CADILLAC MOTOR CAR COMPANY c.1
1923 Engineering data and specifications

ADVANCE INFORMATION

CONFIDENTIAL TO

CADILLAC DISTRIBUTORS

DEALERS and

SALESMEN

TYPE V-63

CADILLAC MOTOR CAR COMPANY
DETROIT

Foreword

Each succeeding type introduced by the Cadillac Motor Car Company has been heralded the world over as the greatest Cadillac.

And each one in its turn has been the greatest Cadillac.

Now comes Type V-63.

Type V-63 represents the most noteworthy advance in Cadillac design and construction since the inception of the V-eight engine in 1914.

Without doubt, here *is* the greatest Cadillac.

That distributors, dealers and salesmen may know the Type V-63—its fundamentals, its improvements, its refinements—this advance information has been prepared.

By way of introduction, we wish to outline briefly the three outstanding features of the Type V-63:

A new V-Eight motor which has eliminated vibration at all speeds.

Four-wheel brakes of Cadillac dependability and exclusive design.

New bodies unsurpassed by the costliest custom-built jobs.

In addition, there are many refinements, mechanical and otherwise.

The complete line of Type V-63 cars is as follows:

Closed Models

Two-passenger Coupe, five-passenger Coupe, five-passenger Town Brougham, five-passenger Sedan, five-passenger Imperial Sedan, seven-passenger Limousine, seven-passenger Suburban, and seven-passenger Imperial Suburban.

Open Models

Roadster, Phaeton and seven-passenger Touring Car.

Advance Information

NINE years ago, the Cadillac Motor Car Company brought out its first eight-cylinder car. Back of this radical departure from the former program of four-cylinder production was the realization of a growing public demand for more dependable, comfortable and economical transportation.

In framing the structural characteristics of this car, the Cadillac engineers and designers took recognition of the fact that an automobile is primarily a passenger-carrying vehicle, and that a motor car having a maximum passenger capacity on a minimum of chassis length serves to best advantage the basic purpose for which it is intended.

Of all the motor types then available none fulfilled the requirements for such a car as did the 90° V-eight. Its short overall dimension required a minimum of chassis length, leaving maximum room for passenger accommodation. Its compact arrangement and sturdy components promised the utmost in rugged dependability. Its smooth flow of power was a revelation to all. With these desirable attributes the 90° V-eight was selected as the engine on which Cadillac could stake its future and *serve* the public.

Experience has proved that the creators of the first Cadillac V-eight planned well for the future, probably better by far than they themselves realized. Their foresight, careful analysis, and painstaking execution laid the foundation for five subsequent types, each one incorporating refinements and improvements over its predecessor but retaining the fundamental characteristics and tried features of the original.

After manufacturing and marketing over 155,000 90° V-type engines, the Cadillac Motor Car Company is today a stronger exponent of this type than ever before.

The Type V-63 is as logical a result of the Cadillac established policy of consistent growth as were the eight-cylinder models that preceded it. Research and experimentation during the last two years have been

crowned with an unusual degree of success and have made possible the incorporation of advanced engineering features that mark a greater step forward than any which have been made since the first V-eight. The most seasoned motorist, seated behind the wheel of the Type V-63, will experience a pleasant surprise at discovering a docility and pliability such as has never been before realized in automobile design.

The Type V-63 Engine

The Type V-63 engine, while externally similar in appearance to its forerunners, is the first V-type eight-cylinder engine to be inherently balanced, a development of such significance as to invalidate commonly accepted ideas of balance and to establish a new standard of engine smoothness.

With the same bore and stroke—3⅛ x 5⅛—as all former Cadillac eight-cylinder engines, it has the same piston displacement and the same S. A. E. power rating—314 cubic inches and 31.25 horsepower, respectively.

Conforming to Cadillac engineering practice heretofore, the cylinders are cast in blocks of four each which are placed at an angle of 90° to each other with the cylinders directly opposite.

The Compensated Crankshaft

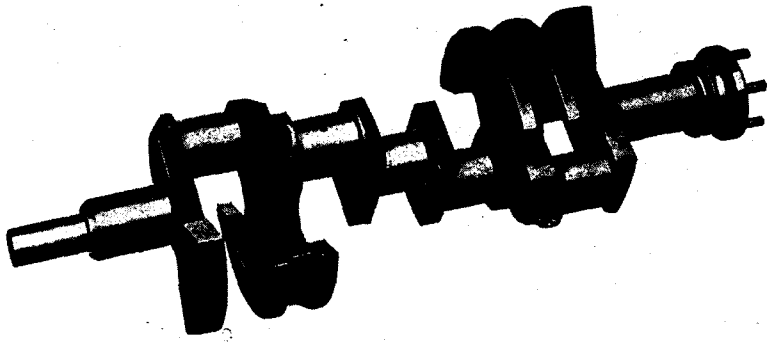
The new principle, introduced in the Type V-63, is embodied mainly in the crankshaft, which is novel in two respects—the arrangement of the cranks or throws and the use of compensators or counter-weights attached to and revolving with the crankshaft.

The Type V-63 crankshaft has four throws or cranks in two planes at right angles to each other, rather than all in one plane as is conventional V-type eight-cylinder practice. If the crank pin at the forward end of the crankshaft be considered to correspond with the figure XII on the dial of a clock, the second, third and fourth crankpins would fall at three, nine and six o'clock, respectively.

This rearrangement of the crankshaft throws makes necessary a new firing *order* but the firing *interval* is the same as on all Cadillac eight-

cylinder engines. The power impulses occur regularly every quarter revolution of the crankshaft. The firing interval is conditioned by the angle between the cylinder blocks, and with no other angle than 90° will an eight cylinder V-type engine have uniformly spaced impulses.

The compensators, which are of forged steel, are placed on the crankshaft at four points: between the front main bearing and the first crankpin; between the first and second crank pins; between the third and



The new Type V-63 compensated crankshaft

fourth crank pins; and between the fourth crank pin and the rear main bearing. Each compensator is attached to the crankshaft by two large bolts of alloy steel, positively secured.

An understanding of the compensating principle of the Type V-63 engine, employed for the first time by any manufacturer, requires an explanation of the disturbing forces which tend to produce vibration in an automobile engine.

They are chiefly of four kinds:

1. Torque reaction or the reaction of the power impulses on the engine supports;
2. Centrifugal forces due to unbalanced rotating parts;
3. Torsional forces tending to twist the crankshaft and cause torsional vibration, and
4. Inertia forces resulting from the reciprocating or alternating movement of the pistons in the cylinders.

1. Torque Reaction

Each power impulse that drives the crankshaft reacts on the cylinder blocks, tending to turn the engine as a whole in the opposite direction. This reaction, called "torque reaction," is resisted by the engine supports which are thus subjected to a repeated force, depending upon the intensity and frequency of the power impulses.

The effect of torque reaction in producing vibration is more noticeable when the impulses are heavier and less frequent and when they occur at irregular intervals. The light, regular overlapping impulses of the 90 degree V-type eight-cylinder engine, occurring four times every revolution of the crankshaft, produce so nearly a constant flow of power that the vibration effect of torque reaction is negligible.

2. Centrifugal Forces

Unbalanced centrifugal forces result when the center of gravity of the rotating parts—flywheel, crankshaft and lower ends of the connecting rods—does not coincide with the axis of rotation. The complete elimination of unbalanced centrifugal forces is made entirely possible by the accurate machining of all surfaces of the rotating parts, and by balancing these parts in sensitive balancing machines. This has always been standard practice on all Cadillac eight-cylinder engines.

3. Torsional Vibration

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. Many engines have crankshafts of such length that the torsional deflation introduce serious vibration, the attempt sometimes being made to minimize this vibration by the use of auxiliary loose-rim flywheels or so-called vibration dampeners.

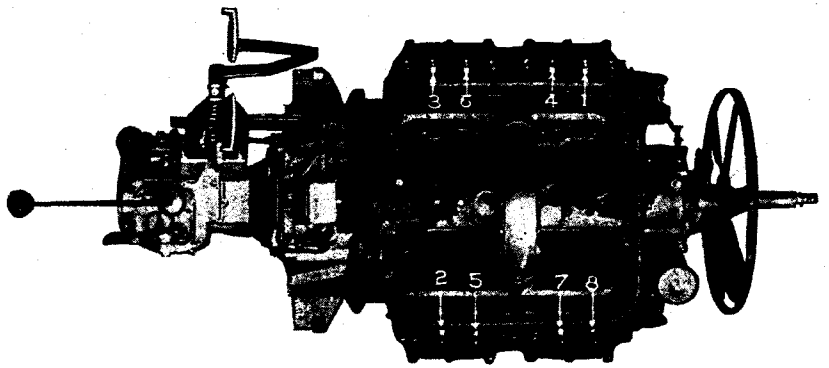
It is because of this inherent defect of a long crankshaft that Cadillac engineers have never approved of more than four cylinders in line. The V-type eight-cylinder engine has, in fact, the shortest crankshaft of all

types of engines, having four or more cylinders and with the same piston displacement.

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

4. Reciprocating Inertia Forces

Inertia forces, due to the alternating movement of the pistons, are the principal disturbing forces in an automobile engine and their elimination is one of the designer's most difficult problems. At a crankshaft speed of 2,500 revolutions per minute, a piston is traveling at the rate of



New firing order

over 3,000 feet a minute at mid-stroke. When it is realized that this piston must be stopped, started, and accelerated to the same velocity in the opposite direction within a distance of approximately five inches, and during an interval of one-eightieth of a second, it can be seen that the forces involved assume tremendous proportions.

Engineers have always attempted to neutralize the effect of inertia forces by arranging the crankshaft throws so as to cause the forces more or less to cancel each other. Types of engines in which the inertia forces *completely* cancel each other are designated as "inherently balanced." The Type V-63 engine is of this type and is the first V-type eight-cylinder engine to be "inherently balanced."

To demonstrate the inherent balance of the Type V-63 engine requires a discussion too technical for these pages. Suffice it to say that 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 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.

Bearings Promise Long Life

Three main bearings support the crankshaft, a smaller number of long bearings being preferable to a large 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, and, unless the alignment is accurately maintained, the loads are not uniformly distributed among the bearings.

It should be observed, that although the compensated crankshaft of the Type 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. Obviously, distributing a smaller load over a larger bearing, insures longer life.

The pistons and connecting rods are the same as those previously used except that the connecting rod bearings and the lower ends of the rods have been enlarged to correspond with the increased crank pin diameter.

Lighter Flywheel

The flywheel is a steel forging similar to that on former Cadillac eight-cylinder engines except in weight. The flywheel effect of the compensators and the larger crankshaft permit a lightening of the flywheel itself.

Ports in Cylinder Block Machined

The cylinder blocks are essentially the same as heretofore. A minor change, of significance to the mechanic, relocates two of the studs by which the cylinder blocks are attached. The nuts on these studs which are at the ends of the inner rows of studs, are outside the valve compartments and thus are more accessible.

Camshaft Has Sixteen Cams

The valve system of the Type V-63 is materially the same as that of the Type 61. Tungsten steel valves, giving an opening $1\frac{11}{16}$" in diameter, are operated from a single camshaft through rocker arms suspended from the upper crankcase cover plate. The hollow camshaft, however, has sixteen instead of eight cams, each valve being operated by an individual cam. The valve rocker arm and plate assembly has been redesigned to conform with the new camshaft. Additional supports are provided for the rocker arm shafts so that there is a support on each side of each rocker arm, thereby making a more rigid assembly.

