the directions in §149.

Exercise care, in replacing the distributor head, not to catch the rotor button on the side of it, also to make sure that the head fits down evenly and that it is locked in place.

HEADLAMPS

416 Removal

REMOVAL OF ONE HEADLAMP: Disconnect the head lamp wire by pushing up the connector "A" (Fig. 79) (which has a bayonet lock), turning it slightly counter-clockwise and then pulling it out.

Disconnect, at its rear end, the rod "Q" from the lamp to the cross shaft on the rear of the radiator. (On Type 61 cars this rod can be disconnected at the lamp.)

Unscrew the nut on the lamp support under the cross tube and lift up the lamp.

REMOVAL OF CROSS TUBE WITH LAMP: If both lamps and the cross tube are to be removed, this may be done by removing one lamp from the tube as directed above, disconnecting the wire and rod to the other lamp, and removing the two cap screws which fasten each end of the cross tube to the front fender supports. The end of the cross tube from which the lamp was removed can then be telescoped sufficiently to permit removal of the cross tube without interference with the fenders. (On Type 61 cars it is not necessary to remove either head lamp from the cross tube in order to remove the cross tube.)

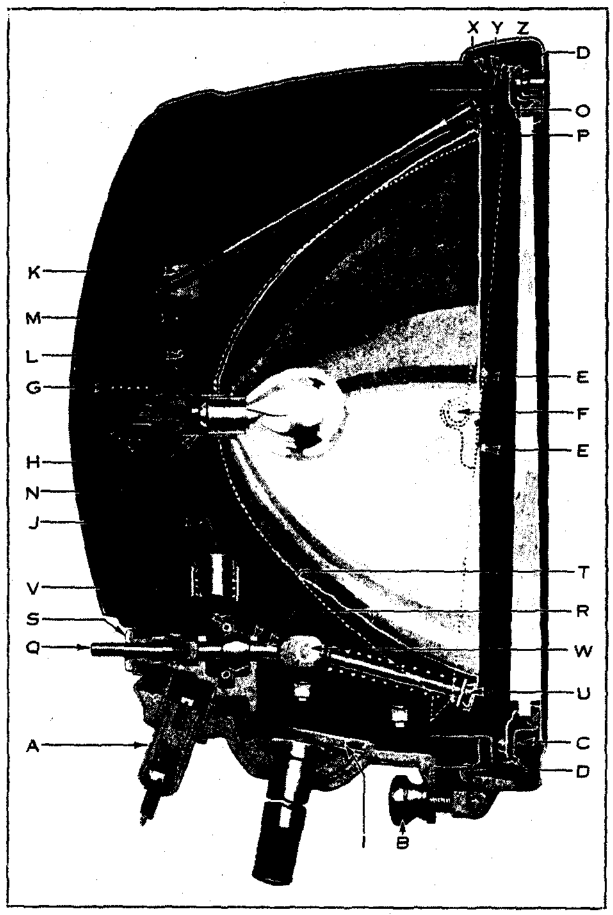

Fig. 79—Sectional View of V-63 Headlamp

417 Disassembly

Loosen the nut "B" on the door catch, permitting the catch to drop out of the slot in the lamp.

Remove the door by pulling it forward at the bottom and then lifting it straight up.

To remove the lens, remove the six small screws "C" which hold the lens retainer "D" to the door and remove the retainer. The lens can then be removed.

To remove the headlamp reflector, proceed as follows:

Remove the bulb.

Remove the two screws "E" which fasten the reflector to the trunnion "F" on each side.

Remove the two screws on each side of the tilting adjustment "U" which is near the bottom of the reflector.

The reflector can then be pulled out far enough to reach the knurled retainer "G" at the rear of the reflector. Unscrew the retainer "G" and remove the spring "H."

The reflector with focus adjustment can then be entirely removed.

To disassemble the focusing mechanism from the reflector, remove the pin "L," raise the lever "M," and remove the sleeve "N." The lever "M" can then be removed by unscrewing the trunnion "K" from the focus adjusting rod "O" To remove the focus adjusting rod "O" from the reflector, spread the four sections of the split sleeve "P," permitting the rod to pass through the sleeve.

Remove the connecting wire "J" by unscrewing the connector at the lower end from the lamp.

To disassemble the tilting mechanism, proceed as follows:

Remove the pull rod "Q" by unscrewing it from the threaded end of the slide "R."

Remove the nickel-plated sleeve screw "S," and the felt washer between the head of the screw and the lamp.

Remove the four screws which hold the cap "T" and remove the cap. The slide "R" with the spring "V" and its retainers can then be removed.

To disassemble the tilting adjusting rod "U" from the slide "R," unscrew it from the trunnion "W."

The lamp support may be removed after taking out the S-shaped retaining spring "I."

The trunnions "F" on which the reflector pivots can be removed by unscrewing them from the lamp.

418 Inspection

Inspect the reflector, and clean it with rouge as directed in §142, or if necessary have it resilvered.

Examine the headlamp shell for dents.

Test the focus adjusting mechanism, making sure that turning the rod "O" moves the bulb back and forth.

Make sure that the wire "J" is securely fastened in the connectors at its ends.

Inspect the felt "X." If it is necessary to remove it, this may be done after removing the eight screws "Z" and the ring "Y".

Test the operation of the tilting mechanism, making sure that the spring "V" has sufficient tension, and that the cone on the slide "R" is not worn too much to give positive locking of the slide in the extreme forward and back positions.

Inspect the reflector trunnions "F," and see that the spring washers have enough tension to prevent rattle.

419 Replacement

In replacing, reverse the operations under "Removal" and "Disassembly."

In assembling the tilting mechanism, the wearing surfaces should be lubricated with light cup grease.

Before the door is replaced, the tilting and focusing adjustments should be made in accordance with the directions in §§140, 141.

PORTABLE LAMP

420 Removal

Disconnect the portable lamp feed wire from the terminal on the reel housing.

Unscrew from the lamp socket the connector on the end of the wire.

Remove the four screws holding the reel housing to the dash and remove the reel housing.

421 Inspection

Inspect the lamp cord and switch.

If the cord fails to return the lamp to its socket, remove the three nuts and screws holding the cover to the reel housing and remove the cover. Wind the cord one or two additional turns around the reel. Do not wind the cord around the reel any more than just enough to cause the lamp to return properly to its socket.

422 Replacement

To replace, reverse the operations under "Removal," being careful to replace in their proper places all nuts and screws.

CIGAR LIGHTER

423 Removal

Remove the wire leading to one of the terminals.

Remove the round nut and washer from the handle tube and remove cigar lighter.

To remove the heating unit remove the ash guard. The unit can then be removed by turning it in the socket as is done with a lamp bulb.

424 Replacement

To replace, reverse the operations under "Removal."

The tube can then be pulled out. Before putting in a new tube, tin it its entire length. After the tube is in place and the fins are lined up, solder the tube to the fins, using a blow torch. With a soldering iron, solder the ends to the headers.

Whenever radiator tanks are removed for any purpose, it is a good plan to test all of the tubes. Test each tube separately by plugging one end and forcing air under approximately fifteen pounds pressure into the open end, while the radiator is immersed in water.

Inspect the radiator fins. They should be parallel to each other and equally distant from each other. To insure maximum radiator efficiency, each fin must be soldered to each tube.

Inspect the radiator cap gaskets.

427 Replacement

Before replacing radiator, flush it out with water. In replacing, reverse the operations under "Removal."

Unless the radiator is properly lined up the hood will not fit properly. The position of the radiator may be adjusted as directed in §177.

GASOLINE SYSTEM

CARBURETOR

428 Removal

Relieve the pressure in the gasoline system by removing the gasoline tank filler cap.

Disconnect the gasoline feed pipe at the carburetor.

Loosen the clamp screw holding the drain pocket under the carburetor and force the pocket down.

Remove the carburetor control rods at the carburetor.

Remove the two cap screws which hold the carburetor to the intake manifold and remove the carburetor.

429 Disassembly

Remove the carburetor bowl. To do so remove the nut "A" (Fig. 80.)

Remove gasket "B."

The cork float "H" can be removed after the two hinge pins "D" and "E" (Fig. 38) are pulled out. (The carburetors on some Type 61 cars have only one hinge pin, "D" (Fig. 80.)

430 Inspection

Inspect the face of the carburetor body which bolts against the intake manifold. This face must be in good condition and perfectly flat to insure against air leaks when the carburetor is bolted in place. The throttle, "I" must move freely from the open to the closed position.

When the disc is squarely across the mixing chamber the sum of clearances on opposite sides of the disc should be no more than .002 inch. Greater clearance will make it impossible to throttle the engine down to the recommended speed of 300 R. P. M. Make sure that the disc is not bent and that the small screw holding it in place is well tightened.

End play in the throttle shaft should not exceed .004 inch. Clearance between the throttle shaft and the bronze bushings in which it operates should not exceed .010 inch.

The shaft of the automatic throttle "J" (Figs. 39 and 80) must work freely in its bearings. Test this by rotating the shaft approximately 180 degrees from the normal position and allowing it to return slowly. If there is any tendency of the shaft to stick, remove it in the following manner and clean the bearings. Remove the two small screws holding the small clamp plate "K" at the side of the carburetor body. Remove the small screw holding the throttle disc. Remove the shaft, being careful not to damage the spring.

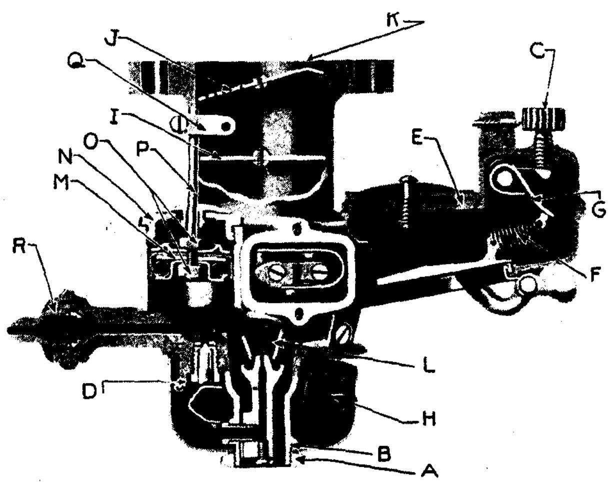

Fig. 80—Sectional View of Type 61 Carburetor, Single Thermostat Type

After making sure that the shaft of the automatic throttle "J" works freely in its bearings check up the tension of the spring on the shaft. (§189).

Examine the strangle tube "L" to see that it is firmly in place. Examine the throttle pump plunger "M" by removing the throttle pump cap "N." The leather should have a good seat and the nuts "O" should be tight on throttle pump rod "P." The rod "P" should be screwed into the clamp "Q" to the full extent of the thread on the rod or so that the plunger leather does not touch the bottom of well when the throttle is in the wide open position. The throttle pump plunger "M" should work freely the entire length of the pump well with leather resting firmly against the side wall.

Remove and disassemble the carburetor strainer by removing the screw "C" (Fig. 35) and the cap "B." Clean and inspect the strainer body and the three gauze discs. In assembling the strainer place the two discs with fine mesh gauze in first with the rolled edges out. The coarse mesh disc is the outer one and should have the rolled edge towards the other discs.

(The strainer on early Type 61 carburetors (Fig. 80) can be removed for inspection and cleaning by unscrewing the nut which holds the inlet nipple to the carburetor.)

The clip "D" (Fig. 35) must be adjusted to insure pinching the head of the inlet valve with enough tension to hold the clip on the float lever without interference with the float movement.

POWER AIR COMPRESSOR IN THE GASOLINE SYSTEM

431 Removal

Disconnect the air pipe from the compressor by unscrewing the union.

Remove the two one-fourth inch nuts and washers and remove the compressor body.

Crank the engine over until the compressor piston is at the top of its stroke.

Remove the piston with connecting rod by sliding the connecting rod forward, then upward.

432 Inspection

Clean all parts and with a cloth wipe out the cylinder and wipe off the piston.

The cylinder and piston should be free from scores. There should be no more than .003 inch clearance between these parts.

There should be no more than .002 inch clearance between the piston pin and the piston and no more than .003 inch between the bearing at the lower end of the connecting rod and the eccentric upon which it operates.

Disassemble the check valve on the pump and thoroughly clean the valve and valve seat.

433 Replacement

Wipe out the cylinder, wipe off the piston and lubricate these parts with engine oil of a suitable quality before replacing.

See that the check valve stands in the upright position.

In replacing, reverse the operations under "Removal."

GASOLINE TANK

434 Removal of Gasoline Quantity Gauge

To remove the gasoline gauge, first remove the large nickel plated nut and the glass. The gauge can then be lifted out with a pointed tool inserted in the hole in the dial. Care must be exercised not to injure the cork gaskets.

435 Removal of Tank

Relieve the tank of all air pressure by removing the filler cap.

Remove the drain plug and drain the tank.

Disconnect the air and gasoline pipes from the tank by unscrewing the unions.

Remove the long filler by removing the four screws holding the filler to the tank. (On early Type 61 cars the filler is part of the tank and need not be removed.)

The tank can now be removed after removing the nut at the rear and the cotter pins and the two nuts at the front and pushing the tank forward. In removing the two forward nuts observe the manner in which the washers are placed. These washers must be replaced as originally assembled.

436 Removal of Gasoline Strainer on early Type 61 cars

Remove the gasoline tank. (§435).

Remove the four small cap screws and remove the connection plate with strainer and stand pipe.

437 Inspection

With the gasoline tank removed test it by screwing on and tightening the filler cap, replacing the drain plug, temporarily plugging the nipple from which the gasoline pipe was disconnected, attaching an air hose to the nipple from which the air pipe was disconnected, and with the tank immersed in water turning on an air pressure of approximately six pounds. Do not use a pressure greater than six pounds.

Test the gasoline quantity gauge by draining the gasoline tank, then refilling it with five measured gallons of gasoline. The gauge should indicate five. If it does not, remove it as directed in §434, and slightly bend the float arm.

438 Replacement

In replacing the stand pipe in the gasoline tank be sure that its lower end enters the hole in the support at the bottom of the tank.

In replacing the washers on the forward tank supports make sure that they are replaced as originally assembled. When assembled correctly, a spherical joint is provided at the bottom of each forward support.

Before replacing the connection plate or filler make sure that the gaskets are in good condition.

CLUTCH AND TRANSMISSION

TRANSMISSION CASE

439 Removal

Remove and disassemble the transmission. (§§479, 480).

440 Inspection

Clean all parts removed.

INSPECTION OF TRANSMISSION CASE—Carefully examine the transmission case and inspect all machined surfaces.

INSPECTION OF OTHER PARTS—Before replacing, inspect all parts removed in accordance with directions in this book.

441 Replacement

After inspecting all parts, reassemble and replace the transmission. (§482).

Refill the transmission with two quarts of suitable transmission lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended.

CLUTCH

442 Inspection Without Removal

The amount of wear on the clutch discs may be determined roughly by noting the distance which the ends of the six studs "V" (Fig. 83) project beyond the retainer plate "W." This inspection may be made after removing the floor boards and the hand hole plate "X." If the ends of the studs project more than one-half inch beyond the retainer plate, the clutch discs should be removed and recovered.

443 Removal of Clutch

Remove the transmission. (§479).

Remove the nut "T" and the large lock washer under it, and pull off the clutch. Wrench No. 72817 is for use with nut "T". Puller No. 56667 is for removing the clutch.

444 Removal of Clutch Thrust Bearing

Remove the clutch. (§443).

Remove the retainer which holds the thrust bearing to the clutch spider and remove the bearing. Ordinarily the bearing can be removed by pulling it off by hand.

445 Removal of Clutch Spring

Remove the clutch. (§443).

Place the clutch under an arbor press with the ball thrust bearing up. Place a block of wood over the upper end of the clutch spider and with the arbor press slightly compress the clutch spring.

Remove the nuts from the six long studs "V" (Fig. 83.)

Remove the clutch from the arbor press and remove the clutch spider and clutch spring.

446 Removal of Clutch Discs

Remove the transmission. (§479).

Compress the clutch spring by pushing down on the clutch pedal and place a piece of metal nine-sixteenths inch long between the screw collar which locks the rear annular ball bearing to the clutch connection shaft and the rear face of the clutch spider.

Remove the nuts from the six long studs "V" (Fig. 83) and remove the clutch discs.

447 Inspection

Examine the ball thrust bearing. If the bearing is noisy or feels rough in spinning the races, replace it by a new one.

Be sure that the bearing is filled with suitable lubricant. Cadillac Gun Grease is recommended.

The clutch spring should have a minimum free length of seven and one-half inches and should support a load of from 290 to 310 pounds when compressed to three and one-quarter inches.

Examine the clutch spider. If the spider has no grease throw-off shield "BB" (Fig. 83) riveted to it, one should be installed. To do this, drill and countersink four $\frac{7}{64}$-inch holes in the arms of the spider using the shield as a template. Then rivet the shield securely to the spider, finishing the rivet heads flush on both sides.

Examine the clutch discs. There should be no more than .008 inch clearance between the driven discs and the keys of the clutch hub, and no more than .010 inch clearance between the teeth of the driving discs and the teeth in the clutch ring.

Examine the linings on the discs. If the total thickness of a disc with the two linings is less than five-sixteenths inch, the disc should be recovered. (§193).

Warped clutch discs should be straightened or replaced.

Examine the faces of the driven discs.

The six long studs should be tight in the plate to which they are fastened.

The clutch hub should be a sliding fit on the splines of the clutch connection.

448 Replacement

In replacing, reverse operations under "Removal."

In replacing the discs, make sure that the small reinforcements on the driven discs are on the driving sides of the keys of the clutch hub. Also that the teeth of driving discs line up.

In replacing the nuts on the six long studs, screw them down until their upper faces are just flush with the ends of the studs.

TIRE AIR COMPRESSOR* (KELLOGG)

449 Removal

Remove the floor boards.

Remove the drain plug "Q" (Fig. 83) and drain the transmission.

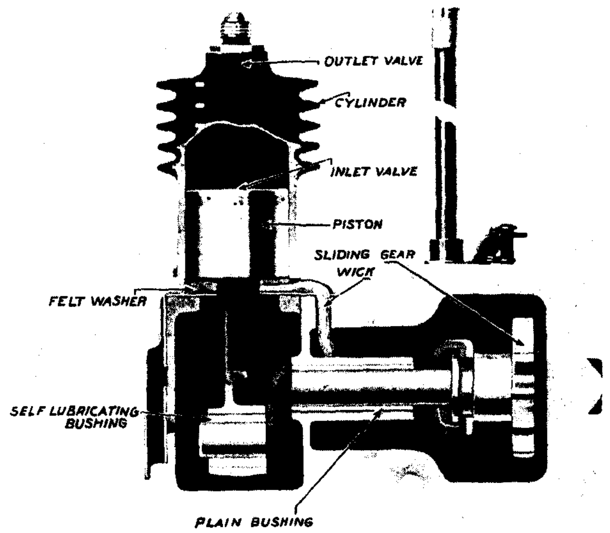

Fig. 81—Kellogg Tire Air Compressor, Sectional View

Remove the copper pipe which connects the compressor and the frame of the car.

Remove the four nuts which hold the body of the compressor to the transmission case and remove the compressor.

450 Disassembly

Remove the plate at front end of the crankcase of the compressor (Fig. 81.)

Remove the nut at the top of the compressor cylinder, also the valve and spring.

*The tire air compressor is standard equipment on Type 61 and early V-63 cars. On later V-63 cars it is special equipment.

Remove the four screws holding the cylinder in place and remove the cylinder.

Remove the two pieces of felt and the felt retainers.

Remove the connecting rod with piston. With the piston at the highest point in its stroke the connecting rod can be removed by sliding it forward.

Remove the locking ring at the rear of the forward crankshaft bearing and pull out the crankshaft.

To remove the shifter yoke from the shaft, drive out the taper pin between these parts. The taper pin can be driven out after removing the small machine screw in the side of the case.

The bushings in which the crankshaft rotates can be removed by tapping them out.

The piston pin can be removed by first pulling out the cotter pin, then lightly tapping it out.

451 Inspection

Clean all parts.

Inspect the cylinder bore. It should be free from scores.

Clearance between the piston and cylinder should not exceed .006 inch.

The clearance between the crankshaft and its bearings should not exceed .004 inch.

The clearance between the crankshaft and the driving gear should not exceed .005 inch.

Inspect the teeth of the driving gear.

The clearance between the piston pin and the piston should not exceed .003 inch.

The clearance between the crank pin bearing and the crank pin should not exceed .004 inch.

Placed on lathe centers, the crankshaft should run true within .002 inch.

Inspect the felts. They should be in good condition and well soaked with engine oil.

Inspect the inlet and outlet valves, regrinding them if necessary.

Inspect the inlet and outlet valve springs. The inlet and outlet valve springs should have a free length of one-half inch. When the valve is opened one-sixteenth inch, the outlet valve spring should show a pressure of seven and one-half ounces, the inlet valve spring four and one-half ounces.

452 *Replacement*

In replacing, reverse the operations under "Removal."

After replacing the drain plug "Q" (Fig. 83) refill the transmission with suitable transmission lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended. Two quarts of lubricant are required.

TIRE AIR COMPRESSOR* (CASSCO)

453 *Removal*

Remove the floor boards.

Remove the drain plug "Q" (Fig. 83) and drain the transmission.

Remove the copper pipe which connects the compressor and the frame of the car.

Remove the four nuts which hold the body of the compressor to the transmission case and remove the compressor.

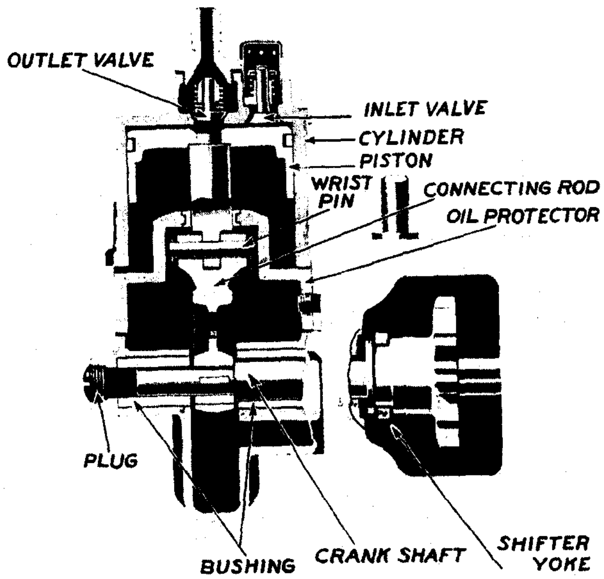

Fig. 82—Cassco Tire Air Compressor, Sectional View

454 *Disassembly*

Remove the ¼ inch plug in end of base. (Fig. 82.)

Remove the end cover.

Insert a punch in pipe plug hole and drive out crankshaft.

*The tire air compressor is standard equipment on Type 61 and early V-63 cars. On later V-63 cars it is special equipment.

Remove the nut at the top of the cylinder, also the valve and spring.

Remove the four nuts and four screws holding the cylinder and oil protector to the base.

Remove the connecting rod with piston and oil protector from cylinder.

Remove the wrist pin.

To remove the shifter yoke from shaft, remove the $\frac{1}{8}$ inch pipe plug and drive out the taper pin between these parts.

The bushings in which the crankshaft rotates can be removed by tapping them out.

455 *Inspection*

Clean all parts.

Inspect the cylinder bore. It should be free from all scores.

Clearance between the piston and cylinder should not exceed .005 inch.

The clearance between crankshaft and its bearings should not exceed .004 inch.

The clearance between the eccentric and connecting rod should not exceed .005 inch.

The clearance between the crankshaft and driving gear should not exceed .005 inch.

The clearance between the piston pin and connecting rod should not exceed .003 inch.

Placed on centers, the crankshaft should run true within .002 inch.

Inspect the inlet and outlet valves, regrinding them if necessary.

The inlet valve spring should have a free length of five-eighths inch. The outlet valve spring should have a free length of three-quarter inch. When the valve is opened one-sixteenth inch, the outlet valve spring should show a pressure of eighteen ounces, the inlet spring ten ounces. The shifter ball spring should have a free length of three-eighths inch.

456 *Replacement*

In replacing reverse the operations under "Removal."

After replacing the drain plug "Q" (Fig. 83) refill the transmission with suitable transmission lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended. Two quarts are required.

CLUTCH CONNECTION AND CLUTCH CONNECTION REAR BEARING

457 *Removal*

Remove the clutch. (§443).

Remove the six cap screws which hold the clutch connection bearing cap in place, and remove the clutch connection "B" (Fig. 83) with bearing.

Remove the locking ring which holds the check nut in place and remove the nut which has a left hand thread. Use Cadillac wrench No. 83224.

Remove the oil throw-off ring.

The bearing can be removed from the shaft by tapping it off.

458 Inspection

Clean all parts removed.

Inspection of the Clutch Connection and Rear Bearing—Examine the clutch connection "B." Placed between lathe centers it should run true within .0025 inch. The bore in which the roller bearing "P" operates should be smooth and free from pits. The faces of the gear teeth should show very little wear and should be free from pits. The clutch hub "Z" should be a light press fit on the splines of the clutch connection.

Inspect the rear bearing on the clutch connection. The bearing should rotate smoothly. There should be no more than .015 inch end play in the races.

Inspection of Other Parts—Examine the roller bearing "P." The rolls should be free from pits and not chipped on the ends.

Examine the ball bearing "D" which supports the forward end of the clutch connection. It should rotate smoothly and quietly and have no more than .015 inch end play. With the clutch connection, main transmission shaft, and roller bearing in place, there should be no more than .004 inch shake between the shaft and the clutch connection.

459 Replacement

In replacing, reverse the operations under "Removal." (See note in §482.)

SHIPPER GEARS

460 Removal of High and Intermediate Shipper Gear

Remove the jackshaft. (§464).

Remove the transmission shaft "L" (Fig. 83). (§476). In pulling out the shaft do not allow the shipper gears "M" and "N" to drop.

The high and intermediate shipper gear "N" can now be removed from the bottom.

461 Removal of Low and Reverse Shipper Gear

Remove the jackshaft. (§464).

Remove the main transmission shaft. (§476). In pulling out the shaft do not allow the shipper gears "M" and "N" to drop.

The low and reverse shipper gear "M" can now be removed from the bottom.

462 Inspection

Clean all parts removed..

Inspection of Gears—The clearance between the sides of the splines of the shaft "L" (Fig. 83) and the sides of the spline ways of the shipper gears should not exceed .004 inch.

The teeth of the gears should show very little wear and be free from pits.

There should be no more than .015 inch between the shifter fork and groove in the gear in which it operates.

Inspection of Other Parts—Inspect the main transmission shaft "L" and its bearings. (§477).

Inspect the jackshaft gears and bearings. (§465).

Inspect the teeth of the clutch connection gear "A" (Fig. 83) and of the reverse gear. The faces of the teeth should show very little wear and be free from pits.

463 Replacement

In replacing, reverse the operations in §§460 and 461. (See note in §482).

Refill the transmission up to the proper level with suitable transmission lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended. Two quarts are required.

JACKSHAFT AND JACKSHAFT GEARS

464 Removal

Remove the plug "Q" (Fig. 83) and drain the transmission.

Remove the bottom cover plate. The plate is held in place by nine five-sixteenth inch nuts.

Determine the amount of end play in the jackshaft. (§465).

Remove the cap "U."

Remove the screw which holds the shaft "J" in place.

Remove the shaft "J." To do so, screw a ½ inch x 12 cap screw into the rear end of the shaft and with the cap screw pull out the shaft. Be careful in removing the shaft that neither the jackshaft, nor the spacer washers drop.

465 Inspection

Clean all parts removed.

Inspection of Jackshaft and Jackshaft Gears—Inspect the teeth of the gears. Gear teeth faces should show but little wear and be free from pits.

Examine the bore of the hub on which the jackshaft gears are forged.

With the roller bearings "I" and the shaft "J" (Fig. 83) in place there should be no more than .004 inch play between the shaft "J" and the jackshaft gears.

The jackshaft gears when in place in the transmission should have no more than .015 inch end play.

Inspection of Other Parts—Inspect the roller bearings "I." The rolls should be free from pits and not chipped at the ends.

Inspect the bearing surfaces of the shaft "J."

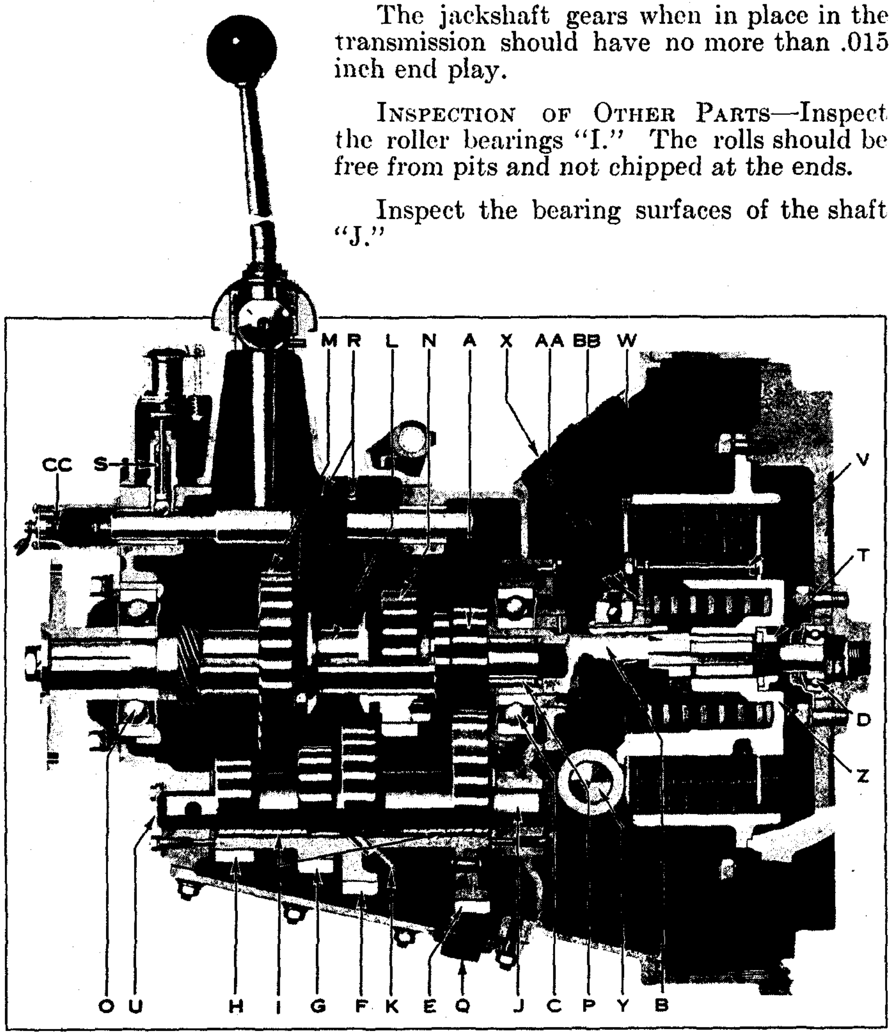

Fig. 83—Clutch and Transmission, Sectional View.

Inspect the teeth of the gears which mesh with teeth of the jackshaft gears. The faces of the teeth should show but little wear and be free from pits.

466 *Replacement*

In replacing, reverse the operations under "Removal." (See note in §482).

After replacing the bottom cover plate and the drain plug, refill the transmission with enough transmission lubricant of suitable quality to bring the level up to the filling hole. This will require approximately two quarts. Cadillac Rear Axle and Transmission Lubricant is recommended.

CONTROL LEVER

467 *Removal*

Remove the ball at the top of the control lever by unscrewing it.

Remove the nut which holds the nickel plated dust cover in place and remove the dust cover.

Remove the large adjusting collar by unscrewing it and remove the felt washer and spring.

The control lever can now be removed by lifting it out. Care must be exercised not to drop the centralizing pin into the transmission.

468 *Inspection*

Inspection of Control Lever—Inspect the ball on the control lever which supports it. If the ball has been injured clean it up with a fine mill file.

Inspection of Other Parts—Inspect the centralizing pin.

Inspect the felt washer and spring.

Inspect the seat in which the ball of the control lever rests.

469 *Replacement*

In replacing, make sure that the centralizing pin is properly in place before replacing the felt washer and screwing down the collar.

REVERSE PINION

470 *Removal*

Remove the drain plug "Q" (Fig. 83) and drain the transmission.

Remove the tire air compressor. (§§449, 453).

Determine the amount of end play in the reverse pinion. (§471).

Remove the set screw which holds the reverse pinion shaft in place. This screw is in the left-hand side of the transmission case.

Remove the reverse pinion, being careful not to drop the spacing washer at the rear end of the pinion.

471 Inspection

With kerosene or gasoline carefully clean all parts.

There should be no more than .004 inch clearance between the bearing in the pinion and the shaft. If it is necessary to replace the bearing press it out and press in the new one. Ream the new bearing to .937 inch to .938 inch after it is in place.

When the gear is in place in the transmission case there should be no more than .015 inch end play.

Inspect the pinion teeth. The faces of the teeth should be free from pits and show very little wear.

472 Replacement

In replacing, reverse the operations under "Removal."

In replacing the pinion have the beveled ends of the teeth forward.

After bolting the tire air compressor in place and replacing the drain plug "Q," refill the transmission case up to the level of the filling plug with transmission lubricant of the proper quality. Cadillac Rear Axle and Transmission Lubricant is recommended. Two quarts of lubricant are required.

SHIFTER FORKS AND SHAFTS

473 Removal

Remove the transmission top cover plate. The plate is held in place by six cap screws.

Remove the rod and spring from the accelerator pedal.

Remove the two plungers "S" (Fig. 83.)

Remove the taper pin "R" in the shifter fork.

The shaft may now be removed by tapping it out through the rear end of the transmission case, at the same time driving out the rear bearing. There is a nine-sixteenth inch ball between the bearings which support the front ends of the shifter fork shafts. The purpose of the ball is to make it impossible to bring both shipper gears into mesh at the same time. Do not allow this ball to drop into the transmission case, and be sure to remove it in case it does.

474 Inspection

Clean all parts removed.

Inspection of Shifter Fork and Shaft—There should be no more than .004 inch clearance between the shaft and the bushings in which it operates.

There should be no more than .015 inch between the shifter fork and the groove in the gear in which it operates.

The shaft placed on lathe centers should run true within .003 inch.

Inspection of Other Parts—The plunger spring should have a free length of one and one-half inches, and when compressed to one and one-eighth inches should support a load of 13 to 16 pounds.

Examine the ball between the shifter shafts.

On later V-63 cars, examine the two plungers in the shifter shafts opposite the lower end of the control lever and see that they work properly.

475 Replacement

In replacing, reverse the operations under "Removal."

MAIN TRANSMISSION SHAFT AND MAIN TRANSMISSION SHAFT REAR BEARING

476 Removal

Remove the floor boards.

Remove the plug "Q" (Fig. 83) and drain the transmission.

Remove the top cover plate. The plate is held in place by six cap screws.

Remove the shield over the forward universal joint. The shield is held in place by two small machine screws.

Remove the eight bolts holding the front universal joint to the flange on the transmission shaft and remove the joint. Be careful in removing the bolts that the joint does not drop and injure the rear joint casing.

Remove the six cap screws directly back of the flange and remove the transmission drive shaft and bearing, taking care not to let the shipper gears drop and be injured.

Remove the large cap screw which holds the flange to the shaft and remove the flange with Cadillac puller No. 83225.

Remove the felt washer, felt washer retainer, steel plate and gasket.

Remove the oil throw-off ring.

The bearing "O" (Fig. 83) can now be removed from the shaft by tapping it off.

477 Inspection

Clean all parts removed.

Inspection of Shaft and Ball Bearings—The main transmission shaft placed on lathe centers should run out of true no more than .0025 inch.

There should be no more than .004 inch clearance between the sides of the splines on the shaft and the sides of the spline ways in the shipper gears.

The large annular ball bearing should rotate smoothly and quietly and should have no more than .015 inch end play.

There should be no more than .004 inch shake between the front end of the main transmission shaft and the clutch connection when these parts are in place with the roller bearing.

INSPECTION OF OTHER PARTS—Inspect the roller bearing. It should be free from pits and chips.

Examine the teeth of the gears. These should show very little wear and be free from pits.

Examine the felt washer. If it is worn replace it. It should be well soaked in engine oil.

Inspect the forward universal joint. (§486).

478 Replacement

In replacing, reverse the operations under "Removal."

TRANSMISSION

479 Removal

Remove the floor boards.

Disconnect the brake rods at the hand brake lever and at the brake pedal.

Remove the rod and spring from the accelerator pedal.

Remove the shield over the forward universal joint. The shield is held in place by two small screws.

Disconnect the universal joint from the flange on the transmission shaft. The joint is held to the flange by eight bolts.

Be careful in removing the bolts that the joint does not drop and injure the rear joint casing.

Remove the copper tube between the tire air compressor and the frame of the car.

Disconnect the clutch control rod from the lever at the bottom end of the rod, and remove the clutch pedal pull-back spring.

Remove the four nuts holding the pedal shaft bracket and remove assembly from transmission.

Remove the starter pedal.

Remove the speedometer cable.

Lift front end of car about twelve inches.

Remove the eight bolts holding the transmission to the crankcase. Remove the transmission by moving it straight back. Care must be exercised in removing the transmission not to drop it.

480 Disassembly

Remove the clutch. (§443).

Remove the hand hole cover "X" (Fig. 83.)

Remove the drain plug "Q" and drain the transmission.

If the car is equipped with a tire air compressor, remove it (§§449, 453).

Remove the clutch release shaft "Y." To remove the shaft proceed as follows: Remove the lever from the left-hand end of the shaft, also remove the Woodruff key. Remove the two taper pins which hold the clutch release yoke to the shaft. The shaft may now be removed, tapping it out from the left side.

Remove the transmission top cover plate by removing the six cap screws.