Timing Chains Wider

The camshaft and fanshaft are driven by silent chains of the same make as before, but of a new type. Each chain also is one-quarter of an inch wider than formerly. The new design and the increased width of the chains, together with the smoothness of crankshaft rotation, has increased the life of these chains so far as to render a chain adjustment unnecessary. The sprockets on the front end of the camshaft are accordingly combined in one sprocket which is keyed to the camshaft.

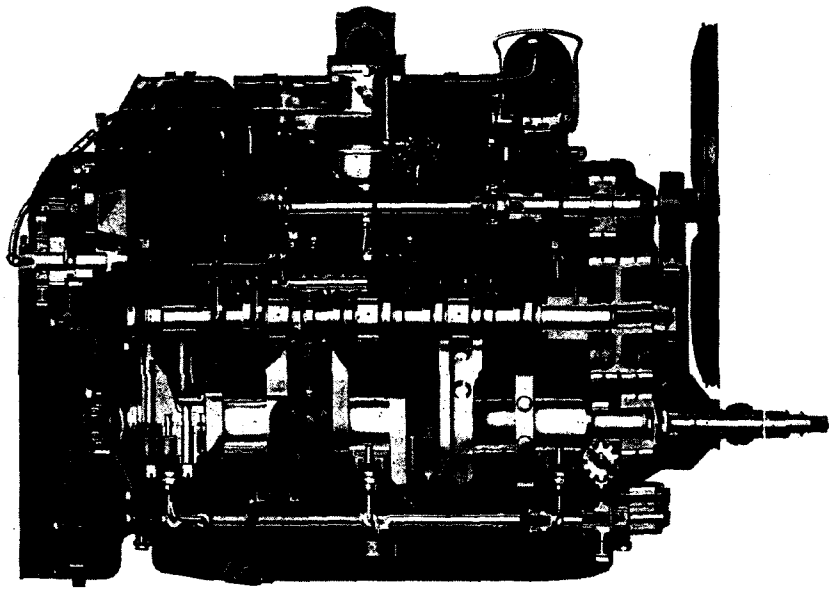
Fuel System

Pressure feed, for the fuel supply, is given continued preference over other systems. The elements are practically the same as on previous types.

The twenty-gallon gasoline tank is improved in two details. The quantity gauge is placed in a more convenient location at the left end

of the tank corresponding to the filler, which is situated as on the Type 61. The gasoline and air connections are in accessible positions on the front side of the tank, with ample clearance below the frame cross-member.

The two-inch carburetor, with thermostatically controlled vents and air valve spring, is identical with that on the Type 61, permitting the



Cadillac engine Type V-63

use of both high- and low-test fuels and insuring a correctly proportioned mixture at varying degrees of temperature.

Provision is made as before for draining to the ground any gasoline overflowing from the carburetor. The valve channel, however, is kept free of drain pipes by using a single pipe passing between the two center cylinders on the right hand side.

There is no change in the strainers and settling chambers, the same thorough consideration being given to cleaning the gasoline supply as heretofore.

The exhaust-heated intake manifold is also used, but the flanges for the connections to the cylinder blocks are placed parallel to the cylinders instead of being vertical. This renders unnecessary any springing of the manifold in removing and installing, and insures tight joints.

Ignition System

The Cadillac-Delco high-tension ignition system, with double timer-contact points, is continued for its eighth year. The conduits enclosing the ignition wiring are supported on bosses especially cast for that purpose on the cylinder blocks, instead of on brackets fastened by the cylinder head nuts. This renders it unnecessary to disturb the ignition wiring conduits when removing the cylinder heads.

A new ignition coil of the transformer type is used, securing greater efficiency. The coil is also completely enclosed in moulded Bakelite, making it weather-proof.

The high-tension terminal has been removed from the side of the coil towards the front seat and placed above the coil where it is concealed within and protected by the Bakelite casing.

Cooling System

Minor improvements have been made in the cooling system. The radiator condenser is located further toward the rear and is suspended in a vertical position so that the incoming vapor will have to pass through a greater depth of liquid. Necessity for filling the condenser through the floor board has been eliminated, the operation being automatic.

The two centrifugal pumps are driven by a spiral gear from the crankshaft and contain thermostatically controlled valves as before.

Lubrication

Lubrication of the Type V-63 engine is by pressure feed from a gear pump on the front of the crankcase, typical of all eight-cylinder Cadillac cars. The pump drive, the location of the oil reservoir, and the circulating system are the same as before.

A larger and more convenient oil filler is provided, bringing the opening above the hose connection between the radiator and the engine.

This filler is provided with a hinged, instead of a threaded, cap, and has a large strainer.

The oil-level indicator has been improved, eliminating the glass and thus insuring permanent visibility of the indicator ball.

Starting and Lighting System

The Cadillac-Delco single-unit, two-pole motor-generator, successfully used on the Type 61 and other former Cadillac cars, is continued.

For the fifth year the head-lamps have the tilting reflectors but they have been redesigned in shape and mechanism.

The side-lamps are similar in appearance to the head lamps.

The tail-lamp has been included in a triple utility lamp. Besides the customary red light for ordinary use, there is a bright red light for traffic signalling, and a bright white light for use when backing up. The traffic lamp 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. The stop and back-up lamp bulbs have the same candle-power as the head-lamp bulbs. The connection to the triple utility lamp is made through a special cable and plug carrying all three wires.

The Cadillac-Exide storage battery is in a case reinforced by through-bolts between adjacent cells. Simpler filler caps are used, making removal of the caps for adding distilled water more convenient. The storage battery is carried, as before, under the left hand dust shield.

The ignition and lighting switch is of a new type simpler in construction. Instead of blades giving a wiping contact, brushes are used to make contact with rotors or commutators.

The head lamps, side lamps, instrument board lamps, and tail lamp are controlled by the lighting switch lever. The lock is so arranged that the instrument board and tail lamps can be turned on while the switch is locked. When this is done, the side lamps are automatically turned on as soon as the switch is unlocked.

Power Transmission System

The Type V-63 clutch and transmission units have proven their superiority through previous use in the Type 61. Only a minor change is incorporated in the transmission to provide for the operation of the back-up light switch by the transmission control lever.

The transmission gear tooth surfaces, which engage in intermediate gear and direct drive, are finished by a grinding process, first used by Cadillac, that results in exceptional quietness.

Substantially the same full-floating rear axle is used as on later Type 61 cars. The pinion carrier is bolted directly to the differential carrier with shims between the flanges for adjustment.

Frame and Wheels

The Type V-63 frame is even more rigid than its predecessors. While the side bars have the same dimensions as the Type 61 frame, two new cross-members have been added. One of these, tubular in shape, is placed a short distance in the rear of the transmission. The other is a cross-member of channel section located directly opposite the front ends of the rear springs.

The artillery type wheels, with steel felloes and twelve hickory spokes, are similar to those used on Type 61 cars.

Steering System and Front Axle

Former Cadillac cars have been remarkable for the ease with which they are steered. The worm and sector type of steering gear which has been largely responsible for this result is continued in the Type V-63. The ratio of movement between the steering wheel and the sector shaft has been increased, however, making for still easier operation as well as reducing road shock.

A minor, but much appreciated, improvement has been made at the upper end of the steering column. A large, adjustable packing gland has been placed at this point to prevent the lubricant in the column from overflowing when too much has been injected. In connection with this change the oil hole for lubricating the bushing at the upper

end of the column has been re-located, enlarged, and provided with a plug.

The front axle has been entirely re-designed and strengthened to resist the additional stresses imposed by the front wheel brakes. It is of the reverse-Elliot type with forked spindles, and straight axle ends. The parallel rod, connecting the two steering spindles, is in the rear, rather than in the front, of the axle. The connections at the ends of the parallel rod are of the adjustable ball-and-socket type instead of the yoke-and-pin construction.

Adjustable taper roller bearings are used as before in the steering spindles. The number of rollers in each bearing has been increased resulting in more uniform distribution of wear on the bearing cups.

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. The caster effect, by which the reaction of the road on the wheels tends to keep them in the straight-ahead position, is retained.

Spring System

The three-quarter platform spring system, by which Cadillac cars have been distinguished almost since their inception, is used on Type V-63 cars. No change has been made except in the selection of spring weights and deflections to conform to new chassis and body requirements.

Four Wheel Brakes

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

The complete braking system of the Type 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 Major Consideration

Type 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. A front wheel which is sliding without rotating has no power to change the direction of the car. Front wheel brakes must provide against the contingency of locking both front wheels on a turn.

This is accomplished in the Type 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,

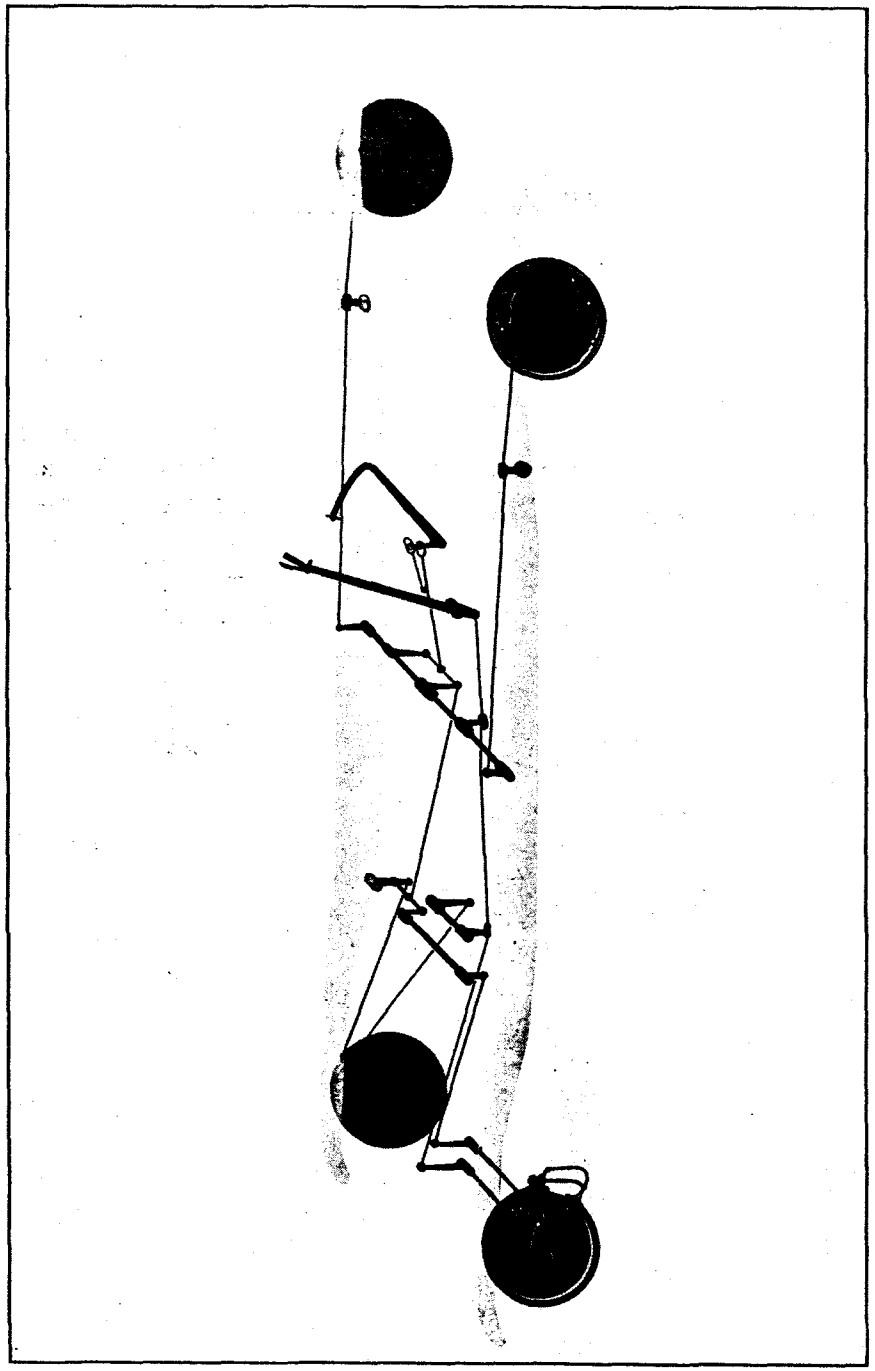


Diagram of four-wheel brake system

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, no matter how much pressure is applied to the pedal.

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. The proportion of braking effect taken by the front wheels can be adjusted within limits to meet the requirements of differently distributed loads or to suit individual preference.

Finally, safety is enhanced by the provision made to counterbalance the effect of heat in expanding the brake drums. It is not an uncommon experience in touring mountainous roads, to find that the brake pedal—if it operates external brakes—will apply the brakes earlier in its travel, after braking down a long grade, than at the beginning of the grade. This is the result of the heat from friction, which expands the drums and decreases the clearance between the brake lining and the drums. If the original adjustment is fairly close, some brakes, under such conditions, are apt to seize.

Conversely, a brake pedal which operates internal brakes will not take effect as early in the pedal travel when the brake drums are hot as at other times. If the brake clearance has become excessive, the pedal may even strike the toe board before the brakes take effect.

If all four brakes of a four-wheel brake system are either external or internal brakes, these effects are doubled.

On the Type 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.

The use of internal brakes on the front wheels also produces an automatic thermal equalizing effect which is sufficient when the car is traveling straight ahead to correct any slight inequality which might exist in the adjustment of the front wheel brakes. If one front-wheel brake has slightly less clearance than the other and takes effect first, the greater friction will heat and expand the corresponding brake drum. The expansion of the drum will increase the clearance slightly and permit the pedal to be depressed further until the other brake takes effect.

Adjustment Infrequent

A second consideration in the design and construction of brakes should be freedom from attention. Unusual steps have been taken to render the necessity for adjustment of Type V-63 four-wheel brakes infrequent.

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 toe board, the upper connection takes effect and the rate of pedal travel is reduced. The result of this two-stage construction is that the brakes can be used for a much longer time before the pedal touches the toe board. At the same time, the change in leverage gives notice to the driver that the second stage has been reached and that adjustment must be made in the near future.

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.

Not content with this, Cadillac engineers have provided for Type V-63 front-wheel brakes a special type of lining, which is highly compressed and subjected during manufacture to a heat treatment. This lining, moreover, is burnished by machine before assembling the brake bands on the axles. As a result an extraordinary amount of braking service is rendered before the clearance between the lining and the drums has been appreciably increased. Instead of requiring twice the amount of adjustment usually given rear wheel brakes, Type V-63 four-wheel brakes do not require nearly as frequent attention as rear wheel 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.

Flexible brake bands are also self-energizing, the friction between the lining and the drum assisting to increase the pressure with which the brake is applied.

The rear-wheel external brakes are essentially the same as the corresponding brakes on former Cadillac cars. The toggle lever and the anchor, however, have been moved to lower positions on the brake bands giving a greater length of the band above the drum. The upper part of an external brake band is more effective than the lower part because the forward rotation of the wheel tends of itself to wrap the upper part of the band more tightly around the drum. By increasing the length of the upper part of the band, more effective braking is obtained.

A stop screw has been added above each external brake to preserve a uniform clearance throughout the increased length of the upper part of the band. The anchor adjusting screw has also been made self-locking.

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. As in the external brakes, the location of the anchor with relation to the toggle makes use of the self-applying effect of rotation of the wheel.

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 previously used. The hole for the inspection and adjustment of the brakes has been enlarged and a new type of cover, more easily removed and attached, is employed.

Each set of brakes is mechanically operated through positive pull-rod 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.

New Cadillac Bodies

IN THE creation of the eleven body styles for the Type 63, Cadillac and Fisher body builders have produced bodies which in construction are unsurpassed by the costliest custom-built jobs.

The lines of the Type 63 offer a pleasing development of Cadillac body design, and the many improvements and refinements mark these new productions as masterly examples of the coach builder's art.

The bodies afford more leg room, side room, and head room, both in the front and in the rear compartments. In this respect they are more comfortable than any former model. Yet, the Type V-63 bodies appear larger and lower to the observer because of the skillful blending and proportioning of the lines.

All frame work in the closed and open body styles is constructed of first quality, selected ash, which is thoroughly seasoned and kiln dried before being used. The wooden parts of the bodies are compactly braced and the joints are mortised and glued. All metal stampings are made from special automobile steel and sheet aluminum.

The Factory has striven to give the purchasers of the Type V-63 the best paint job procurable in the standard colors—coach-makers, blue, claret lake (maroon), and Buckingham gray—also in special colors. In the Type V-63 there is offered, for the first time, a special relief design around the windows and doors of all closed body styles, which may be painted in colors to match the under body, or in any harmonizing shade desired. Painting a Type V-63 body takes 28 days for the standard jobs.

Type V-63's radiator is one inch higher than was the Type 61, and the hood is longer. The radiator cap marks a distinct departure from caps manufactured by other companies. This original cap is attractive in its nickel and Bakelite dress. Bakelite is used for the grip part while nickel trimmings appear above and below it.

Retaining the characteristic of sturdiness, the Type V-63 hood is a graceful expression of the designer's art. Hood rattles are eliminated by the new hood pulls, which have been designed to hold the hood absolutely rigid. Concealed bolts secure the hood fastenings to the hood.

Both the head and side lamps are of a new design—dignified, rich, typically Cadillac. The head-lamps are more nearly cylindrical in shape while the side-lamps are more of the bullet type.

The new fenders are original in design and are constructed of a special 18-gauge steel. The edging continues into the black enameled edge of the running board to give the fenders the effect of running the complete length of the car.

Likewise, the running boards are made of special steel. Binding on the outside edge is secured to the board by concealed bolts, a exclusive Cadillac feature.

The new instrument board is improved both in appearance and utility. A separate eight-day clock is a feature.

The flush-type ventilator with a wind deflector is another refinement of merit, as is the mirror of universal adjustability.

No metal bars are placed on the rear of the bodies as on Type 61. Instead there are special Cadillac trunk racks which will not permit the trunk to touch the surface of the car. The aluminum strips on these racks are fastened with concealed bolts. An improved tire carrier has also been installed.

Closed Bodies

One of the most important improvements to be found in the closed bodies, and one which will appeal especially to the men and women who prefer to drive their own cars, is the front-door post of special design, which allows the driver a greater vision. For years boby designers have sought to improve this condition with indifferent success, but Cadillac bodies of this year have eliminated an inch and a half of the "blind spot." The two-piece ventilating wind-shield, besides being rain-proof and wind-proof, also aids the driver's vision.

The division between the front and rear compartments of the chauffeur driven cars—the Imperial Suburban, the Imperial Sedan, the Open

Limousine, and the Town Brougham—extends across the full width of these cars and allows for the lowering of the special curved glass. The plate glass in all closed bodies is $\frac{7}{32}$ inch thick, and is of the mirror finish.

The doors, which are fitted with a patented door check, are of the flush type and are perfectly water-proof and dust-proof. Genuine butt-walnut veneer panels, brought through in matched sets, are used on the inside of all doors in the closed cars. The walnut moulding, the mohair finishings trimmed in a panel effect, and the tufted pockets add to the richness of the interior appearance of the doors.

Window lift handles on the front doors are located so that they do not interfere with the driver's hands while he is operating the car.

Silk roller-type curtains are carried on the body header above the doors, rather than on the doors themselves.

Improved riding qualities are found in the rear seats of the closed models. In the Type V-63, the seats approximate more nearly the lounge type. The horizontal cushion is made to fit underneath the back springs, in such a way that it causes the shape of the back and the seat to conform more naturally with the occupants' position. The spring seats and the back springs are made of specially graded individual coils which insure utmost pliability. The rubber padded arm rest adds to the comfort.

The roof is of superior soft, slat construction which tends to deaden sound.

A word only about the finishings. The carpets, curtains, and upholstery have been planned with the care that would be used in decorating the most elaborate drawing room. The upholstery and other interior trimmings are of a new line of velvet mohair which may be had in either plain or cut designs. The pleasing shades offered in the upholstery harmonize with the body colors. This mohair is made from the first carding of goat hair.

Similarly, the smoking and vanity cases have been specially designed so that they will match the interior wood work.

In the Imperial Suburban, the Open Limousine, and the Town Brougham an additional eight-day clock is mounted above the division window for the convenience of the rear seat passengers.

Facts About the Closed Cars

TWO-PASSENGER COUPE. The inside of the body is one inch longer. A special golf-bag compartment, which locks, is located on the side of the car. The leather back and buggy bows add a touch of distinction to this model.

FIVE-PASSENGER COUPE. The body is one inch higher and two inches longer. The rear seats have been widened four inches as has the driver's seat. The cushion in the driver's seat is one inch longer and one-half inch higher. The auxiliary seat is specially designed to duplicate closely the driver's seat in style and appearance. Its cushion is four inches longer than that of the Type 61 and the back is two inches higher.

FIVE-PASSENGER SEDAN. The rear compartment is seven inches longer, affording more leg room. The car is two inches wider across the rear seat and one-half inch higher inside than was the Type 61. Here again we find the leather back and buggy bows.

IMPERIAL SEDAN. The dimensions are the same as those of the five-passenger Sedan. The chief difference lies in the glass division between the tonneau and the driver's compartment. This glass can be lowered completely if so desired. The leather back and buggy bows are also features on this car.

SEVEN-PASSENGER SUBURBAN. The rear seat of this model is one and one-half inches longer than its predecessor, the Type 61. It is two inches wider across the rear seat and the doors are one-half inch higher.

IMPERIAL SUBURBAN. The tonneau offers the same improvements as those embodied in the seven-passenger Suburban. The glass division between the front and rear compartments, which may be lowered completely, is a distinct characteristic of this body style.

OPEN LIMOUSINE. The changes are the same as in the seven-passenger Suburban.

TOWN BROUGHAM. This new addition to the Cadillac line is an aristocratic creation, eminently suited for milady's shopping tours, social calls and theater use. The driver's seat is not enclosed as is the rest of the car, and is separated from the occupants' compartment by the division glass which may be lowered completely. The leather back and other fine appointments bespeak custom body building.

Open Bodies

Nineteen-gauge steel is used in constructing the doors of the open models, which are opened and shut from the inside by flush-type handles of improved design. The outside handles are of polished nickel.