Remove the transmission bottom cover plate.

Remove the shifter forks and shafts. (§473).

Remove the reverse pinion. (§470).

Remove the main transmission shaft. (§476).

Remove the jackshaft with gears. (§464).

Remove the clutch connection and the large annular ball bearing. (§457).

Remove the mounting for the annular ball bearing. This may be removed by tapping it out.

Remove the hand brake lever ratchet.

481 Inspection

Inspect all parts removed in accordance with the directions in this book under the appropriate headings.

482 Reassembly and Replacement

In reassembling and replacing the transmission, reverse the operations under "Disassembly" and under "Removal."

Before replacing the transmission make sure that the annular ball bearing "D" (Fig. 83) is in good condition and well lubricated.

(On Type 61 cars the forward end of the clutch connection shaft has a key-way to receive the pin in the collar which fits into the annular ball bearing "D." In replacing the transmission, first make certain that the pin in the collar and the key-way in the shaft line up. This is very important. Care must be exercised in replacing the transmission not to damage the ball bearing or the clutch connection shaft.)

Note:—The high and intermediate shipper gear on Type 61 cars beginning with transmission numbered 11075 have a longer hub on the main transmission shaft. This necessitates a slightly shorter clutch connection and a somewhat narrower constant mesh gear on the jackshaft. As a result of these changes these parts from an early type transmission cannot be used in a late type transmission; neither can these late type transmission parts be used in the early type transmission.

UNIVERSAL JOINTS

483 Removal of Forward Universal Joint

Remove the shield over the joint. The shield is held in place by two small machine screws.

Remove the eight bolts which hold the joint to the flange on the rear end of the transmission shaft. Care must be exercised not to allow the joint or shaft to drop and injure the rear joint casing.

Remove the collar "A" (Fig. 84) by unscrewing it. The joint can now be removed.

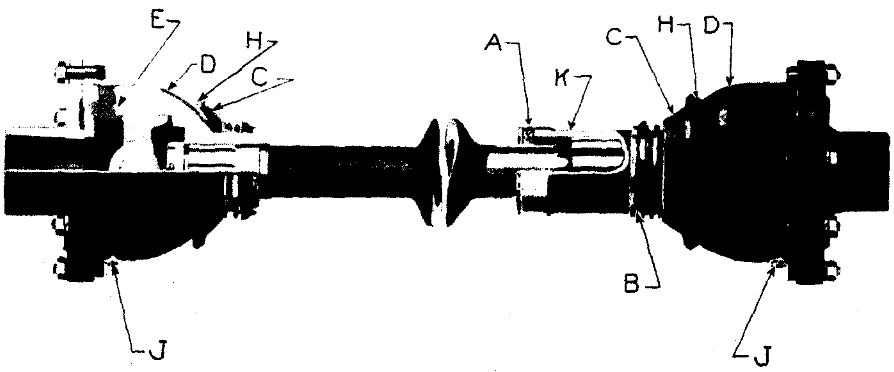

Fig. 84—Universal Joints and Drive Shaft.

484 Removal of Rear Universal Joint

Remove the eight bolts holding the universal joint to the flange on the shaft of the axle. Care must be exercised not to allow the joint to drop.

Remove the collar "A" by unscrewing it.

The joint with drive shaft can now be removed by lowering it and pulling it back. Do not allow the forward end of the shaft to drop.

485 Disassembly of Universal Joints

Remove the joints as directed in §§483, 484.

Remove the locking ring "B" and the casings "C" and "D."

Remove the locking rings "E" and tap out the bushings. The crosses can then be removed.

486 Inspection

Thoroughly clean all parts.

There should be no more than .003 inch clearance between the sides of the splines of the drive shaft and the sides of the spline ways in the hub of the forward joint.

The clearance between the eight bolts which attach each joint and the holes in the flanges should not exceed .002 inch.

There should be no more than .005 inch clearance between the arms of the crosses of the joints and the bushings in which they operate, and no more than .010 inch clearance between the sides of the yokes and the shoulders of the crosses.

Inspect the welded joints of the drive shaft.

Inspect the casings "C" and "D," also the packing washers "H."

Inspect the threads of the filler plugs "J" and the threads in the casings "D" into which they screw.

Drive shafts are tested for balance rather than accuracy of alignment. The center of a shaft may run out several thousandths when revolved upon centers and the shaft may still be in perfect balance. A shaft which has been sprung as a result of accident will obviously be no longer balanced and should be rebalanced.

487 Replacement

In reassembling, have the mark on the drive shaft and the mark on the hub of the forward joint point directly toward each other. This will bring the yokes on the drive shaft ends in the same plane.

The bolt holes in the universal joint flanges and casings are spaced irregularly so that the filling holes in the casings "D" will not come opposite the ends of the universal crosses. This makes it easier to fill the joints.

After replacing the joints refill each with five ounces of suitable lubricant. Cadillac Universal Joint Lubricant is recommended.

REAR AXLE

488 Removal

Block the front wheels and jack up the rear end of the frame at least six inches. Block up the frame securely.

Disconnect the four brake rods at the brake arms on the axle.

Disconnect the rear universal joint by removing the eight bolts. Do not allow the joint to drop.

Disconnect the front end of the torque arm from the torque arm bolt, by removing the cotter pin and the nut at the bottom of the bolt. Do not allow the torque arm to drop.

Remove the nuts from the two spring clips at each side, and disconnect the snubber straps. (On Type 61 cars, which are not equipped with snubbers, the rebound straps should be disconnected.)

The axle complete with wheels can now be rolled from under the car.

489 *Disassembly*

Remove the wheels. (§555).

Remove the brake bands. (§§492, 493).

Remove the differential complete with gear. (§496).

Remove the driving pinion. (§506).

The cage "R" (Figs. 43 and 44) may be removed after removing the six cap screws "I."

Remove the internal brake shafts by pulling them out after removing the cotter pins "S" and loosening the clamp bolts "T" on the levers at the inner ends of the shafts.

Remove the external brake shafts (not used on Type 61) as follows: Drive out the taper pin in the collar on the outer end of the shaft and push the shaft in until it clears the support. Remove the two screws which fasten the bracket "W" to the axle housing and remove the shaft with levers and bracket.

Remove the torsion arm by taking out the torsion arm shaft. This shaft is held in place by two hollow clamp bolts with two long differential carrier bolts carried in them. Remove the caps at either end of the shaft by removing the long bolt holding them in place.

Remove the felt washers in the axle housing sleeves. To do so, remove the cotter pins and remove the retainers.

490 *Inspection*

Inspect all parts in accordance with the directions in this book under the appropriate headings.

491 *Reassembly and Replacement*

In reassembling and replacing the axle, reverse the operations under "Disassembly" and under "Removal."

BRAKES

492 *Removal of External Brake Band*

Remove the wheel. (§555).

Remove the pin "S" (Fig. 48). (On Type 61 cars, disconnect the brake pull rod and the pull-back spring from the upper end of the lever "D" (Fig. 53).

Remove the rear anchor adjusting screw "A" (Figs. 48 and 53.) (On Type 61 cars the cotter pin in the screw must first be removed.)

Remove the cotter pin in the outer end of the anchor pin "U" (Fig. 48).

Remove the nut "C," the two flat washers and the spring "M" (Fig. 48) from the yoke bolt "V".

Remove the brake band, taking care not to lose the springs and washers at the rear anchor.

493 Removal of Internal Brake Band

Remove the wheel. (§555).

Remove the cotter pins from the supports just to the rear of the adjusting screws "R" and "O" (Figs. 48 and 53).

Remove the adjusting screw "J" and the spring "D" (Fig. 48).

Remove the pin "Y" (Fig. 48) and remove the brake band. (On Type 61 cars remove the pin "M" (Fig. 53) instead of the pin "Y.")

494 Inspection

Inspect the brake band lining. The lining should be at least three thirty-seconds inch thick and not glazed. If it is glazed clean it up with gasoline and a stiff wire brush. Lining rivets should be tight and the heads should be beneath the surface of the lining. If it is necessary to reline a brake band follow the directions in §§212, 213.

All brake pins should fit the shackles and levers within .005 inch.

Brake bands when in place, in correct adjustment and released, should be equally distant at all points from the brake drum. If not, the bands should be reshaped.

495 Replacement

After replacing the brake bands adjust them in accordance with the directions in §§207-211 and 214-218.

DIFFERENTIAL AND LARGE DRIVEN GEAR

496 Removal

It is unnecessary to remove the axle in order to take out the differential.

Remove the axle shafts by removing the hub caps and locking rings and pulling them out. (See Fig. 57).

Remove the twelve cap screws which hold the rear cover plate "P" (Figs. 43 and 44) in place and remove the plate.

Remove the wires which lock the four large cap screws and loosen the screws. Unscrew the adjusting collars "O" and "N" one-half turn or more, then remove the four large cap screws and the bearing caps "K." Be careful not to drop the differential.

Remove the differential complete with driven gear.

Note:—On some of the type 61 cars the ring gear is riveted to the gear mount. On others it is bolted on. To remove a ring gear mount, with a bolted on ring gear, from the axle of some of the type 61 cars, it is first necessary to remove two adjacent bolts to prevent interference with the carrier. (§497).

497 Disassembly

Great care must be taken in disassembling not to spring the ring gear or ring gear mount.

To remove a ring gear which is riveted to the gear mount center punch the center of the oval head of each rivet, drill the head off and carefully tap out the rivet.

To remove a ring gear of the bolted on type counter-sink the center of each bolt and drill off the riveted over portion. The nut may then be removed and the bolt tapped out.

To disassemble the differential remove the twelve cap screws and separate the halves of the housing.

To remove the differential carrier bearings use Cadillac puller No. 83230.

498 Inspection

Thoroughly clean all parts.

Inspection of Differential and Driven Gear—The flange of the differential housing should run true laterally and radially within .002 inch.

Examine the faces of the teeth of the driven gear, and of those of the six differential gears. They should show but little wear and should not be pitted. The teeth should not be chipped on the ends.

The hubs of the two large differential gears should have no more than .005 inch clearance in the hub of the cross. The end play in these two gears when the differential halves are bolted together should not exceed .008 inch.

The four small differential gears should have no more than .006 inch clearance on the arms of the cross and no more than .010 inch end play, when in place in the differential housing.

The ends of the cross should fit tightly into the differential housing.

Inspection of Other Parts—Examine the mountings, cones and rolls of the roller bearings. They should be smooth, free from pits and not chipped on the ends. The cages for the rolls should be in good condition.

With the bearing caps bolted in place the mounting for the roller bearings and the adjusting collars should be clamped.

Examine the faces of the pinion teeth. They should show but little wear and should be free from pits. The ends of the teeth should not be chipped.

499 Replacement

In replacing reverse the operations under "Removal."

In replacing a ring gear of the riveted type, bolt the new gear on instead of riveting it. To do this proceed as follows:

Clean thoroughly the ring gear and gear mount surfaces coming in contact and place ring gear on gear mount, making certain that the holes are concentric. It is advisable to face off the gear mount in a lathe before installing the ring gear.

Using two temporary bolts, bolt the ring gear to the gear mount. Place the bolts diametrically opposite and draw them up tightly.

Enlarge two diametrically opposite gear mount holes. Select two 90° from the temporary bolts. Using Cadillac reamer No. 82799, size .430 inch. Finish ream with Cadillac reamer No. 82800, size .4375 inch. Then ream the countersink in the gear with Cadillac reamer No. 82802, using the smaller pilot furnished. Tap permanent bolts into these two holes, screw on nuts, and draw them up tightly.

Remove the temporary bolts. Then enlarge, finish ream and countersink ream all of the remaining holes in the manner explained in the preceding paragraph.

Tap the permanent bolts into the reamed holes, screw on the nuts and draw them up evenly and tightly. (On early Type 61 rear axles, two adjacent bolts must be left out to permit installation of the differential assembly.)

Install the differential assembly and, if it was necessary to leave out two bolts as described in the preceding paragraph, insert them and draw all the nuts up evenly and tightly.

After the gears have been adjusted and found satisfactory lock the nuts in place by riveting over the cup shaped ends of the bolts with the peen of a hammer. Hold a bar against the bolt heads when riveting. Care must be exercised not to spring the gear mount.

When installing a ring gear where bolts have been used previously, the same procedure is followed except that it is necessary to use oversize bolts and the holes must be reamed with Cadillac reamer No. 82801, size .4575 inch. The countersinks in the gear must be reamed with reamer No. 82802 using the larger pilot furnished.

After replacing differential adjust the bearings in accordance with directions in §§199, 201.

After replacing the rear cover plate and tightening the twelve nuts refill the housing with suitable lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended. Five quarts are required.

REAR AXLE HOUSING

500 Removal

Remove and disassemble the axle. (§§488, 489).

501 Inspection

Clean all parts.

Inspection of Housing—Stretch a line through the axle, having it pass through the centers of the axle ends at "A" and "B," (Figs. 85 and 86). Dimensions "C" and "D" (Fig. 85) taken from the line to the front and rear machined faces of the housing should vary by no more than one thirty-second inch. Dimensions "E" and "F" (Fig. 86) taken from the line to the centers of bolt holes "H" and "I" in the front face of the housing should vary by no more than one thirty-second inch.

The spring seats should have no more than .010 inch lateral play and no more than .006 inch radial play. The radial play can be taken up by reducing the edges of the caps with a mill file.

All rivets should be tight.

The threads on the ends of the housing should be in good condition.

INSPECTION OF OTHER PARTS—Inspect all parts removed in accordance with directions in this book.

It is possible to straighten rear axle housing sleeves without removing the axle from the car by using Cadillac tool No. 71971, furnished by our Parts Department.

502 *Reassembly and Replacement*

After inspecting all parts, reassemble and replace the axle. (§491).

Fig. 85—Rear Axle Housing, Top View

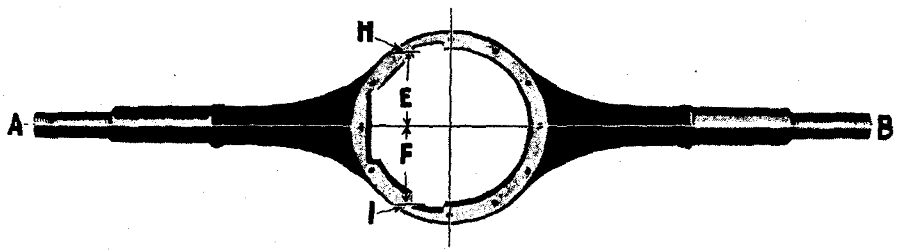

Fig. 86—Rear Axle Housing, Side View.

AXLE SHAFTS

503 *Removal*

Remove the hub cap "B" (Fig. 57) by unscrewing it. (On some Type 61 cars there is an oiler which must be removed before the hub cap can be unscrewed.)

Remove the locking ring "I."

Determine the amount of clearance between the drivers on the axle flange and the recesses which receive the drivers in the hub of the wheel. (§504).

Withdraw the axle shaft. If the axle shaft sticks it may be removed by tapping a cold chisel between the inner faces of the drivers on the axle flange and the bottoms of the recesses in the hub flange. If one of the axle shafts fits particularly tight, remove the looser one in accordance with these directions and drive out the other, by passing a bar of suitable size and length through the opposite end of the axle housing.

504 *Inspection*

There should be no more than .010 inch clearance between the drivers on the flange of the axle shaft and the recesses in the hub which receive the drivers.

The clearance between the splines of the axle shaft and the spline ways in the hub of differential gears should not exceed .006 inch.

Placed on lathe centers the axle shaft should run out of true no more than .004 inch.

505 *Replacement*

Replace on the proper side. The axle shafts are of the same length but are not interchangeable because the spiral grooves in the inner ends lead in opposite directions. The shafts are marked "R" and "L."

Replace the hub cap.

DRIVING PINION AND PINION SHAFT

506 *Removal*

It is unnecessary to remove the axle to remove the pinion and shaft.

Remove the differential complete with driven gear. (§496).

Disconnect the rear universal joint by removing the eight bolts. Do not allow the joint to drop and injure the rear joint casing.

Remove the nut which holds the flange to the pinion shaft and remove the flange with Cadillac puller No. 83225, furnished by our Parts Department.

Remove the shell directly at the rear of the flange and remove the cork disc, packing, spacing ring and spring.

Pull out through the front of the cage the pinion with the shaft and the bearings.

The front pinion bearing may be removed with Cadillac puller No. 83228.

The rear or small pinion bearing may be removed with Cadillac puller No. 83229.

507 *Inspection*

Clean all parts.

Inspection of Pinion and Shaft—Inspect the faces of the teeth of the pinion. They should show very little wear, and be free from pits. The teeth should not be chipped on the ends.

The shaft placed on lathe centers should run true within .002 inch.

Examine the threads on the end of the pinion shaft, also those in the nut.

Inspection of Other Parts—Examine the bearing mountings, rolls and cones. These parts should be smooth and free from pits and not chipped. The bearing cages should be in good condition.

The cone of the rear bearing should be a snug fit on the tapered hub of the pinion. The cone of the forward bearing should have no more than .002 inch clearance on the shaft.

Examine the faces of the teeth of the driven gear. They should show but little wear and should be free from pits. The ends of the teeth should not be chipped.

508 Replacement

In replacing the pinion and driving shaft, reverse operations under "Removal." In replacing the bearings, the driven gear and the driving pinion, make adjustments in accordance with the directions in §§198-203.

Refill the axle with suitable lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended. Five quarts are required.

V-63 FRONT AXLE

STEERING AND PARALLEL ROD ARMS

509 Removal

Jack up the axle and remove the front wheel. (§554).

If the arm is a parallel rod arm, disconnect it from the parallel rod by removing the nut "AA" (Fig. 92) and tapping out the pivot "GG." In doing this, support the arm and be careful not to spring the arm nor injure the threads on the pivot.

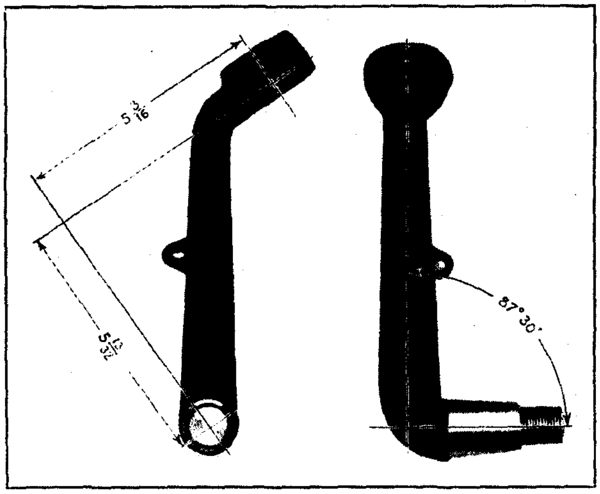

Fig. 87—V-63 Parallel Rod Arm (R. H. Shown)

If the arm is the steering arm, disconnect the steering connecting rod from the arm. (§550).

Remove the nut "A" (Fig. 49) on the end of the arm and drive the arm out of the spindle, which should be properly supported from the inside to prevent springing the spindle.

510 Inspection

Inspection of Arm—Examine the threads on the arm and in the large nut.

Determine if the arm is bent or sprung. (See Figs. 87 and 88. Also see §230).

Examine the forging carefully.

INSPECTION OF OTHER PARTS—Examine the pivot on the arm. The ball end should be round within .010 inch.

If the steering arm is removed, examine the threads in the end of the steering connecting rod, the threads on the adjusting screw and the surfaces of the bronze bearings.

511 Replacement

In replacing, reverse the operations under "Removal."

In adjusting the screw at the front end of the steering connecting rod do not take it up too tightly. Tighten it only sufficiently to take up all shake.

FRONT AXLE

512 Removal

Jack up the front end of the car until the front wheels are clear of the ground.

Remove the front wheels. (§554).

Disconnect the front end of the steering connecting rod. (§550).

Disconnect the front brake cables from the levers on the operating yokes by removing the cap "U" (Fig. 92), loosening the lock nut "S" and unscrewing the stud "T." On early V-63 cars, which have rods instead of cables, the rods may be disconnected by removing the cap "U" and then removing the nut and ball on the end of the rod.

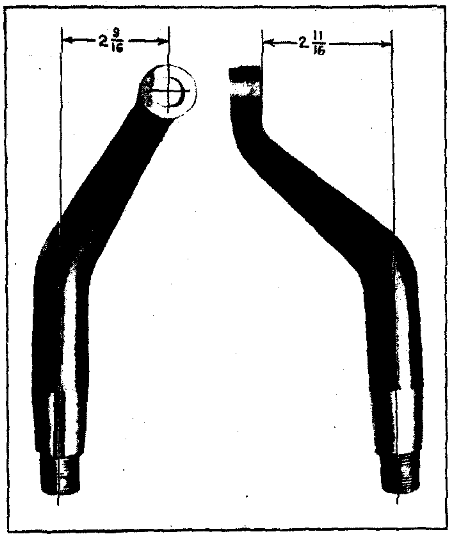

Fig. 88—V-63 Steering Arm

Disconnect the yoke guides "F" from the frame by removing the nut "L," and tapping out the pivot "K."

Remove the nuts on the spring clips which hold the axle to the springs and remove the spring clips.

Remove the axle complete with spindles and parallel rod.

513 Disassembly

Remove the grease connections from the ends of the axle and from the parallel rod arms.

Remove the parallel rod. (§516).

Remove the spindles with steering arms from the axle. (§520).

514 Inspection

The lines through the centers of the holes in the ends of the axle should be in the same plane and at an angle of 5° with the vertical. (Fig. 89).

This may be tested by placing the axle upside down upon parallel bars under the spring seats and with a square taking dimensions "A" and "B" $11\frac{7}{16}$ inches apart. The difference between "A" and "B" should be one inch. (§230).

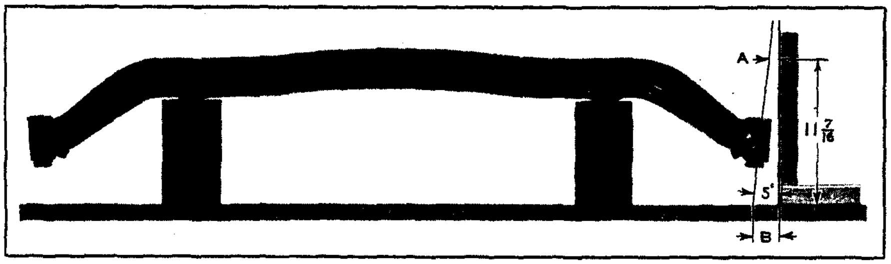

Fig. 89—Side View of V-63 Front Axle, Inverted

The center lines of the holes in the ends of the axle should be at an angle of 87½° with the spring seats. This may be tested by taking dimensions "A" and "B" $11\frac{29}{64}$ inches apart (Fig. 90). The difference between dimensions "A" and "B" should be one-half inch. (On the first V-63 cars the spring seats are machined at right angles to the spindle bolt holes. On these axles dimension "A" and "B" should be the same. Wedges can be obtained on order from the Parts Department to insert between the first type axles and the springs to give the spindle bolts the proper inclination. These wedges, symbol No. 56241, effect improvement on cars with first type axles but must not be used with axles having the spring seats on an angle).

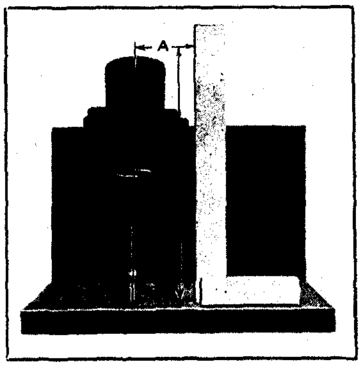

Fig. 90—End View of V-63 Front Axle, Inverted (Rear of Axle toward Scale)

Inspection of Other Parts—Inspect the spindle bolt bushing at the lower end of the spindle bolts. There should be no more than .005 inch clearance between the bushing and the lower end of the bolt.

The mountings, cones, and rollers of the spindle bearings should be smooth, free from pits, and not chipped. The cages should be in good condition.

Inspect the spindles. (§521).

The brake dust shields when mounted on the spindles should be true with the center line of the spindle. This may be checked by taking the dimension "TT" (Fig. 92) with dividers. The distance "TT" should not be less than $10\frac{7}{16}$ inches nor more than $10\frac{17}{32}$ inches at any point.

515 Replacement

In assembling and replacing the front axle, reverse the operations under "Removal" and "Disassembly."

In replacing a spindle bolt, line up the flat surface on the bolt with the hole in the axle for the locking key.

In adjusting each spindle nut "O" (Fig. 92), draw it up tight and then loosen it just enough to free the adjustment.

For the adjustment of the stud "T" in connecting the front brake cable to the lever on the operating yoke see §209.

Adjust the front wheel bearings in accordance with the directions in §228.

In adjusting the screw at the front end of the steering connecting rod, do not adjust it too tightly. Tighten it only sufficiently to take up all shake.

Adjust the spindle arm stop screws "X" (Fig. 92) in accordance with the directions in §219.

PARALLEL ROD

516 *Removal*

Remove the nut "AA" (Fig. 92) on the pivot in each parallel rod arm and tap the pivot out of the arm. In doing this, support the arm and be careful not to spring the arm nor injure the threads on the pivot. The parallel rod with ball and socket joints may then be removed.

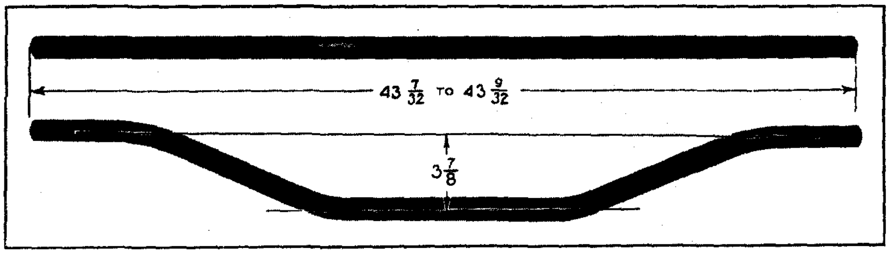

Fig. 91—V-63 Parallel Rod

517 *Disassembly*

Remove the bronze cap "CC" (Fig. 92) between the steering arm and the yoke on the parallel rod.

Remove the clamping screw "EE" and take out the locking key "FF."

Unscrew the castellated adjusting retainer "KK." The lower seat "JJ," the upper seat "DD," the pivot "GG," and the block "HH," which is only at the left end of the parallel rod, may then be removed.

The yoke "NN" may be unscrewed from the end of the parallel rod, if necessary, after removing the clamping screws "LL" and, at the left end, removing the key "MM."

518 *Inspection*

Examine the rod carefully. The straight ends should be in alignment with each other and the center of the offset section should be 3⅞ inches from the center line of the straight ends. The overall length of the rod should be 43¼ inches. (See Fig. 91). The rod should be free from dents. The threads on the ends of the rod and in the yokes should be in good condition.

The pivots should be round within .010 inch.

At the left-hand end of the rod, the clearance between the sliding block "HH" (Fig. 92), and the round shank of the lower end of the pivot

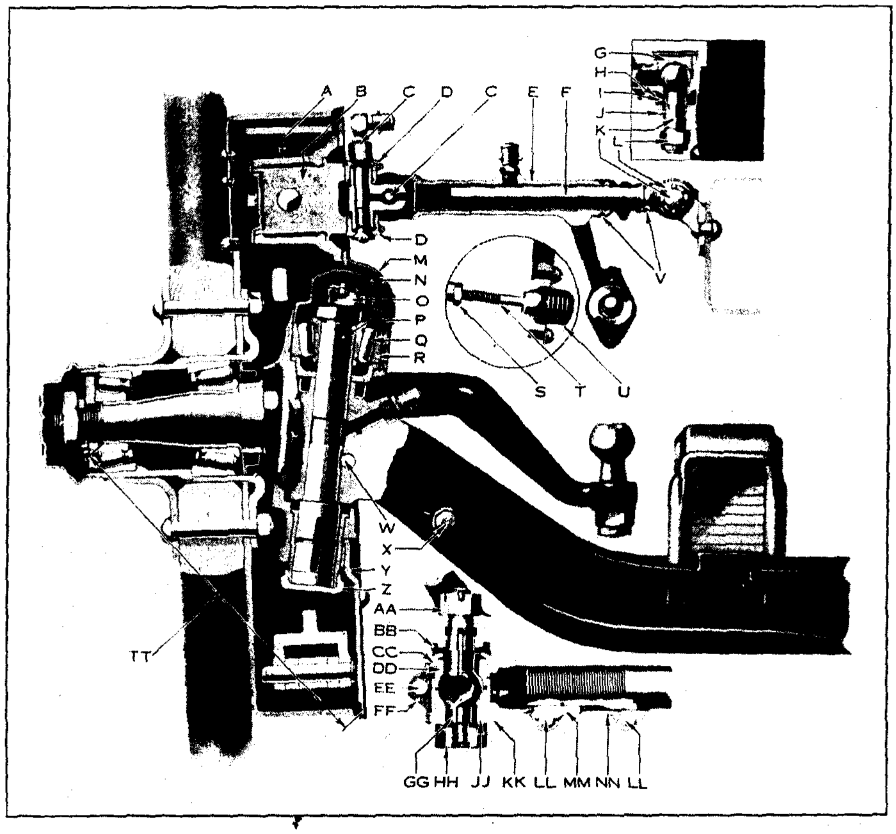

Fig. 92—Sectional View of V-63 Front Spindle

should not exceed .020 inch. The clearance between the sides of the block and the slot in the seat "JJ" should not exceed .020 inch.

The threads in the yoke, on the retainer and on the pivot, and the felt washers in the steering arm should be in good condition.

519 Assembly and Replacement

To reassemble and replace the parallel rod, reverse the operations under "Removal" and "Disassembly."

The threaded ends of the rod should extend into the yokes at least one inch and should extend into both yokes the same amount.

Make sure before screwing the retainer "KK" into place that the slot in the side of the upper seat "DD" is aligned with the slot in the yoke, and that the tongues on the lower seat "JJ" engage the slots in the lower edge of the upper seat. Adjust the retainer so that the pivot works freely, but has no perceptible clearance.

After replacing the parallel rod, align the front wheels in accordance with the directions in §229.

FRONT AXLE SPINDLE

520 *Removal*

Jack up the front axle and remove the wheel. (§554).

Disconnect the parallel rod from the parallel rod arm by removing the nut "AA" (Fig. 92) and tapping out the pivot. In doing this, support the arm and be careful not to spring the arm nor injure the threads on the pivot.

If removing a left spindle, disconnect the steering connecting rod from the steering arm. (§550).

Disconnect the front brake cable from the lever on the operating yoke by removing the cap "U", loosening the lock nut "S" and unscrewing the stud "T." On early V-63 cars, which have rods instead of cables, the rods may be disconnected by removing the cap "U" and then removing the nut and ball on the front end of the rod.

Disconnect the yoke guide from the frame by removing the nut "L" and tapping out the pivot "K."

Remove the nut and lock washer on the locking key "W" and drive out the key. The right key must be driven out from the front and the left key from the rear. Be careful not to injure the threads on the key.

Remove the three springs, "E", "G" and "M" (Fig. 49).

Remove the clevis pins "B", "C" and "D", and remove the link "U" with the toggle.

Remove the eight bolts "P" which fasten the dust-shield "Q" to the spindle. Tilt the dust-shield with the brake attached in at the top so as to give access to the upper spindle cap "N" (Fig. 92).

Remove the upper cap "N" and the lower cap "Z" by unscrewing them.

Remove the nut "O" after first removing the cotter pin.

Remove the spindle bolt by tapping it down from the top, being careful not to injure the threads.

Remove the roller bearing "Q."

Remove the spindle, taking care not to injure the oil retainers between the spindle and the axle.

To remove a steering arm from the spindle, remove the large nut "A" (Fig. 49) and press the arm out, being careful not to injure the threads.

521 *Inspection*

Clean all the parts removed.

INSPECTION OF SPINDLE—With the spindle placed on lathe centers, that part of the spindle which receives the wheel bearings should run true within .002 inch. (§230).

There should be no more than .002 inch clearance between the cones of the wheel bearings and the spindle.

The threads on the spindle should be in good condition.

INSPECTION OF OTHER PARTS—Inspect the roller bearing. The cone, rollers, and mountings should be smooth and free from pits and chips. The roller cage should be in good condition.

There should be no more than .005 inch clearance between the lower end of the spindle bolt and the bushing in the spindle.

The threads on the upper end of the spindle bolt, in the nut, and in the front wheel adjusting nut and lock nut, should be in good condition.

Inspect the steering and parallel rod arms. (§510).

The brake dust shield when mounted on the spindle should be true with the center line of the spindle. This may be checked by taking the dimension "TT" (Fig. 92) with dividers. The distance "TT" should be not less than $10\frac{7}{16}$ inches nor more than $10\frac{17}{32}$ inches at any point.

522 *Replacement*

In replacing a spindle, reverse the operations under "Removal."

In replacing the spindle bolt, line up the flat surface on the bolt with the hole in the axle for the locking key.

Before adjusting the nut "O" be sure the bearing cup "R" is all the way down in the spindle. In adjusting the spindle nut "O," draw it up tight and then loosen it just enough to free the adjustment. After adjusting the nut "O" and locking it with the cotter pin, install the cap "N" and be sure to draw it down tightly against the bearing cup.

For the adjustment of the stud "T" in connecting the front brake cable to the lever on the operating yoke see §209.

Adjust the front wheel bearing in accordance with the directions in §228.

In adjusting the screw at the front end of the steering connecting rod, do not adjust it too tightly. Tighten it only enough to take up all shake.

Adjust the spindle arm stop screws "X" (Fig. 92) in accordance with the directions in §219.

FRONT WHEEL BRAKE BANDS

523 *Removal*

Jack up the front axle and remove the wheel. (§554).

Remove the three springs "E," "G" and "M" (Fig. 49).

Remove the three clevis pins "B," "C" and "D".

Remove the link "U" with the toggle joint attached.

Remove the anchor screw "J" and the shims "W" through which the screw passes.

Remove the brake band.

524 *Inspection*

Inspect the brake band lining. The lining should be at least $\frac{3}{32}$ of an inch thick and not glazed. If it is glazed, it may be cleaned with kerosene and a stiff wire brush. The rivets attaching the lining should be tight and the heads should be beneath the surface of the lining. If it is necessary to reline a brake band, follow the directions given in §§212, 213.

All brake pins should fit the shackles and levers within .005 of an inch.

525 *Replacement*

In replacing, reverse the operations under "Removal." When the bands have been replaced, adjust the brakes and re-shape the bands, if necessary, in accordance with the directions in §208.

FRONT WHEEL BRAKE TRUNNIONS AND YOKES

526 *Removal*

Jack up the front axle and remove the wheel. (§554).

Disconnect the front brake cable from the lever on the operating yoke by removing the cap "U," (Fig. 92) loosening the lock nut "S" and unscrewing the stud "T." On early V-63 cars, which have rods instead of cables, the rods may be disconnected by removing the cap "U" and then removing the nut and ball on the front end of the rod.

Disconnect the yoke guide "F" from the frame of the car by removing the nut "L" and tapping out the pivot "K".

Remove the two screws "Y" (Fig. 49) and remove the cap on the outer end of the trunnion.

Remove the clevis pin "D" and the nut and stop "S" on the bolt "I" and remove the bolt "I."

Remove the trunnion with universal joint, yoke, and guide from the brake dustshield.

To disassemble the universal joint, proceed as follows:

Remove the grease gun connection from the upper arm of the universal joint. Remove the screws "C" (Fig. 92) passing through the arms of the universal joint. The bushings "D" in the trunnion and in the yoke may then be forced out from inside the arms.

To disassemble the yoke from the guide, remove one of the wires "V" (Fig. 92) and pull the guide out of the yoke.

To disassemble the ball and socket joint on the inner end of the guide, remove the retainer "H" and the cork washer "I." Unscrew the bronze seat "G" after first removing the cotter pin. Remove the pivot "K" from the guide.

527 *Inspection*

The clearance between the trunnion "B" and the bronze bearing "A" which is riveted to the brake dustshield should not exceed .008 inch.

There should be no more than .020 inch end play in the trunnion when the cap is in place on the outer end of the trunnion. End play in the trunnion may be reduced by dressing down slightly the outer end of the bronze bearing.

The bushings on the universal joint arms should not have more than .010 inch clearance on the arms of the spider.

The clearance between the guide and the bushings in the yoke should not be more than .010 inch.

The pivot at the inner end of the guide should be round within .010 inch and the threads on it should be in good condition.

The cork washer "I" should be in good condition.

528 *Replacement*

To replace the trunnion and yoke, reverse the operations under "Removal."

In replacing the pivot "K" the small pin "J" in the socket must line up with the slot in the shank of the pivot. The bronze seat "G" should be adjusted so that the pivot moves freely without perceptible clearance.

For adjustment of the stud "T" at the front end of the brake cable, see §209.

Adjust the front wheel bearings in accordance with the directions in §228.

TYPE 61 FRONT AXLE

STEERING ARMS

529 Removal

Remove the nut "P" (Fig. 98) from the parallel rod bolt.

In removing the left steering arm, next disconnect the steering connecting rod from the arm. (§550).

Remove the cotter pin and the large nut from the rear end of the arm and drive out the arm.