Ventilating curtains for all doors, and a special metal door stop, which makes its appearance for the first time, are important features. The stop has an adjustable rubber bumper to prevent rattles.

The tonneau floor is constructed so that it reinforces the entire rear end of the body.

The front seat construction makes it the most rigid seat ever used on any Cadillac type. Pivot pins in the auxiliary seats are an important addition, as they are so designed that they take up all the play in the auxiliary seats and brackets, and, further, prevent any rattles.

A large tool box, built in the right hand dust shield, contains all hand tools in a separate compartment while the larger tools and equipment are held in place by spring clips. The tool box is equipped with a key lock.

Facts About the Open Models

ROADSTER. Two extra passengers may be accommodated in the comfortable cushion-back auxiliary seat placed beneath the rear deck. A combination door and step, of new design, on the right side of the car opens into a compartment where golf-bag, week-end bag, or small parcels may be carried. When opened, this door serves as a step to assist the occupants of the deck seat in entering the car. New pulls on the cover of the deck make it easier to open. The top bows are of a special construction to facilitate lowering and folding the top in a compact manner.

The PHAETON. Has a new trunk support fastened with concealed screws.

TOURING CAR. The rear seat has been widened one inch, now measuring 46 inches.

The Story of
CADILLAC
CONSTRUCTION

The Story of
CADILLAC
CONSTRUCTION

Edited by the Engineering Department of the
CADILLAC MOTOR CAR COMPANY
Division of General Motors Corporation
DETROIT, MICHIGAN, U. S. A.

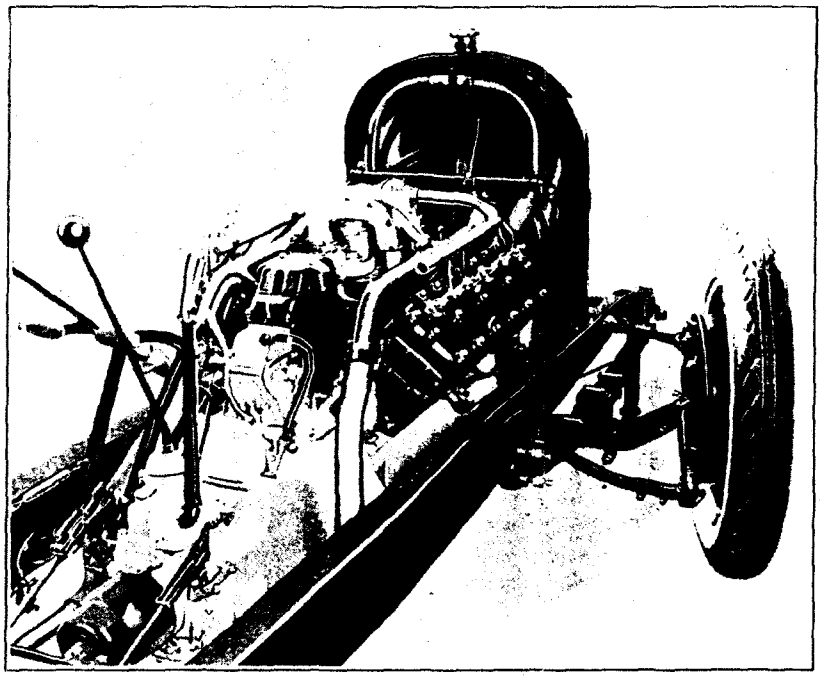
The Story of Cadillac Construction

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.

Cadillac also introduces this season four-wheel brakes which are effective under all operating conditions.

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:

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

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

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 speed*

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. *High compression high efficiency*

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 *Short sturdy crankshaft*

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 revolu-

Four compensators of forged steel are secured to the crankshaft. Each crankshaft with its compensating weights 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, now employed for the first time by any manufacturer, requires an explanation of the disturbing forces which tend to produce vibration.

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

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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.

Rigid crank

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 $2\frac{3}{8}$ inches. This gives the crankshaft a great degree of rigidity.

Bearin

THREE main bearings support the crankshaft, a smaller number of long bearings being preferable to a large 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.

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 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.

THE pistons are of unusually light design, the entire eight pistons weighing 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 ring has two small grooves cut in its circumference which entrap lubricating oil, rendering the seal against compression leakage most effective.

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.

Cylin

CADILLAC cylinders are cast *en bloc*, in fours, with detachable heads.

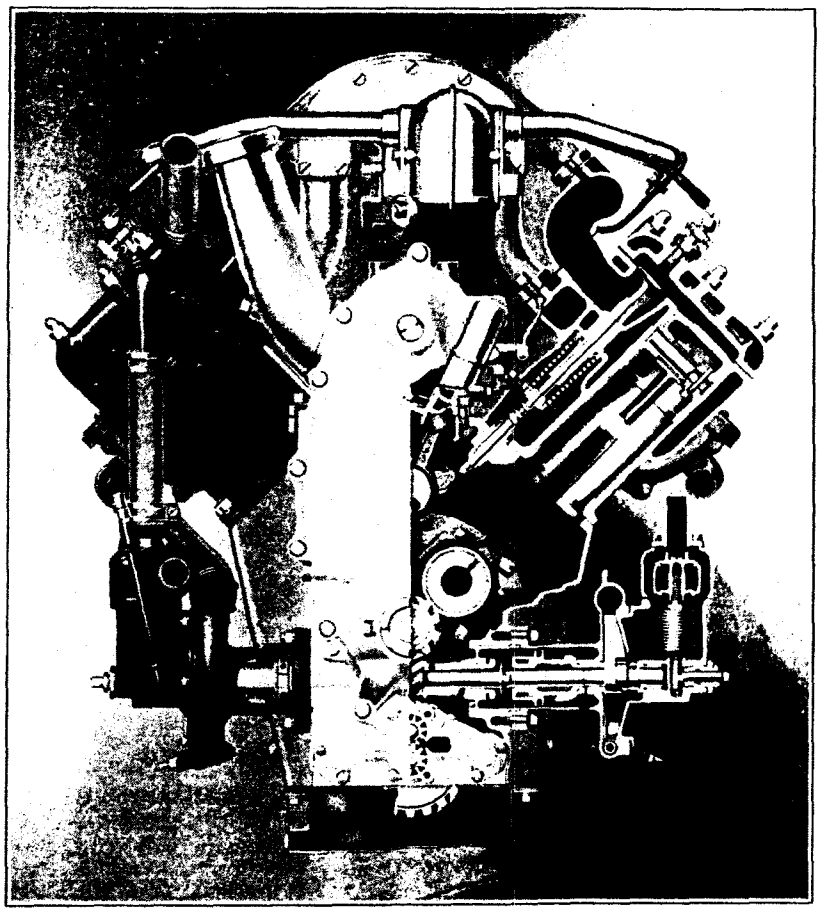
Both inlet and exhaust valves are on the same side of the combustion chamber.

Detach 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.

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.



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 overall 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 tungsten 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.

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.

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

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.

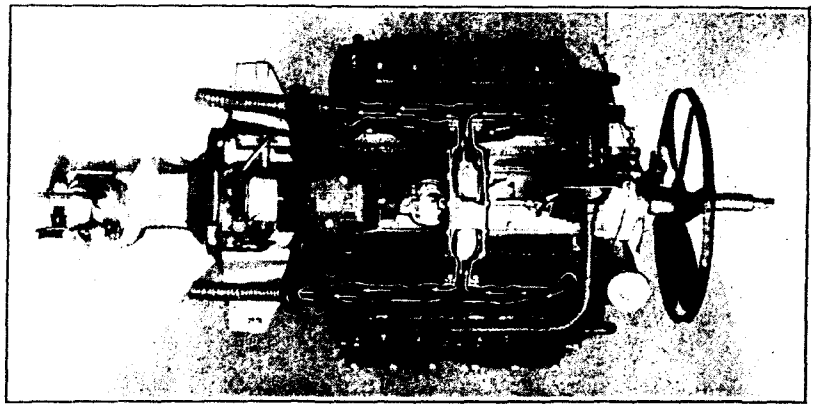
The auxiliary air supply, by which the correct mixture is automatically maintained at all speeds and throttle openings, is controlled by a leather-seated swing valve, governed by an adjustable spring.

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.

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.

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

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



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

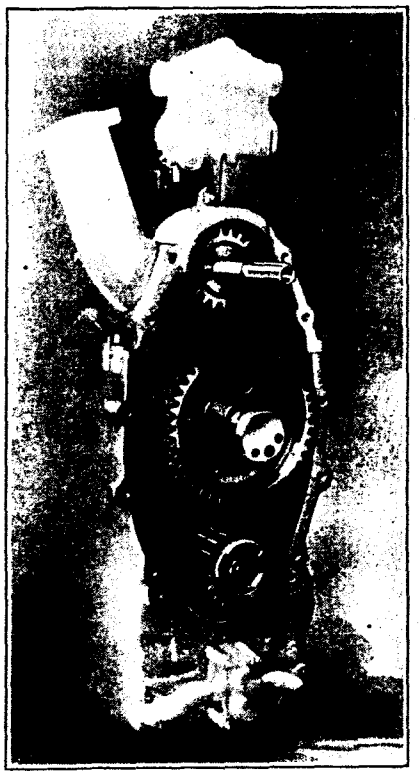
EACH block of four cylinders has its individual exhaust system, insuring the rapid conduction of the spent gases away from the cylinders.

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.

A large double sprocket is keyed directly to the camshaft and is driven from the crankshaft sprocket by a

hains



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:

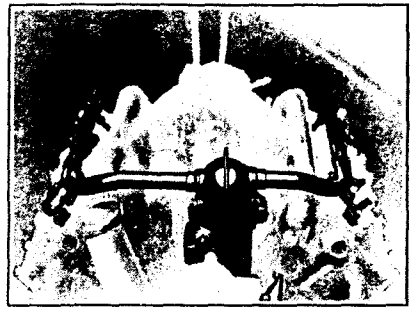
A source of current, the generator, or, at low speeds, the storage battery.

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.



Timer distril conder resist one ea access

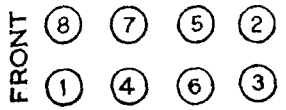
A resistance unit, which protects the ignition coil and timer contacts from injury.

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.