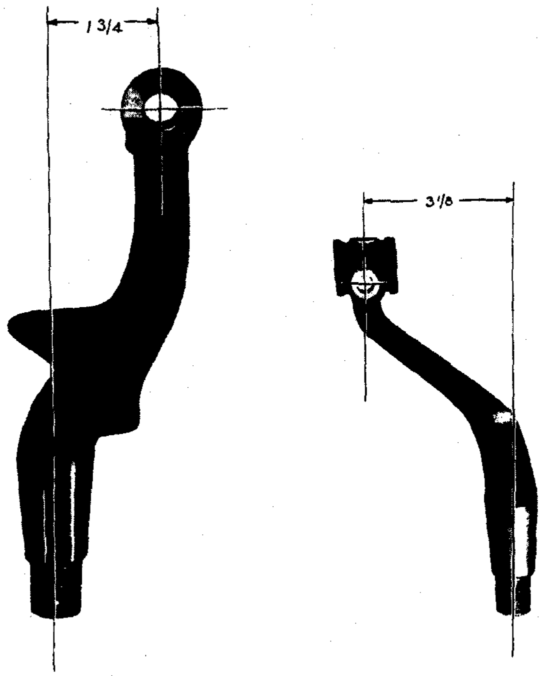

Fig. 93—Type 61 Right Steering Arm

530 Inspection

INSPECTION OF ARM—Examine the threads on the steering arm, also the threads in the large nut.

Determine if the arm is bent or sprung. (See Figs. 93 and 94.) (See also §230).

Examine the forging carefully.

INSPECTION OF OTHER PARTS—There should be no more than .005 inch clearance between the bushings in the parallel rod yoke and the bolt. If it is necessary to remove one of these bushings, do so with a press or drive it out, and press or drive in the new one.

If the left-hand steering spindle is removed examine the pivot on the arm. It should be round within .010 inch.

Examine the threads in the end of the steering connecting rod, also the threads on the adjusting screw and the surfaces of the bronze bearings.

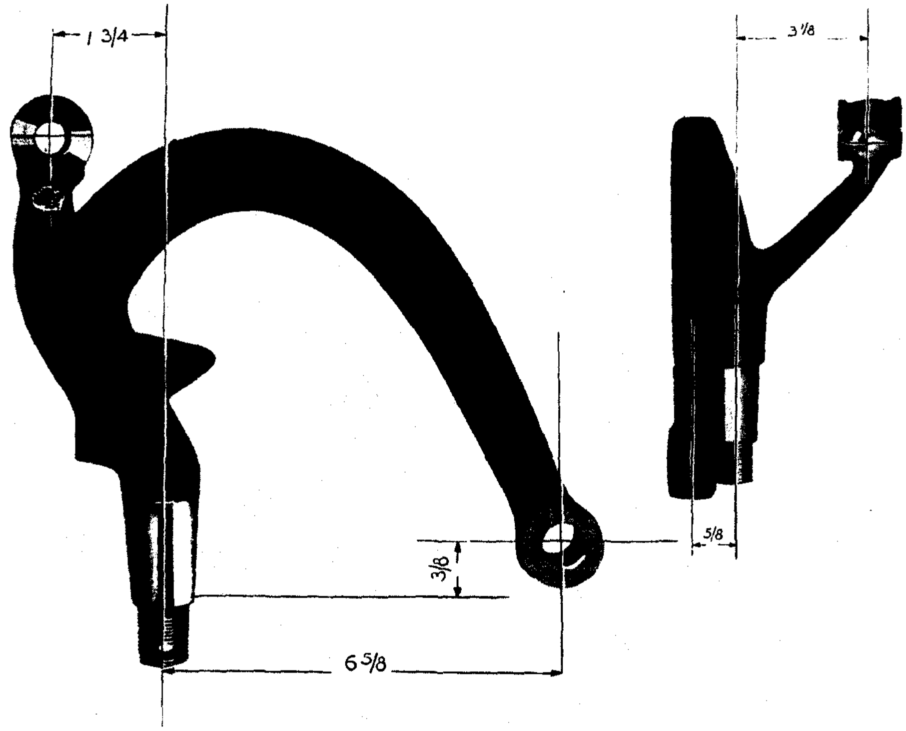

Fig. 94—Type 61 Left Steering Arm.

531 Replacement

In adjusting the screw at the front end of the steering connecting rod do not take it up too tightly. Tighten it only sufficiently to take up all shake.

Do not tighten the nut "P" (Fig. 98) sufficiently to bind the yoke on the steering arm.

FRONT AXLE

532 *Removal*

Jack up the front end of the car until the front wheels are free from the ground.

Remove the front wheels. (§554).

Disconnect the front end of the steering connecting rod. (§550).

Remove the nuts on the spring clips which hold the axle to the spring and remove the spring clips and axle complete with spindles.

533 *Disassembly*

Remove the grease connections from the spindles and steering arms.

Remove the parallel rod. (§536).

Remove the spindles with steering arms. (§539).

Remove the roller bearing mountings in the upper ends of the axle yokes and the plain bearings at the lower ends of the axle yokes by tapping them out.

The roller bearing mounting can be removed by placing tool No. 72407 in position as shown in Fig. 95, using the large washer. Screw on and tighten the nut. This will force out the mounting.

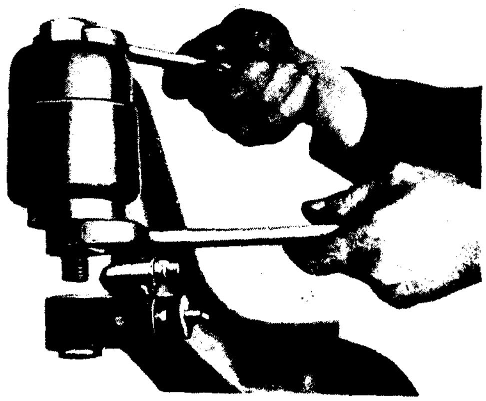

Fig. 95—Removing Roller Bearing Mounting, Type 61 Front Axle

To replace mounting reverse the large casting, having it bear against the upper edge of the axle yoke, and with the washer in place against the lower edge of the mounting and the mounting lubricated, screw on and tighten the nut. This will force the mounting into place.

534 *Inspection*

Lines "C" and "D" (Fig. 96) drawn through the centers of the bores in the axle yokes from which the bearing mountings and bearing bushings were removed, should be in the same plane and parallel. (§230).

The center line of the bores in the yokes should be perpendicular or at right angle with the spring seat. This may be tested by placing the axle upside down upon parallel bars as shown in Figs. 96 and 97 and with a square as shown in Fig. 97, taking dimensions "A" and "B." These dimensions should be the same.

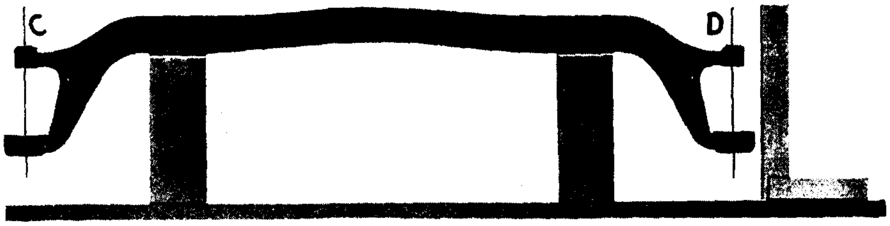

Fig. 96—Side View of Type 61 Front Axle, Inverted

The mountings at the upper ends of the yokes, and the bushings in the lower ends of the yokes should be a press fit into the axle.

The mountings, cones and rolls of the roller bearings should be smooth, free from pits and not chipped. The cages should be in good condition.

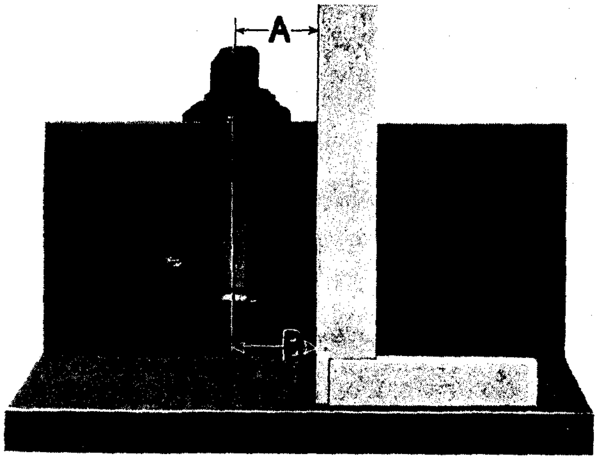

Fig. 97—End View of Type 61 Front Axle, Inverted

There should be no more than .005 inch clearance between the spindle bolt and the bushing at the lower end of the axle yoke.

Inspect the spindles. (§540).

535 *Replacement*

In replacing the spindle bolts adjust the nuts at the lower ends in accordance with the directions in §221.

Adjust the front wheel bearings in accordance with the directions in §228.

In adjusting the nut at the front end of the steering connecting rod do not adjust it too tightly. Tighten it only sufficiently to take up all shake.

Adjust the spindle arm stop screws "H" (Fig. 98) in accordance with the directions in §219.

PARALLEL ROD

536 *Removal*

Remove the nut "P" (Fig. 98) at each end of the parallel rod.

Remove the taper pins which prevent the parallel rod bolts from turning and tap out the bolts, being careful not to damage the threads.

537 *Inspection*

Inspection of Parallel Rod—Examine the rod. It should be straight and free from dents. The threads on the ends of the rod and in the rod yokes should be in good condition.

There should be no more than .005 inch clearance between the bushings in the yokes and the bolts. If it is necessary to replace one of the bushings remove it with a press, or by driving it out, and press, or carefully drive in, the new bushing.

Inspection of Other Parts—Examine the bearing surfaces of the spindle bolts, also the threads on the ends of the bolts and the threads in the nuts.

538 *Replacement*

In replacing the yokes on the rod have the threaded ends at each end extend an equal amount into the yokes.

After replacing the rod, align the front wheels in accordance with directions in §229. Do not re-align the front wheels by adjusting one yoke only. Adjust both yokes so that the parallel rod will extend into each yoke an equal amount after the work is completed. Be sure that the parallel rod extends into each yoke at least one inch.

Do not tighten the nuts "P" sufficiently to bind the yokes on the steering arm.

FRONT AXLE SPINDLES

539 *Removal*

Jack up the axle and remove the wheel. (§554).

Remove the nut "P" (Fig. 98) from the parallel rod bolt "J."

Remove the taper pin which prevents the parallel rod bolt from turning and tap out the bolt "J," being careful not to damage the threads.

If removing a left spindle, next disconnect the steering connecting rod from the steering arm. (§550).

Remove the nut "B."

Remove the taper pin "A."

Drive out the spindle bolt "C," being careful not to injure the threads. Use Cadillac spindle bolt starter No. 83223.

Remove the spindle.

To remove the steering arm, first remove the large nut, then either press or drive it out, being careful not to injure the threads.

540 Inspection

Clean all parts removed.

Inspection of Spindle—Placed on lathe centers, that part of the spindle which receives the wheel bearings should run true within .002 inch. (§230).

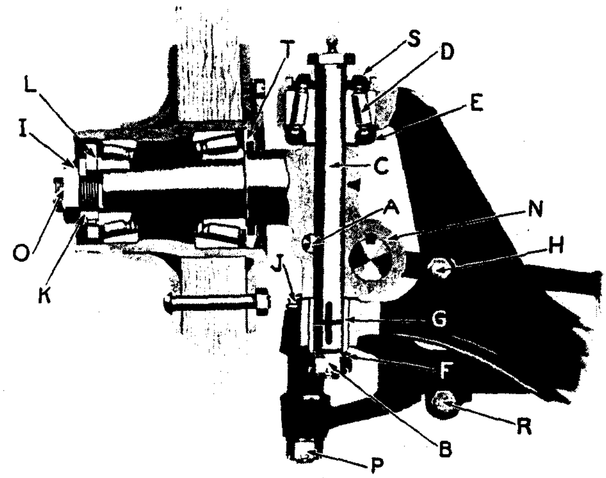

Fig. 98—Sectional View of Type 61 Front Spindle

There should be no more than .002 inch clearance between the cones of the roller bearings and the spindle.

The threads on the spindle should be in good condition.

Inspection of Other Parts—Inspect the roller bearings. The cones, rolls and mountings should be smooth and free from pits and chips. The roller cage should be in good condition.

There should be no more than .005 inch clearance between the lower end of the spindle bolt and the bushing in the axle yoke.

The threads on the lower end of the spindle bolt in the nut and in the front wheel adjusting nut and lock nut must be in good condition.

Inspect the spindle arm. (§530).

541 *Replacement*

In replacing, reverse the operations under "Removal."

In adjusting the nut at the front end of the steering connecting rod, do not adjust it too tightly. Tighten it only sufficiently to take up all shake.

In adjusting front wheel bearings follow the directions in §228.

In replacing the nut "B" make the adjustment in accordance with the directions in §221.

Adjust the spindle arm stop screws "H" (Fig. 92) in accordance with the directions in §219.

STEERING GEAR

542 *Removal—(Body on Car)*

Remove the splash pan under the engine.

Remove the steering arm "H" (Fig. 56) from the sector shaft. The end of the sector shaft and the hole in the steering arm are tapered and serrated, the parts being held together by a large nut locked with a spring washer. After removing the nut and lock washer, remove the arm with Cadillac puller, No. 72354.

Remove the cap screw "F" and the wrench "G" and pull out the long eccentric adjusting bushing.

Remove the two three-sixteenths inch control rods between the steering gear and engine.

Remove the cover plate "P" (Fig. 55) on the rear face of the steering gear housing. This plate is held in place by five five-sixteenth inch cap screws.

Push in the sector shaft until its outer end is just beyond the inner face of the frame.

Remove the set screw "Q" (Fig. 55) permitting removal of the horn button and the control disc cover "S".

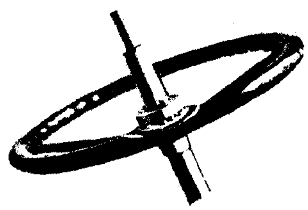

Fig. 99—Removing Steering Wheel

Disconnect the horn wire conduit from the lower end of the spark control tube and push the horn wire up through the column enough to permit removing the contact at the upper end of the wire. Then pull the horn wire down out of the column. (On early Type 61 cars the contact is soldered to the upper end of the wire).

*Remove the small bronze segment gears from the lower ends of the spark and throttle control tubes. These gears are clamped to the tubes by one-quarter inch cap screws.

*Remove the upper housing which is held in place with two special screws and springs.

*Remove the two hand levers "A" and "B" and friction plate. Lay back the top and pull out the staff. The staff is clamped in place at the lower end by a $\frac{5}{16}$ inch cap screw in the housing support bracket which is bolted to the lower end of the steering gear housing.

*If the staff does not pull out easily, open the clamp by carefully tapping in a small chisel. Open the jaws of the clamp only sufficiently to make possible the removal of the staff.

*Remove the nut which holds the steering wheel in place using socket wrench No. 84492 and with Cadillac puller No. 83220, (see Fig. 99) remove the wheel.

*Remove the cap from the steering gear bracket attached to the instrument board.

Remove the four three-eighths inch bolts which hold the steering gear housing to the frame.

Raise the front end of the car about six inches and remove the steering gear by passing it down between the crankcase of the engine and the frame of the car.

543 Removal—(Body off Car)

*To remove the steering gear with the body off the car, omit operations preceded by asterisks in §542 and lift the steering gear out.

544 Disassembly

It is necessary to partly disassemble the steering gear before removing it, provided the engine or body is in place. With the steering gear removed in accordance with the directions in §542, proceed as follows in completing the disassembly:

Remove the support bracket at the lower end of the steering gear housing. The bracket is held to the steering gear housing by four three-eighths inch cap screws. In removing the bracket do not allow the thrust bearing to drop.

Through the lower end of the housing remove the steering tube with worm, upper thrust bearing for the worm and the spring, washer and cone of the bearing at the upper end of the housing tube.

Remove the two screws "B" (Fig. 56) and the collar "F" (Fig. 55) by unscrewing.

To remove the felt packing "D" at the upper end of the housing tube, remove the locking wire and unscrew the packing nut "C".

545 Inspection

Inspect the teeth of the worm and sector. They should show very little wear and be free from scores.

There should be no more than .004 inch clearance between the sector shaft and the eccentric bushing in which it has its bearing. The eccentric bushing should be a snug sliding fit in the housing and free from scores.

There should be no more than .004 inch clearance between the hubs of the steering worm and the bearings which receive them.

Inspect the balls and races of the thrust bearings. They should be free from pits and in good condition.

Examine the serrations on the end of the sector shaft and in the steering arm, also the threads on the end of the sector shaft.

The adjusting spring at the upper end of the steering tube should have a minimum free length of three inches. The bushing should be in good condition. The bushing should move freely on the steering tube.

The serrations at the bottom ends of the spark and throttle tubes and in the segment gears should be in good condition.

Inspect the housing, also all machined surfaces of the housing.

546 Reassembly and Replacement

In reassembling and replacing steering gear, reverse the operations under "Removal and Disassembly."

Adjust the thrust bearings for the worm in accordance with the directions in §222.

In replacing the long eccentric adjusting bushing have the thick side of the bushing face in the direction of the worm of the steering gear, and make certain that the tongues on the inner end of the bushing enter the tongue ways in the thrust ring. Before putting the wrench "G" (Fig. 56) on the outer end of the bushing, rotate the bushing in a counter-clockwise direction until the correct adjustment between the worm and sector is made. (§223).

In replacing the small segment gears on the lower ends of the spark and throttle tubes, so mesh the teeth with the teeth of the larger segment gears, that the end teeth of the smaller gears do not pass the ends of the larger gears in moving the spark or throttle levers from the extreme retard to the extreme advance position, or vice versa.

The adjustment of the control rods should be checked. The throttle in the carburetor should be permitted to "close" but should start to open immediately the throttle lever on the steering post is moved from the fully closed position. The lever on the distributor and timer should be permitted to reach the fully retarded position but should move immediately the spark lever is moved from the retarded position. After completing this work it is a good plan to recheck the ignition timing. (§149).

Refill the steering gear housing with suitable lubricant. Cadillac Steering Gear Lubricant is recommended.

If the adjustment of screw "O" (Fig. 55) has been changed, it should be readjusted in accordance with the directions in §224. Make sure that the cap screws in the cover plate are tight before making this adjustment.

When replacing the steering arm on the sector shaft, have the front wheels pointing straight ahead and the steering wheel in the central position. Then apply the arm so that the pivot can be connected to the steering connecting rod without moving either the rod or the arm. To find the central position of the steering wheel note the number of turns required to turn the wheel from extreme right to extreme left and turn the wheel back half this amount.

In replacing the nut which holds the steering arm to the sector shaft, be sure that it is well tightened.

HOUSING FOR STEERING GEAR WORM AND SECTOR

547 Removal

Remove and disassemble the steering gear. (§§542-544).

548 Inspection

Clean all parts removed.

INSPECTION OF HOUSING—Inspect the housing carefully.

The long eccentric bushing should be a sliding fit in the housing.

INSPECTION OF OTHER PARTS—Inspect all parts in accordance with the directions in this book under the appropriate headings.

549 Reassembly and Replacement of Steering Gear

After inspecting all parts in accordance with directions in this book, reassemble the steering gear and replace it. (§546).

STEERING CONNECTING ROD

550 Disconnecting Rear End

Remove the grease connection.

Remove the leather boot.

Remove the cotter pin, adjusting screw and spring.

The rear end of the rod can now be removed from the pivot on the steering arm.

To remove the rear pivot bearing, screw into it a one-fourth inch rod threaded on the end with 20 thread.

551 Disconnecting Front End

Remove the grease connection.

Remove the leather boot.

Remove the cotter pin and adjusting screw.

The front end of the rod can now be removed from the pivot on the steering arm.

552 Inspection

Clean all parts removed.

INSPECTION OF STEERING CONNECTING ROD—Examine the rod. It should be true and free from dents.

Examine the welds at each end of the rod.

The thread in each end should be in good condition.

Inspect the adjusting screws. The threads should be in good condition.

Examine the bronze bearings. All machined surfaces should be in good condition.

The springs should have a free length of approximately eleven-sixteenths inch.

Inspection of Other Parts—Examine the pivots on the steering arms. These should be in good condition and out of round no more than .010 inch.

553 Replacement

In replacing pack the bearings with cup grease. Cadillac Gun Grease is recommended.

Take up the adjustment just enough to take up all play in the bearings, but not sufficiently to bind the bearings on the pivots. If the adjusting screws are too tightly drawn up, excessive wear on the pivots and bearings, and stiff steering will result.

Do not replace the used cotter pins. Use new ones.

WHEELS

Before starting to remove a wheel, jack up the axle, turn the wheel slowly and determine if it is out of true. A wheel should run out of true no more than five thirty-seconds inch. Do not make this test either on the tire, or on the demountable rim, but on the felloe band of the wheel.

554 Removal of Front Wheel and Bearings

Jack up the axle until the wheel is free from the ground.

Remove the hub cap by unscrewing it.

Remove the cotter pin "E" (Fig. 58.)

Remove the locking nut "A."

Remove the washer "B."

Remove the adjusting nut "C."

Remove the wheel, being careful not to drop the outer roller bearing.

The inner roller bearing can be removed, after removing the retainer. The inner and outer mountings can be removed by driving them out.

555 Removal of Rear Wheel and Bearings

Remove the hub cap by unscrewing it. (On early Type 61 cars there is an oiler which must be removed before the hub cap can be unscrewed.)

Remove the locking ring "I" (Fig. 57) and withdraw the axle shaft. If the axle shaft sticks it may be removed by tapping a cold chisel between the rear faces of the drivers on the axle flange and the bottoms of the recesses in the hub flange. If one of the axle shafts fits particularly tight, remove the looser one in accordance with these directions and drive out the other, by passing a bar of suitable size and length through the opposite end of the axle housing.

Jack up the axle until the wheel is free from the ground and remove the lock nut "D," the washer "E," and the adjusting nut "F."

Remove the wheel, being careful not to drop the outer bearing. The removal of the wheel is facilitated if it is removed squarely.

The inner bearing may be removed after removing the retainer. The inner and outer mountings can be removed by driving them out.

556 Inspection

Inspection of Wheel—The wood parts should be free from cracks and fitted together tightly.

The nuts on all hub and brake drum bolts should be tight. The ends of the bolts should be headed over slightly to prevent the nuts loosening.

Bearing mountings should be a driving fit into the wheel hubs.

Wheels at the felloe band should run true within five thirty-seconds inch laterally.

The brake drums on all wheels should run true within one-sixteenth inch radially.

Inspection of Other Parts—Examine the bearing surfaces of the mountings, cones and rolls. The surfaces should be smooth and free from pits and chips. The roller cages should be in good condition.

The bearing cone should have no more than .002 inch clearance on the spindles of the axle.

The bolts for the rim wedges should be straight. The threads on the bolts and in the wedges should be in good condition.

Inspect the demountable rims. Demountable rims should be free from dents or other injuries, and when off the wheel should be round within one-eighth inch. The locking ring, the lock, and the rivet which holds the lock to the rim, should be in good condition. When off the rim, the ends of the locking ring should point directly toward each other and come together.

557 Replacement

Before replacing the bearings, fill between the rolls with suitable lubricant. Approximately three ounces are required for each wheel. Cadillac Wheel Bearing Grease is recommended.

In replacing the retainer "T" (Fig. 98) screw it in until flush with the inner face of the wheel hub. Adjust the bearings in accordance with the directions in §§226, 228.

FRAME AND SPRINGS

FRAME

558 Removal

Remove the combination rear lamp and remove the bracket on the conduit from the tire carrier. Remove the tire carrier. (On Type 61 cars the tire carrier may be removed with tail lamp attached.)

Remove the body complete with top and windshield. (§567).

Remove the front fenders. (§573).

Remove the running boards and dust shields. (§§569, 570).

Remove the radiator. (§425).

Remove the dust shield over the forward universal joint, and disconnect the joint from the drive shaft on the transmission. Do not allow the joint to drop and injure the rear joint casing.

Disconnect the brake rods from the brake pedal and the hand brake levers.

Remove the pull-back spring between the clutch pedal and the frame and remove the copper pipe between the tire air compressor and the frame.

Remove the engine in accordance with the directions in §301 but do not disconnect the transmission from the engine.

Remove the front axle. (§§512, 532).

Remove the rear axle. (§488).

Remove the torque arm support from frame. Use Cadillac wrenches Nos. 83236 and 83237.

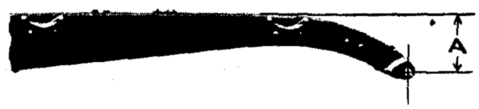

Fig. 100—Side Bar, Front End

Remove the three rear springs by removing the spring bolts at the front ends of the side springs and the two spring clips at the center of the cross spring.

Remove the front springs. The bolts at the upper ends of the shackles at the rear ends can be started with tool No. 83235 and removed with Cadillac puller No. 83222.

Remove the gasoline tank by disconnecting the unions on the two pipes to the tank and removing the three nuts. In removing the washers under the two forward nuts observe the manner in which they are assembled. These washers must be put back as originally assembled.

Remove the piping from the frame.

Remove the brake cross shafts from the tubular cross-member back of the transmission and from the channel cross-member opposite the front ends of the rear springs.

Remove the steering gear by first removing the steering arm and then removing the four three-eighths inch bolts.

559 Inspection

Determine if the frame has become bent or sprung. To do so take the following dimensions:

From the machined face of bracket, "C" (Fig. 101) to the machined face of bracket "D" should be from $24\frac{5}{16}$ to $24\frac{3}{8}$ inches.

Dimensions "A" and "B" taken from the center of the socket "E" to the centers of the large bolt holes in the brackets "C" and "D" should vary by no more than .020 inch.

Pass a center line through the center of the socket "E" and through a point equally distant from the machined faces of the bracket "C" and "D." Dimensions "F" and "J," taken from the line to the centers of brackets "H" and "I," should vary by no more than .060 inch. Dimensions "O" and "P" taken from the centers of the brackets "M" and "N" should vary by no more than .100 inch. Dimensions "R" and "S" taken from the centers of brackets "K" and "L" should vary by no more than .025 inch.

The distance "A" (Fig. 100) from the center of the spring bolt hole in the brackets at the front ends of the side bars (fenders and hood shelves removed) should be five and eleven-sixteenths inches.

To determine if the frame side bars are parallel, lay parallel bars across the frame directly over the front engine support and over brackets "H" and "I" (Fig. 101). By sighting across these bars it may be determined if the frame is twisted.

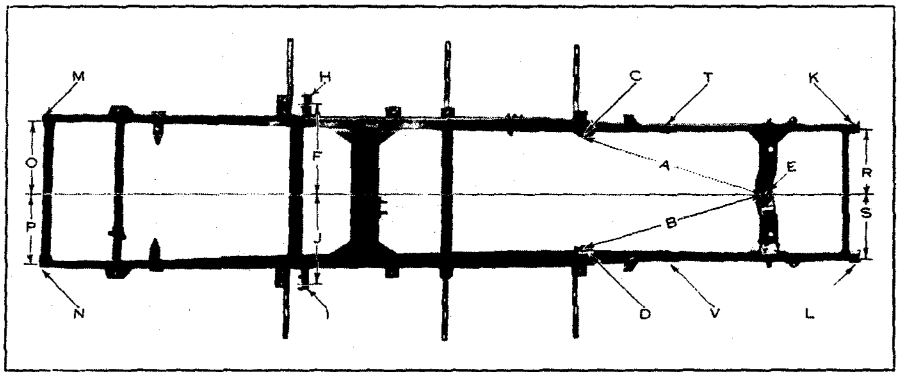

Fig. 101—Frame.

Examine all rivets. They should be tight in the frame.

Examine the machined surfaces of socket "E," also the threads for the socket cap screws.

Inspect the steel bushings "T" and "V." There should be no more than .005 inch clearance between these bushings and the bolts. The bushings should be a tight driving fit into the frame brackets.

These bushings may be removed by using Cadillac puller No. 71953 as shown in Fig. 102.

To force out a bushing place the tool in position as shown in Fig. 102 and draw up on the large nut. To replace a bushing reverse the tool. Lubricate the bushing before pulling it in.

The clearance between the sides of the brackets "K," "L," "I" and "H" (Fig. 101) and the spring ends should be taken up by means of the washers of different thicknesses which are provided for this purpose. The spring ends must not bind in the brackets, however.

Examine the bushings in which the brake shafts operate. They should be in good condition.

Examine the tubular cross members. They should be straight and tight in the brackets at each end.

560 Replacement

In replacing, reverse the operations under "Removal."

All spring bolts, brake shafts, etc., should be well lubricated before they are replaced.

Do not tighten spring bolts sufficiently to bind the spring ends. After tightening the large bolts which hold the rear engine supports to the frame, loosen the nuts one notch before putting in the cotter pins.

SPRINGS

561 Removal of Front Spring

Disconnect the lower ends of the snubber straps from the front axle.

Jack up the front end of the car approximately four inches.

Remove the nuts from the double clip.

Remove the bolts at each end of the spring and remove the spring. Use tool No. 83235 to start the bolts and puller No. 83222 to remove them.

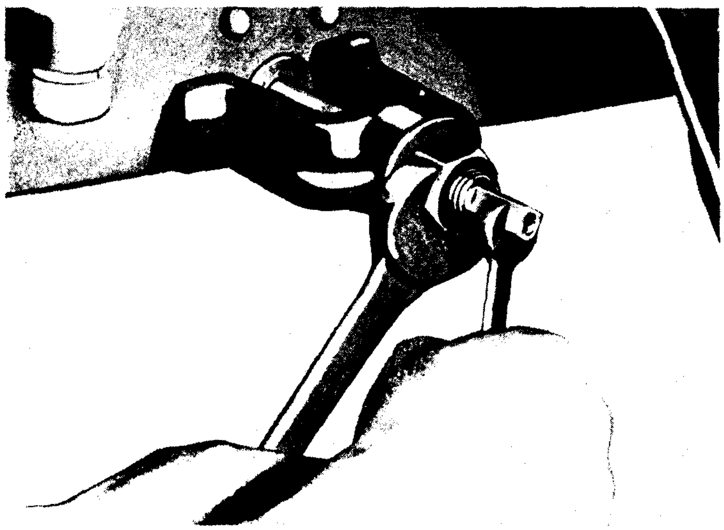

Fig. 102—Removing Shackle Bolt Bushings from Frame

562 Removal of Rear Side Spring

Disconnect the lower ends of the snubber straps from the rear axle.

Jack up the rear end of the car approximately four inches.

Remove the nuts from the double clip.

Remove the bolt at each end of the spring and remove the spring.

A small door is provided in each dust shield to facilitate the removal of the forward bolts.

563 Removal of Cross Spring

Disconnect the lower ends of the snubber straps from the rear axle.
Jack up the rear end of the car approximately five inches.
Remove the nuts from the two spring clips.
Remove the bolts at each end of the spring and remove the spring.

564 Disassembly

Remove the bolt in the center of the spring and the bolts in the clips which enclose a portion of the leaves. These bolts are headed over on the ends. File the ends off flush with the nuts and remove the nuts. Use new bolts in reassembling springs.

565 Inspection

Examine the spring leaves; they should be unbroken, free from cracks and smooth where they contact with other leaves. If they are not smooth, clean them up.

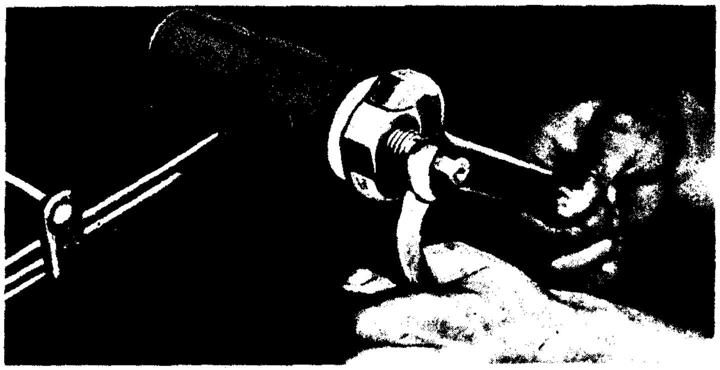

Fig. 103—Removing Spring Eye Bushing

Examine the bronze bushings in the eyes of the longest leaf. The bushings should be a tight driving fit into the spring eyes and have no more than .005 inch clearance on the spring bolts.

These bushings may be removed by using Cadillac puller No. 72355, as shown in Fig. 103.

Place the tool in position as shown in Fig. 103. The bushing may then be removed by screwing up on the nut.

To pull a bushing into place, place the tool in the reverse position, lubricate the bushing and tighten up on the nut.

566 Replacement

All rust should be cleaned from the surfaces of the leaves, which contact with other leaves, and the surfaces should be well lubricated with suitable lubricant before the spring is reassembled. Graphite grease is recommended.

Care must be exercised in drawing up the spring shackle bolts not to bind the spring ends in the shackles.

By substituting washers of greater thickness, take up all clearance between the front ends of the rear and front side springs and the brackets, but do not permit the springs to bind in the brackets.

All spring clips should be well tightened.

BODY, RUNNING BOARDS AND SHEET METAL PARTS

BODY

567 *Removal*

Remove the combination rear lamp and remove the bracket on the conduit from the tire carrier. Remove the tire carrier. (On Type 61 cars the tire carrier may be removed with the tail lamp attached.)

Remove the rear fenders. (§574).

Remove the floor boards.

Remove the cap from the steering gear bracket attached to the instrument board.

Remove the tie rod between the body and the radiator.

Disconnect the two pipes at the left side bar.

Disconnect the wires from the stop light switch on the clutch and brake pedal support and from the backing light switch on the rear of the transmission.

Disconnect the pipe at the pressure regulator.

Disconnect the speedometer cable from the speedometer head.

Disconnect one of the cables from the storage battery, and block it up with a dry piece of wood to prevent it touching the terminal of the battery. Remove the generator top cover plate and remove from the generator the three small wires.

Disconnect from the front face of the dash the flexible tube which runs to the right-hand high tension conduit. Disconnect the low tension and high tension wires from the coil and remove these wires through the hole in the dash. On cars which have the horn mounted on the fan-shaft housing, also disconnect the horn wire from the portable lamp.

Disconnect the two headlight wires from the body. Connectors are provided at the front end of the body on each side.

On cars which have the horn mounted on the intake manifold, disconnect both wires at the horn and disconnect the horn wire to the steering column at the connector at the front of the body on the left side.

Disconnect the rod between the cowl and the carburetor.

Remove the head-lamp reflector control rod button at instrument board and pull out rod.

Place a suitable covering over steering wheel to prevent it's being scratched or dented.

Remove the ten nuts which hold the body to the frame and remove the body.

568 *Replacement*

Before replacing body make sure that the "anti-squeak" material is in good condition. All body bolts should be drawn down firmly.

Before replacing the wires to the generator, or to the coil or the cable to the storage battery, make sure that the terminals are clean. All terminals should be well tightened.

In setting on the body, care must be exercised not to allow it to strike the steering wheel. A suitable covering should be used to protect the wheel.

RUNNING BOARDS AND DUST SHIELDS

569 Removal of Right Running Board and Dust Shield

Remove the two cap screws which hold the rear fender to the running board and the three bolts which hold the fender to the dust shield.

Remove the front fender. (§573).

Remove the four bolts which hold the tool box to the side bar of the frame. (No dust shield tool box is fitted to Type 61 cars).

Remove the nine nuts which hold the running board to the running board brackets and the six (three on Type 61) nuts which hold the dust shield to the running board.

Remove the running board.

Loosen the forward body bolt and remove the dust shield.

570 Removal of Left Running Board and Dust Shield

Remove the two cap screws which hold the rear fender to the running board and the three bolts which hold the fender to the dust shield.

Remove the front fender. (§573).

Remove the storage battery. This may be done after disconnecting the two cables and removing the nuts on the two long hold-down bolts. Care must be exercised in removing the battery not to drop it or to spill the contents.

Remove the four bolts which hold the battery box to the frame.

On cars which are equipped with a tire air compressor, disconnect at the dust shield, the terminal on the end of the tube from the compressor.

Remove the nine nuts which hold the running board to the running board brackets and the six nuts which hold the dust shield to the running board.

Remove the running board.

Loosen the forward body bolt and remove the dust shield.

571 Inspection

Examine the dust shields for cracks and dents.

Rusted spots on the running board should be cleaned and painted.

The wooden running board on Type 61 cars should be free from cracks and should not be warped.

Examine the threads on the running board hold-down bolts and nuts.

Examine the linoleum on the running board and if necessary replace it. Armstrong's Nonpareil Linoleum Cement is recommended. The surface of the metal should be clean and roughened as much as possible (preferably by sand blasting).

572 Replacement

In replacing the dust shield make sure that the "anti-squeak" material between the fenders and shield is in good condition.

All bolts and nuts should be well tightened.

FENDERS

573 Removal of Front Fender

Remove the hood.

Disconnect at their rear ends the small rods which extend from the headlamps back to the cross-shaft on the rear of the radiator. (On Type 61 cars these rods may be disconnected at the headlamps.)

Disconnect one of the headlamp wires at the lamp and remove the lamp.

Remove the cap screws holding the ends of the cross tube to the fender supports. The cross tube can then be telescoped enough to permit it to be removed without interference with the fenders.

(On Type 61 cars, telescoping of the cross tube is not necessary to remove it. On these cars both headlamps with cross tube can be removed together.)

Remove the two hood fasteners. Each hood fastener is held in place by two small machine screws.

Remove the radiator splash shield mouldings. On later V-63 cars, each moulding is held in place by two bolts passing completely through the side bar. On early V-63 cars, the bolts pass only through the upper flange of the side bar. (On Type 61 cars the moulding is a part of the hood shelf.)

(On Type 61 cars disconnect, at the body, the wire to the head-lamp. The connector is at the forward end of the body.)

Remove the hood shelf. Each shelf is held by the hood fastener screws and by two short bolts, one through the dust shield and one through the upper flange of the side bar. (On Type 61 cars which have the hood shelf and the radiator splash shield moulding in one piece, the hood shelf is held in place by five bolts.)

Remove the two cap screws which hold the fender to the running board.

Remove the six small machine screws which hold the fender to the dust shield.

Remove the two large nuts which hold the fender support arms to the fender brackets on the frame, and remove the fender.

574 Removal of Rear Fender

Remove the two cap screws which hold the fender to the running board.

Remove the three small bolts which hold the fender to the dust shield.

Remove the two bolts which hold the fender to the small corner shield at the rear of the car.