Doubl contac

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:

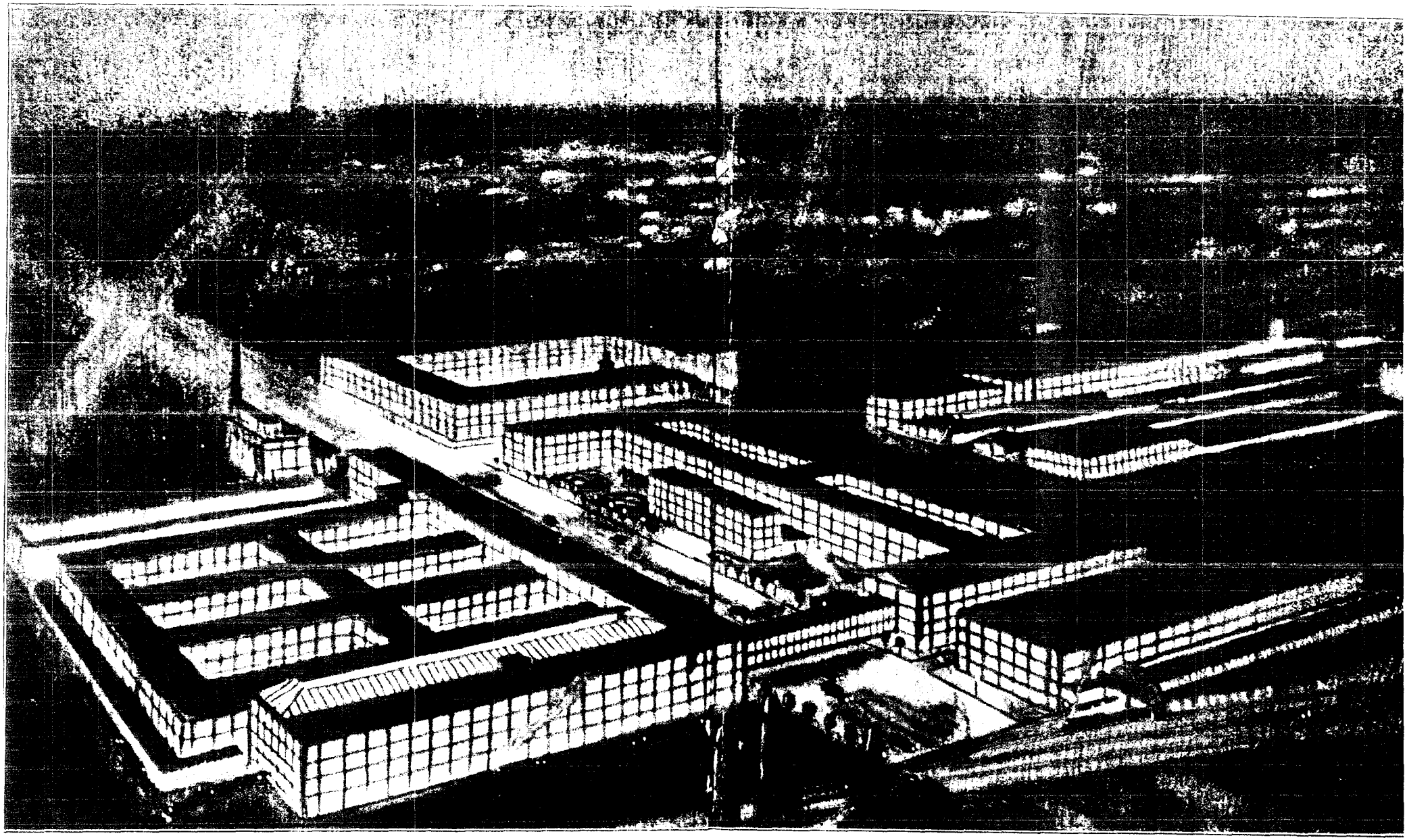


Auton spark

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.



Where craftsmanship is creed and accuracy a law

umps

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

ostatic ontrol

THERMOSTATIC control of motor 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.

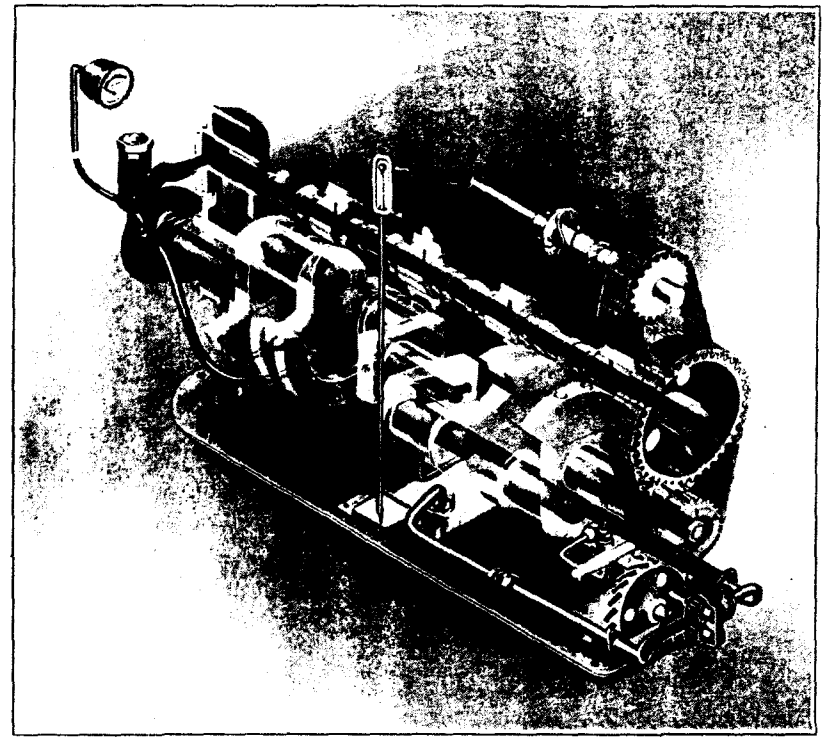
liator ction

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.

holds dition

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.



Lubr syste pers path indic dark porti Oil h indic press show

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.

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.

Leads bearin

OIL passages drilled through 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.

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.

THE valve rocker arms are lubricated by oil entrained in cup-like depressions at 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 the Cadillac.

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.

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

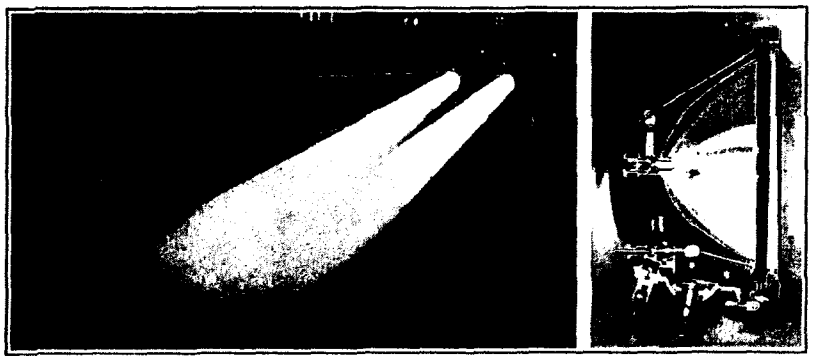
As a generator, the armature is driven at engine speed by an extension of the fanshaft, which in turn is driven through a silent chain from the camshaft.

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 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.



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 red 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 ignition, lighting and horn circuits by circuit breakers.

The Power Transmission System

THE clutch has seventeen steel plates; nine plain driven discs and eight 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.

Gears

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.

Propel

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

The re

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. Pinion gear and shaft are integral, being supported on each side of the gear by tapered roller bearings. 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 kick-up at the rear.

The side bars are rigidly tied together by seven 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 spring and four additional cross members of steel tubing.

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.

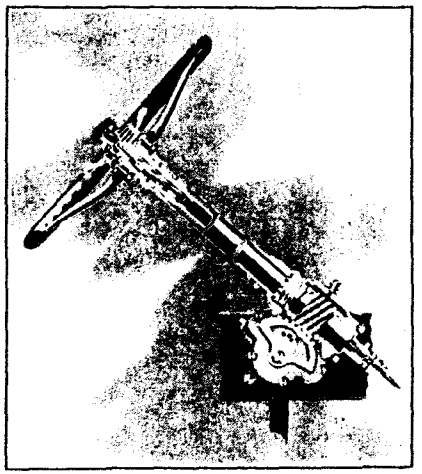
THE front axle has been entirely redesigned and strengthened to resist the additional stresses imposed by the front wheel brakes. It is of the reverse Elliott type with forked spindles, and straight axle ends.

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. The caster effect, by which the reaction of the road on the wheels tends to keep them in the straight-ahead position, is a feature which has been employed by Cadillac for years.

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 posi-

tion 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 is forty-four 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.

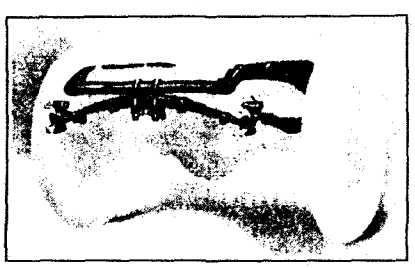
The combined length of all five units is more than nineteen feet.

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.

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.



lliptic pring on in three- lform nsion t rear

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.

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. However, the proportion of braking effect taken by the front wheels can be adjusted within limits to meet the requirements of differently distributed loads or to suit individual preference.

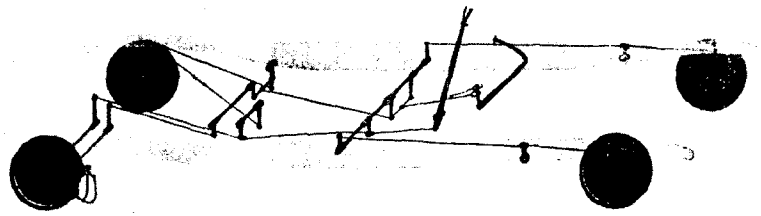
Finally, safety is enhanced by the provision made to counterbalance the effect of heat in expanding the brake drums.

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.

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



The sim mechan Cadillac four-wh

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 construc

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 pull rod 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.

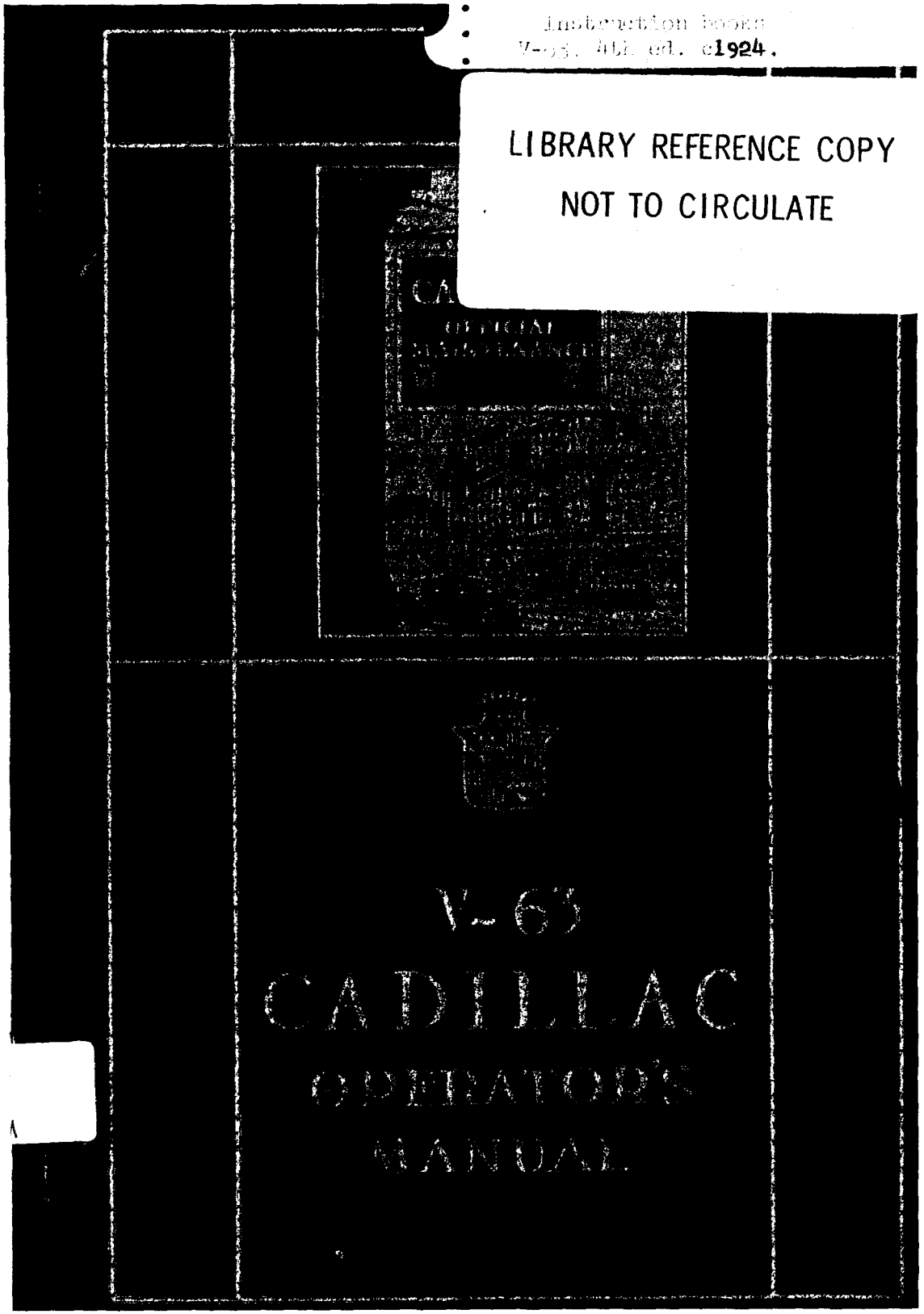
All lever and rocker shaft bearings are provided with lubricating connections for use with the pressure gun in the tool equipment.