Remove the cap screws which hold the fender to the body and remove the fender.

575 Inspection

Examine the fenders for cracks and dents.

576 Replacement

Make sure that the "anti-squeak" material between the front fender and the frame, between the rear fender and the body and between the front and rear fenders and dust shield is put back as originally assembled, or replaced by new if not in good condition.

MUFFLERS

577 Removal

Disconnect from the side bar the bracket supporting the front end of the tail pipe. Loosen the clamping screws at the ends of the muffler and slide the muffler toward the rear until it is clear of the exhaust pipe. Remove the muffler by pulling it off from the tail pipe.

578 Disassembly

Remove the forty machine screws holding the ends of the muffler to the center section.

Remove the baffle plates, noting their relative positions so they can be re-assembled in the same order.

579 Inspection

Clean the carbon from the inside of the muffler shell and from the baffle plates. Inspect the shell and plates, making sure all holes are free.

580 Reassembly and Replacement

Reassemble the baffle plates in their original order and replace the muffler, reversing the operations under "Removal." Make sure that the end of the muffler with the conical shaped plates is toward the front.

PART IV
LUBRICATION

LUBRICANTS

701 Cadillac Engine Oil

There are many grades of oils. There are none too good. Naturally, we have experimented a great deal with numerous lubricants to determine which are best adapted for the various parts of the Cadillac car. It is not always an easy matter to obtain suitable lubricants. The constant demand made upon us has induced us to provide suitable lubricants.

Cadillac Engine Oil is recommended and is supplied in two grades: light, for cold weather, and heavy, for warm weather. In the absence of Cadillac Engine Oil we recommend lubricant of the following specifications:

702 Light Oil Specifications

Flash test (Cleveland open cup)—not below 335° Fahr.
Viscosity (Saybolt Universal)
180-220 seconds at 100° Fahr.
Carbon residue (Conradson)—not over 0.2%.
Fire point (Cleveland open cup)—not below 380° Fahr.
Pour test—0° Fahr. or below.
Color—not darker than number 4 National Petroleum Association.

703 Heavy Oil Specifications (Paraffine base)

Flash test (Cleveland open cup)—not below 420° Fahr.
Viscosity (Saybolt Universal)—450-575 seconds at 100° Fahr.
Carbon residue (Conradson)—not over 0.8%.
Fire point (Cleveland open cup)—not below 480°.
Pour test—40° Fahr. or below.
Color—not darker than number 5 National Petroleum Association when mixed 50-50 by volume with water-white kerosene.

704 Heavy Oil Specifications (Non-paraffine base)

Flash test (Cleveland open cup)—not below 360° Fahr.
Viscosity (Saybolt Universal)—450-575 seconds at 100° Fahr.
Carbon residue (Conradson)—not over 0.4%.
Fire point (Cleveland open cup)—not below 410° Fahr.
Pour test—10° Fahr. or below.
Color—not darker than number 6 National Petroleum Association.

705 General Specifications

The oil should not corrode any metal used for machine construction.

Oil purchased under these specifications must be properly refined petroleum oil. It should not contain water, sediment, acid, soap, resin, or any substance not derived from petroleum.

Tests should be made according to standard and tentative methods of the American Society for Testing Materials.

Engine oil should be strained through cheese cloth or fine mesh wire cloth before using.

A list of approved oils will be mailed on request.

706 *Cadillac Rear Axle and Transmission Lubricant*

Cadillac Rear Axle and Transmission Lubricant is recommended for the rear axle and transmission. This lubricant is made in two grades, heavy and light, for use during warm and cold weather, respectively. It is important that the light grade be used at low temperatures and the heavy grade at higher temperatures. If necessary to secure easier gear shifting at extremely low temperatures the light grade of lubricant can be thinned with the light grade of engine oil.

707 *Transmission and Rear Axle Lubricant Specifications*

Heavy

Pour test—not above 60° Fahr.
Flash test (Cleveland open cup)—not below 460° Fahr.
Viscosity (Saybolt Universal—140-160 seconds at 210° Fahr.
Precipitation No. not to exceed 1.0 cc.
Water and sediment not to exceed 0.5% by volume.

Light

Pour test—not above 10° Fahr.
Flash test (Cleveland open cup)—not below 325° Fahr.
Viscosity (Saybolt Universal)—80-100 seconds at 210° Fahr.
Precipitation No. not to exceed 5.0 cc.
Water and sediment not to exceed 0.5% by volume.

Lubricant purchased under these specifications must be properly refined petroleum oil. It must not contain grit, sediment, acid, alkali, soap, resin, excessive moisture or any substance not derived from petroleum. The lubricant must not corrode any metal used for machine construction.

708 *Gun Grease*

Cadillac Gun Grease is recommended for use in the grease gun or, in its absence, No. 3 cup grease.

709 *Distributor Grease*

Cadillac Distributor Grease is recommended for the distributor.

710 *Universal Joint Grease*

Cadillac Universal Joint Grease is recommended for the universal joints on the drive shaft or, in its absence, No. 3 fibre grease.

711 *Steering Gear Lubricant*

A mixture consisting of seventy-five per cent of Cadillac Rear Axle and Transmission Lubricant and twenty-five per cent Cadillac Gun Grease or No. 1 cup grease is recommended for the steering gear.

712 *Wheel Bearing Grease*

Cadillac Wheel Bearing Grease is recommended for the wheel bearings. In its absence, No. 1 cup grease is recommended.

ENGINE LUBRICATION

713 *Lubricating System*

The lubrication of the engine is by oil under pressure. A supply of oil is carried in the oil pan "A" (Fig. 104.) Oil is drawn from the oil pan by the oil pump "C" through the pipe "B" and forced to the main bearings "E," "F" and "G," through the supply pipe "D."

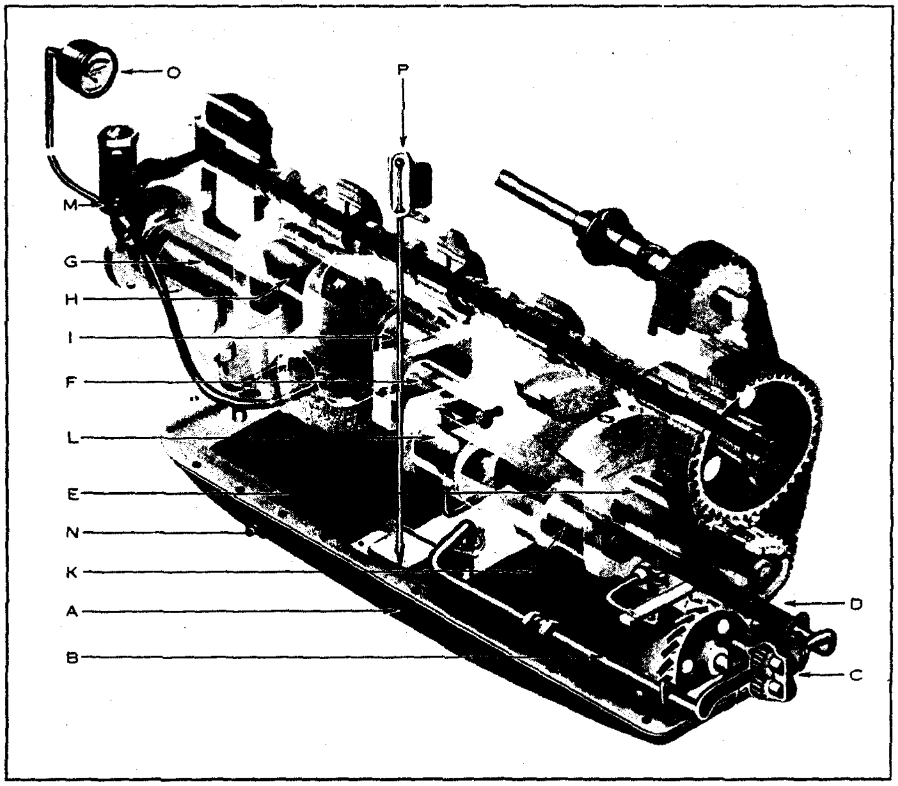

Fig. 104—Engine Lubricating System.

The pressure of the oil is regulated by an overflow valve or pressure regulator "M," containing a valve under spring tension. When the pressure is reached for which the valve is set, the valve is forced open and the oil overflows past the valve. A small hole "D" (Fig. 106) drilled in the regulator housing allows oil to by-pass the valve when the valve is seated. Oil flowing through the by-pass and oil forced past the valve is carried to the camshaft bearings and power air compressor in the gasoline system through the camshaft. The oil flows to the sprockets and to the chains through the camshaft and holes drilled in the sprockets.

The crank pin bearings "H," "I," "K" and "L," (Fig. 104) on the crankshaft, are lubricated by oil from the main bearings forced through holes drilled in the crankshaft. The hole drilled in the forward end of the crankshaft communicates with a hole drilled in the crankshaft sprocket through which oil is supplied to the camshaft chain. The cylinders are lubricated by oil thrown from the lower ends of the connecting rods.

There is one gauge and one indicator in the lubricating system. The pressure gauge "O" is located on the instrument board. The indicator "P" is attached to the upper cover of the crankcase near the carburetor and indicates the level of the oil in the oil pan "A."

714 Filling Lubricating System

A filling hole is provided on the fanshaft housing just forward of the distributor and timer. It is of the utmost importance that engine oil be free from dirt and lint and of suitable quality. (§§701–705).

Add oil if the oil level indicator (Fig. 105) is down to the line marked "Fill."

If it is believed that the oil level indicator does not operate from any cause or fails to indicate correctly, it may be checked by draining out all of the oil and refilling with 7 quarts. The indicator should then indicate "Full."

715 Replace Engine Oil

At the end of each 500 miles of travel remove the drain plug from the engine oil pan (Fig. 105.) After the oil has drained out replace the plug and through the oil filler on the housing just back of the fan, add seven quarts of fresh engine oil (§714). A socket wrench with a long handle is supplied with the tool equipment to facilitate the removal and replacement of the drain plug.

At the end of the first 1,000 miles of travel, at the end of the next 3,000 miles of travel and at the end of every 4,000 miles of travel thereafter, drain the oil pan as directed in the preceding paragraph, replace the plug and through the filler add a mixture consisting of three quarts of kerosene oil and one quart of engine oil. The mixture must be free from dirt and lint. Run the engine at a speed of between 600 and 1,000 revolutions per minute for the period of one minute. Then drain the oil pan, remove it and the screen from the engine and thoroughly clean the oil pan and screen. Do not fail to add seven quarts of fresh engine oil after replacing the oil pan.

After cleaning the lubricating system with a mixture of kerosene and engine oil it is a good plan to clean the valve and seat of the pressure regulator. The regulator is located just back of the right hand block of cylinders. The valve can be removed after removing the regulator cover by unscrewing it. It is important also to make certain that the small by-pass hole by which oil is permitted to escape when the regulator valve is closed, is clean and free from any obstruction.

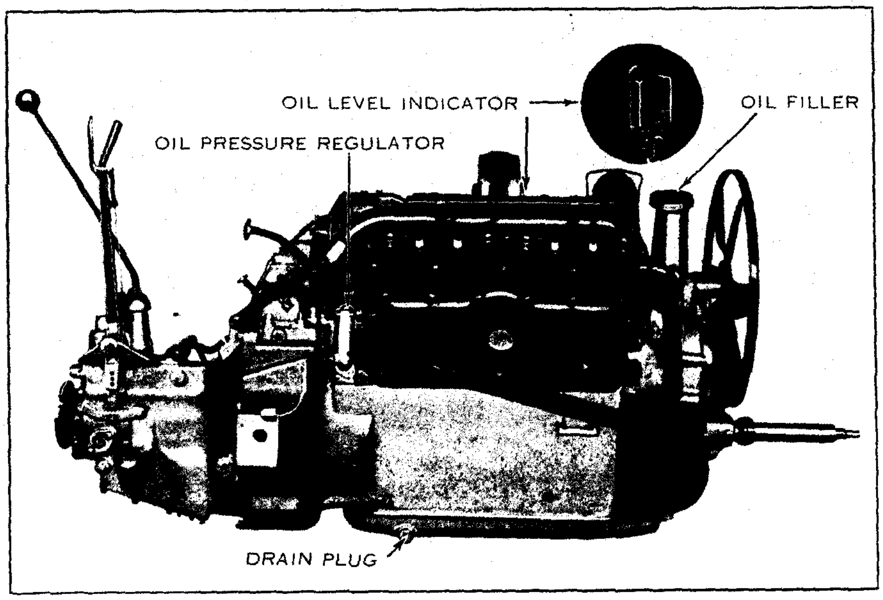

Fig. 105—Side View of V-63 Engine Showing Oil Filler, Level Indicator, Pressure Regulator and Drain Plug

Do not use waste in cleaning the regulator or its seat. Use cloth free from lint.

Caution:—Do not fail to replace the engine oil as frequently as suggested.

716 Replace Engine Oil Frequently During Cold Weather

The mileages given in §715 at which engine oil should be replaced and the oil pan and screen cleaned are those at which this work should be done during warm weather.

During cold weather water and gasoline may accumulate in the crankcase of the engine. It is necessary, therefore, to drain the oil pan and clean the oil pan and screen much more frequently than during warm weather.

The frequency with which it is necessary to do this depends very largely upon the manner in which the car is driven. In cases where the car is driven short distances only and frequent stops are made so that the engine base and the oil remain cold it will be necessary to drain the oil pan and to clean the oil pan and screen much more frequently than in cases where the car is driven for longer distances with fewer stops, so that the engine base becomes thoroughly warmed.

If the car is constantly making short trips in cold weather the oil should be drained every 350 miles of travel or once a week and the oil pan and screen cleaned once a month.

Unless the oil is drained out and the oil pan and screen are cleaned frequently in cold weather, serious damage to the engine may result, particularly on cars in short trip service.

717 Oil Pressure

The pressure indicated by the oil gauge on the instrument board varies with the speed and temperature of the engine and the viscosity of the oil. When the engine is warm and supplied with fresh Cadillac Engine Oil or oil of approximately the same viscosity, the pressure as indicated by the gauge should be from five to seven pounds when the engine is idling. (When idling the engine should run at approximately 300 revolutions per minute, if the throttle stop-screw at the carburetor is properly adjusted.) At higher speeds a higher pressure should be indicated and at lower speed a lower pressure. Before the engine has become warm, higher pressures will be indicated at given speeds. In other words, maximum pressures will be indicated at given speeds when the engine is cold and the oil is fresh; minimum pressures, when the engine is hot and the oil becomes thin from use.

Practically all engine lubricating oils become less viscous from use even under normal conditions. Running the engine too long with the auxiliary air control lever pulled back will cause the oil to be thinned more rapidly due to the condensation of gasoline from the rich mixture.

718 Adjustment of Oil Pressure Regulator

If, when the engine is supplied with fresh Cadillac Engine Oil, or oil of approximately the same viscosity, and the engine is warm and running at approximately 300 revolutions per minute, the pressure of the oil is more than seven pounds, a readjustment of the pressure regulator should be made. If the pressure is less than five pounds, dirt between the valve and its seat, or an incorrect adjustment of the regulator is indicated. To readjust proceed as follows:

Remove the cap "A" (Fig. 106) by unscrewing it and loosen the lock nut "C."

If a pressure of more than seven pounds is indicated, screw up on the spring seat "B." If a pressure of less than five pounds is indicated and the valve and its seat are clean, unscrew the seat "B."

Lock the adjustment with the nut "C."

If it is found upon replacing the cap and starting the engine that the pressure is still incorrect, remove the cap again and make further adjustment.

Caution:—If when starting the engine after replacing the oil it is found that the gauge does not register pressure, stop the engine immediately and prime the oil pump. This may be done by disconnecting the oil pipe from the pressure regulator and forcing two to three gunfuls of clean engine oil into the regulator. Connect the pipe and tighten the union before starting the engine.

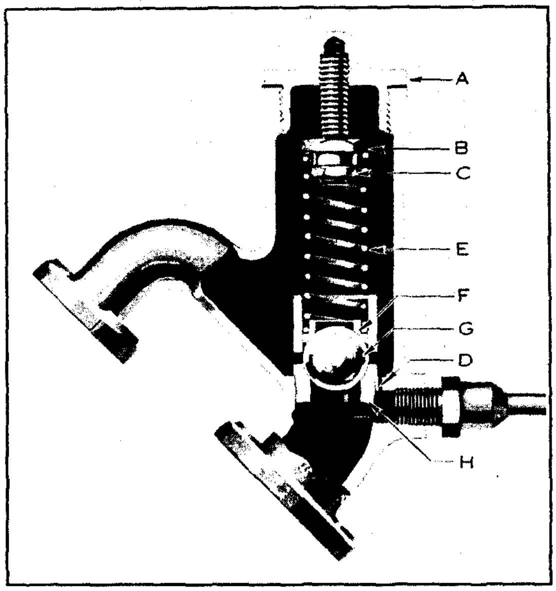

Fig. 106—Oil Pressure Regulator, Sectional View.

GENERAL LUBRICATION

It is manifestly impossible to give exact directions in every instance as to just how frequently each individual point should be oiled or exactly how much lubricant should be applied. In the following directions this is given approximately, based on average use. The numbers refer to Fig. 107.

With the tool equipment of each car is packed a lubrication chart with a schedule for the lubrication of the car. This is intended to be hung in a garage to serve as a reminder.

EVERY 125 MILES

719 Engine: 28

At every 125 miles, or oftener, determine the quantity of oil in the engine and add oil if required. (§§714, 715).

EVERY 500 MILES

720 Grease Gun Connections: G

Points "G" should be lubricated with the grease gun at every 500 miles of travel. Cadillac Gun Grease or No. 3 Cup Grease is recommended.

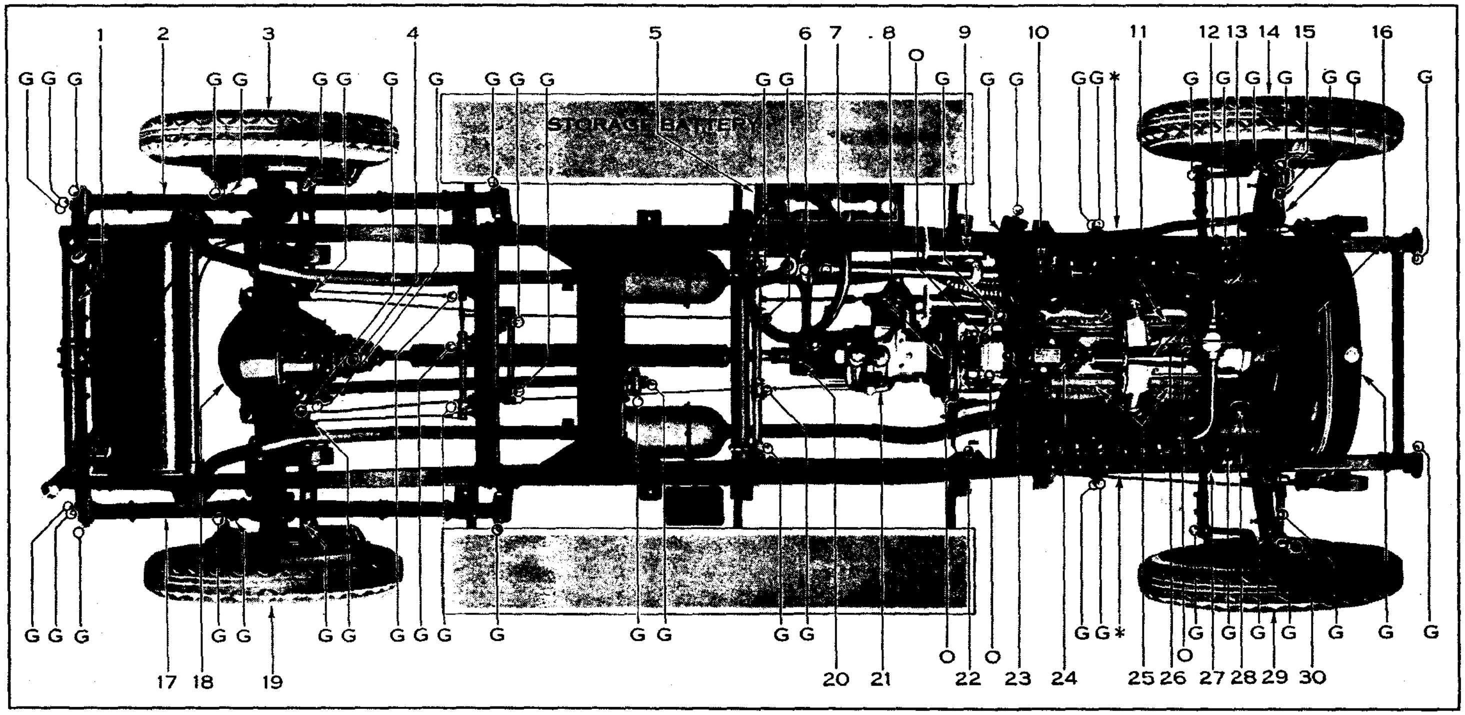

Fig. 107—General Lubrication Diagram.

Each "G" indicates a Grease Gun Connection. Each "O" indicates an Oiling Point at which Engine Oil should be applied. Each number indicates a Lubricating Point for which instructions are given under "General Lubrication."

Lubricating Points which are visible in the diagram are surrounded by circles. Others are indicated by arrows.

**These points are grease gun connections for the front brake rod idler levers, used on early V-63 cars. Other V-63 cars are fitted with cables and do not require grease gun connections at these points.*

721 Springs: 1, 2, 12, 17, 27

It is recommended that the springs be lubricated every 500 miles by painting the edges and ends of the leaves with engine oil. A small, stiff brush should be used. After applying the oil, the car should not be washed until it has been driven far enough to allow the lubricant to work in between the leaves. Do not open up the leaves and insert lubricant.

722 Replace Engine Oil

Replace the engine oil at the end of every 500 miles of travel. (§§715, 716).

723 Water in Storage Battery: 5

Every 500 miles, inspect the level of the acid in the storage battery and add distilled water if the level is low. (§159).

EVERY 1000 MILES

724 Oil Cups: O

A few drops of engine oil should be applied at points "O" every 1,000 miles.

725 Universal Joints: 4, 20

Fill the forward and rear universal joints on the drive shaft between the transmission and rear axle with Cadillac Universal Joint Grease every 1,000 miles. A connection is furnished with the grease gun which fits the filling holes.

The forward joint is covered by a cylindrical shield to prevent grease from being thrown onto the under side of the floor. To fill the joint it is necessary first to detach the shield from the transmission case and to slide it back over the drive shaft. This may be done after loosening the two screws which hold the shield and turning the shield through a small arc in a counter-clockwise direction.

726 Fan Driving Clutch: 16

There is a lubricating point in the hub of the rear fan disc just forward of the shield which encloses the fan spring. On some V-63 cars there is a grease gun connection at this point and on others an oil hole. Cadillac Gun Grease or Engine Oil should be applied at this point every 1,000 miles. It may be necessary to crank the engine to bring the connection or hole to the top so the lubricant can be applied.

727 Generator Oil Cups: 23, 24

These oil cups conduct lubricant to the forward and rear bearings on the armature shaft of the motor generator. A few drops of engine oil should be applied every 1,000 miles.

728 Oil Holes at Steering Wheel: 6, 7

A few drops of engine oil should be applied every 1,000 miles. The oil hole at the upper end of the steering column is closed by a screw plug, which must be removed before the oil can be applied.

729 Engine Rear Supports: 9, 22

There are felt wicks in the frame bracket to which the engine supports are bolted. Engine oil should be applied at these points every 1,000 miles of travel or oftener if necessary.

730 Clean Engine Lubricating System

At the end of the first 1,000 miles of travel, at the end of the next 3,000 miles of travel, and at the end of every 4,000 miles of travel thereafter, clean the lubricating system and the oil pan and screen. (§§715, 716).

EVERY 2000 MILES

731 Transmission: 21

The transmission should contain sufficient lubricant to bring it up to the level of the filling hole at the right hand side. The level should be inspected every 2,000 miles and lubricant added if necessary. Cadillac Rear Axle and Transmission Lubricant is recommended. The light grade should be used in cold weather and the heavy grade in warm weather.

732 Rear Axle: 18

The rear axle should contain lubricant to bring it up to the level of the filling hole in the rear cover plate. The level should be inspected every 2,000 miles and lubricant added if necessary. Cadillac Rear Axle and Transmission Lubricant is recommended. The light grade should be used in cold weather and the heavy grade in warm weather.

733 Timer and Distributor: 26

Every 2,000 miles remove the small breather at the rear of the distributor housing by unscrewing it, and pack Cadillac Distributor Grease around the gears by which the timer and distributor are driven.

734 Valve Stems: 11, 25

Apply engine oil to the valve stems and cam slides every 2,000 miles. This may be done by lifting the valve compartment covers and inserting the spout of the oil can.

735 Steering Gear: 10

The steering gear should be lubricated every 2,000 miles by applying the grease gun to the connection on the steering gear housing. Lubricant made by mixing 75% of Cadillac Rear Axle and Transmission Lubricant with 25% of Cadillac Gun Grease, or No. 1 cup grease is recommended. In order to determine when sufficient grease has been injected, remove the screw plug "E" (Fig. 55) from the hole in the steering column just below the steering wheel and inject grease with the gun until it flows from this hole.

736 Speedometer Flexible Drive Shaft

The flexible shaft by which the speedometer is driven is carried in a flexible casing. The shaft should be removed from the casing and lubricated at the end of every 2,000 miles of travel. Cadillac Gun Grease is recommended.

Do not under any circumstances attempt to lubricate the speedometer head. Any parts in the head which require lubrication are amply supplied when the head is assembled.

EVERY 4000 MILES

737 Clutch Thrust Bearing: 8

Every 4,000 miles remove the cover plate shown at 8. With the engine not running reach in and turn the clutch thrust bearing so that the small filler screw is at the top. Remove the screw with a screwdriver. Care must be exercised not to drop the screw into the clutch case.

A small connection for the grease gun is furnished with the tool kit. Screw this into the threaded hole from which the filler screw was removed and attach the grease gun.

Cadillac Gun Grease or No. 3 cup grease is recommended.

738 { Wheels: 3, 14, 19, 29
Front Brake Trunnions 15, 30

Every 4,000 miles, or every six months if the car is driven but little, all the wheels should be removed (§§225-228) and the bearings thoroughly cleaned in either gasoline or kerosene and examined. The bearings should be lubricated with a thin grease. Cadillac Gun Grease is recommended. Do not use heavy grease, as it will roll away from the path of the rollers and will not return.

Every 4,000 miles, while the front wheels are removed for lubricating, the brake operating trunnions inside the front wheel brake drums should also be lubricated as follows:

Remove the screw plug "A," Fig. 108 (shown at 15 and 30 in Fig. 107) and replace it with the grease gun connection furnished in the tool kit. Attach the grease gun and inject grease just until it begins to appear around the trunnion bearing inside the drum. Do not inject too much grease. Remove the grease gun connection and replace the screw plug. Before replacing the wheel be sure and wipe off any grease appearing around the trunnion bearing. Do not inject any grease at "A" except when the wheel is off and the application of too much grease can be positively avoided.

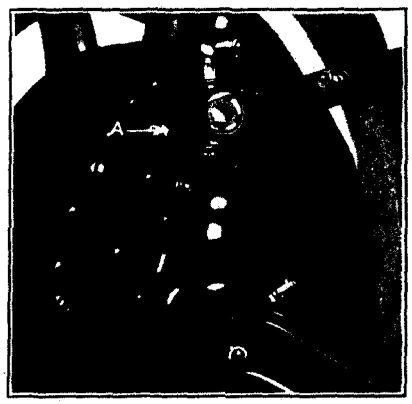

Fig. 108—Front Wheel Brake Lubricating Plug

739 Clean Engine Lubricating System

At the end of every 4,000 miles of travel, clean the engine lubricating system and the oil pan and screen (§§715, 716).

740 Horn: 13

The horn is lubricated when assembled and does not require further lubrication, but the commutator of the horn should be inspected every 4,000 miles and cleaned if necessary. (§138.) To do this, remove the motor shell from the horn. (On cars with the horn mounted on the fan-shaft housing, the horn with bracket must be removed from the engine before the motor shell can be removed from the horn.) If the commutator appears to be dirty, clean it with a dry cloth. This should be done with the horn motor running, so that the commutator will be cleaned on all sides. Do not attempt to polish the commutator or brushes with oil or vaseline. These parts are designed to run dry.

741 Replace Transmission Lubricant: 21

At the end of every 4,000 miles of travel remove the drain plug from the under side of the transmission case and drain out all of the lubricant. Refill with two quarts of suitable lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended. The light grade should be used in cold weather and the heavy grade in warm weather. The filler is shown at "21."

742 Replace Rear Axle Lubricant: 18

At the end of every 4,000 miles of travel remove the drain plug from the axle and drain out all of the lubricant. Refill with 5 quarts of suitable lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended. The light grade should be used in cold weather and the heavy grade in warm weather. The filler is shown at "18."

ADDITIONAL

In addition to the places specially mentioned, note carefully and oil all of the small connections and joints throughout the car, such as the various brake rod connections and joints in the brake mechanism.

Remember that wherever one part moves in contact with another, wear will be reduced to the minimum by lubrication.

GENERAL LUBRICATION

Part of Car	Lubricant to Use	Total Amount	Location of Filler	
Engine	Engine oil	Seven quarts	On fan shaft housing	28
Engine rear supports	Engine oil	Several drops	Felts in oil holes	9 22
Valve stems	Engine oil	Spray from oil gun	Remove valve cover plates	11 25
Bearings on armature shaft	Engine oil	Several drops	At front and rear of generator	23 24
Bearing at upper end of steering shaft	Engine oil	Several drops	Oil holes at steering wheel	6 7
Springs	Engine oil or Cadillac Rear Axle and *Transmission* Lubricant		Apply to sides and ends of leaves	1, 2 12 17 27
Wheel bearings	Number one cup grease	Three ounces in each wheel	Remove wheels	3 14 19 29
Mechanism in distributor housing	Cadillac Distributor Grease	Ten ounces	Breather at rear of distributor housing	26
Transmission	Cadillac Rear Axle and Transmission Lubricant	Two quarts	On right side of transmission case	21
Rear axle	Cadillac Rear Axle and Transmission Lubricant	Five quarts	On rear cover plate	18
Clutch thrust ball race	Cadillac Gun Grease or No. 3 Cup Grease	One-half ounce	On collar of ball race	8
Universal joints	Cadillac Universal Joint Grease or Number three fibre grease	Five ounces each	On casings around joints	4 20
Steering gear	Cadillac Steering Gear Grease or a mixture consisting of ¾ 600 W Lubricant and ¼ number one cup grease	Three pounds	Grease gun connection	10

NOTE—The figures in the last column refer to the "General Lubrication Diagram," Fig. 107

SPECIAL TOOLS

Axles

	Tool No.	Used on
Wrench—Spanner wrench for pinion adjusting shell	79249	61–63
Wrench—Spanner wrench for pinion cage locking ring	81846	61
Puller—Removal of small pinion bearing	83229	61–63
Puller—Removal of large pinion bearing	83228	61–63
Puller—Removal of differential carrier bearings	83230	61–63
Device—To straighten rear axle housing sleeve	71971	1912–63
Bar—Adjustment of differential bearing adjusting nuts	72799	1912–63
Puller—Removal of flange on rear axle driving pinion shaft	83225	61–63
Puller—Removal and replacement of front axle yoke upper bearing mountings	72407	59–61
Drum—Adjustment of internal or external brakes	49839	1912–63
Sleeve—For use with Drum 49839 to adjust front wheel brakes	87981	63
Reamer .430 — For bolts in rear axle gear and mount	82799	61–63
Reamer .4375	82800	61–63
Reamer .4575	82801	61–63
Countersink reamer	82802	61–63
Starter—Removal of spindle bolts	83223	61
Puller—Installation of felt washers on rear axle drive shafts	89263	51–63

Carburetor

	Tool No.	Used on
Weight—Adjustment of automatic throttle valve spring	76037	59–63

Electrical

	Tool No.	Used on
Puller—Removal of generator driving clutch	83227	61–63
Puller—Removal of generator roller bearing inner race	65400	53–61
Puller—Removal of distributor drive gear on fan shaft	83221	53–63

Engine

	Tool No.	Used on
Arbor (Master)—To aid in fitting engine bearings	72395	51–61
	87635	63
Gauge—To test connecting rods for alignment	71969	51–63
Indicator ring (Master)—To test cylinder bores for size and parallelism	71967	51–63
Indicator holder — To determine clearance in main crankshaft bearings	65530	51–63
Indicator	196B	51–63
Bar	72631	51–63
Indicator holder — To determine clearance in straight connecting rod lower bearings	67870	51–63
Indicator	196B	51–63
Bar	57736	51–63
Cleaner—For cleaning valve stem guides	84924	51–63
Valve lifter—To lift single valve	65201	51–63

	Tool No.	Used on
Valve lifter—To lift four valves simultaneously	85783	61
Puller—Removal of camshaft driver	83234	59–61
Pusher—Installation of camshaft driver	83233	59–61
Pusher—Installation of camshaft sprocket	85797	63
Puller—Removal of camshaft sprocket	85799	63
Puller—Removal of fanshaft coupling	71955	51–63
Puller—Removal of water pump drive shaft bushings	66869	51–63
Puller—Removal and replacement of number 2, 3 and 4 camshaft bushings	72407	1913–63
Puller—Removal of cam slide guides	72394	51–63
Puller—Removal of spiral gear and crankshaft sprocket from crankshaft	70003	51–61
Pusher—Installation of valve rocker arm bushings	89077	63
Reamer (Martell) To ream main and connecting rod bearings	79255	51–61
Returning tool (Weber)—To true up crank pins	79256	51–61
Reamer—To ream piston pin holes oversize	68200	55–63
Reamer—To ream connecting rod bushings oversize	68201	55–63
Reseater—To reseat engine valves	79964	55–63
Riveting block—For fan shaft chain	83231	61–63
Riveting block—For camshaft chain	56332	51–63
Rivet inserter } For camshaft and fanshaft chains	56331	51–63
Rivet set } For camshaft and fanshaft chains	56322	51–63
Wrench (less socket)—Removal and replacement of counterweight screws	89025	63
Socket—Removal and replacement of screws in large counterweights	89026	63
Socket—Removal and replacement of screws in small counterweights	89027	63
Wrench—Removal and replacement ¼, $\frac{5}{16}$, ⅜ and $\frac{7}{16}$-inch cylinder block nuts	71968	51–63
Wrench—Removal and replacement of main bearing cap nuts	71970	51–63
Wrench—Removal and replacement of straight connecting rod nuts	73075	51–61
Wrench—Removal and replacement of forked connecting rod nuts	72813	51–63
Wrench—Holding cam slide from turning	87964	63
	72843	61
Wrench—Adjustment of camslide	88745	61–63
Wrench—Adjustment of gland packing nut on water pump shafts	83232	61–63
Wrench—Removal and replacement of rear engine support bolts	72836	51–63

Transmission and Clutch

Puller—Removal of flange on transmission drive shaft	83225	61–63
Puller—Removal of clutch driver from shaft	56667	51–63
Riveter—To set rivets in clutch facing	71975	51–63
Wrench—Removal of nut at front end of clutch connection shaft	72817	51–63
Wrench—Removal of clutch connection nut	83224	61–63

Springs

	Tool No.	Used on
Puller—Removal and replacement of spring eye bushings	72355	51–63
Puller—Removal and replacement of spring shackle bushings in frame at rear of front springs	71953	51–63
Puller—Removal of shackle bolts	83222	61–63
Starter—Removal of spring bolts	83235	61–63

Miscellaneous

	Tool No.	Used on
Puller—Removal of steering arm	72354	57–63
Puller—To remove steering wheel	83220	61–63
Wrench—Removing and replacing steering wheel nut	84492	61–63
Wrench—Removal and adjustment of bolt for front end of torque arm	83237	61–63
Wrench—Removal and adjustment of nut on bolt for front end of torque arm	83236	61–63
Tool—Flanging oil, air and gasoline pipes	71974	All

Clearance between splines on drive shaft and splineways in differential gear.............. Not over .006.

Clearance between wheel bearing cones and axle sleeve.................................. Not over .002.

Clutch

Clutch pedal clearance....................... Free movement of pedal, $1\frac{1}{4}$ inches.

Specifications for clutch spring............... Free length $7\frac{1}{2}$ inches. Compression at $3\frac{1}{4}$ inches: 290-310 lbs.

Thickness of clutch driving disc with lining..... Not less than $\frac{5}{16}$ inch.

Clearance between teeth of clutch driving disc and teeth in clutch ring................... Not over .010.

Clearance between clutch driven disc and keys on clutch hub............................ Not over .008.

Electrical

Motor Generator

Charging rate.............................. Ammeter reading 16.

Radial play in ball bearings.................. Not over .005.

End play in ball bearings..................... Not over .015.

Specifications for motor brush arm spring...... 30-36 oz. pressure on commutator.

Specifications for generator brush arm spring... 25-30 oz. pressure on commutator.

Specifications for generator third brush arm spring................................. 16-20 oz. pressure on commutator

Ignition

Gap between timer contact points............ 1st 2000 miles: .020.
After 2000 miles: .015-.018

Side play in distributor ball bearing........... Not over .003.

Side play in distributor plain bearing.......... Not over .004.

	Length of spring	Load
Specifications for distributor advance spring..	$1\frac{3}{16}$	0
	$1\frac{1}{16}$	1 lb.
	$\frac{15}{16}$	1 lb. $13\frac{1}{2}$ oz.
	$\frac{13}{16}$	2 lb. 11 oz.
	$\frac{11}{16}$	3 lb. 15 oz.
	$\frac{9}{16}$	5 lb. 1 oz.
	$\frac{7}{16}$	6 lb. 7 oz.

Circuit Breakers

Vibrating circuit breaker..................... Vibrates at 30 amps. or more.
Does not vibrate at 25 amps. or less.

Lockout circuit breaker...................... Locks open at 30 amps. or more.
Does not open at 25 amps. or less.

Engine

Main and Connecting Rod Bearings

Crankpins and journals	Round within .003.
Clearance between crankshaft and main bearings	.001—.002.
End play in crankshaft	Not over .020.
Clearance between crankpin and connecting rod bearing	.0015—.006.
End play in connecting rod bearing	Not over .015.
Clearance between outside of connecting rod bearing and single connecting rod	V-63: .003—.004. Type 61: .0025—.0035.
Play between single connecting rod and shoulders on connecting rod bearing	Not over .008.
Tightness between double connecting rod and connecting rod bearing	Hole in rod .002 smaller than outside diam. of bearing.

Cylinders and Pistons

Limits of standard cylinder bore	3.125—3.127.
Limits of 1st oversize cylinder bore	3.141—3.143.
Limits of 2nd oversize cylinder bore	3.156—3.158.
Cylinder bore	Round within .002.
Piston	Round within .002.
Clearance between piston and cylinder	Not over .007.
Clearance between piston rings and grooves in pistons	Not over .003.
Clearance between ends of piston rings	Not over .025.
Clearance between wrist pin and piston	Not over .0015.
Clearance between wrist pin and bushing in connecting rod	Not over .003.
Reaming size for bushing in connecting rod	.7495—.7502.

Valve System

Camslide clearance (V-63)	Inlet: .004. Exhaust: .006.
Camslide clearance (Type 61)	Inlet: .002. Exhaust: .003.
Specifications for valve spring (cylindrical type)	Free length 4¾. Compression at 3 inches, not less than 90 lbs.
Specifications for valve spring (conical type)	Free length 4⅛. Compression at 3 inches, not less than 72 lbs.
Clearance between valve stem and guide in cylinder block	Not over .004.
Clearance between cam slide and guide	Not over .004.
Clearance between rocker arm bushing and shaft	Not over .004.
Clearance between rocker arm roller and pin or sleeve	Not over .003.

Rocker arm roller	True within .0015.
Clearance between camshaft and camshaft bearings	Not over .005.
Slack in chains (Type 61)	Not over 1 inch movement on rim of fan.

Oil Pump and Spiral Gears

Clearance between oil pump gears and oil pump body	Not over .004.
Clearance between oil pump bushings and bearing surfaces on gears and shaft	Not over .004.
End play in oil pump gears	Not over .006.
Thickness of oil pump gaskets	.009—.011.
End play in spiral gear for oil pump drive	Not over .008.
Backlash between any two spiral gears	Not over .018.

Water Pumps

Elongation of thermostat	$\frac{3}{16}$—$\frac{1}{4}$ inch in 15 to 30 seconds at 165°—170° Fahr.
Clearance between water pump drive shaft and bushings	Not over .006.
Wear on thrust washer or gear on water pump drive shaft	Not over .006.
End play in water pump drive shaft	.002—.005.
Clearance between water pump shaft and bushings	Not over .006.
Clearance between water pump impeller and water pump body	Not over .010.

Oil Pressure Regulator

Oil pressure	5—7 lbs. when engine is warm, idling, and has fresh oil of correct viscosity.
Specifications for oil pressure regulator spring	Free length $2\frac{7}{16}$ inches. Compression at $1\frac{3}{4}$ inches: $6\frac{1}{2}$—$7\frac{1}{2}$ lbs.

Gasoline System

Pressure relief valve setting	$2\frac{1}{2}$ lbs.

Carburetor

Adjustment of enriching device	Air valve $\frac{1}{16}$—$\frac{1}{8}$ inch open at 65°—85° Fahr.
Throttle pump control thermostat	Vent hole closed at 75° Fahr. Vent hole open at 77° Fahr.
Vent control thermostat	Vent hole closed at 130° Fahr. Vent hole open at 135° Fahr.
Float	Top of float (carburetor inverted) $\frac{7}{16}$—$\frac{15}{32}$ inch from flange.

Throttle pump adjusting screw .... Seven turns fully opens by-pass.
Clearance between throttle disc and mixing chamber .... Not over .002.
End play in throttle shaft .... Not over .004.
Clearance between throttle shaft and bushings. . Not over .010.

Power Air Compressor

Clearance between cylinder and piston .... Not over .003.
Clearance between piston and piston pin .... Not over .002.
Clearance between eccentric and connecting rod. Not over .003.

Springs

Clearance between spring bolts and spring eye bushings .... Not over .005.

Steering

Clearance between steering gear sector shaft and eccentric bushing .... Not over .004.
Clearance between hubs of steering gear worm and bearings .... Not over .004.
Specifications for spring at upper end of steering column .... Free length 3 inches.
Specifications for steering connecting rod springs. Free length $\frac{11}{16}$ inch.

Tire Air Compressor

Kellog

Clearance between piston and cylinder .... Not over .006.
Clearance between crankshaft and bearings. . . . Not over .004.
Clearance between crankshaft and driving gear. Not over .005.
Clearance between piston and piston pin .... Not over .003.
Clearance between crankpin and crankpin bearing .... Not over .004.
Crankshaft .... True within .002.
Specifications for inlet valve spring .... Free length ½ inch. Compression at $\frac{1}{16}$ inch valve opening: 4½ oz.
Specifications for outlet valve spring .... Free length ½ inch. Compression at $\frac{1}{16}$ inch valve opening: 7½ oz.

Cassco

Clearance between piston and cylinder .... Not over .005.
Clearance between crankshaft and bearings. . . . Not over .004.
Clearance between connecting rod and eccentric. Not over .005.

Clearance between crankshaft and driving gear	Not over .005.
Clearance between piston pin and connecting rod	Not over .003.
Crankshaft	True within .002.
Specifications for shifter ball spring	Free length $\frac{3}{8}$ inch.
Specifications for inlet valve spring	Free length $\frac{5}{8}$ inch. Compression at $\frac{1}{16}$ inch valve opening: 10 oz.
Specifications for outlet valve spring	Free length $\frac{3}{4}$ inch. Compression at $\frac{1}{16}$ inch valve opening: 18 oz.

Transmission

Clutch connection	True within .0025.
End play in clutch connection rear bearing	Not over .015.
End play in clutch connection front bearing	Not over .015.
Shake between clutch connection and transmission main shaft	Not over .004.
Clearance between splines of transmission main shaft and splineways of shipper gears	Not over .004.
Transmission main shaft	True within .0025.
End play in transmission rear bearing	Not over .015.
Shifter shafts	True within .003.
Clearance between shifter shaft and bushings	Not over .004.
Clearance between shifter fork and groove in shipper gear	Not over .015.
Specifications for shifter plunger springs	Free length $1\frac{1}{2}$ inches. Compression at $1\frac{1}{8}$ inches, 13—16 lbs.
Play between jackshaft and jackshaft gears	Not over .004.
End play in jackshaft gears	Not over .015.
Clearance between reverse pinion shaft and bushing	Not over .004.
Reaming size for reverse pinion bushing	.937—.938.
End play in reverse pinion	Not over .015.

Universal Joints and Drive Shaft

Clearance between splines of drive shaft and splineways in hub of forward joint	Not over .003.
Clearance between universal joint flange bolts and holes	Not over .002.
Clearance between universal joint crosses and bushings	Not over .005.
Clearance between sides of universal joint yokes and shoulders on crosses	Not over .010.

Wheels

Wheels must run true within	$\frac{5}{32}$ inch, measured on felloe band.

ILLUSTRATIONS

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Engine

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CADILLAC TOOL MANUAL

1925

Special Tools
for the Maintenance of
Cadillac Eight Cylinder
Motor Cars

PRICE $1.50

Book Number T- 1190

Please refer to the above number in
writing us in regard to this manual.

Technical Department
Cadillac Motor Car Company
Detroit, Michigan

Contents

Foreword

Special tools are as necessary in properly maintaining motor cars as in building them. Certain operations cannot be done without a tool for the purpose. Other operations require a special tool in order to be performed in a workmanlike manner. Still other operations can be done in much less time if a specially designed tool is used.

It is the practice of the Cadillac Motor Car Company to render available to Cadillac distributors and dealers those special tools which are either necessary or are of practical advantage in performing maintenance operations on Cadillac motor cars and which cannot be obtained from commercial sources. These tools are des'gned, made, and inspected under the supervision of Cadillac tool engineers. No profit is intended from the sale of the tools, which are priced as low as possible consistent with quality.

The purpose of this Tool Manual is to list and describe all of the special tools which are available for Types 51 to V-63, inclusive, and to give directions for their use. The tools are presented in numerical order to permit the addition of new tools as they are made up. To facilitate finding the number of a tool when only its use is known, the Index on page 5 lists each tool under the unit or part of the car on which it is used, the units being arranged alphabetically. Prices are quoted in a separate numerical list on page 11.

Cadillac special tools are carried in stock by our Parts Department, with which distributors should place their orders. Dealers should order through their respective distributors. Prices quoted are net and are subject to change without notice.

The Tool Manual is in loose leaf form, to permit the addition and replacement of pages with new or revised items. Revised or added pages will be mailed to all who return the mailing list card sent with each Manual.

Questions from shop superintendents or foremen regarding any tool or its use are invited, as well as suggestions for new tools.

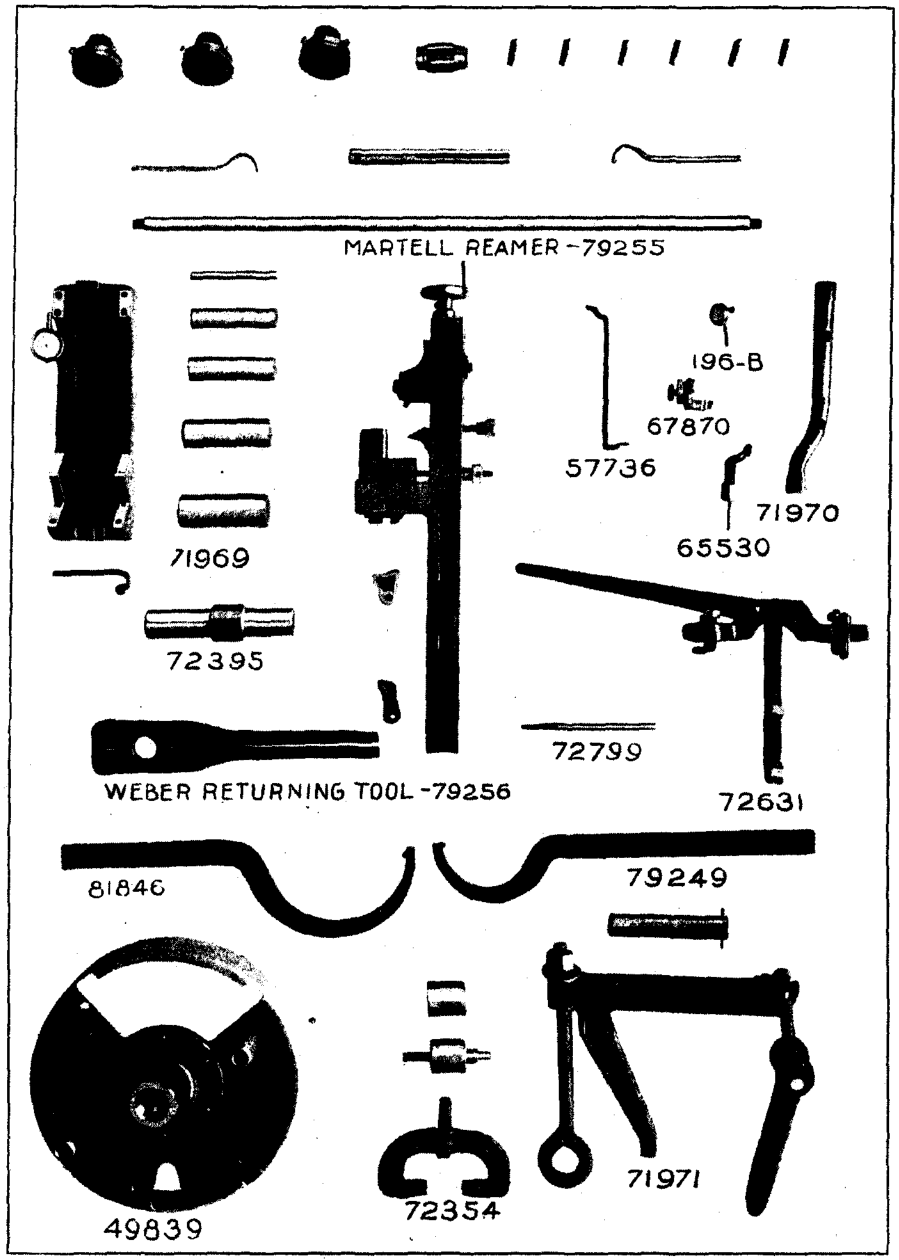
MARTELL REAMER -79255
196-B
67870
57736
71970
65530
71969
72395
72799
WEBER RETURNING TOOL -79256
72631
81846
79249
71971
49839
72354

Fig. 1

Index

(Alphabetical, by name of unit or part on which tool is used.)

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Camshaft			
Camshaft sprocket puller	51–57, 63	85799	62
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Camshaft sprocket pusher	63	85797	61
Camshaft driver pusher	59–61	83233	58
Camshaft driver puller	59–61	83234	58
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Puller for camshaft and spindle bearings	51–63	72407	39
Carburetor			
Tool for carburetor air valve seat	51–59	55405	18
Carburetor balancing weight (for automatic throttle)	51–59	67327	25
Carburetor balancing weight (for automatic throttle)	59–63	76037	44
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Chain rivet set	51–63	56322	19
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Wrist pin bushing reamer	55–63	68201	27
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Wrench for water pump drive shaft packing	51–59	72841	43
Wrench for water pump drive shaft packing	61–63	83232	57

Crankshaft

	Types Used On	Tool Number	Descriptive List Page
Dial indicator	51-63	196-B	17
Indicator holder for main bearings	51-63	65530	23
Crankshaft prying lever	51-63	72631	41
Indicator holder for crankpin bearings	51-63	67870	26
Connecting rod prying bar	51-63	57736	22
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Master arbor	51-61	72395	38
Master arbor	63	87635	62
Martell reamer	51-63	79255	45
Crankpin returning tool	51-61	79256	49
Crankshaft returning tool	51-61	80369	50
Crankshaft gear puller	51-63	70003	28
Compensator wrench	63	89025	63
Socket for large compensators	63	89026	63
Socket for small compensators	63	89027	63
Screw driver for crankpin plugs	63	91075	67

Cylinders

	Types Used On	Tool Number	Descriptive List Page
Valve cap wrench	51-55	55773	19
Water plug wrench	51-55	55910	19
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Distributor

	Types Used On	Tool Number	Descriptive List Page
Distributor shaft wrench	51-55	72840	42
Fanshaft coupling puller	53-63	71955	29
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Electrical System

	Types Used On	Tool Number	Descriptive List Page
Puller for generator bearings	51-57, 61-63	51300	17
Clamp for removing generator ball bearings	51-57, 61-63	59599	23
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Battery terminal wrench	55-61	72352	36
Distributor shaft wrench	51-55	72840	42
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Generator driving clutch puller	51-63	83227	55

Engine

	Types Used On	Tool Number	Descriptive List Page
Dial indicator	51-63	196-B	17
Indicator holder for main bearings	51-63	65530	23
Crankshaft prying lever	51-63	72631	41
Indicator holder for crankpin bearings	51-63	67870	26
Connecting rod prying bar	51-63	57736	22
Connecting rod alignment gauge	51-63	71969	31
Forked connecting rod wrench	51-63	72813	41
Straight connecting rod wrench	51-63	73075	44
Main bearing wrench	51-63	71970	33

	Types Used On	Tool Number	Descriptive List Page
Engine (continued)			
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Master arbor	63	87635	62
Martell reamer	51–63	79255	45
Crankpin returning tool	51–61	79256	49
Crankshaft returning tool	51–61	80369	50
Compensator wrench	63	89025	63
Socket for large compensators	63	89026	63
Socket for small compensators	63	89027	63
Piston pin press	51	56478	21
Piston reamer, 1st operation	51	68350	27
Piston reamer, 2nd operation	51	68351	27
Piston reamer	53	67927	27
Wrist pin bushing reamer	53	67928	27
Piston reamer	55–63	68200	27
Wrist pin bushing reamer	55–63	68201	27
Crankshaft gear puller	51–63	70003	28
Chain rivet set	51–63	56322	19
Chain rivet inserter	51–63	56331	20
Chain riveting block	51–63	56332	21
Chain riveting block	61–63	83231	57
Valve reseating tool	51–53	55592	18
Valve reseating tool	55–63	79964	50
Valve grinding tool	51–63	56330	20
Valve spring lifter	51–63	90439	66
Camslide holder	51–59	72843	43
Camslide holder	61–63	87964	63
Valve adjusting wrench	51–59	75368	44
Valve adjusting wrench	61–63	88745	63
Valve stem guide cleaner	51–63	84924	61
Camslide guide puller	51–63	72394	38
Valve rocker arm plate reamer	51–61	85780	61
Wrench for reamer	51–61	87205	62
Valve rocker arm bushing press	63	89077	64
Camshaft sprocket puller	51–57, 63	85799	62
Camshaft sprocket pusher	51–57	66160	24
Camshaft sprocket pusher	63	85797	61
Camshaft driver pusher	59–61	83233	58
Camshaft driver puller	59–61	83234	58
Camshaft forward bearing puller	51–57	72406	39
Puller for camshaft and spindle bearings	51–63	72407	39
Valve cap wrench	51–55	55773	19
Water plug wrench	51–55	55910	19
Cylinder bore indicator	51–63	71967	30
Puller for water pump drive shaft bushings	51–63	66869	24
Fan disc puller	51	56218	19
Fan press	51	56598	21
Puller for tire pump gear	51	57081	22
Fanshaft coupling puller	53–63	71955	29

	Types Used On	Tool Number	Descriptive List Page
Fanshaft bearing nut wrench, R. H.	51–57	72849	43
Fanshaft bearing nut wrench, L. H.	51–57	72855	44
Distributor driving gear puller	53–63	83221	54
Wrench for water pump drive shaft packing	51–59	72841	43
Wrench for water pump drive shaft packing	61–63	83232	57
Engine support wrench	51–63	72836	42
Screw driver for crankpin plugs	63	91075	67

Fan

Fan disc puller	51	56218	19
Fan press	51	56598	21
Fanshaft coupling puller	53–63	71955	29
Fanshaft bearing nut wrench, R. H.	51–57	72849	43
Fanshaft bearing nut wrench, L. H.	51–57	72855	44

Front Axle

(See Axle, Front).

Generator

Puller for generator bearings	51–57, 61–63	51300	17
Clamp for removing generator ball bearings	51–57, 61–63	59599	23
Clamp for removing generator roller bearings	51–57, 61–63	65400	23
Generator driving clutch puller	51–63	83227	55

Miscellaneous

Puller for tire pump gear	51	57081	22
Universal socket wrench for general use	51–63	71968	31
Pipe flanging tool	51–63	71974	35
Offset screw driver	51–63	72810	41
Top support wrench	53–57	72820	42
Brace socket wrench	51–63	72825	42

Pistons

Piston reamer, 1st operation	51	68350	27
Piston reamer, 2nd operation	51	68351	27
Piston pin press	51	56478	21
Piston reamer	53	67927	27
Piston reamer	55–63	68200	27

Rear Axle

(See Axle, Rear).

Springs

Puller for spring shackle bracket bushings	51–63	71953	28
Spring eye bushing puller	51–63	72355	37

	Types Used On	Tool Number	Descriptive List Page
Spring shackle bolt starter	51-63	83235	59
Spring shackle bolt puller	51-63	83222	54

Steering Gear

Steering wheel puller	51-59	56479	21
Steering wheel puller	61-63	83220	53
Flange and steering arm puller	51-63	72354	36
Steering wheel nut wrench	61-63	84492	60
Steering pivot press	51-63	90743	67

Torque Arm

Torque arm support wrench (nut)	61-63	83236	59
Torque arm support wrench (bolt)	61-63	83237	59
Torque arm pin puller	51-59	83238	60

Transmission

Flange and steering arm puller	51-63	72354	36
Clutch connection nut wrench	61-63	83224	55

Valves

Valve cap wrench	51-55	55773	19
Valve grinding tool	51-63	56330	20
Valve reseating tool	51-53	55592	18
Valve reseating tool	55-63	79964	50
Camslide holder	51-59	72843	43
Camslide holder	61-63	87964	63
Valve adjusting wrench	51-59	75368	44
Valve adjusting wrench	61-63	88745	63
Valve stem guide cleaner	51-63	84924	61
Valve spring lifter	51-63	90439	66
Camslide guide puller	51-63	72394	38
Valve rocker arm plate reamer	51-61	85780	61
Wrench for reamer	51-61	87205	62
Valve rocker arm bushing press	63	89077	64

Water Pumps

Puller for water pump drive shaft bushings	51-63	66869	24
Wrench for water pump drive shaft packing	51-59	72841	43
Wrench for water pump drive shaft packing	61-63	83232	57

Tool Price List

Tool Number	Name	Types Used On	*Classi-fication	Descriptive List Page	Net Price
196-B	Dial indicator	51–63	I	17	$ 8.10
49839	Brake adjusting drum	51–63	N	17	18.00
51300	Puller for generator bearings	51-57, 61-63	N	17	3.00
55405	Tool for carburetor air valve seat	51–59		18	9.25
55592	Valve reseating tool	51–53		18	2.50
55773	Valve cap wrench	51–55		19	4.50
55910	Water plug wrench	51–55		19	1.25
56218	Fan disc puller	51		19	1.50
56322	Chain rivet set	51–63	I	19	1.00
56330	Valve grinding tool	51–63		20	.50
56331	Chain rivet inserter	51–63	I	20	.75
56332	Chain riveting block	51–63	I	20	1.90
56478	Piston pin press	51		21	6.00
56479	Steering wheel puller	51–59		21	3.75
56598	Fan press	51		21	3.50
56667-T	Clutch hub puller	51–63	I	22	5.25
57081	Puller for tire pump gear	51		22	3.00
57736	Connecting rod prying bar	51–63	I	22	1.25
59599	Clamp for removing generator ball bearings	51-57, 61-63		23	6.50
65400	Clamp for removing generator roller bearings	51-57, 61-63		23	6.50
65530	Indicator holder for main bearings	51–63	I	23	2.50
66160	Camshaft sprocket pusher	51–57		24	3.00
66869	Puller for water pump drive shaft bushings	51–63	I	24	7.85
67327	Carburetor balancing weight	51–59		25	.75
67870	Indicator holder for crankpin bearings	51–63	I	26	6.00
67927	Piston reamer	53		27	2.65
67928	Wrist pin bushing reamer	53		27	2.40
68200	Piston reamer	55–63	I	27	2.65
68201	Wrist pin bushing reamer	55–63	I	27	2.40
68350	Piston reamer, 1st operation	51		27	4.00
68351	Piston reamer, 2nd operation	51		27	4.00
70003	Crankshaft gear puller	51–63	I	28	7.50
71953	Puller for spring shackle bracket bushings	51–63	I	28	3.50
71955	Fanshaft coupling puller	53–63	N	29	2.50
71967	Cylinder bore indicator	51–63	I	30	
	Complete				20.50
	Master ring only				7.00
	Indicator and holder only				13.50
71968	Socket wrench for general use	51–63	I	31	10.50

*I = indispensable. N = necessary for good work. Tools not classified are for types prior to Type 61.

Tool Number	Name	Types Used On	Classi-fication	Descriptive List Page	Net Price
71969	Connecting rod alignment gauge	51-63	N	31	
	Complete				$ 33.95
	Arbors for V-63				4.45
71970	Main bearing wrench	51-63	I	33	2.00
71971	Device for straightening rear axle sleeves	51-63	N	33	14.00
71974	Pipe flanging tool	51-63	N	35	2.60
71975	Clutch facing riveter	51-63	N	35	3.50
72352	Battery terminal wrench	55-61		36	.25
72353	Wrench for front wheel hub retainer	55-59		36	1.95
72354	Flange and steering arm puller	51-63	I	36	1.50
72355	Spring eye bushing puller	51-63	N	37	2.00
72394	Camslide guide puller	51-63	N	38	.75
72395	Master arbor	51-61	N	38	6.60
72406	Camshaft forward bearing puller	51-57		39	3.75
72407	Puller for camshaft and spindle bearings	51-63	N	39	6.30
72631	Crankshaft prying lever	51-63	N	41	5.00
72799	Gear mount bearing adjusting bar	51-63	N	41	.50
72810	Offset screw driver	51-63	N	41	.50
72813	Forked connecting rod wrench	51-63	N	41	1.20
72817	Wrench for clutch retaining nut	51-63	N	42	.90
72820	Top support wrench	53-57		42	.75
72825	Brace socket wrench	51-63		42	1.00
72836	Engine support wrench	51-63	N	42	1.35
72840	Distributor shaft wrench	51-55		42	.75
72841	Wrench for water pump drive shaft packing	51-59		43	1.00
72843	Camslide holder	51-59		43	.35
72849	Fanshaft bearing nut wrench, R. H.	51-57		43	.50
72850	Pinion bearing adjusting wrench	51, 53, 59		43	1.10
72855	Fanshaft bearing nut wrench, L. H.	51-57		44	.50
73075	Straight connecting rod wrench	51-63	N	44	1.20
75368	Valve adjusting wrench	51-59	N	44	.65
76037	Carburetor balancing weight	59-63	I	44	.75
79249	Pinion bearing adjusting wrench	61-63	I	45	1.30
79255	Martell reamer			45	
	For main and connecting rod bearings:				
	Complete set	51-61			72.50
	Additional parts for V-63	63			26.25
	Complete set	51-63			98.75
	For connecting rod bearings only:				
	Complete set	51-61			35.75
	Additional parts for V-63	63			18.75
	Complete set	51-63			54.50
79256	Crankpin returning tool	51-61		49	157.50
79964	Valve reseating tool	55-63	I	50	3.00
80369	Crankshaft returning tool	51-61		50	50.00
81846	Spanner wrench for pinion cage locking ring	61	N	52	1.40
82799	Gear and mount reamer, size .430	61-63	I	52	2.15

Tool Number	Name	Types Used On	Classification	Descriptive List Page	Net Price
82800	Gear and mount reamer, size .4375	61-63	I	52	$ 2.15
82801	Gear and mount reamer, size .4575......	61-63	I	53	2.15
82802	Gear countersink reamer................	61-63	I	53	4.50
83220	Steering wheel puller..................	61-63	I	53	3.40
83221	Distributor driving gear puller..........	53-63	N	54	4.15
83222	Spring shackle bolt puller..............	51-63	N	54	4.10
83223	Spindle bolt starter and pusher.........	51-61	N	54	10.80
83224	Clutch connection nut wrench..........	61-63	N	55	4.45
83227	Generator driving clutch puller.........	51-63	I	55	1.40
83228	Pinion forward bearing puller	61-63	N	56	6.10
83229	Pinion rear bearing puller..............	61-63	N	56	5.45
83230	Gear mount bearing puller.............	61-63	N	57	6.95
83231	Chain riveting block...................	61-63	I	57	.45
83232	Wrench for water pump drive shaft packing..............................	61-63	I	57	1.15
83233	Camshaft driver pusher................	59-61	I	58	2.95
83234	Camshaft driver puller................	59-61	I	58	2.20
83235	Spring shackle bolt starter............	51-63	N	59	4.25
83236	Torque arm support wrench (nut).......	61-63	N	59	1.25
83237	Torque arm support wrench (bolt)......	61-63	N	59	1.55
83238	Torque arm pin puller.................	51-59	N	60	8.15
84491	Brake adjusting wrench................	51-63	N	60	2.45
84492	Steering wheel nut wrench.............	61-63	I	60	1.15
84924	Valve stem guide cleaner...............	51-63	N	61	1.45
85780	Valve rocker arm plate reamer..........	51-61	N	61	6.00
85797	Camshaft sprocket pusher..............	63	I	61	5.75
85799	Camshaft sprocket puller..............	51-57, 63	I	62	5.00
87205	Wrench for reamer....................	51-61	N	62	4.00
87635	Master arbor.........................	63	N	62	4.50
87964	Camslide holder......................	61-63	I	63	.40
87981	Brake adjusting drum sleeve...........	63	N	63	3.00
88745	Valve adjusting wrench................	61-63	N	63	.65
89025	Compensator wrench..................	63	I	63	1.75
89026	Socket for large compensators..........	63	I	63	.40
89027	Socket for small compensators..........	63	I	63	.40
89077	Valve rocker arm bushing press.........	63	I	64	5.50
89263	Puller for rear axle shaft felt packing....	51-63	N	65	4.50
90439	Valve spring lifter....................	51-63	I	66	5.00
90743	Steering pivot pusher.................	51-63	N	67	3.50
91075	Screw driver for crankpin plugs.........	63	I	67	1.15
91220	Indicator holder for rear axle gears......	51-63	I	67	1.55
91221	Crank for turning pinion shaft	51-63	I	69	
91222	Pinion shaft puller.....................	61-63	I	69	
91671	Gear mount adjusting wrench...........	63	I	70	
92251	Wrench for spindle bearing dust cap.....	63	I	71	

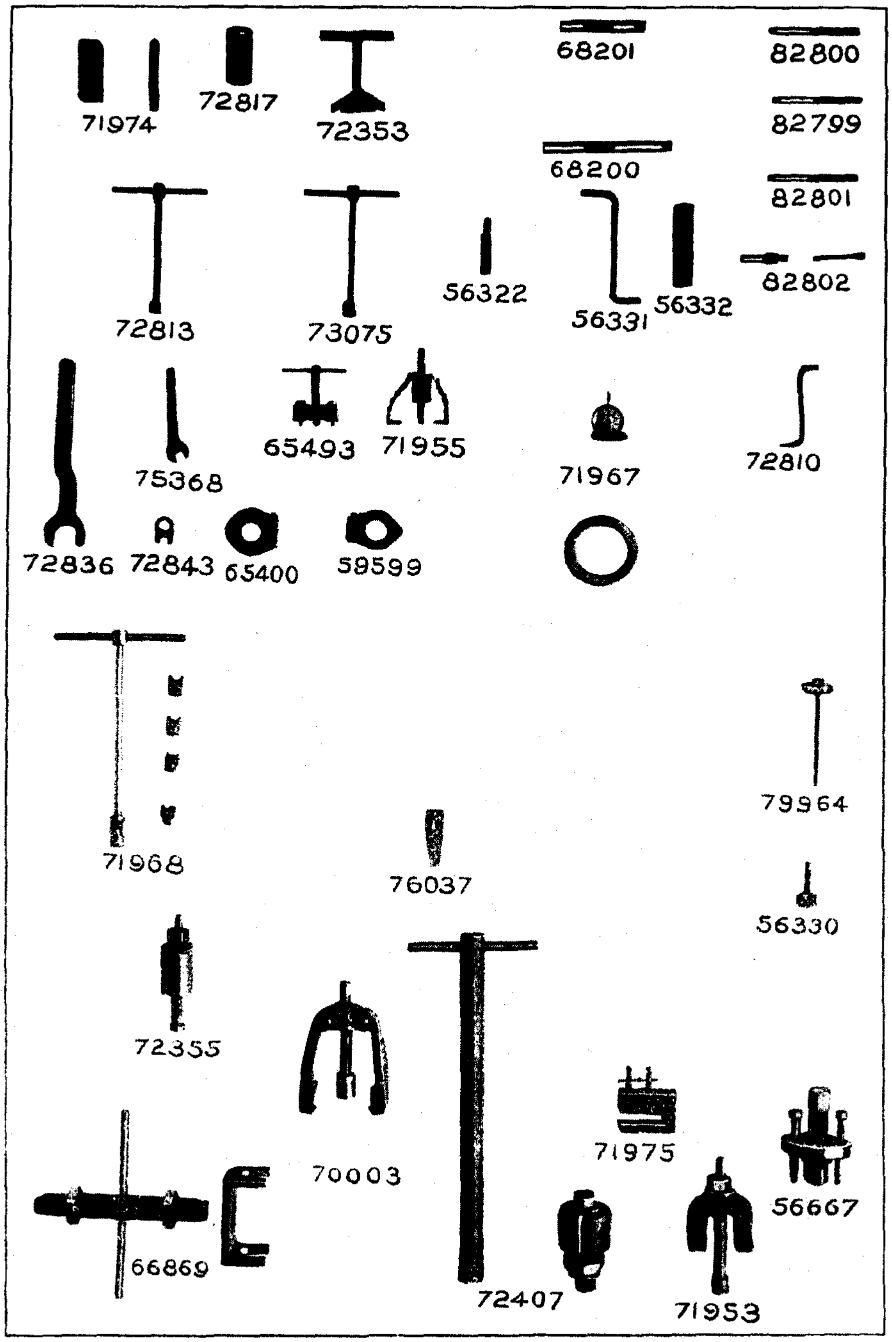
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Fig. 2

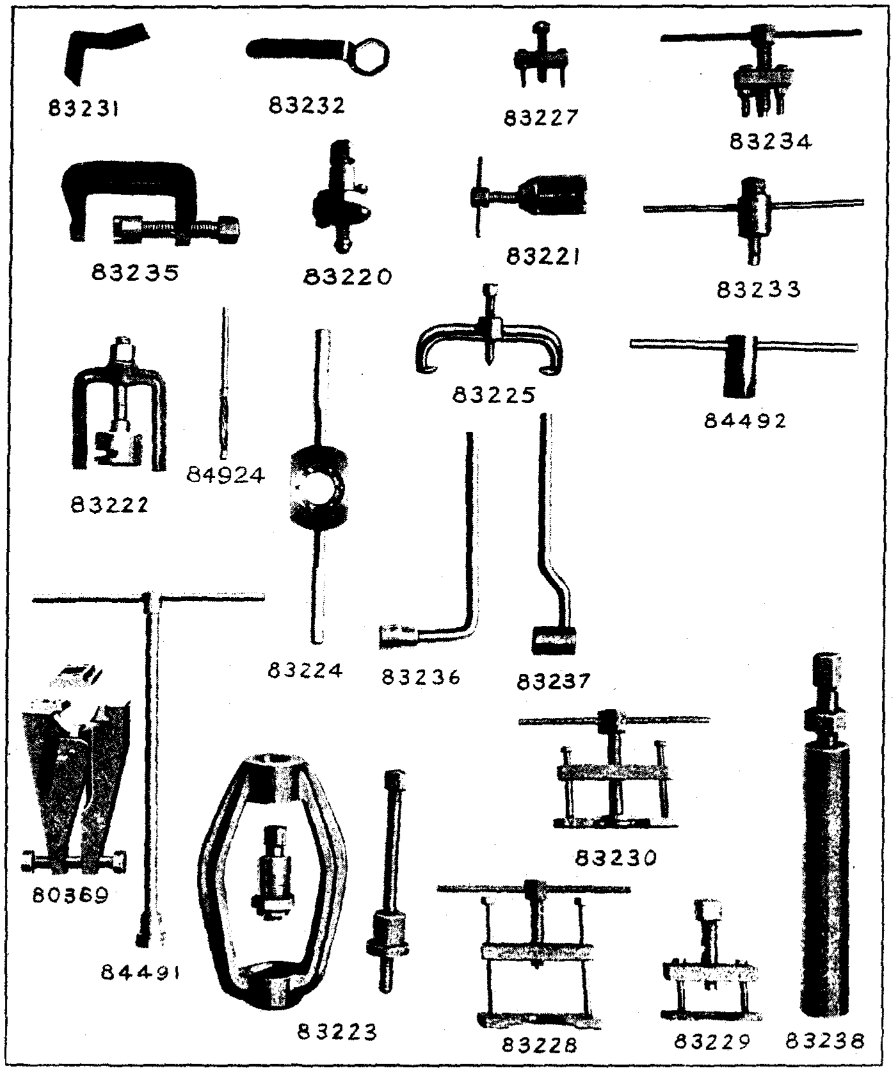
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Fig. 3

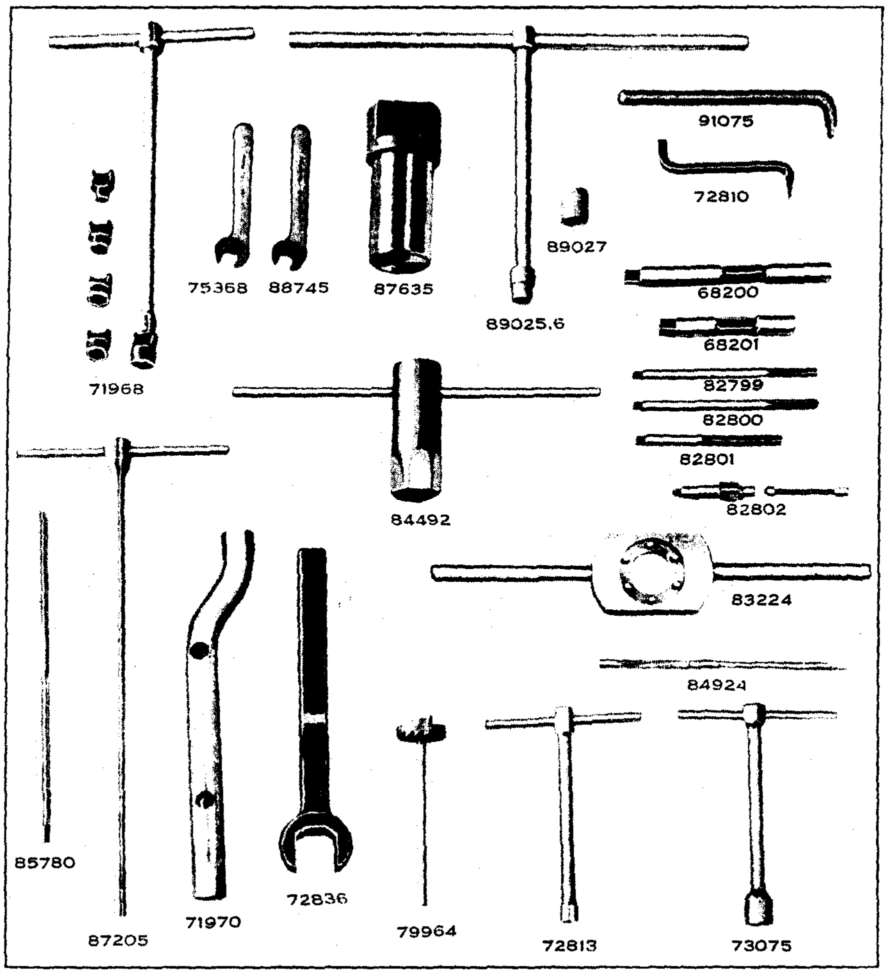

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Fig. 4

196-B Dial indicator.