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.

The la
analys

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



CADILLAC

OPERATOR'S MANUAL

V-63

PRICE 35 CENTS

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DETROIT

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DETROIT

FOURTH EDITION

OPERATION

Part I

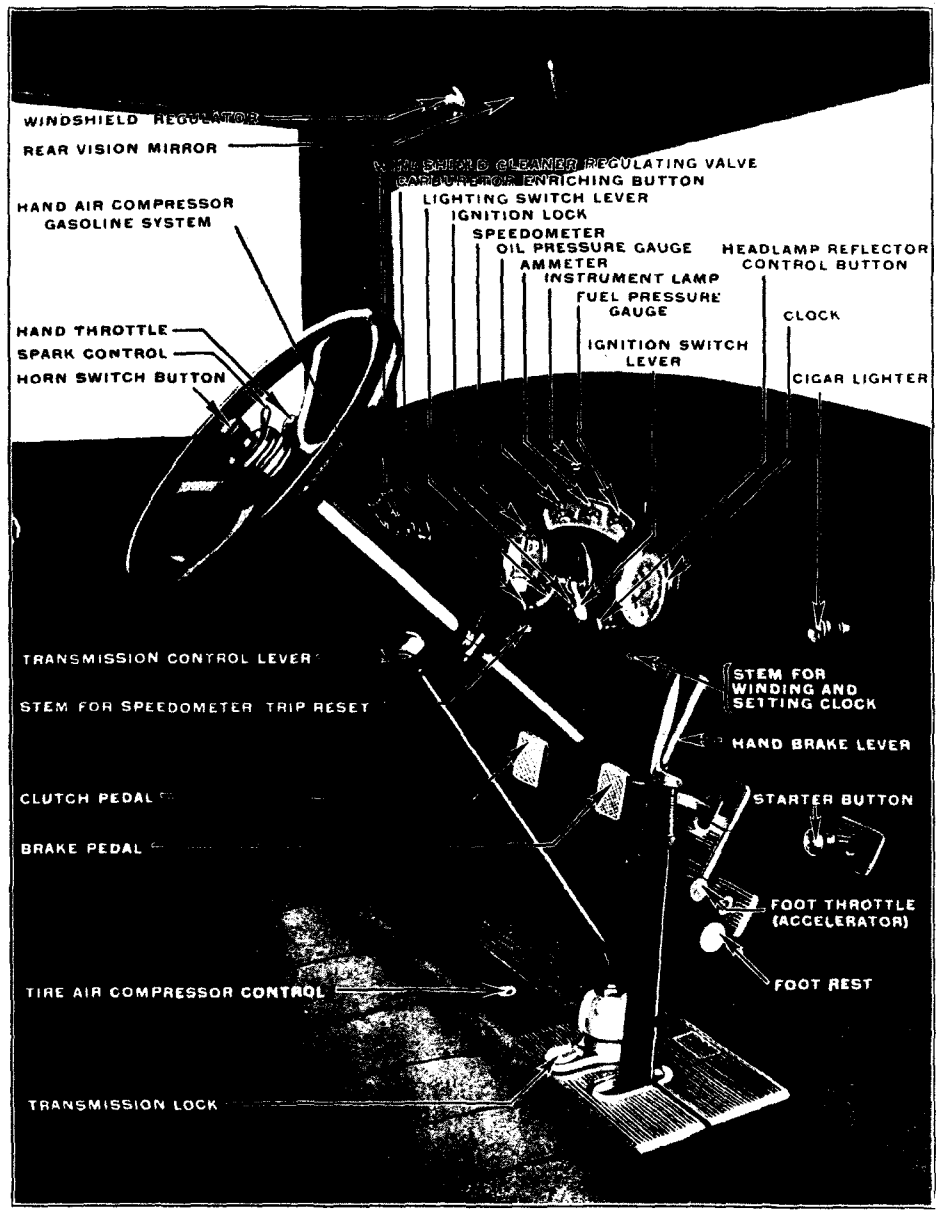

Fig. 1. Instruments, Control Levers and Pedals.

LICENSE DATA

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

Number of cylinders 8

Cylinder bore ..... 3⅛ in.

Piston displacement ..... 314 cubic in.

Stroke ..... 5⅛ 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 31.)

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 33 and "Replace Engine Oil Frequently During Cold Weather," page 34.)

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 23.)

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 23.) 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 32.) 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.)

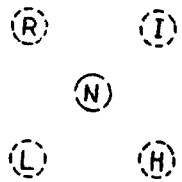

Fig. 2.

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.

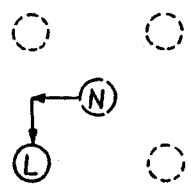

Fig. 3.

Neutral to Low Gear.

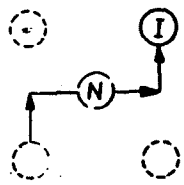

Fig. 4.

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.

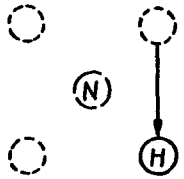

Fig. 5.
Intermediate Gear to High Gear.

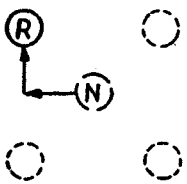

Fig. 6.
Neutral to Reverse Gear.

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, tha the operator attempt to shift from high to intermediate gear in this manne 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 retur the transmission control lever to the neutral position. The clutch may the be re-engaged. Stop the car by pushing forward on the brake pedal. Afte the car has been brought to a stop, apply the hand brake by means of th hand brake lever.

Stopping the Engine

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

TILTING HEAD LAMP REFLECTORS

Cadillac headlamps are provided with highly efficient diffusing lense which deflect and spread out the rays. To provide for deflecting the ray still further on special occasions when more illumination is desired neare the car, as in rounding sharp corners and going over the crests of stee grades, the reflectors in the headlamps are pivoted so that they can b 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 th reflectors for illumination of the distant road pull the button out from th 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 al parts of the country. The following are some of the rules which are universa 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 i necessary to turn the car around to do this, it should be done.

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

Never enter upon street car tracks without making sure that there i 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 certai that it is absolutely safe to do so. At any railroad crossing which is on a up grade or which for any reason must be approached very slowly, it is wise precaution to shift to intermediate gear before crossing as the car ca 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.

DONT'S 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 i 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 59.)

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

CURTAINS

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.

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 (Figure 7). This type of fastener cannot be released by lifting it at any other side.

Fig. 7.
Curtain Fastener

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 fo 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 "
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

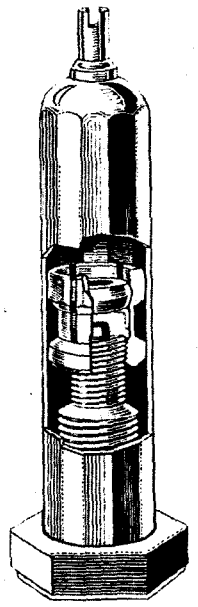

Fig. 8
Tire Valve Cap

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 17.)

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.

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.)

Fig. 11.
Removing Tire from Rim,
Third Position.

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°

It is a good plan to draw out a sample of the solution occasionally and to test its specific gravity with a hydrometer graduated between the limits of the foregoing table.

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.

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 31.)

Frequent Changing of Oil

Water and gasoline may accumulate in the crank case of the engin during cold weather. It is necessary, therefore, to drain the oil frequentl; and replace it. (See under "Replace Engine Oil Frequently During Col Weather," page 34.) If water and gasoline are permitted to accumulate i 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 lin more frequently during cold weather in order to prevent an accumulatio of water at these points which would freeze and prevent the gasoline fro flowing to the carburetor. (See under "Settling Chambers and Strainers," page 50.)

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.

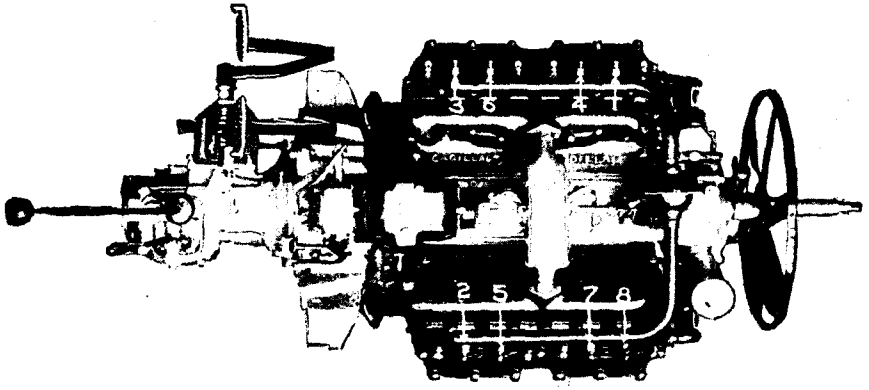

Fig. 16. Firing Order

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 36 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. In its absence we recommend a mixture of steam cylinder oil and a small amount of cup grease mixed to such a consistency that the mixture flows easily at temperatures from 60° to 70° Fahrenheit. If necessary to secure easier gear shifting at extremely low temperatures the lubricant can be thinned with the light grade of engine oil.

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

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 is recommended for the steering gear.

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 radiator on the right side. (See Figure 17.)

Use only oil which is suitable (see under "Lubricants," page 31), 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.