Purpose: For use with holder 65530 to determine main bearing clearances; with holder 67870 to determine the clearances in the bearings at the lower ends of the straight connecting rods; and with holder 91220 for measuring backlash between the rear axle ring gear and pinion. Types 51-63.

Description: Figs. 10, 12, 57 and 58. A dial indicator with dial graduated in thousandths of an inch.

Directions for Use: See tools 65530, 67870 and 91220.

49839 Brake adjusting drum.

Purpose: To aid in the adjustment of the brakes. Particularly useful in the adjustment of internal brakes. Types 51-63.

Description: Fig. 5. Consists of a drum with inside and outside diameters the same as the standard brake drums. The drum has two large openings for access to the internal brakes, and two knurled handles for manipulating. The hub of the drum fits the rear axle sleeves.

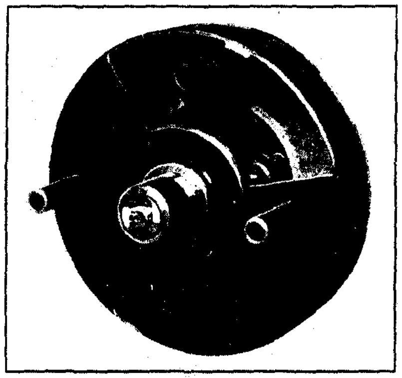

Fig. 5.—Brake Adjusting Drum 49839 With Adapting Sleeve 87981 for Front Wheel Brakes

Directions for Use: Remove the wheel and place the drum over the axle sleeve. Then make the adjustment as directed in the Shop Manual. In using the drum to adjust V-63 front wheel brakes, place sleeve 87981 between the spindle and the hub of the drum.

51300 Puller for generator bearings.

Purpose: To remove the generator bearings from the armature shaft. Types 51-57, 61-63.

Description: A hinged-jaw puller with forged steel hooks. Has a ½-inch screw with swivel end and T-handle.

Directions for Use: This puller must be used in combination with clamps 59599 and 65400. For ball bearings, use clamp 59599. For roller bearings, use clamp 65400.

55405 Tool for carburetor air valve seat.

Purpose: To replace the leather seat for the carburetor auxiliary air valve. Types 51-59.

Description: Consists of three parts: two split dies and a tapered expanding tool.

Directions for Use: Remove the carburetor from the engine and the following parts from the carburetor: scoop, auxiliary air valve cover plate, valve, spring, retaining ring, and leather seat.

Place the new retaining ring on the plain die. Insert the die with the ring on it into the hole in the carburetor for the air valve. With a blunt screw driver or other suitable tool, force the new leather seat into place with the bevelled edge toward the air valve.

When the leather seat is properly in place, turn the carburetor upside down, with the upper face of the air valve chamber resting upon a solid surface. Insert the expanding tool in the die and tap it lightly. This will expand the retaining ring against the carburetor body and will hold the ring and leather seat in place.

Remove the expanding tool and the plain die and substitute the beaded die. Insert the expanding tool again and tap it firmly into place. This will crimp the ring and fasten the leather seat securely.

55592 Valve reseating tool.

Purpose: To reseat the valve seats in the cylinder blocks. Types 51-53. (See tool 79961 for Types 55-63.)

Description: A 16-tooth 45° cutter with a 6-inch pilot ground to fit the hole in the valve stem guide. Has a hexagonal nut to receive a socket wrench for turning.

Directions for Use: Do not use lubricant of any kind on the cutter. Remove only enough metal to clean up the valve seat. It is recommended that the valves also be refaced in a grinder before being ground to their seats.

55773 Valve cap wrench.

Purpose: To remove and install valve chamber caps. Types 51-55 (engines without detachable cylinder heads).

Description: A special wrench to fit the notched valve caps; has a T-handle 25 inches long.

55910 Water plug wrench.

Purpose: To remove and install the water plugs in the cylinder blocks. Types 51-55 (engines without detachable cylinder heads).

Description: A special wrench with slotted end to fit the water plugs; has a 7½-inch T-handle.

56218 Fan disc puller.

Purpose: To remove the fan driving disc. Type 51.

Description: A hinged jaw puller with cast steel nut and hooks. The case-hardened screw is ⅝ inch in diameter and has a square head.

56322 Chain rivet set.

Purpose: To place the washer on the end of the seat pin in riveting the ends of the timing chains. Types 51-63.

Description: Fig. 6. Consists of a rivet set which is countersunk to receive the washer and force it over the end of the seat pin.

Directions for Use: Bring the ends of the chain together and insert the rocker pin and a used or extra seat pin as a temporary pin to align the links. (See Shop Manual.) Rivet one of the small washers on one end of the new seat pin. Insert the new seat pin from the rear, forcing out the temporary seat pin. Tool 56331 is for this purpose. Place a riveting block (83231 or 56332) behind the

Fig. 6.—Rivet Set 56322 and Riveting Block 83231 for Timing Chains

chain to back up the seat pin. Place a washer on the outer end of the seat pin and force it on with the rivet set, tapping the set lightly with a hammer. (See Fig. 6.) Then peen over the end of the seat pin carefully with a hammer. After riveting a seat pin, test to see that it is not broken by applying pliers to the washer and pulling endwise.

Caution: Make sure that the seat and rocker pins are inserted in their proper positions, as shown in the Shop Manual, and that the arrows stamped on the chain links point in the direction in which the chain is to run.

56330 Valve grinding tool.

Purpose: To oscillate the valves in grinding. Types 51-63.

Description: Fig. 2. A bit with blade specially shaped to engage the slots in the valves; of tempered tool steel with 3/8-inch straight round shank.

56331 Chain rivet inserter.

Purpose: To insert the seat pin in riveting the ends of the camshaft driving chain on Types 51-63, and the fanshaft driving chain on late Type 61 and V-63 engines (which have a hole in the rear wall of the fanshaft housing).

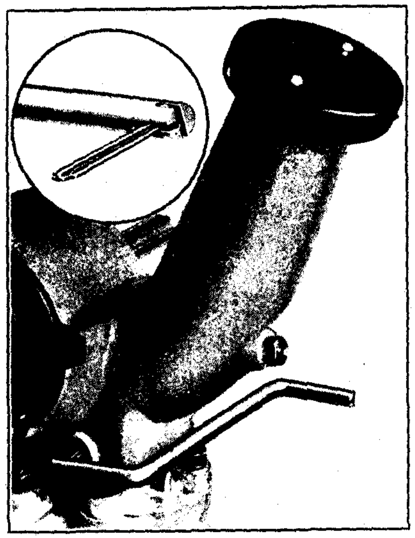

Fig. 7.—Inserting Seat Pin in Fanshaft Driving Chain with Tool 56331

Description: Fig. 7. An S-shaped rod slotted at the ends to receive the seat pin.

Directions for Use: Place the new seat pin with washer riveted on one end in one of the slotted ends of the tool, as shown in Fig. 7. Having previously aligned the links with a used or extra seat pin, manipulate the tool so as to insert the new seat pin from the rear, forcing out the temporary seat pin. Fig. 7 shows the tool as used in riveting the fanshaft driving chain on late Type 61 and

V-63 engines. (See Shop Manual for complete directions for riveting chains.)

56332 Chain riveting block.

Purpose: To back up the seat pin in riveting the ends of the camshaft driving chain. Types 51-63.

Description: Fig. 8. A hardened steel block with a knurled thumb screw for adjusting to the space between the chain and the crankcase.

Directions for Use: When the ends of the chain have been brought together and the new pins have been inserted, place the riveting block between the chain and the crankcase in the position shown in Fig. 8, and adjust the knurled thumb screw to clamp it in position. The washer can then be applied with rivet set 56322 and the pin peened over. (See Shop Manual for complete directions for riveting chains.)

Fig. 8.—Riveting Block 56332 for Camshaft Driving Chain

56478 Piston pin press.

Purpose: To remove and install the piston pins. Type 51.

Description: A cast-steel vise with a 1-inch square-end screw for exerting pressure. Supplied with two extensions for 5/8-inch and 3/4-inch piston pins, respectively.

56479 Steering wheel puller.

Purpose: To remove the steering wheel. Types 51-59. (See puller 83220 for Types 61-63.)

Description: Consists of a two-piece hinged clamp of cast steel connected by long bolts to a cast iron nut. Pressure is applied by a case-hardened 1-inch screw with swivel end and hexagonal head.

56598 Fan press.

Purpose: To install the fan driving disc. Type 51.

Description: Consists of a 1-inch screw with ends threaded internally to fit the threaded end of the fanshaft, a U-collar, and a case-hardened hexagonal nut.

56667-T Clutch hub puller.

Purpose: To remove the clutch hub from the clutch connection shaft. Types 51-63.

Description: Fig. 9. Consists of a cast-steel block, with two long screws to fit the tapped holes in the clutch hub, and a $1\frac{1}{4}$-inch case-hardened screw with swivel end and hexagonal head.

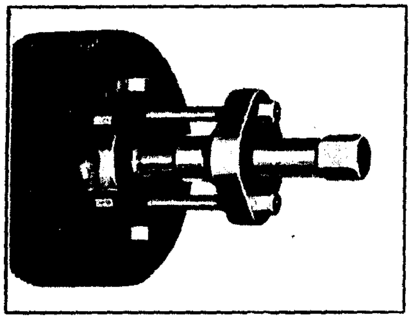

Fig. 9.—Clutch Hub Puller 56667

Directions for Use: With the transmission removed from the car, attach the puller to the clutch hub by screwing the two long screws into the holes in the hub. Tighten the screw against the end of the clutch connection shaft and turn until the hub is removed.

57081 Puller for tire pump gear.

Purpose: To remove from the fanshaft the gear which drives the tire pump. Type 51.

Description: A steel plate with two hooks for gripping the gear and a $\frac{5}{8}$-inch square-end screw for exerting pressure.

57736 Connecting rod prying bar.

Purpose: For use with dial indicator 196-B and indicator holder 67870 to determine the clearances in the bearings at the lower ends of the straight connecting rods. Types 51-63.

Description: Fig. 12. A flat bar with ends bent and shaped to act as a pry between the straight and forked connecting rods.

Directions for Use: See tool 67870.

59599 Clamp for removing generator ball bearings.

Purpose: To clamp over the armature shaft back of the bearing, giving a surface with which to engage puller 51300. (Use clamp 65400 for roller bearings.) Types 51-57, 61-63.

Description: Fig. 2. Consists of two case-hardened semi-circular pieces, hinged at one end and provided with a clamp screw at the other.

Directions for Use: Place the clamp in position over the armature shaft between the bearing and the armature. Apply puller 51300 to the clamp, drawing up the screw against the end of the armature shaft.

65400 Clamp for removing generator roller bearings.

Purpose: To clamp over the armature shaft back of the bearing, giving a surface with which to engage puller 51300. (Use clamp 59599 for ball bearings.) Types 51-57, 61-63.

Description: Fig. 2. Similar to clamp 59599 for ball bearings.

Directions for Use: See clamp 59599.

65530 Indicator holder for main bearings.

Purpose: To hold dial indicator 196-B in determining the clearances in crankshaft main bearings. Types 51-63.

Description: Fig. 10. A bronze bracket with threaded sleeve for attaching to the nipple on the main bearing cap. A spring-controlled plunger rests on the shaft and operates the indicator.

Directions for Use: Remove the oil pan, the baffle plate, and the pipe between the oil manifold and the main bearing cap. Screw the threaded sleeve on the nipple in the bearing cap. Attach the indicator to the holder, lining up the indicator button with the plunger in the holder. Insert the holder into the sleeve, adjust it so that the end of the plunger rests on the crankshaft and tighten the knurled thumb screw.

Turn the crankshaft so that the cheeks next to the bearing are in the horizontal plane. Place prying lever 72631 in position, as directed for that tool. Press the lever down as far as it will go, and set the dial

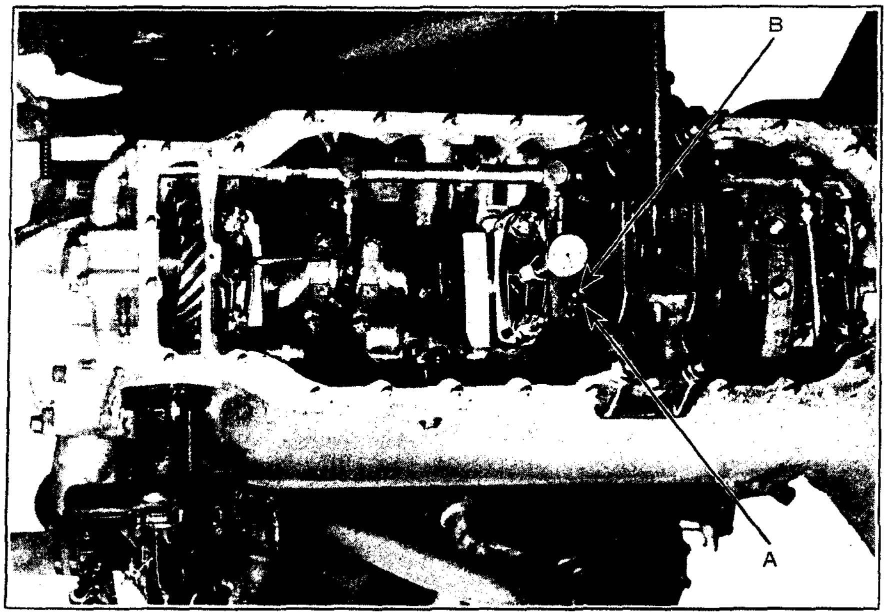

Fig. 10.—Determining Clearance in Crankshaft Main Bearings. Dial Indicator 196-B, Holder 65530, Prying Lever 72631

of the indicator at zero. Then move the lever up as far as it will go, and the indicator will show the bearing clearance in thousandths of an inch.

66160 Camshaft sprocket pusher.

Purpose: To install the camshaft sprocket. Types 51-57.

Description: Consists of two parts: a ¾-inch square-head screw, the end of which is turned down and threaded to fit the tapped hole in the front end of the camshaft; and a cast-steel nut with 7½-inch T-handle.

66869 Puller for water pump drive shaft bushings.

Purpose: To remove from the crankcase the bushings in which the water pump drive shaft has its bearings. Types 51-63.

Description: Fig. 11. Consists of a cast-steel base, a large case-hardened screw, and two hexagonal nuts. The screw is 1¼ inches in diameter, and has right-hand threads on one end and left-hand threads on the other. The extreme ends are turned down and threaded to fit the thread in the water pump drive shaft bushings.

Directions for Use: Remove the water pump and the gland nut and packing in the outer end of the bushing. On Types 51-57, it is also necessary to remove the set screw which holds the bushing in place.

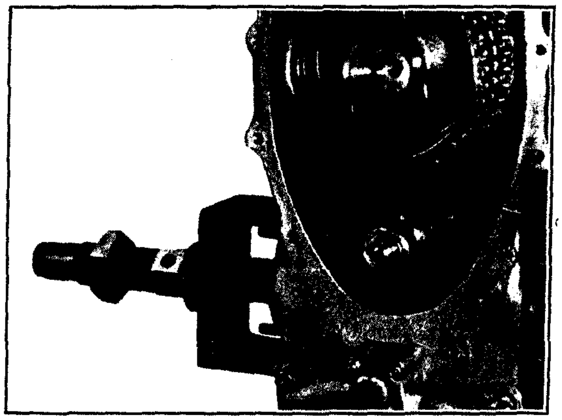

Fig. 11. Puller 66869 for Water Pump Drive Shaft Bushings

Select that end of the tool which has the correct thread (the right-hand bushing has a left-hand thread, and vice versa), and screw the nut all the way back toward the hexagonal center portion. Place the base as shown in Fig. 11, insert the screw through the hole in the base, and thread the screw well into the bushing. Tighten the nut against the base, and draw it up until the bushing is withdrawn.

67327 Carburetor balancing weight.

Purpose: To adjust the carburetor automatic throttle spring. Types 51-57 and Type 59 (carburetors with 1$\frac{11}{16}$ inch opening).

Description: Consists of a piece of flat metal, shaped to hook over the automatic throttle and of the exact weight to balance the spring when properly adjusted.

Directions for Use: Use in identically the same manner as tool 76037.

67870 Indicator holder for crankpin bearings.

Purpose: To hold dial indicator 196-B while determining the clearance between the straight connecting rod and the outside of the crankpin bearing. Types 51-63.

Description: Fig. 12. A two-piece bracket with a clamp screw for attaching to one of the bosses on the forked connecting rod.

Directions for Use: With the oil pan and baffle plate removed, crank the engine by hand to bring the bearing which is to be indicated to the lower center.

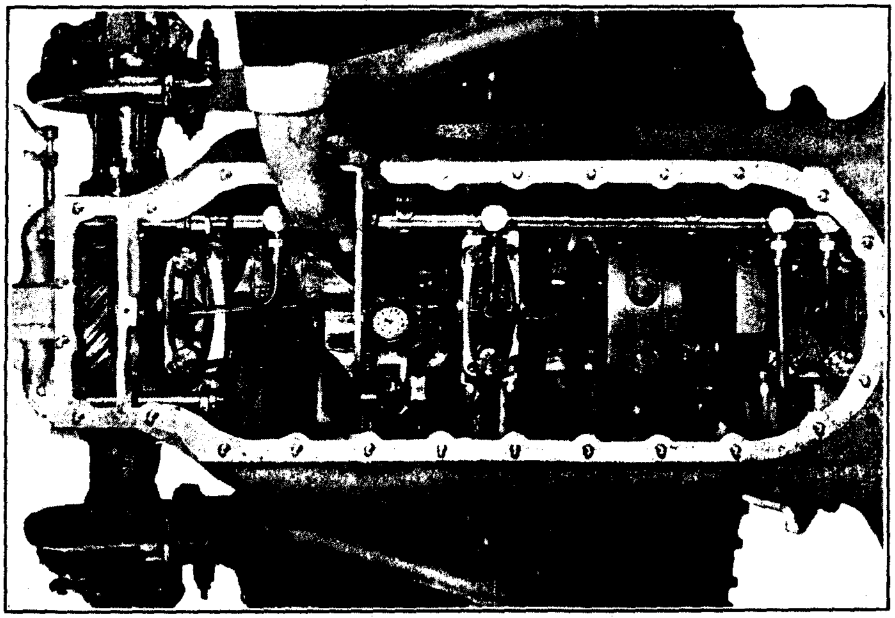

Fig. 12.—Indicator 196-B, Holder 67870, and Prying Bar 57736 for Crankpin Bearings

Place the indicator in the holder and clamp the holder to the forked connecting rod, as shown in Fig. 12. Adjust the indicator so that the button rests on the cap of the straight rod. With prying bar 57736 in position, as shown, force the straight rod up and set the dial on the indicator at zero. Then with the bar over the head of the straight connecting rod bolt and under the nut on a forked rod bolt, force the straight rod down. The clearance will be indicated on the dial.

The bar should be placed on the side opposite to that to which the indicator holder is fastened. Use as much care in handling the indicator as in handling a fine watch.

67927 Piston reamer.

Purpose: To ream the wrist pin holes in the pistons for .003 oversize wrist pins. Type 53.

Description: A straight-fluted reamer with pilot, straight shank, and square end. Reamer ground to .628; pilot, .625.

67928 Wrist pin bushing reamer.

Purpose: To ream the bushings in the upper ends of the connecting rods for .003 oversize wrist pins. Type 53.

Description: A straight-fluted reamer with pilot, straight shank, and square end. Reamer ground to .628; pilot, .625.

68200 Piston reamer.

Purpose: To ream the wrist pin holes in the pistons for .003 oversize wrist pins. Types 55-63.

Description: Fig. 4. A straight-fluted reamer with 2½-inch pilot, straight shank, and square end. Reamer ground to .752; pilot, .749. Same as 68201 except in length of pilot.

68201 Wrist pin bushing reamer.

Purpose: To ream the bushings in the upper ends of the connecting rods for .003 oversize wrist pins. Types 55-63.

Description: Fig. 4. A straight-fluted reamer with 1½-inch pilot, straight shank, and square end. Reamer ground to .752; pilot, .749. Same as 68200 except in length of pilot.

68350, 1 Piston reamers.

Purpose: To ream the wrist pin holes in the pistons for oversize wrist pins. Type 51.

Description: Expansion reamers, one for the small hole, the other for the large hole.

70003 Crankshaft gear puller.

Purpose: To remove the sprocket and the spiral gear from the front end of the crankshaft. Types 51-63.

Description: Fig. 13. A hinged-jaw puller with cast-steel nut and jaws and ¾-inch case-hardened swivel and screw. The jaws have double hooks, one for the sprocket and one for the spiral gear.

Directions for Use: Remove the front cover plate and camshaft driving chain as directed in the Shop Manual. Remove the retaining nut (or screw, if used) and washer in the end of the crankshaft. Apply the jaws of the puller to the sprocket, as shown in Fig. 13, tighten the screw against the end of the crankshaft and turn until the sprocket is removed.

If the spiral gear is also to be removed, apply the hooks at the ends of the jaws to the gear and draw up the screw.

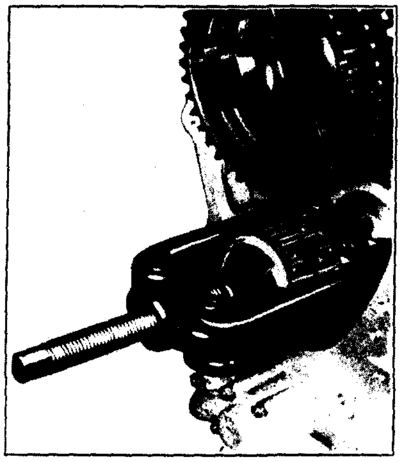

Fig. 13.—Puller 70003 for Crankshaft Sprocket and Spiral Gear

71953 Puller for spring shackle bracket bushings.

Purpose: To remove and install the bushings in the brackets on the frame at the rear ends of the front springs. Types 51-63.

Description: Fig. 14. Consists of a cast-steel yoke with ¾-inch case-hardened screw, nut, and washer.

Directions for Use: To remove the bushing from the bracket, remove the shackle bolt and force the shackle down out of the way. Place the yoke in position, as shown in Fig. 14, and insert the screw through the bushing and the yoke with the head of the screw inside. Place the washer over the screw and screw on the nut, holding the screw from turning with a second wrench.

To install a bushing, insert the screw through the bushing and the bracket with the head of the screw toward the outside. (The yoke is not used in installing a bushing.) Place the washer and nut on the screw and draw up the nut. Lubricate the bushing before pulling it into place.

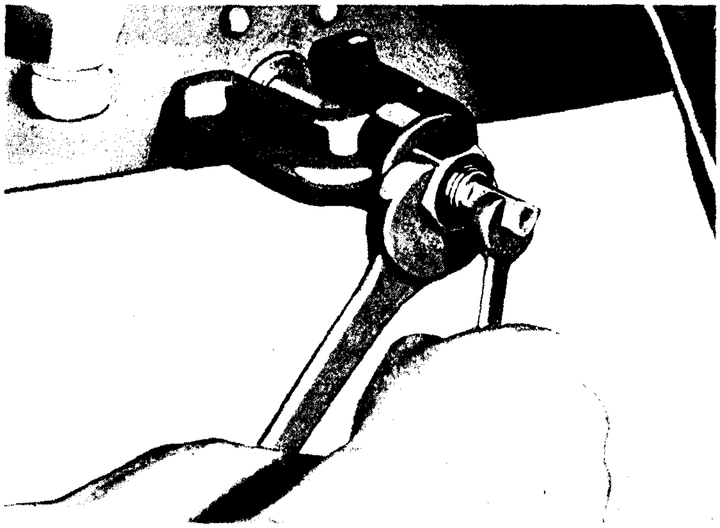

Fig. 14.—Puller 71953 for Spring Shackle Bracket Bushings

71955 Fanshaft coupling puller.

Purpose: To remove from the rear end of the fanshaft the coupling which connects it to the generator drive shaft. Types 53-63.

Description: Fig. 15. Consists of a steel plug which fits in the end of the coupling, two pins for securing the plug to the coupling, and a ½-inch screw with case-hardened ends. The pins are chained to the tool to prevent loss.

Directions for Use: Remove the carburetor and the generator drive shaft. Remove the cap screw and the washer in the end of the fanshaft. Insert the tool in the coupling and secure it to the coupling by inserting the two pins "A" (Fig. 15) through the holes drilled for the purpose in the coupling. Screw the screw "B" in against the end of the fanshaft and draw it up until the coupling is withdrawn.

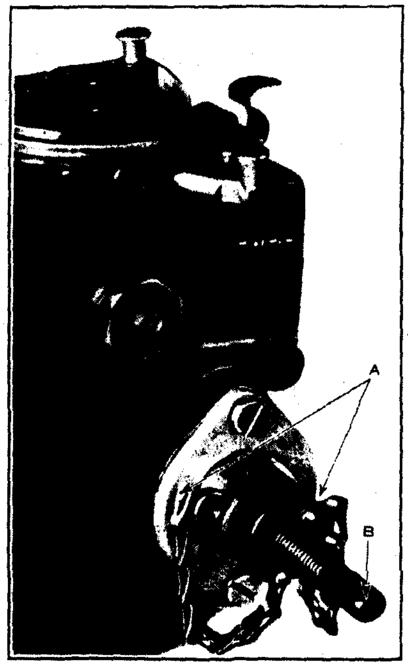

Fig. 15.—Puller 71955 for Fanshaft Coupling

71967 Cylinder bore indicator.

Purpose: To test the cylinder bores for size and parallelism. Types 51-63.

Description: Figs. 16 and 17. Consists of a dial indicator, with holder, and a master ring for setting the indicator.

Directions for Use: Carefully clean out the cylinder bore with a cloth free from lint and soaked in gasoline, and then wipe it dry. Wipe

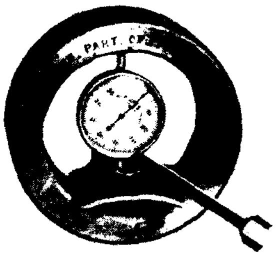

Fig. 16.—Setting Cylinder Indicator with Master Ring, Tool 71967

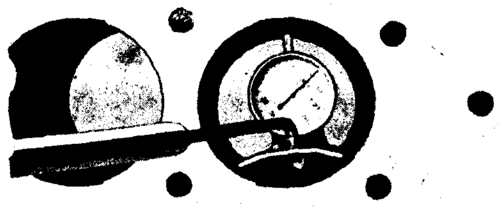

Fig. 17.—Indicating Cylinder Bore with Tool 71967

the master ring and the shoe which holds the indicator. Then place the indicator with the shoe inside the master ring, as shown in Fig. 16, and set the indicator dial to zero. The master ring is ground to 3.126 inches, which is the mean standard cylinder size, halfway between the inspection limits of 3.125-3.127.

Place the indicator with the shoe inside the cylinder bore, as shown in Fig. 17, and move it back and forth by means of the handle. Any variation in size between the upper and lower ends will be shown by the indicator. The size of the cylinder bore can be determined by adding the indicator reading to 3.126.

Cadillac oversize cylinders are ground to the following limits:

First oversize — 3.141 to 3.143 inches
Second oversize — 3.156 to 3.158 inches

To use the indicator for oversize cylinders the dial may be set in either of two ways. The dial may be set to zero in the master ring, in which case the reading will be the increase in cylinder diameter above the mean oversize diameter, plus the difference between the standard and oversize diameters. To determine the actual diameter of the cylinder the indicator reading must be added to 3.126 inches.

The second method is to set the dial to read minus .016 for the first oversize, or minus .031 for the second oversize, instead of zero. In this case the indicator reading shows directly the increase in cylinder diameter above the mean oversize diameter. To find the actual diameter the reading must be added to the mean oversize diameter, that is, 3.142 or 3.157 as the case may be.

Caution: Use as much care in handling the master ring and indicator as in handling a fine watch. These parts may easily be rendered inaccurate.

71968 Universal socket wrench.

Purpose: For general use. Types 51-63.

Description: Fig. 4. A 16-inch socket wrench with five detachable universal sockets and an 8-inch T-handle. Sizes of sockets: $\frac{3}{8}$, $\frac{33}{64}$, $\frac{37}{64}$, $\frac{39}{64}$ and $\frac{45}{64}$.

71969 Connecting rod alignment gauge.

Purpose: (1) To test connecting rods for alignment. Types 55-63.
(2) To assist in fitting crankshaft main bearings. Types 51-63.

Description: Figs. 18 and 19. Consists of a cast-iron base with machined V-blocks; a dial indicator; arbors for both ends of the connecting rods; and a support for the dial indicator when using the bottom of the base as a surface plate. Includes six arbors of the following diameters:

1.878—large end of forked rod, Types 55-61
2.377—large end of forked rod, V-63
2.255—large end of straight rod, Types 55-61
2.755—large end of straight rod, V-63
.750—small end of both rods, Types 55-63.

Directions for Use: (1) Alignment of straight rod: Select a large arbor of the correct diameter and clamp it in the large end of the rod. Lightly force the small arbor through the wrist pin bushing. Set the dial indicator in place, as shown in Fig. 18. Make sure that the arbors and the bearing surfaces on the gauge are clean, and place the rod with its arbors in the gauge.

The first test is to eliminate any twist in the rod, that is, to make sure that the center lines of the large and small holes are in the same plane. To make this test, observe whether both ends of the small arbor rest squarely on the machined surfaces of the gauge. If they do not, remove the rod and twist it slightly in the proper direction, repeating until both ends of the small arbor rest squarely on the gauge.

The second test is to make sure that the center lines of the large and small holes are parallel. To make this test, move the small end of the rod up and down past the stem of the indicator, observing the movement of the indicator hand. By turning the dial, set the indicator

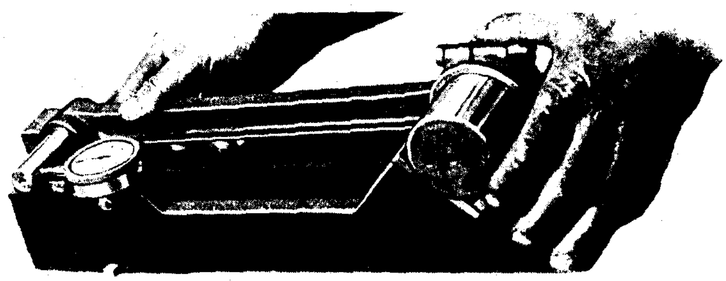

Fig. 18.—Aligning Straight Connecting Rod with Gauge 71969

to zero. Then turn the rod upside down, so that the other end of the small arbor is opposite the indicator. Move the small end of the rod up and down as before and watch the indicator. The maximum reading should again be zero. If it is not, remove the rod and spring it slightly, repeating until the indicator reading is the same for both positions of the rod.

If, in making the second test, the indicator readings for the two positions of the rod are greatly different, check the rod for straightness by lining up the large end with the bosses machined for the purpose on that end of the gauge, and observing whether the small end is in line with the boss at the other end of the gauge.

Alignment of forked rod: To test the forked rod for alignment, proceed as directed in the preceding paragraphs, but with the lower bearing clamped in place in the rod, using an arbor of appropriate size. If the used bearing does not fit the arbor tightly, replace it with a new bearing for the test.

(2) Fitting crankshaft main bearings: To use the gauge as a surface plate in fitting crankshaft main bearings, turn it upside down and clamp the indicator in position with the holder, as shown in Fig. 19.

When the clearance between the crankshaft and the bearing has been determined, place the lower half of the bearing under the gauge, as shown in Fig. 19, and, sliding the bearing back and forth, set the indicator to zero. Reduce the bearing by stretching emery cloth over the face plate and rubbing the bearing on the emery cloth. By making tests at intervals, the actual amount of metal taken off can be determined accurately. See the Shop Manual for directions concerning main bearing adjustments.

Caution: Use care in handling the arbors and in handling the gauge not to mar the finished surfaces. Use as much care in handling the indicator as would be used in handling a fine watch.

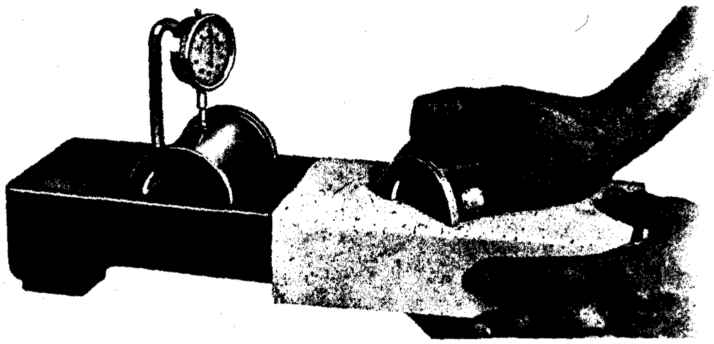

Fig. 19. Gauge 71969 Used as a Surface Plate in Fitting Main Bearings

71970 Main bearing wrench.

Purpose: To remove and install the nuts on the main bearing cap bolts. Types 51-63.

Description: Fig. 4. A double-end tubular socket wrench with one end offset to reach the rear bearing bolts; has two sets of holes for T-handle.

71971 Device for straightening rear axle sleeves.

Purpose: To test and straighten the sleeves in the ends of the rear axle housing. Types 51-63.

Description: Fig. 20. A steel casting with forged steel eyebolt and links to attach it to the rear axle. Includes a set of cross-hair sights for testing the axle for straightness.

Directions for Use: Jack up the car and remove the rear wheels. Place the sights on the ends of the axle sleeves and, by sighting through the longer sight, determine which sleeve is sprung and in which direction. Remove the sights and place the tool in position, as shown in Fig. 20, with the curved strut against the side of the sleeve away from which the end of the sleeve is sprung. Insert the pin in the eye-bolt into the

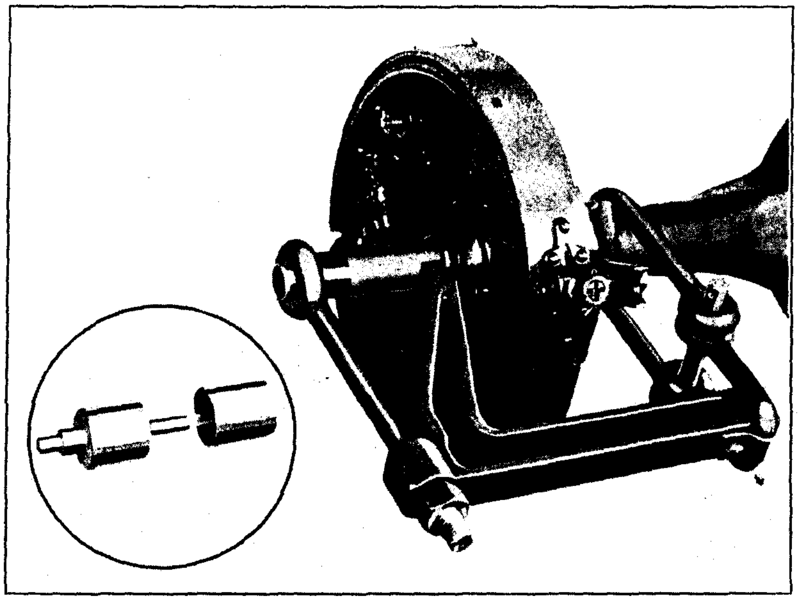

Fig. 20.—Straightening Rear Axle Sleeve with Tool 71971
(Cross-hair sights shown in circle)

end of the sleeve and connect the double link at the other end of the tool to the axle housing just inside the spring seat. Draw up the nut on the eye-bolt until sufficient pressure is applied to straighten the sleeve.

Note: This tool cannot be used to straighten a rear axle housing which is bent at any other point than at the sleeves.

71974 Pipe flanging tool.

Purpose: To flange the ends of the oil, air, and gasoline pipes. Types 51-63.

Description: Fig. 21. Consists of a die block in two halves and a punch. The die block has holes for 1/4, 5/16, and 3/8-inch pipe.

Directions for Use: Place the end of the pipe to be flanged in the proper hole in the die block and clamp the die block in a vise. Insert the punch in the open end of the pipe and tap it with a hammer until the metal is flared to the shape of the countersunk hole in the die block.

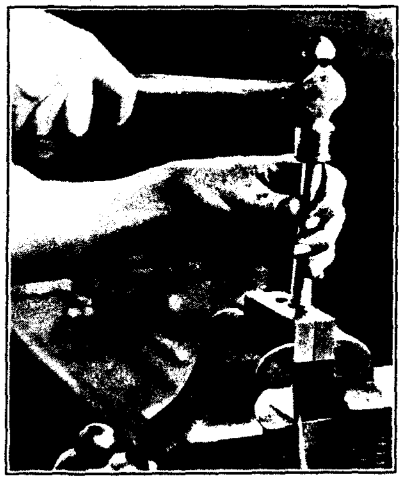

Fig. 21.—Pipe Flanging Tool 71974

71975 Clutch facing riveter.

Purpose: To rivet the clutch facings to the clutch discs. Types 51-63.

Description: Fig. 22. Consists of a steel block with two spring-controlled rivet sets for tubular rivets.

Directions for Use: Clamp the tool in a vise. Assemble the clutch disc and the two facings, inserting alternate rivets from opposite sides.