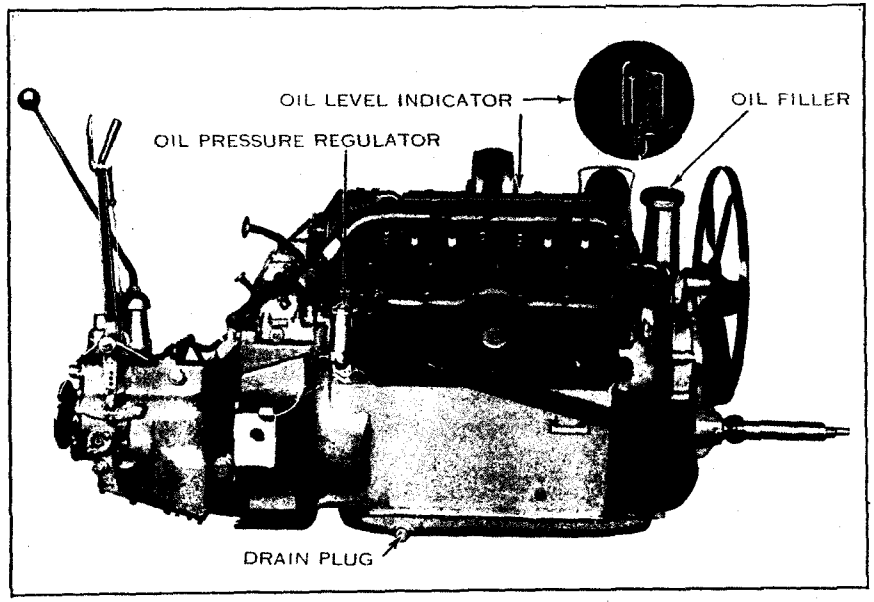

Fig. 17.
Oil Filler, Pressure Regulator, Level Indicator and Drain Plug.

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 34). 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.

Every alternate time the oil pan and baffle plate are removed and cleaned, it is also recommended that the plugs in the crankpins be removed and the oil passage-ways cleaned. The car should be taken to a Cadillac distributor or dealer for this work.

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 33.*)

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 32, and under "Replace Engine Oil," page 33).

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.

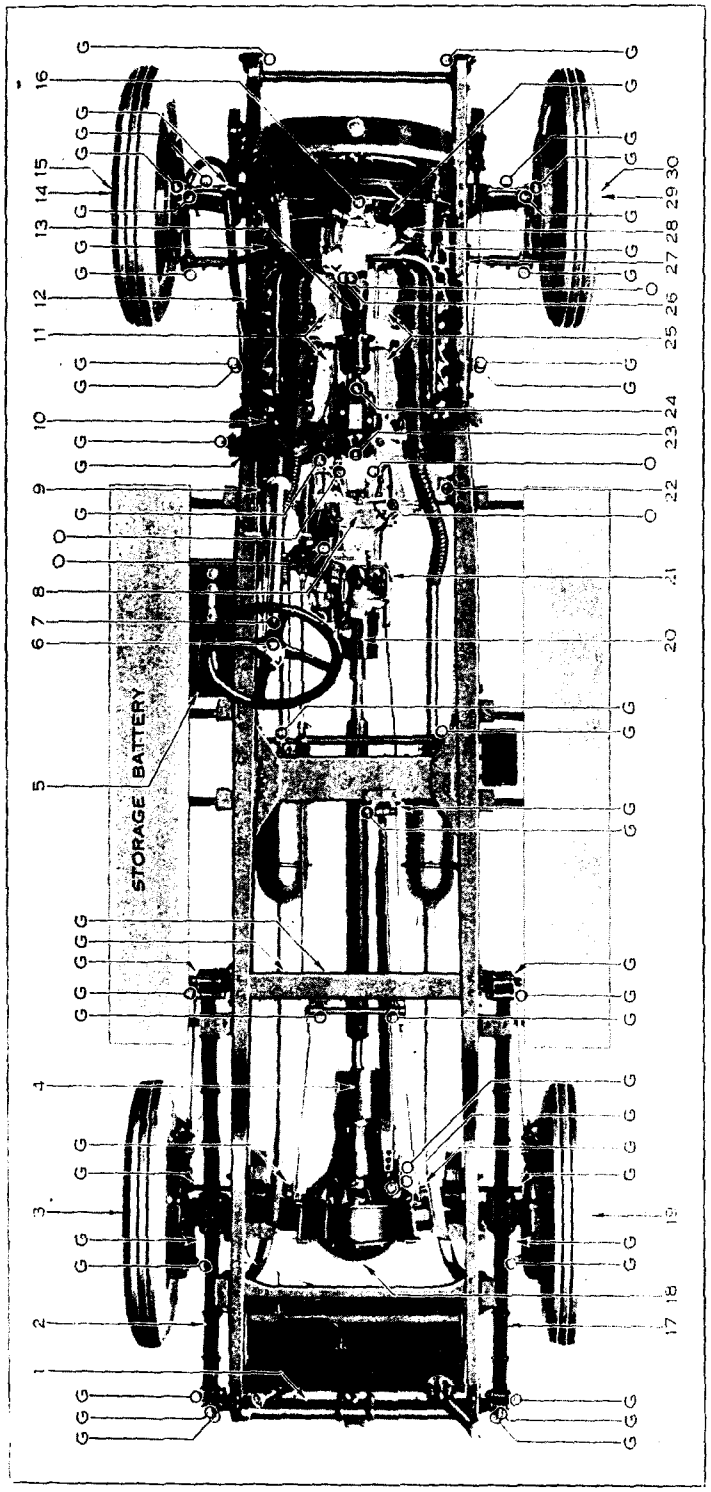

Fig. 18. General Lubrication Diagram

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 33 and "Replace Engine Oil Frequently During Cold Weather," page 34.)

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 59.)

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. On some cars there is a grease gun connection at this point and on others an oil hole. Lubricant should be applied at this point every 1000 miles, using Cadillac Roller Bearing and Cup Grease if the car has a grease gun connection or engine oil if it has an oil hole. It may be necessary to crank the engine to bring the connection or hole to the top so the lubricant can be applied.

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 33 and "Replace Engine Oil Frequently During Cold Weather," page 34.)

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.

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.

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. 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 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 64) 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.

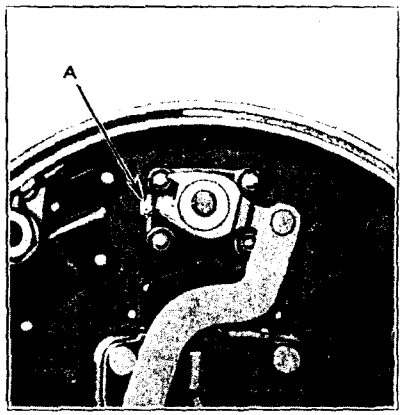

Fig. 19. Front Wheel Brake Lubricating Connection. (Front Wheel Removed.)

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 33 and "Replace Engine Oil Frequently During Cold Weather," page 34.)

Every alternate time the oil pan and baffle plate are removed and cleaned. it is also recommended that the plugs in the crankpins be removed and the oil passage-ways cleaned. The car should be taken to a Cadillac distributor or dealer for this work.

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. (On cars with the horn mounted on the fanshaft 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.

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 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. 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.

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

GENERAL CARE

Part III

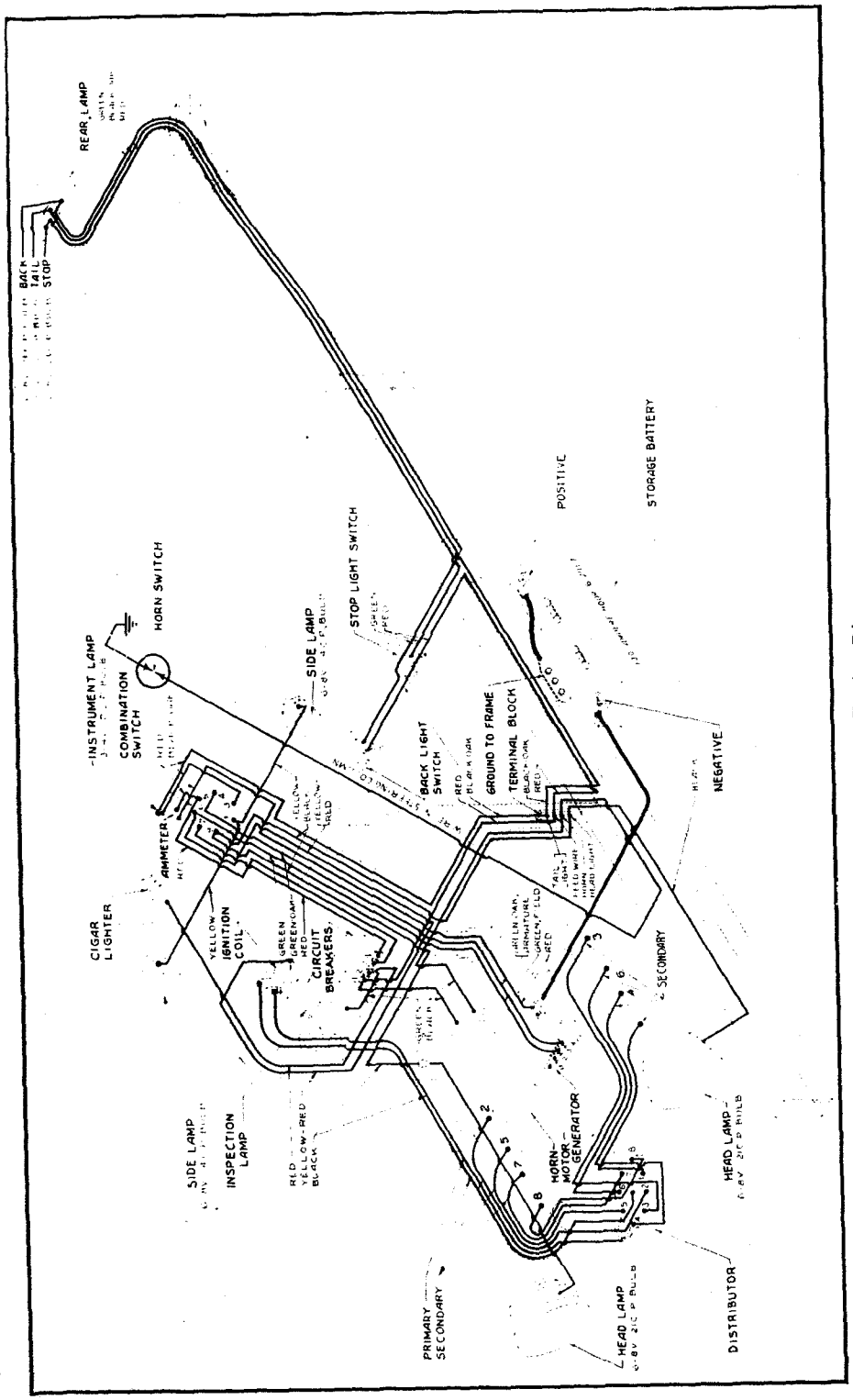

Fig. 20. Wiring Diagram

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 52.) 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 54.

Storage Battery

(*See under "Preparing Battery for Winter Storage," page 60*).

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 33.)

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 THE 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

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.

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 periodically—one at the point where the gasoline feed pipe is attached to the carburetor, and the other attached to the drain plug in the settling chamber under the front floor boards. (See Fig. 21.)