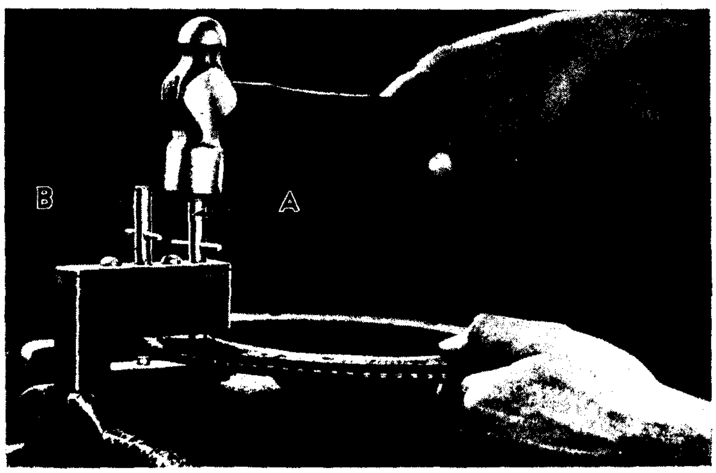

Fig. 22.—Clutch Facing Riveter 71975

Place the disc with the facings in the tool, as shown in Fig. 22, so that the punch "A" will enter one of the rivets. Tap the punch firmly, then move the disc until the rivet is under the punch "B" and complete the riveting. Set each rivet in a similar manner.

After completing the work, smooth down the new facings with a press or a steel block and hammer.

72352 Battery terminal wrench.

Purpose: To remove and install the nuts on the battery terminal clamp screws. Types 55-61. (For V-63 use a standard wrench for $\frac{1}{4}$ inch U. S. S. nuts.

Description: A flat open-end wrench with $\frac{35}{64}$-inch opening.

72353 Wrench for front wheel hub retainer.

Purpose: To remove and replace the retainer for the dust-washer in the front wheel hub. Types 55-59.

Description: Fig. 2. A T-handle wrench with a tempered blade of special shape to fit the slot in the retainer.

72354 Flange and steering arm puller.

Purpose: (1) To remove the flanges from the rear axle pinion shaft and the transmission shaft. Types 51-63.

(2) To remove the steering arm from the sector shaft. Types 57-63.

Description: Fig. 23. A solid jaw puller with a cast steel yoke and a case-hardened, $\frac{7}{8}$-inch, square-end screw.

Directions for Use: (1) Disconnect the rear universal joint from the pinion shaft flange and remove the retaining nut and washer. Place the puller in position, and tighten the screw against the end of the shaft.

(2) To remove the steering arm from the sector shaft, remove the retaining nut, place the puller

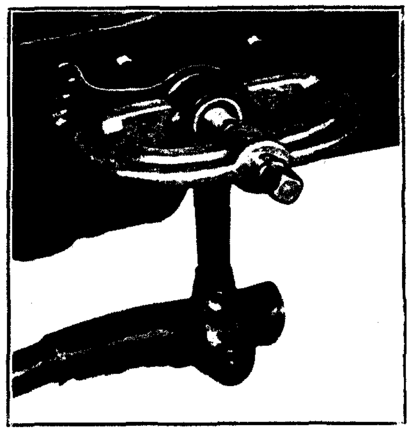

Fig. 23.—Removing Steering Arm with Puller 72354

as shown in Fig. 23, tighten the screw against the end of the sector shaft, and draw it up until the arm is removed.

72355 Spring eye bushing puller.

Purpose: (1) To remove and install the spring eye bushings. Types 51-63. (This tool cannot be used to remove the flanged bushings at the rear ends of the front springs on Types 59-63.)

(2) To remove and install the lower bushings in the front axle yokes. Types 51-61.

Description: Figs. 24 and 25. Consists of a cast-steel hollow cup to receive the bushing, a $^3/_4$-inch screw with square end and a case-hardened nut and washer.

Directions for Use: (1) To remove the bushing from the spring eye, insert the screw through the eye of the spring as shown in Fig. 24 and place the cup over the end of the screw with the open end toward the spring. Place the washer and nut on the screw and draw up the nut until the bushing is withdrawn.

To install the bushing in the spring eye, insert the screw through the bushing and then through the spring. Place the washer and nut on the

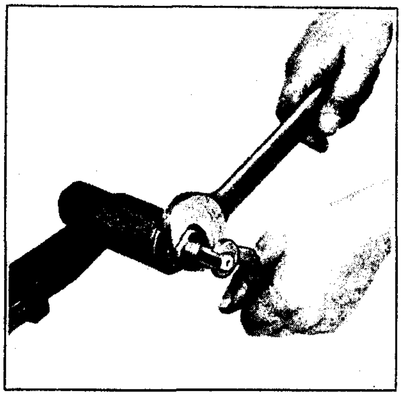

Fig. 24.—Removing Spring Eye Bushing with Puller 72355

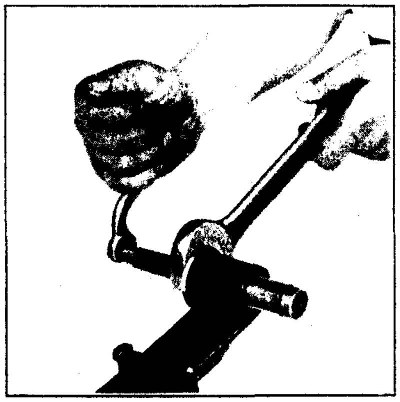

Fig. 25.—Installing Spring Eye Bushing with Puller 72355

screw (Fig. 25) and tighten the nut until the bushing is as far in as the threads on the screw permit. Then remove the nut and washer, place the cup between the spring and the washer and again draw up the nut, forcing the bushing in the rest of the way.

(2) To remove the lower bushing in the front axle yoke, insert the screw through the bushing from below and place the cup over the end of the screw with the open end down against the axle. Place the washer and nut on the screw and draw up the nut until the bushing is withdrawn.

To install the bushing in the front axle yoke, reverse the cup, placing it below the axle with the open end up. Insert the screw from below through the cup and the axle, and place the bushing, the washer, and nut on the screw. Tighten the screw and draw it up until the bushing is forced into place.

72394 Camslide guide puller.

Purpose: To remove the camslide guides from the crankcase. Types 51-63.

Description: Fig. 26. Consists of a hardened steel hook, a locking wire, and a ring to hold the hook and wire together.

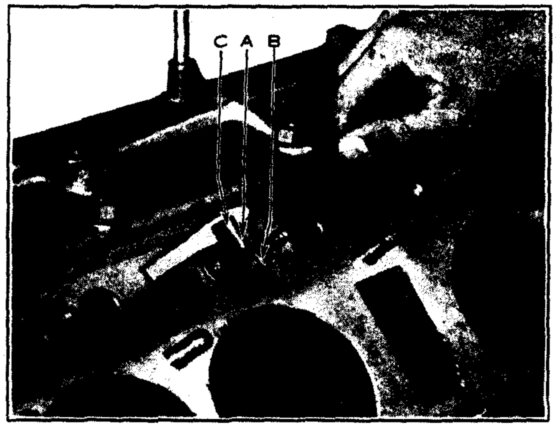

Fig. 26.—Puller 72394 for Camslide Guides

Directions for Use: Remove the camslide and the clamp for the camslide guide. Insert the hook "A" (Fig. 26) in the camslide guide, catch the hook at the lower end under the lower end of the guide, and insert the locking wire "B." With a suitable pry under the hook "C," the guide can then be removed.

72395 Master arbor.

Purpose: To assist in fitting crankshaft main bearings and crankpin bearings. Types 51-61.

Description: Fig. 1. A steel arbor 9 inches long, one end of which is ground to 1.875 for Types 51-61 and the other to 2.000 for Types 59 and 61.

Directions for Use: Whenever possible, crankshaft main bearings should be reamed in line with tool 79255. If a reamer is not available, each bearing must be fitted by scraping. If the crankshaft is removed, the bearing should be fitted directly to the crankshaft. If the crankshaft is not removed, scrape the bearing first to fit the master arbor, and then finish scraping to fit the crankshaft.

Standard size crankpin bearings are already reamed to size when they are shipped. Undersize or unreamed crankpin bearings should be reamed to fit the crankpin, if possible. If no reamer is available, crankpin bearings should be scraped the same as main bearings, first to fit the master arbor, and then to fit the crankpin.

The arbor is also useful to hold the crankpin bearing and the forked connecting rod while the straight rod is being fitted to the outside of the bearing.

72406 Camshaft forward bearing puller.

Purpose: To remove the forward camshaft bearing from the crankcase. Types 51-57.

Description: Consists of a cast-steel yoke, a cast-steel hook, and a 5/8-inch screw with T-handle.

Directions for Use: Remove the front cover plate, chains, fanshaft housing, and camshaft sprocket. Remove the set screw in the upper face of the crankcase which holds the bushing in place. Engage the hook of the puller over the bead on the front end of the bushing, adjust the yoke against the crankcase, and draw up on the handle.

72407 Puller for camshaft and spindle bearings.

Purpose: (1) To remove and install the bearing mountings at the upper ends of the front axle spindles. Types 51 and 55-61.

(2) To remove and install the camshaft intermediate bearings. Types 51-63.

Description: Figs. 27 and 28. Consists of a cast-iron cup, two case-hardened washers of different diameters, a case-hardened screw and nut, two flat washers, and a long T-handle socket wrench.

Directions for Use: (1) To remove a spindle bearing mounting, first remove the front wheel, the spindle, and the cap on the upper end of the axle yoke. Place the tool in position, as shown by Fig. 27, using the smaller washer above the axle yoke and the larger washer below the cup. Screw on the nut and draw it up until the mounting is forced out.

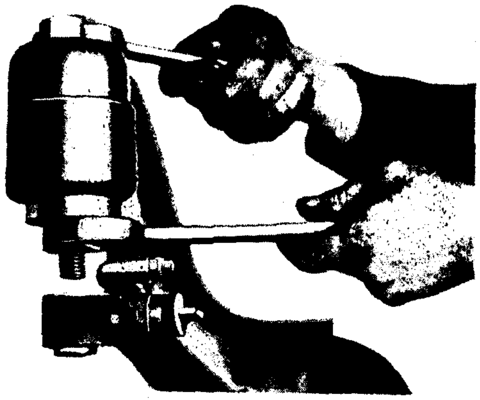

Fig. 27.—Removing Spindle Bearing Mounting with Puller 72407

To install a spindle bearing mounting, reverse the cup and place it above the axle yoke. Lubricate the mounting, and with the large washer against the lower edge of the mounting, screw on and draw up the nut. This will force the mounting into place.

(2) To remove a camshaft bearing, remove the camshaft and place the cup with the open end against the web of the crankcase and the slot in the cup over the oil tube above the bearing, as shown in Fig. 28. (This last is not necessary on Type 61 and V-63 cars, as on these types the oil passes through the hollow camshaft and there is no oil tube.)

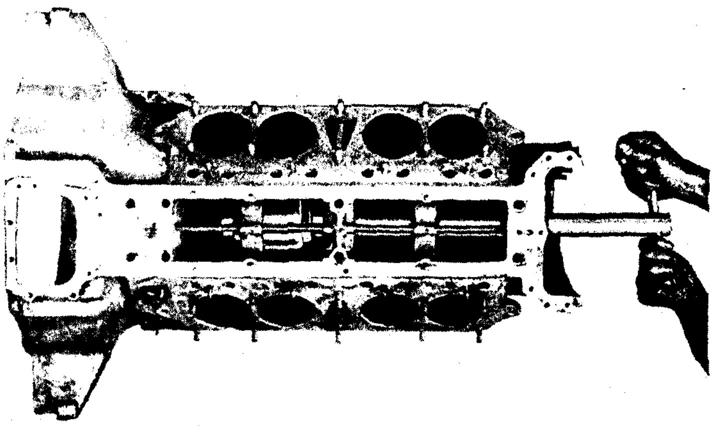

Fig. 28.—Removing Camshaft Bearing with Puller 72407

With the smaller washer in place against the edge of the bearing, screw on and draw up the nut, using the long socket wrench.

To install a camshaft bearing, reverse the casting so that it is behind the web of the crankcase into which the bearing is to be forced. Place the bearing over the screw, place either of the washers against the bearing and screw on and draw up the nut. Lubricate the bearing before forcing it into its place.

72631 Crankshaft prying lever.

Purpose: To furnish leverage for moving the crankshaft in determining clearances in crankshaft main bearings. To be used with dial indicator 196-B and holder 65530. Types 51-63.

Description: Figs. 1 and 10. Consists of a 15-inch lever, pivoted in a bracket which is provided with hook bolts for clamping to the crankcase.

Directions for Use: For Types 51-57, the hook bolts should be in the inner holes in the bracket. For Types 59-63, the hook bolts should be in the outer holes. Turn the crankshaft so that the cheeks next to the bearing to be indicated are in the horizontal plane. Place the bracket up against the under side of the crankcase, turn the four hooked clamping bolts outward, and tighten the nut on each bolt. Place the arm "A" (Fig. 10) over the cheek of the crankshaft and tighten the setscrew "B." By forcing the lever up and down, the crankshaft will be moved up and down in the bearing, the amount of movement of the shaft being equal to the clearance in the bearing. (See tool 65530.)

72799 Gear mount bearing adjusting bar.

Purpose: To turn the slotted nuts by which the rear axle gear mount bearings are adjusted. Types 51-63 (roller bearing type axle.)

Description: Fig. 29. A ½-inch round bar 9 inches long, flattened at one end for insertion in the notches of the adjusting nuts.

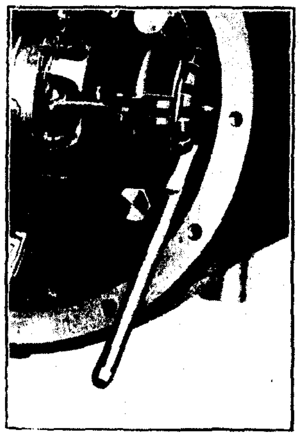

Fig. 29.—Adjusting Gear Mount Bearing with Bar 72799

72810 Offset screw driver.

Purpose: For screws not accessible to a straight screw driver. Types 51-63.

Description: Fig. 4. A double-end S-shaped screw driver, 5 inches long. Made from ⅜-inch octagonal tool steel, spring tempered.

72813 Forked connecting rod wrench.

Purpose: To remove and install the nuts on the forked connecting rod cap bolts. Types 51-63. (See wrench 73075 for straight rod.)

Description: Fig. 4. A straight socket wrench 8 inches long with T-handle.

72817 Wrench for clutch retaining nut.

Purpose: To remove and install the retaining nut on the front end of the clutch connection shaft. Types 51-63.

Description: Fig. 2. A straight tubular socket wrench 3 inches long with hole for T-handle.

72820 Top support wrench.

Purpose: To remove and install the top supports. Types 53-57.

Description: A double-end tubular socket wrench, 7 inches long, with hexagonal sockets $\frac{9}{16}$ and $\frac{3}{4}$ inch, respectively.

72825 Brace socket wrench.

Purpose: For general use. Types 51-63.

Description: A brace socket wrench 21 inches long, with $\frac{5}{8}$-inch hexagonal socket.

72836 Engine support wrench.

Purpose: To remove and install the rear engine support bolts. Types 51-63.

Description: Fig. 4. A single open-end wrench with a 12-inch handle offset $1\frac{3}{4}$ inches; forged from 1-inch x $\frac{1}{2}$-inch steel.

72840 Distributor shaft wrench.

Purpose: To remove and install the nut on the lower end of the distributor shaft. Types 51-55.

Description: A flat, open-end wrench $6\frac{1}{2}$ inches long, with handle offset 1 inch. The opening is 1 inch wide to fit the nut on the lower end of the distributor shaft.

72841 Wrench for water pump drive shaft packing.

Purpose: To tighten the packing gland nuts in the crankcase at the ends of the water pump drive shaft. Types 51-59. (See tool 83232 for Type 61 and V-63.)

Description: A box wrench 7 inches long, with the handle offset $\frac{1}{2}$ inch.

Directions for Use: Remove the water pump and apply the wrench as shown in Fig. 44 for tool 83232. The right- and left-hand nuts turn in opposite directions to tighten. To tighten either nut, turn it in the direction in which the wheels rotate when the car is moving backward.

72843 Camslide holder.

Purpose: To prevent the camslide from turning during adjustment of the valve stem clearance. Types 51-59. (See tool 87964 for Type 61 and V-63.)

Description: Fig. 2. A small, flat block with a $\frac{9}{16}$ inch opening at one end to engage the hexagonal end of the camslide, and a $\frac{5}{8}$-inch round hole in the other end to fit over the nut which holds the camslide guide clamp. Identical with 87964 except for thickness.

The thickness of the block ($\frac{1}{4}$ inch) is designed to cover the entire hexagonal end of the camslide, so as to prevent the adjusting wrench from slipping down and engaging the camslide.

72849 Fanshaft bearing nut wrench, R. H.

Purpose: To install the locking nut for the fanshaft forward bearing. Types 51-57 (rear bearing also on Type 51). Use 72855 for removing.

Description: A hardened steel single-end spanner, 8 inches long. Same as 72855 except that the hook is offset in the opposite direction.

72850 Pinion bearing adjusting wrench.

Purpose: To turn the adjusting nuts for the rear axle pinion bearings. Types 51, 53, 59.

Description: A double-end spanner wrench 8 inches long, made from $\frac{1}{4}$-inch flat stock, case hardened.

72855 Fanshaft bearing nut wrench, L. H.

Purpose: To remove the locking nut for the fanshaft forward bearing. Types 51-57 (rear bearing also on Type 51). Use 72849 for installing.

Description: Same as 72849 except that hook is offset in opposite direction.

73075 Straight connecting rod wrench.

Purpose: To remove and install the nuts on the straight connecting rod cap bolts. Types 51-63. (See wrench 72813 for forked rod.)

Description: Fig. 4. A straight socket wrench 8 inches long with T-handle.

75368 Valve adjusting wrench.

Purpose: For adjusting valve stem clearance. Types 51-59. (See wrench 88745 for Types 61-63.)

Description: Fig. 4. A single-end open-end wrench with $\frac{9}{16}$-inch opening. Fits the adjusting screw and locking nut, Types 51-59, and the camslide on all types.

76037 Carburetor balancing weight.

Purpose: To adjust the carburetor automatic throttle spring. Types 59-63 (carburetors with $2\frac{3}{16}$-inch opening). (See tool 67327 for Types 51-57 and early Type 59.)

Description: Fig. 30. Consists of a piece of flat metal, shaped to hook over the automatic throttle and of the exact weight to balance the spring when properly adjusted.

Directions for Use: Remove the carburetor from the engine and first make certain that the automatic throttle shaft works freely in its bearings. Test this by rotating the shaft a half-turn from the normal position and permitting it to return. If there is any tendency of the shaft to stick, remove it and clean the bearings. (See Shop Manual.)

After making certain that the shaft works freely, hook the balancing weight over the throttle disc, as shown in Fig. 30. Holding the carburetor with the intake manifold flange vertical, press down the end of the weight and then let it balance up and down until it comes to rest. It should come to rest in the horizontal position. If it does not, loosen slightly the two screws holding the plate "K" at the right-hand end of the shaft, and with a screw driver, turn the large slotted cap in the center of the plate. Turning the cap clock-wise increases the tension of the spring; turning it counter-clockwise decreases the tension. Tighten the two screws after the adjustment is complete.

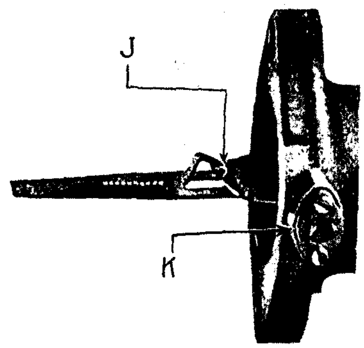

Fig. 30.—Adjusting Carburetor Automatic Throttle with Tool 76037

79249 Pinion bearing adjusting wrench.

Purpose: For turning the pinion bearing shell on the rear axle. Types 61-63 (roller bearing type axle).

Description: Fig. 31. A forged steel spanner wrench, 24 inches long, made from $1\frac{1}{2}$ x $\frac{1}{2}$-inch stock.

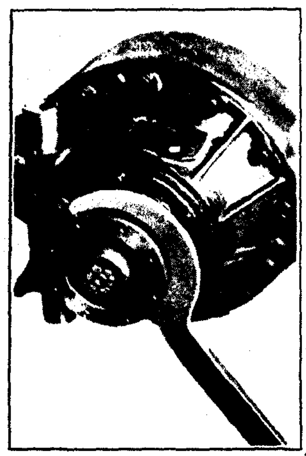

Fig. 31.—Pinion Bearing Adjusting Wrench 79249

79255 Martell reamer.

Purpose: To ream the crankshaft main bearings and crankpin bearings. Types 51-63.

Description: Figs. 1 and 32-34. The complete set consists of two reamers with three sets of reamer cutters for diameters $1\frac{7}{8}$ inches, 2 inches, and $2\frac{3}{8}$ inches; two bars of different lengths; three centering bushings each with two sizes of outside cones; and two spanner wrenches.

Directions for Use: To ream the crankshaft main bearings, disassemble the engine and remove the crankcase from the chassis, placing it upside down upon a suitable support. Place the bearings to be reamed in the crankcase with the liners in place, and tighten the bearing cap nuts. Use liners of such thickness that the caps will clamp the bearings just tight enough to prevent moving them endwise with a lead hammer.

Select the proper reamer and see that it is fitted with cutters of the correct size for the diameter to be reamed. If necessary to change the cutters, proceed as follows:

Place the reamer upon the short bar and clamp the bar in a vise. (Fig. 32.) With one of the spanner wrenches, loosen one of the clamping collars, "A" or "B," and remove the cutters. Assemble the proper cutters on the reamer, placing each cutter in the groove which has the same number as that stamped on the cutter. (The cutters are stamped

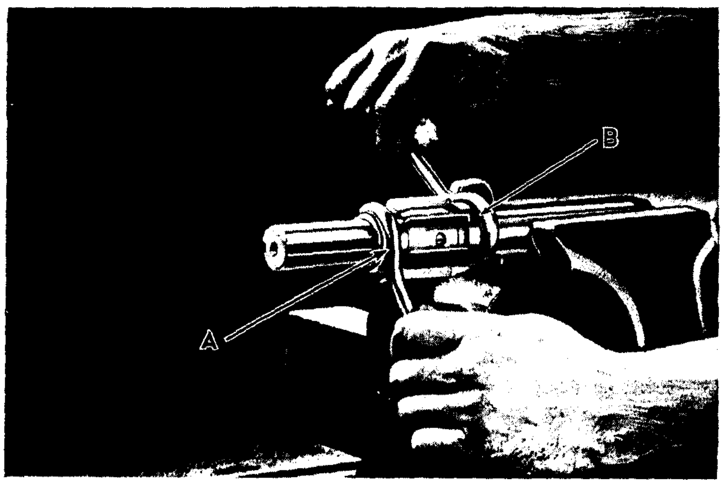

Fig. 32.—Replacing Cutters in Martell Reamer 79255

with figures from 1 to 6, and it is important that each be placed in its proper groove.) Tighten the collar after the cutters are in place.

When cutters of the correct size have been assembled on the reamer, micrometer the journal of the crankshaft and set the reamer .002 to .003 larger than the journal. This will give from .001 to .002 clearance between the shaft and the bearings after the reaming is completed. To increase the size of the reamer, loosen the collar "A" and tighten the collar "B." To decrease the size, loosen the collar "B" and tighten the collar "A."

Assemble together the outside threaded cone and the inside sleeve of each centering bushing, using the large outside cones for V-63 engines and the small outside cones for previous types. With the outside cone and the inside sleeve of each centering bushing fitted tightly together, place the long bar with the three centering bushings and the reamer in the crankcase, as shown in Fig. 33. The 6° cutting edge of the reamer should face toward the forward bearing.

Screw the threaded tapered portion of the outside cones of the centering bushings "A" and "K" carefully into the ends of the forward and rear bearings as shown. Next, screw the outside cone of centering bushing "B" into the rear end of the center bearing. When the centering bushing "B" is firmly in place, move the inner sleeve with the knurled flange back 1/16 inch to 1/8 inch from the outer cone, and adjust the set screws so that they just touch the parallel surface of the inner sleeve. Two of the set screws should be in the horizontal plane and two in the vertical plane.

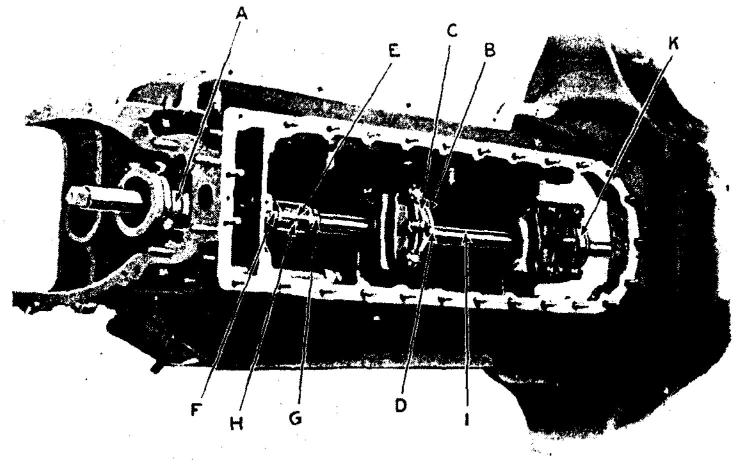

Fig. 33.—Reaming Crankshaft Main Bearings with Reamer 79255

To determine if the centering bushing "B" has been lined up correctly, pull the reamer bar back until it just leaves the forward centering bushing. On pushing it forward again, the bar should enter the hole in the forward centering bushing without clicking. If it does not, readjust the set screws of the centering bushing "B."

When the bar and centering bushing are lined up correctly, lubricate the bar with light engine oil and the reamer cutters with a good quality of lard oil. Then ream the forward bearing, continuing the reaming operation until the reamer just touches the centering bushing. Remove the centering bushing and continue the reaming operation. After completing the reaming, pull the reamer back about one-half way out of the bearing and carefully replace the centering bushing by again screwing it into place.

Carefully slide the bar back just far enough to permit removing the reamer. Then slide the bar forward far enough to place the reamer between the second and third bearings, with the 6° cutting edge toward the rear bearing. Ream the rear bearing in a manner similar to that for the forward bearing.

After completing the rear bearing, place the reamer again between the forward and center bearings, with the 6° cutting edge toward the center bearing, and ream the center bearing.

To ream a connecting rod bearing, clamp the connecting rod in a vise, protecting the rod with wood blocks or copper jaws. Selecting the proper reamer with the proper cutters and setting it to the proper size, assemble it upon the short bar. Place the reamer with the bar and the centering bushing in the connecting rod, as shown in Fig. 34.

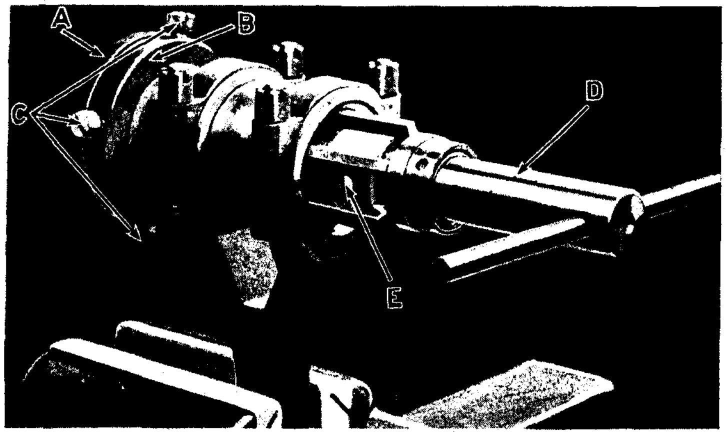

Fig. 34.—Reaming Crankpin Bearing with Reamer 79255

Hold firmly together the outer cone and the inner sleeve of the centering bushing, and with the 6° cutting edge of the reamer held tightly against the opposite end of the connecting rod bearing to center that end of the reamer shaft, screw the centering bushing into place. Lubricate the reamer with a good quality of lard oil, and ream the bearing until the reamer strikes the centering bushing. Remove the centering bushing and continue the reaming operation until completed.

After reaming the bushing, the connecting rod should be aligned in accordance with the directions given for tool 71969.

Caution: Inaccurate work will result unless very great care is used in handling this tool, particularly the long bar, which may be easily rendered inaccurate by rough handling. Keep all parts well oiled and packed in the box in which they are received.

79256 Crankpin returning tool.

Purpose: To true up the crankshaft crankpins. Types 51-61.

Description: Figs. 1 and 35. Includes a wooden clamp for holding emery cloth for polishing the crankpins.

Directions for Use: Remove the crankshaft from the engine, take out the plugs from the oil ways and clean the crankpins. Do not use emery cloth for this purpose. Place the shaft upon lathe centers, as shown in Fig. 35, being careful not to adjust the centers tightly enough to spring the shaft.

Using the scale "A" (Fig. 35), set the tool to the diameter of the crankpin. Three bronze shoes are furnished with each tool. Install the one marked "2", and place the tool over the crankpin as shown. Set

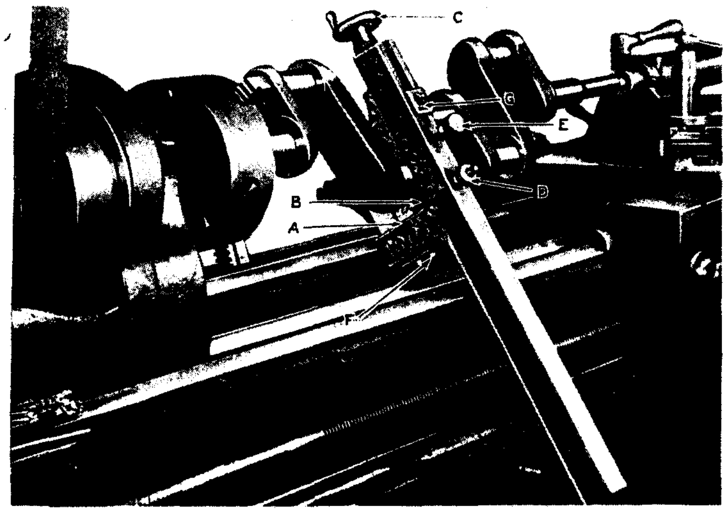

Fig. 35.—Truing Crankpins with Tool 79256

the screw "E," bringing the shoe against the crankpin, thereby holding the shaft firmly in place. Do not adjust the shoe too tightly.

Adjust the cutter by the hand wheel "C," so that it just clears the crankpin at its largest diameter. The lathe should be turned by hand to make certain the cutter is adjusted correctly.

Start the lathe on the lowest back gear. A speed of between 8 and 10 revolutions per minute is recommended. In no event should the speed exceed 15 revolutions per minute. Start the cutting operation with a feed of not more than half a thousandth per revolution. Keep the bronze shoe screwed tightly against the crankpin while the work is being done.

An out-of-round crankpin will result if this is neglected. Remove only enough metal to true up the pin. Use freely a cutting lubricant consisting of equal parts of lard oil and turpentine. Do not use a water compound.

Do not back off the cutter while the lathe is in operation. Injury to the hardened steel plates will result if this is done. If through mistake the plates are injured in this manner, use a fine India oil stone in dressing them up.

All crankpins should be turned to the same diameter. This can be done by using the graduations on the handwheel as a scale.

If a crankpin is worn badly out of parallel with the main bearing, the handle of the tool will oscillate on the ways of the lathe. This can be overcome by running the carriage slightly against the handle of the tool. When overcome, run the carriage back. After the work is completed, stop the lathe, remove the tool, place a piece of No. 00 emery cloth in the wooden hand clamp, and with the pin well lubricated, polish it with this tool. Finish polish with crocus cloth and oil.

After completing the work, thoroughly clean out all oil passages and replace the plugs.

It is important that the cutter edge be sharp and free from nicks. It is recommended that the tool manufacturers, the Sawyer-Webber Tool Manufacturing Company, 350 South Alemada St., Los Angeles, California, regrind the cutters when necessary.

Caution: Care should be used in handling this tool not to injure the surface of the steel plates nor the cutting edges.

79964 Valve reseating tool.

Purpose: To reseat the valve seats in the cylinder blocks. Types 55-63.

Description: Fig. 4. A 16-tooth 45° cutter with a 6-inch pilot ground to fit the hole in the valve stem guide. Has a hexagonal nut to receive a socket wrench for turning.

Directions for Use: Do not use lubricant of any kind on the cutter. Remove only enough metal to clean up the valve seat. It is recommended that the valves also be refaced in a grinder before being ground to their seats.

80369 Crankshaft returning tool.

Purpose: To true and round up the center main journal of the crankshaft. Types 51-61.

Description: Figs. 3 and 36. Consists of four parts: a rigid bracket to be clamped under the main bearing cap bolts, a hinged tool holder with feed screws, and two cutting tools for Types 51-57 and Types 59-61, respectively.

Directions for Use: Remove the oil pan, baffle plate, and the oil feed pipe to the center main bearing. Remove both halves of the bearing and the liner. Cut off ¼ inch from either edge of the upper half of the bearing and replace the bearing in the crankcase to act as a support for the crankshaft when the tool is in place. The purpose of cutting off the bearing is to prevent it from interfering with the tool.

Make sure the cutter in the tool is the proper one for the crankshaft to be returned. Turn the feed screw "B" (Fig. 36) counter-clockwise, and the lock screw "A" clockwise, as far as they go, so that the lower ends are as close together as possible. Place the tool over the bearing bolts, as shown in Fig. 36 with the cutter on the right-hand side of the engine. Tighten the bearing nuts sufficiently to hold the tool firmly, yet allowing it to be moved by tapping lightly with a hammer to align the cutter.

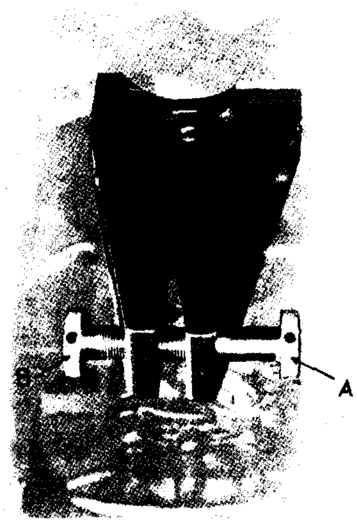

Fig. 36.—Crankshaft Returning Tool 80369 in Position

Before starting to turn the crankshaft, turn the feed screw "B" very slowly in the clockwise direction until the cutter is against the crankshaft, and then align the cutter by tapping the tool lightly with a hammer. This should be done very carefully. Proper alignment is most essential to the successful use of the tool. Then draw the nuts tight so the tool cannot be moved.

Rotate the crankshaft very slowly, observing the cutter carefully, and if the journal is out of round, back off the feed screw when necessary until the cutter just clears the highest point. The tool is now ready for returning the journal.

In operating the tool, one man should turn the crankshaft by hand, while another advances the feed screw, applies the cutting lubricant, and observes the results. The crankshaft should be turned very slowly, at a speed of about eight to ten revolutions per minute and not to exceed fifteen under any circumstances. The feed screw should be turned very slowly in the clockwise direction. As a cutting lubricant, use equal parts of lard oil and turpentine and apply freely.

Continue the turning until all ridges are removed and the journal is smooth. As the work nears completion, lighten the cut but stop turning the crankshaft just as soon as the tool stops cutting. Do not attempt to polish the surface by turning the crankshaft with the cutter merely rubbing against the journal. Remove the tool and the upper half of the bearing and polish the journal with crocus cloth and oil. Remove the plugs at the ends of the oil passage inside the journal and clean the passage thoroughly.

Thoroughly clean the journal and inspect it for size by using outside calipers and inside micrometers to determine what undersize bearings will be needed.

81846 Spanner wrench for pinion cage locking ring.

Purpose: To turn the locking ring for the rear axle pinion cage. Type 61 (first type axle).

Description: Fig. 1. A forged steel spanner wrench 22 inches long. Made from $\frac{3}{4}$-inch square stock.

82799 Gear and mount reamer, size .430 inch.

82800 Gear and mount reamer, size .4375 inch.

Purpose: To ream the bolt holes in the rear axle ring gear and gear mount, when replacing rivets with bolts. Types 61-63.

Description: Fig. 4. Straight-fluted reamers with straight shanks and square ends.

Directions for Use: Bolt the driving gear to the gear mount, using two temporary bolts in holes diametrically opposite. (See Shop Manual.) Enlarge the two holes 90° from the temporary bolts with reamer 82799. Finish ream these holes with reamer 82800. Countersink the two holes in the gear with countersink 82802, using the .436 pilot. Insert permanent bolts in the reamed holes, screw on the nuts and draw them tight. Remove the temporary bolts and enlarge, finish ream, and countersink the remaining bolt holes in the same manner.

82801 Gear and mount reamer, size .4575 inch.

Purpose: To ream oversize the bolt holes in the rear axle ring gear and gear mount, when replacing standard size with oversize bolts. Types 61-63.

Description: Fig. 4. A straight-fluted reamer with straight shank and square end.

Directions for Use: Use in the same manner as reamer 82800, except that it is not necessary to enlarge the holes with reamer 82799 as the holes are already standard size. In countersinking holes reamed with this reamer, use the .456 pilot supplied with countersink 82802.

82802 Gear countersink reamer.

Purpose: To countersink the bolt holes in the rear axle ring gear. Types 61-63.

Description: Fig. 4. A 3/4-inch 82° countersink with two detachable pilots, .436 inch and .456 inch, respectively.

Directions for Use: Use the .436 pilot in countersinking holes which have been reamed to .4375 with tool 82800. Use the .456 pilot in countersinking holes which have been reamed to .4575 with tool 82801.

83220 Steering wheel puller.

Purpose: To remove the steering wheel. Types 61-63. (See puller 56479 for Types 51-59.)