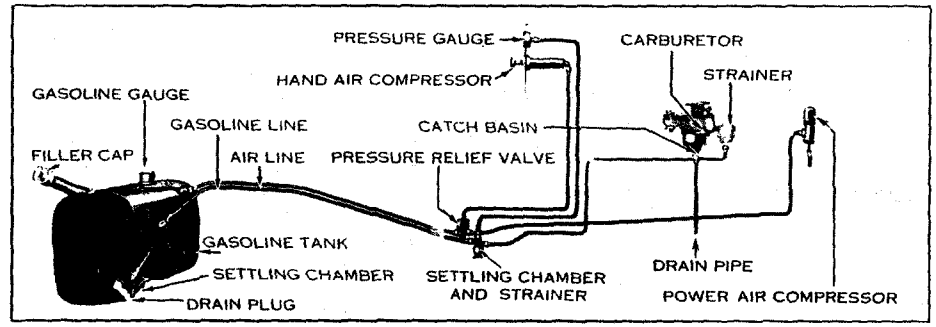

Fig. 21. Gasoline System.

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

CARBURETOR

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

Good carburetor action cannot be expected until the engine is thoroughly warmed up. 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 have it made by a Cadillac distributor or dealer. The adjustment should not be attempted by one unfamiliar with it.

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.

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. 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.

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 23.) 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.

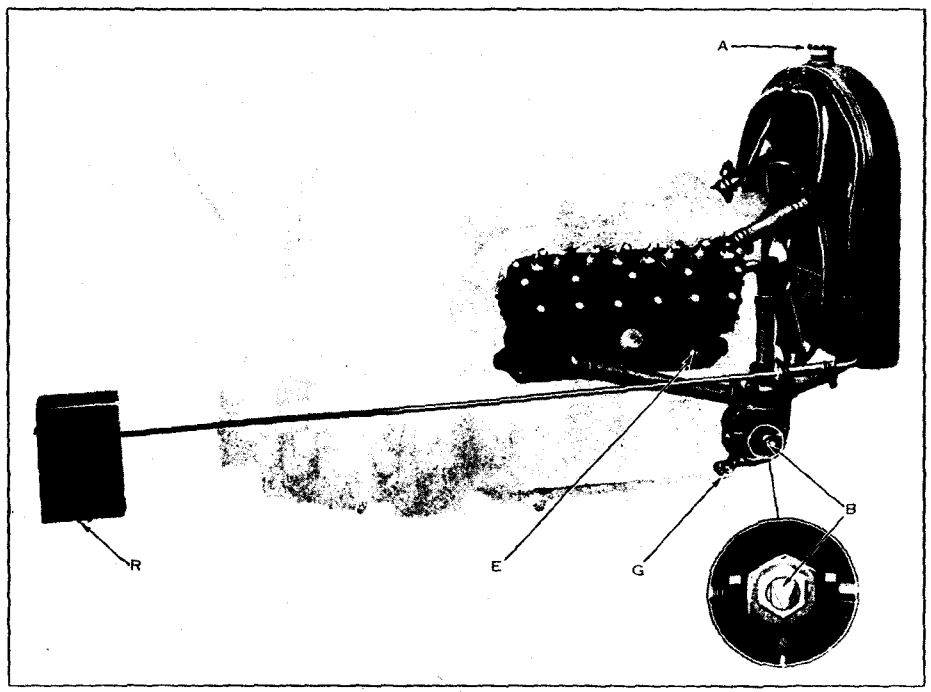

Fig. 22. Cooling System

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.

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 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.

CADILLAC-DELCO ELECTRICAL SYSTEM

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 the engine. The other connections are made with copper wires or cables.

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 in the field are used when the motor generator is used as a generator and 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, located on the instrument board (see Figure 1) indicates on the "discharge" side of the dial, the amount of current drawn from the storage battery for the lights. 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, the current is no longer required for slowly rotating the armature of the motor generator. The ammeter then indicates only the current used for 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 demand, the ammeter indicates on the "Charge" side the excess current. This 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 from 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 from ten to fifteen miles per hour. 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.

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.

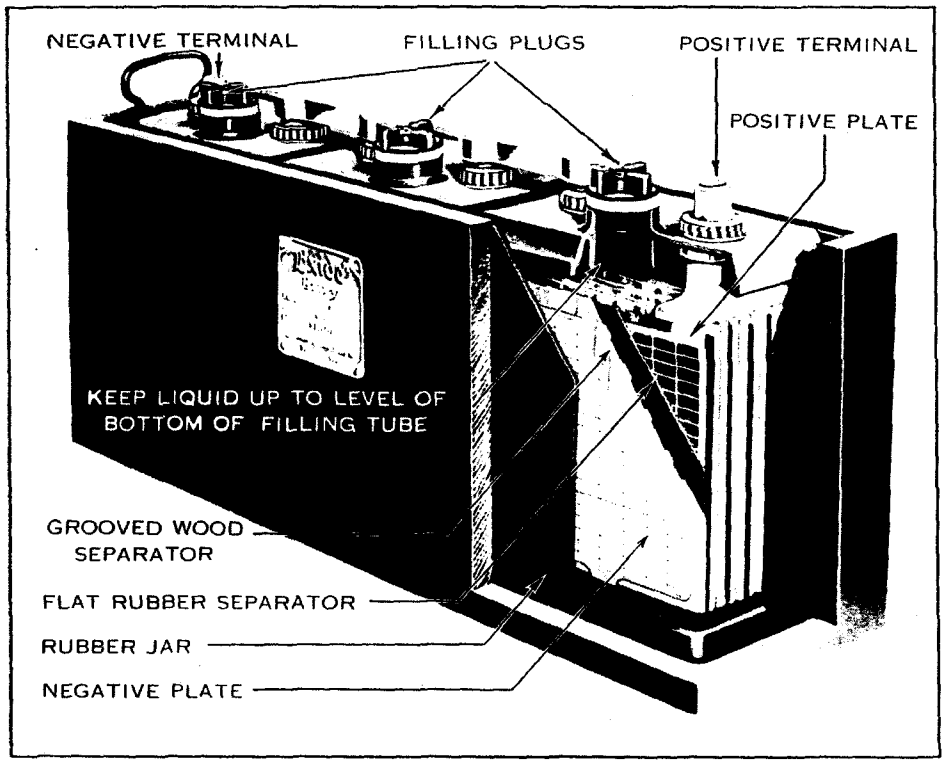

Fig. 23. Storage Battery, Sectional View.

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.

The specific gravity of the acid solution in the battery is an indication of the state of charge. (See under "Hydrometer Syringe," page 60.) 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 candle-power 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.

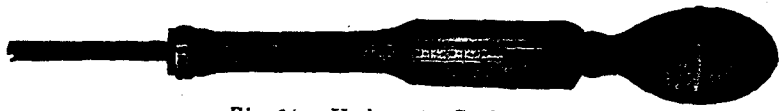

Fig. 24. Hydrometer Syringe

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 59.) 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.

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.

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."

Fig. 25. Clutch Control.

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.

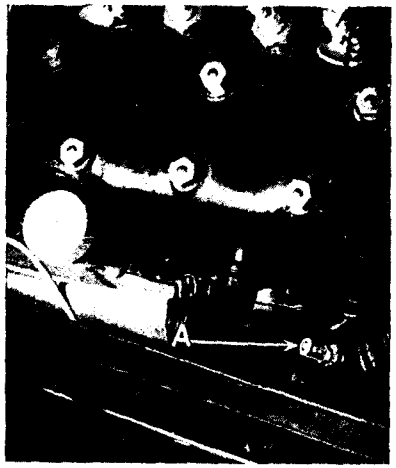

Fig. 26. Steering Gear Lubrication Connection

Lubrication

The steering gear should be lubricated every 2,000 miles by applying the grease gun to the connection at "A", Fig. 26. 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 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.

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 66.) 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.

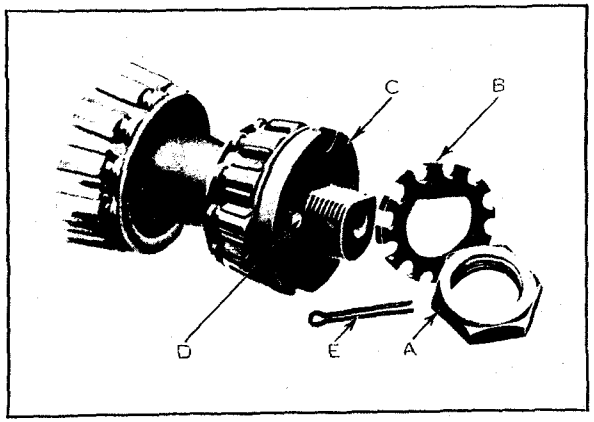

Fig. 27. Front Wheel Bearings and Adjusting Nuts.

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.

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, re-

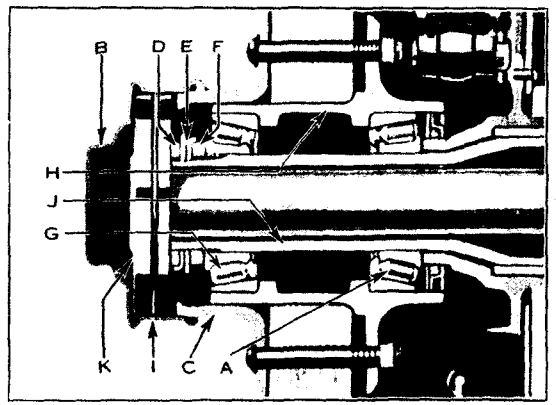

Fig. 28. Sectional View of Rear Hub, Showing Bearings.

versing 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 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.

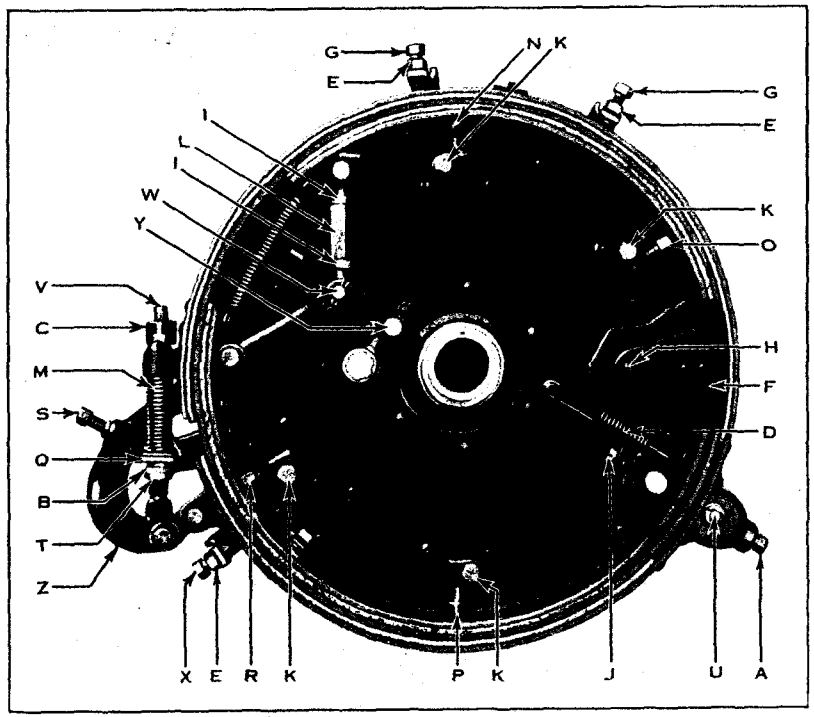

Fig. 29. Rear Wheel Brakes (Wheel Removed)

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-.040 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-.040 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-.040 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-.040 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 $\frac{7}{8}$ inch.

If the end of the lever "Z" travels less than $\frac{7}{8}$ 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.

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