Description: Fig. 37. Consists of four parts: a cast-iron body, two 3/8-inch screws for attaching to the steering wheel hub, and a 3/4-inch case-hardened steel screw with hexagonal head and swivel end.

Directions for Use: Remove the spark and throttle control and support tubes as directed in the Shop Manual. Remove the steering wheel retaining nut with wrench 84492. Fasten the puller to the hub of the steering wheel, as shown in Fig. 37, screwing the two 3/8-inch screws into the holes drilled and tapped for the purpose in the hub. Draw the large screw down against the end of the steering tube until the wheel is withdrawn.

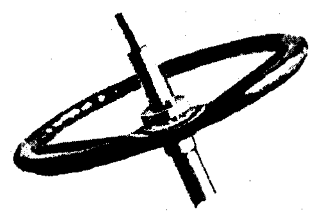

Fig. 37.—Puller 83220 for Steering Wheel

83221 Distributor driving gear puller.

Purpose: To remove from the fanshaft the spiral gear by which the distributor is driven. Types 53-63.

Description: Fig. 38. Consists of a cast-steel semi-cylindrical cup to enclose and hook the gear and a 5/8-inch screw with T-handle for applying pressure.

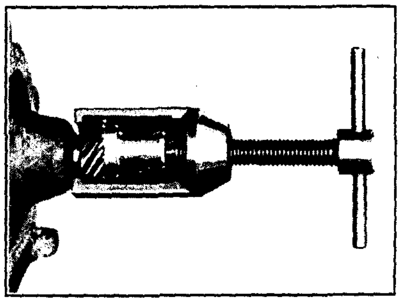

Fig. 38. Removing Distributor Driving Gear with Puller 83221

Directions for Use: Remove the distributor as directed in the Shop Manual. Place the tool in position as shown in Fig. 38. Draw up the screw against the end of the fanshaft and turn the T-handle until the gear is removed.

83222 Spring shackle bolt puller.

Purpose: To remove the spring shackle bolts at the rear ends of the front springs (after bolt has been started). Types 51-63.

Description: Figs. 3 and 39. Consists of a cast-steel hook, a 3/4-inch stud, anchored in the hook, a cast-steel yoke and a nut for applying pressure.

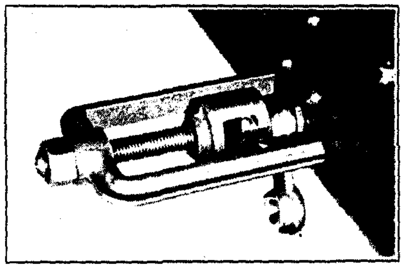

Fig. 39.—Pulling Spring Shackle Bolt with Tool 83222

Directions for Use: This tool cannot be used until the bolt has been started and pulled out at least 1/4 inch. (Tool 83235 is for starting spring shackle bolts.) When the bolt has been thus started, place the hook of the puller over the head of the bolt with the open side of the hook toward the flat side of the bolt head (See Fig. 39.) Place the yoke in position and screw on and tighten the nut.

83223 Spindle bolt starter and pusher.

Purpose: To remove the spindle bolts. Types 51-61.

Description: Fig. 3. The body of the tool is a cast-steel yoke large enough to enclose the spindle and the end of the front axle. Two screws with adapting sleeves are supplied, one of which has a 1-inch x 14 thread and is for starting the bolt. The other is a long ¾-inch screw to push the bolt through the spindle.

Directions for Use: Remove the wheel and take off the nut and washer on the lower end of the spindle bolt. Drive out the tapered key which locks the bolt in the spindle.

Screw the knurled ring on the end of the threaded sleeve, and place the sleeve in the large hole in the yoke with the ring in the countersunk portion. Place the yoke over the end of the axle, with the small hole over the head of the spindle bolt. Adjust the knurled ring until the upper end of the sleeve is against the axle. Insert the short screw and screw it up against the lower end of the spindle bolt. With a heavy wrench, turn the screw until the bolt is forced up flush with the axle.

Remove the large screw with the sleeve and knurled ring, and substitute the plain flanged sleeve. Insert the long screw and draw it up against the spindle bolt until the bolt is forced through the spindle.

83224 Clutch connection nut wrench.

Purpose: To remove and install the retaining nut for the clutch connection rear bearing. Types 61-63.

Description: Fig. 4. Consists of a steel block with pins to engage the holes in the nut, and knurled extension handles 6 inches long.

Directions for Use: This wrench is for use after the clutch connection with rear bearing has been removed from the transmission. In loosening the nut, remember that the thread is a left-hand thread.

83227 Generator driving clutch puller.

Purpose: To remove the driving clutch on the front end of the generator armature shaft. Types 51-63.

Description: Fig. 40. Consists of a steel block with two ¼-inch screws for attaching to the clutch, and a ½-inch screw for exerting pressure.

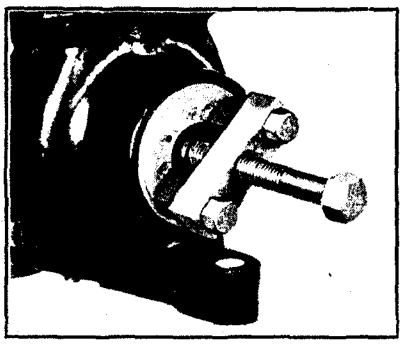

Fig. 40.—Removing Generator Driving Clutch with Puller 83227

Directions for Use: Remove the carburetor and the generator drive shaft. Attach the puller to the generator driving clutch by screwing the two small screws into the holes for the coupling screws. Tighten the large screw against the end of the armature shaft and draw it up until the clutch is withdrawn.

83228 Pinion forward bearing puller.

Purpose: To remove the forward or large pinion bearing from the pinion. Types 61-63 (roller bearing type axle).

Description: Fig. 41. Consists of a U-shaped hook attached by two long screws to a heavy block with a ¾-inch screw; T-handle.

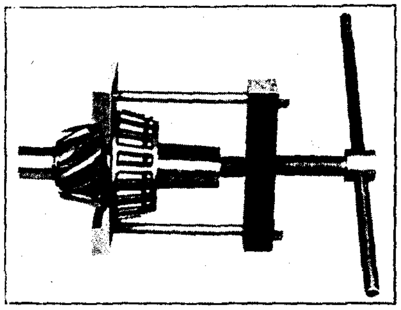

Fig. 41.—Removing Pinion Forward Bearing with Puller 83228

Directions for Use: With the pinion and bearing removed from the axle, place the puller in position, as shown in Fig. 41, and draw up the screw against the end of the pinion shaft.

83229 Pinion rear bearing puller.

Purpose: To remove the rear or small pinion bearing from the pinion. Types 61-63 (roller bearing type axle).

Description: Fig. 42. Similar to tool 83228 but with a differently shaped hook and a ⅞-inch screw.

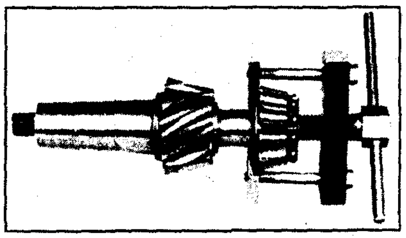

Fig. 42.—Removing Pinion Rear Bearing with Puller 93229

Directions for Use: With the pinion and bearings removed from the axle, place the puller in position, as shown in Fig. 42, and draw up the screw against the end of the pinion shaft.

83230 Gear mount bearing puller.

Purpose: To remove the bearings from the rear axle ring gear mount. Types 61-63 (roller bearing type axle).

Description: Fig. 43. A puller of the same general type as tools 83228 and 83229. The ¾-inch screw carries a swivel plug which fits over the hole in the end of the gear mount.

Directions for Use: With the gear mount and bearings removed from the axle, place the puller in position, as shown in Fig. 43, and tighten the screw.

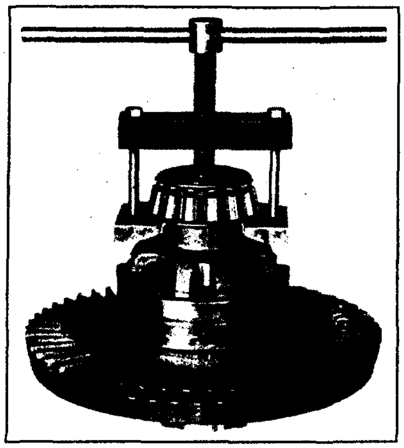

Fig. 43. —Removing Gear Mount Bearing with Puller 83230

83231 Chain riveting block.

Purpose: To back up the seat pin in riveting the ends of the fanshaft driving chain. Types 61-63 (with hole in rear wall of fanshaft housing).

Description: Fig. 6. An L-shaped piece of flat stock of the correct thickness to insert between the inner edge of the chain and the fanshaft housing.

Directions for Use: With the new seat pin opposite the hole in the rear of the fanshaft housing through which it was inserted, place the short arm of the block between the chain and the fanshaft housing directly back of the pin. On Type 61 engines which do not have the hole in the rear wall of the fanshaft housing, the fanshaft driving chain must be riveted before installing.

83232 Wrench for water pump drive shaft packing.

Purpose: (1) To tighten the packing gland nuts in the crankcase at the ends of the water pump drive shaft. Types 61-63. (For Types 51-59, see wrench 72841.)

(2) To turn the adjusting nuts on the radiator support studs. Types 61-63.

Description: Fig. 44. A box wrench, 7 inches long, with handle offset 1¼ inches.

Directions for Use: (1) Remove the water pump and apply the wrench, as in Fig. 44. The right- and left-hand nuts turn in opposite directions to tighten. To tighten either nut, turn it in the direction in which the wheels rotate when the car is moving backward.

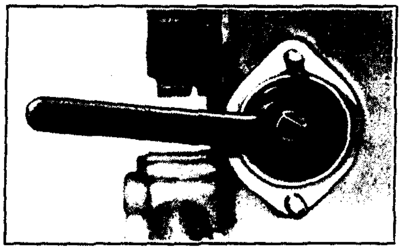

Fig. 44.—Wrench for Water Pump Drive Shaft Packing

(2) To use the wrench for raising or lowering the radiator, refer to the Shop Manual under "Radiator."

83233 Camshaft driver pusher.

Purpose: To install the camshaft driver on the front end of the camshaft. Types 59-61.

Description: Fig. 3. Consists of two parts: a ¾-inch hexagonal head screw, the extreme end of which has a pipe thread to fit the hole in the front end of the camshaft, and a nut with 10-inch extension handles.

Directions for Use: Remove the screw plug from the front end of the camshaft. Start the driver on the camshaft, making sure that the oil holes and the holes for the taper pin are lined up. Screw the end of the pusher into the hole in the end of the camshaft. Tighten the nut against the driver and draw it up until the driver is forced into place.

83234 Camshaft driver puller.

Purpose: To remove the driver from the front end of the camshaft. Types 59-61.

Description: Fig. 3. Consists of a block with two ⅜-inch screws for attaching to the driver, and a ¾ inch screw with T-handle.

Directions for Use: Remove the taper pin by which the driver is fastened to the camshaft. Attach the puller to the driver by screwing the two small screws into the holes drilled and tapped in the driver. Screw the large screw against the end of the camshaft and draw it up until the driver is removed.

83235 Spring shackle bolt starter.

Purpose: To start the spring shackle bolts at the rear ends of the front springs preparatory to removing with puller 83222. Types 51-63.

Description: Fig. 45. Consists of a heavy C-shaped steel casting and a one-inch hexagonal head screw with a hollow swivel end to receive the head of the bolt.

Directions for Use: Remove the nut on the inner end of the bolt and loosen the clamp screw on the inner shackle link. Place the tool in position as shown in Fig. 45 with the small end of the tool against the inner end of the bolt and the hollow swivel over the head of the bolt. Tighten the screw and turn it until the bolt is forced out as far as the tool permits. Tool 83222 should be used if necessary to pull the bolt the rest of the way.

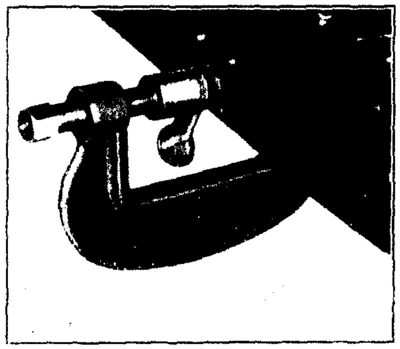

Fig. 45.—Starting Spring Shackle Bolt with Tool 83235

83236, 7 Torque arm support bolt wrenches.

Purpose: To tighten or remove the bolt at the top of the torque arm support. Wrench 83236 is for turning the nut. Wrench 83237 is for holding the bolt. Types 61-63.

Description: Fig. 46. Both tools are socket wrenches with offset handles shaped to clear the brake rods and propeller shaft. The handles are 12 inches long and $\frac{5}{8}$ inch round.

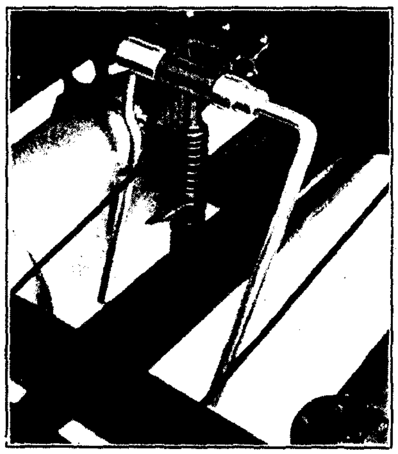

Fig. 46.—Wrenches 83236 and 83237 for Torque Arm Support

83238 Torque arm pin puller.

Purpose: To remove the pin at the rear end of the torque arm. Types 51-59.

Description: Fig. 3. Consists of three pieces: a 1 1/8-inch screw, with a hexagonal head on one end and a sleeve on the other to fit the threaded end of the torque arm pin; a long hollow sleeve to receive the pin as it is withdrawn; and a nut for applying pressure.

Directions for Use: If a pit is not available and the axle is under the car, jack up the car high enough so that there is twice the length of the torque arm pin between the lower end of the pin and the floor.

Remove the nuts and washers from the ends of the torque arm pin. Loosen the clamping bolts in the differential carrier. Apply the tool to the lower end of the torque arm pin by screwing the sleeve on the end of the screw over the threaded end of the pin. Tighten the nut on the screw against the end of the long sleeve, and draw up the nut until the pin is withdrawn.

84491 Brake adjusting wrench.

Purpose: To adjust the nuts on the rear wheel brake yoke bolts. Types 51-63.

Description: Fig. 47. An 18-inch socket wrench with 10-inch T-handle.

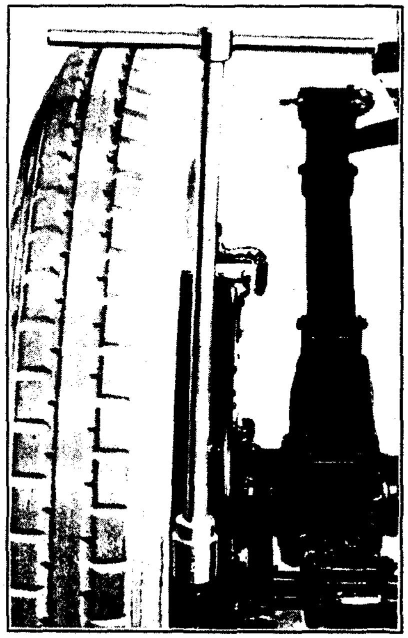

Fig. 47.—Wrench 84491 for Adjusting Brakes

84492 Steering wheel nut wrench.

Purpose: To remove and install the steering wheel retaining nut. Types 61-63.

Description: Fig. 4. A 5-inch tubular socket wrench with T-handle.

84924 Valve stem guide cleaner.

Purpose: To clean the valve stem guides. Types 51-63.

Description: Fig. 4. Consists of a ¼-inch rod with a part of its length surrounded by a series of spirally wound steel wires. The end is round for holding in a drill chuck.

85780 Valve rocker arm plate reamer.

Purpose: To ream the holes in the valve rocker arm plate for oversize shafts. Types 51-61.

Description: Fig. 4. A straight-fluted pilot reamer. Length overall, 12½ inches. Reamer ground to .503, pilot .498. Has a hexagonal end for use with special socket wrench 87205.

85797 Camshaft sprocket pusher.

Purpose: To install the camshaft sprocket. V-63.

Description: Fig. 48. Consists of three parts: a 1⅛-inch screw, one end of which is drilled out and tapped to fit the front end of the camshaft and the other end of which has a T-handle; a nut with 7-inch extension handles; and a sleeve which is pinned to the screw to prevent turning.

Directions for Use: Place the sprocket over the end of the camshaft, lining up the key and keyway. Screw the tapped end of the screw on the end of the camshaft, which has a left-hand thread. Draw up the nut against the end of the sleeve and turn it until the sprocket is forced into place.

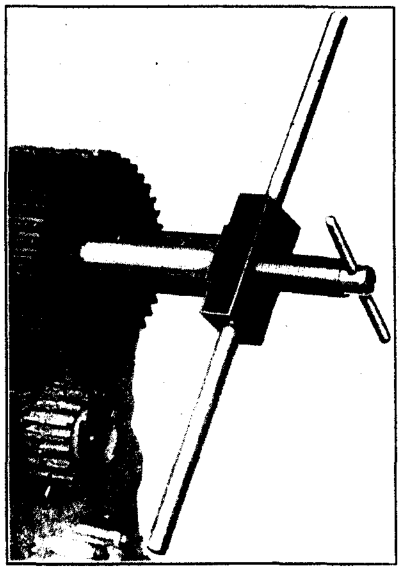

Fig. 48.—Pusher 85797 for Installing Camshaft Sprocket

85799 Camshaft sprocket puller.

Purpose: To remove the camshaft sprocket. Types 51-57 and V-63.

Description: Fig. 49. Consists of a steel block with two hook bolts for attaching to the sprocket, and a $1\frac{3}{8}$-inch screw with T-handle and swivel end.

Directions for Use: Remove the eccentric nut on the front end of the camshaft. Insert the hook bolts on the puller through the holes in the web of the sprocket, turn them out to engage the sprocket, and tighten the screw against the end of the camshaft. (See Fig. 49.) Turn the T-handle until the sprocket is removed.

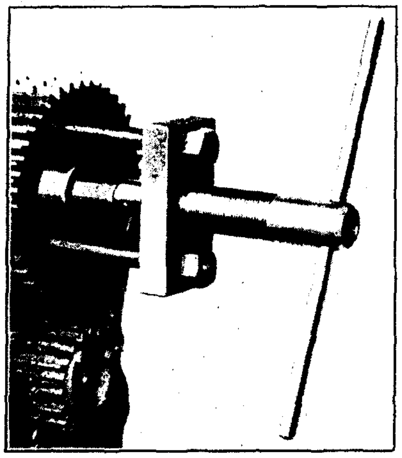

Fig. 49.—Removing Camshaft Sprocket on V-63 with Puller 85799

87205 Wrench for reamer.

Purpose: To be used with reamer 85780 in reaming the valve rocker arm plate. Types 51-61.

Description: Fig. 4. An 18-inch T-handle socket wrench of special diameter for use with reamer 85780.

87635 Master arbor.

Purpose: To assist in fitting crankshaft main bearings and crankpin bearings. V-63.

Description: Fig. 4. A steel arbor 4 inches long with one end flattened to facilitate clamping in a vise. Ground to 2.375.

Directions for Use: See directions for arbor 72395.

87964 Camslide holder.

Purpose: To prevent the camslide from turning during adjustment of the valve stem clearance. Types 61-63. (See tool 72843 for Types 51-59.)

Description: Fig. 50. A small, flat block with a 9/16-inch opening at one end to engage the hexagonal end of the camslide and a 5/8 round hole in the other end to fit over the nut which holds the camslide guide clamp.

The thickness of the block (3/8 inch) is designed to cover the entire hexagonal end on the camslide so as to prevent the adjusting wrench from slipping down and engaging the camslide.

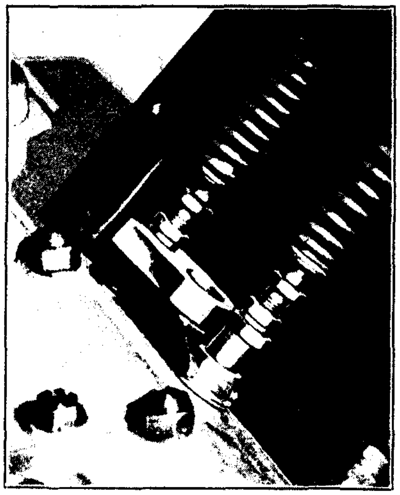

Fig. 50.—Tool 87964 in Place to Hold Camslide

87981 Brake adjusting drum sleeve.

Purpose: To adapt tool 49839 for use with V-63 front wheel brakes. V-63.

Description: Fig. 5. A steel sleeve with inside diameters ground to fit the V-63 front spindle, and outside diameters ground to the same limits as the rear axle sleeves.

Directions for Use: See tool 49839.

88745 Valve adjusting wrench.

Purpose: To adjust valve stem clearance. Types 61-63. (See wrench 75368 for Types 51-59.)

Description: Fig. 4. A single-end open-end wrench with 1/2-inch opening. Fits the adjusting screw and locking nut. (Use holder 87964 for holding the camslide.)

89025,6,7 Compensator wrench.

Purpose: To remove and install the screws by which the compensators are attached to the crankshaft. V-63.

Description: Fig. 4. A 10-inch socket wrench with two detachable sockets and T-handle 18 inches long. Socket 89026 is for the screws in the large counterweights. Socket 89027 is for the screws in the small counterweights.

89077 Valve rocker arm bushing press.

Purpose: To install Durex bushings in valve rocker arms and to size the hole in the bushing without reaming. (See Note.) This tool is not for removing bushings. V-63.

Description: Figs. 51 and 52. Consists of five pieces: a hollow base flattened at one end to permit clamping in a vise and containing a long screw anchored at one end; a pilot having two diameters, one slightly smaller than the unbushed hole in the rocker arm and one the exact size of the hole desired in the bushing after it is pressed into place: a flanged sleeve, the outside diameter of which is slightly smaller than the small diameter of the pilot; a horse-shoe washer; and a T-handle threaded to fit the screw in the base.

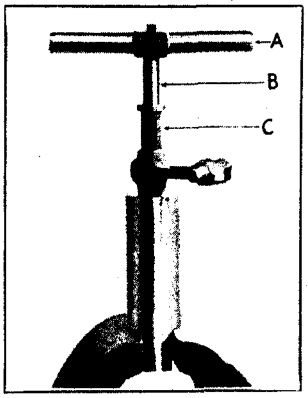

Fig. 51—Valve Rocker Arm Bushing Press 89077: Installing Bushing.

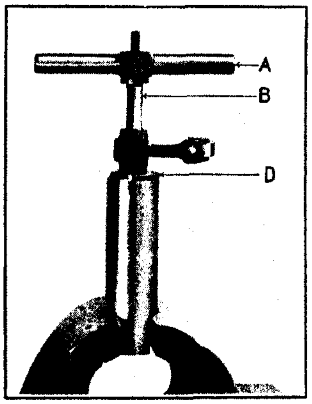

Fig. 52—Valve Rocker Arm Bushing Press 89077: Withdrawing Pilot.

Directions for Use: Clamp the lower end of the press in a vise and remove the handle "A" and the flanged sleeve "B," Figs. 51 and 52. Place the pilot over the screw with the large diameter in the base and the small diameter uppermost. Place the rocker arm from which the used bushing has been removed over the large diameter of the pilot and the new bushing over the small diameter of the pilot directly above the rocker arm.

Be sure to line up the oil hole in the bushing with the oil hole in the rocker arm. (If there is no oil hole in the bushing, a 1/8" hole should be drilled after the bushing is pressed into place.) Next place the sleeve "B" above the bushing with the flange down. Screw on the handle "A" and turn it down until the bushing is pressed into the rocker arm. Fig. 51 shows the press assembled ready to force the bushing into place.

It is next necessary to remove the pilot from the bushing. To do this, proceed as follows:

Remove the handle and lift the rocker arm and pilot sufficiently to slip the horse-shoe washer "D," Fig. 52, under the rocker arm. Be sure that the washer is inserted under the rocker arm as far as it will go, so it will hold the bushing from being pressed out of the rocker arm. Reverse the flanged sleeve "B" so that the flange is uppermost. Screw on the handle and turn it down until the sleeve "B" forces the pilot out of the bushing down into the base of the tool.

Note: Durex bushings must not be reamed. Durex is a porous metal which absorbs oil and transfers it to the bearing surface by capillarity. Reaming has the effect of closing the pores and preventing the oil from reaching the bearing surface.

89263 Puller for rear axle shaft packing.

Purpose: To install the packing at the inner ends of the rear axle drive shafts. Types 51-63.

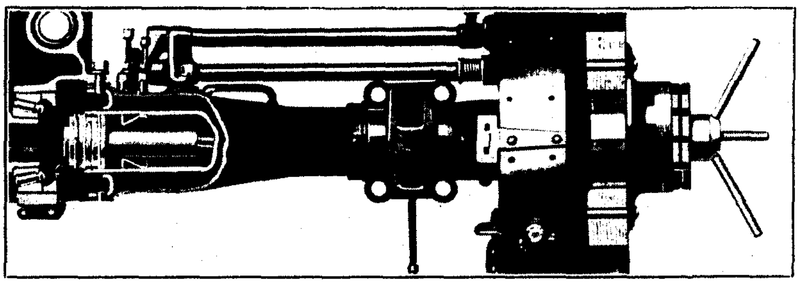

Fig. 53—Installing Rear Axle Shaft Felt Packing in Roller Bearing Type Axle with Tool 89263.

Description: Figs. 53 and 54. Consists of three parts: a long bar, one end of which is the same diameter as the inner end of the axle shaft and the outer end of which is threaded; a plate with a bayonet lock to retain the packing on the end of the tool; and a nut with handles to apply the pressure for pulling the packing into place.

Directions for Use: The tool can be used to install the right-hand packing on all types without removing the gear mount, and the left-hand packing on all types except later Type 61 and V-63. The tool can be used to install the packing on both sides of all types if the gear mount is removed. To use the tool to install the felt packing used in roller bearing type axles, proceed as follows:

Remove the hub cap and rear axle drive shaft. Drain the lubricant from the rear axle and remove the rear cover. Remove the three cotter pins which hold the spring retaining washer in the inner end of the axle sleeve. Remove the used felt washers.

Insert the tool, as shown in the illustration. Place the felt washers over the large end of the bar in the proper order. Place the spring washer in place after the felts, and finally put on the slotted plate and turn it a half-turn. Guide the felts into the sleeve and turn the nut on the outer end of the rod until the felts are pulled into place. Remove the tool and install the cotter pins to hold the retaining washer.

To use the tool to install the leather packing used in V-63 ball bearing type axles, proceed as follows:

Remove the hub cap and drive shaft. Drain the lubricant and remove the rear cover. Insert the tool through the rear axle sleeve and place the slotted plate on the end of the tool with the beveled side of the plate toward the packing. Draw up the nut until the packing spring is compressed so that the locking wire in the sleeve can be removed. Back off the nut, remove the retaining plate and withdraw the tool. Remove the packing retainer, the spring and the packing.

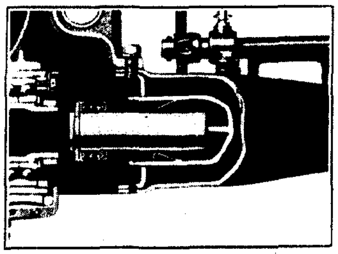

Fig. 54.—Tool 89263 In Use on Ball Bearing Type Axle.

Place the tool again in position and assemble the new packing, packing spring and retainer on the end of the tool as shown in Fig. 54. Place the slotted plate on the end of the tool and draw up the nut until the locking wire can be inserted in its groove.

90439 Valve spring lifter.

Purpose: To lift the valve springs one at a time. Types 51-63.

Description: Fig. 55. Consists of a C-shaped steel casting specially designed for use in limited working space. Pressure is applied by a quick-acting cam manipulated by a half turn of a lever. This lifter can be used to replace a valve spring without removing the cylinder head, by taking out the spark plug or compression relief cock, removing the ignition conduit, and engaging the upper pin in the head of the valve.

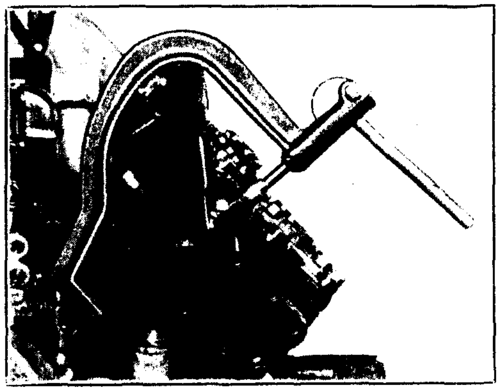

Fig. 55.—Valve Spring Lifter 90439

90743 Steering pivot press.

Purpose: To remove the pivots from the steering arms. Types 51-63.

Description: Fig. 56. Consists of two parts: a recessed block to engage the end of the steering arm, and a ¾-inch screw with hexagonal head to press against the end of the pivot.

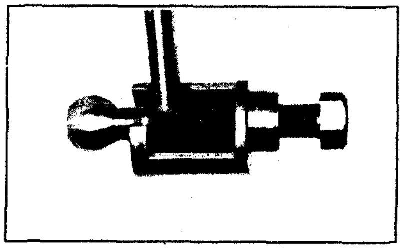

Fig. 56.—Removing Pivot in Steering Arm with Puller 90743

Directions for Use: Disconnect the steering connecting rod from the pivot and apply the tool as shown in Fig. 56. Tighten the screw against the threaded end of the pivot and draw it up until the pivot is forced out.

91075 Screw driver for crankpin plugs.

Purpose: To remove and install the screw plugs in the crankshaft crankpins for cleaning the oil passage-ways. V-63.

Description: Fig. 4. An L-shaped screw driver with specially shaped end. Forged from ¾-inch round steel.

91220 Indicator holder for rear axle gears.

Purpose: To measure the tooth backlash between the rear axle ring gear and pinion. Types 51-63.

Description: Figs. 57 and 58. Consists of a C-clamp for attaching to the differential carrier or rear axle housing and a universally adjustable holder for dial indicator 196-B.

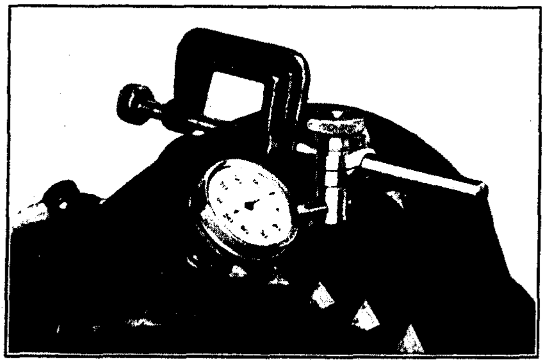

Fig. 57.—Backlash Indicator 91220 Attached to Differential Carrier

Directions for Use: If the differential carrier assembly is removed from the axle, clamp the holder to the flange of the carrier as in Fig. 57. If the rear axle is removed as a unit, clamp the holder to the rear axle housing as in Fig. 58. Place dial indicator 196-B in the holder and adjust it so that the stem rests against the back of one of the ring gear teeth

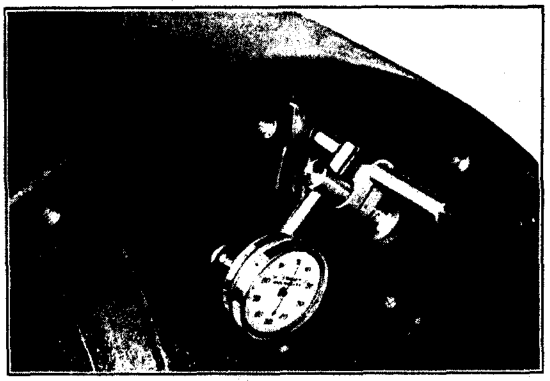

Fig. 58.—Backlash Indicator 91220 Attached to Rear Axle Housing

and is as nearly as possible at right angles to the surface of the tooth. Be sure the indicator does not touch the gear at any other point. With the pinion held firmly from moving, turn the ring gear by hand back and forth as far as the backlash permits. The amount of movement of the ring gear is the amount of backlash and will be shown on the indicator dial in thousandths of an inch.

91221 Crank for turning pinion shaft.

Purpose: To turn the pinion shaft when taking the tooth impression of the rear axle gears with red lead. Types 51-63.

Description: Fig. 59. A cast-steel crank 10½ inches long, with two studs for attaching to the pinion shaft flange.

Directions for Use: It is not necessary to remove the flange retaining nut in order to apply the crank. Simply place the crank over the end

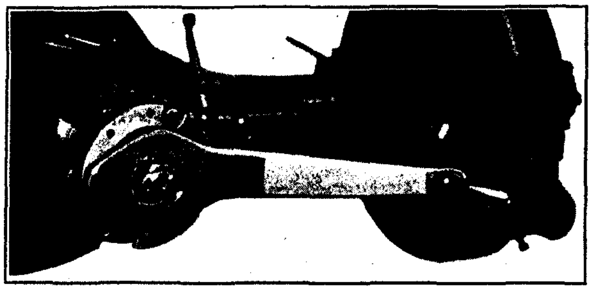

Fig. 59—Crank 91221 for Turning Pinion Shaft

of the pinion shaft, inserting the two studs through two of the holes in the flange, and screw on and tighten the nuts. (Refer to the Shop Manual for complete directions for taking the tooth impression of the rear axle gears.)

91222 Pinion shaft puller.

Purpose: To force the pinion shaft assembly out of the differential carrier for the insertion or removal of the adjusting shims. Types 61, 63.

Description: Figs. 60 and 61. Consists of a U-shaped steel block to insert between the pinion shaft flange and the screws in the differential carrier.

Directions for Use: Remove four of the six screws which hold the pinion carrier or pinion bearing retainer to the differential carrier, leaving two opposite screws in place. Insert the tool between the pinion shaft flange and these two screws. If the axle has roller bearings, the two square bosses should be toward the rear, as shown in Fig. 60. If the axle has ball bearings, the bosses should be toward the front, as in Fig. 61. Holding the tool in position, unscrew the two screws until their heads force the tool against the pinion shaft flange. Turning the screws alternately a little at a time, force the pinion shaft flange away from the differential carrier. The pinion shaft will carry the pinion

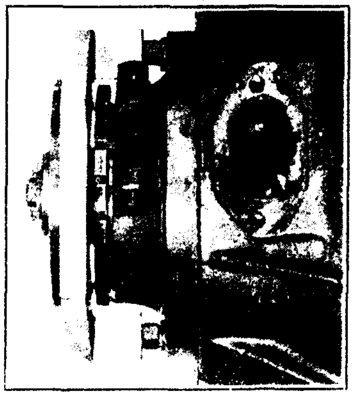

Fig. 60. Puller 91222 on Roller Bearing Axle

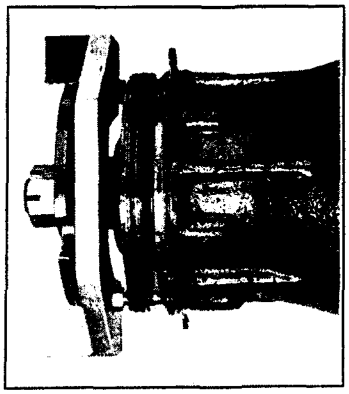

Fig. 61. Puller 91222 on Ball Bearing Axle

carrier and bearings with it and the shims can then be easily removed. (Refer to the Shop Manual for complete directions for adjusting the position of the pinion.)

91671 Gear mount adjusting wrench.

Purpose: To turn the adjusting nut by which the gear mount is moved sidewise. V-63 ball-bearing type axle.

Description: Fig. 62. A spanner-type wrench, shaped to engage two notches of the adjusting nut at the same time. Made from 1-inch by 1/4-inch steel.

Directions for Use: Refer to the Shop Manual for directions for adjusting the position of the gear mount.

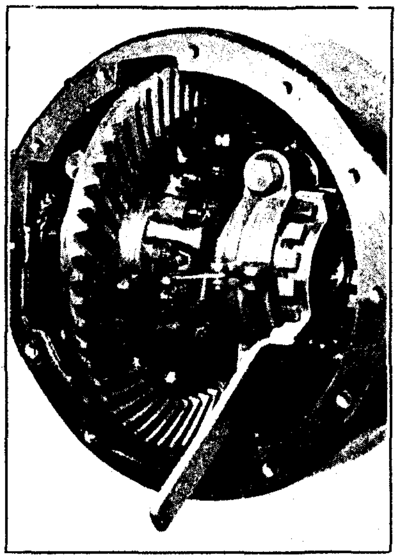

Fig. 62—Gear Mount Adjusting Wrench 91671 for Ball Bearing Type Axle

92251 Wrench for spindle bearing dust cap.

Purpose: To remove and install the dust cap over the spindle bearing adjusting nut. V-63 (engine number 63-H-1501 and after).

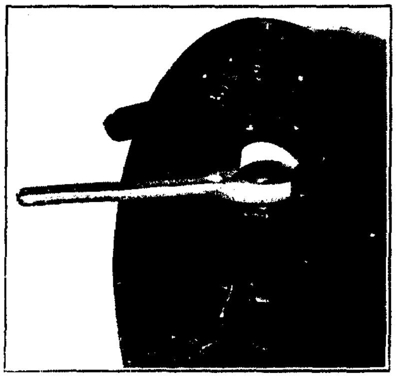

Fig. 63.—Wrench 92251 for Spindle Bearing Dust Cap

Description: Fig. 63. A flat, open-end wrench, with 1¾-inch opening and handle 7 inches long. Has jaws specially shaped to work in the small space around the dust cap.

Directions for Use: Remove the cover plate which is attached to the brake dust shield by two slotted screws. The wrench may then be used to unscrew the dust cap, as shown in Fig. 63. (Refer to the Shop Manual for directions for adjusting the spindle bearings.)