CADILLAC
OPERATORS' MANUAL

TYPE 55

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CADILLAC MOTOR CAR COMPANY

DETROIT, MICH., U. S. A.

(SIXTH EDITION)

THE USER'S RESPONSIBILITY

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

The 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 more satisfaction nor will any car stand more abuse. But no car can be expected to stand continual abuse without resenting it sooner or later.

We want Cadillac cars to 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. We furnish a car that is capable of rendering the best of service and we furnish the instructions which will guide the user toward obtaining that service. But if he persists in ignoring these instructions and in substituting his own ideas there is no one but himself upon whom he can rightfully place the responsibility for any difficulties which may result.

There is a wealth of information, advice and instruction contained in this Manual. There is much that the owner may never have to use, but it is here to be used in the event that it is needed. There is other information which a user cannot get along without, no matter how much he may think he knows, nor how much previous automobile experience he may have had.

READ CAREFULLY THE FOLLOWING PORTIONS OF THIS MANUAL

TABLE OF CONTENTS

REPAIR PARTS

TO ORDER NEW PARTS

With more than a hundred thousand Cadillac automobiles in use it is obviously impractical for us to deal directly with each Cadillac owner. We cannot open accounts with or sell at a discount to any except regular dealers with whom we make annual contracts.

To avoid unnecessary delay and useless correspondence new parts should, where possible, be ordered from the dealer from whom the car was purchased or from the nearest Cadillac dealer, who is generally in a position to know what is desired and to supply it from his stock. 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 us 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 properly tagged, transportation charges prepaid. (See below under "To Return Parts.") Otherwise we cannot promise prompt service or fill the order intelligently.

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

TO RETURN PARTS

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

ENGINE NUMBER

On the Type 55 the engine number is stamped on the crankcase of the engine just back of the right hand block of cylinders. The engine number of each Type 55 car begins with the figures "55."

TIRES, SPEEDOMETERS AND CLOCKS

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

PART I

OPERATION AND GENERAL CARE

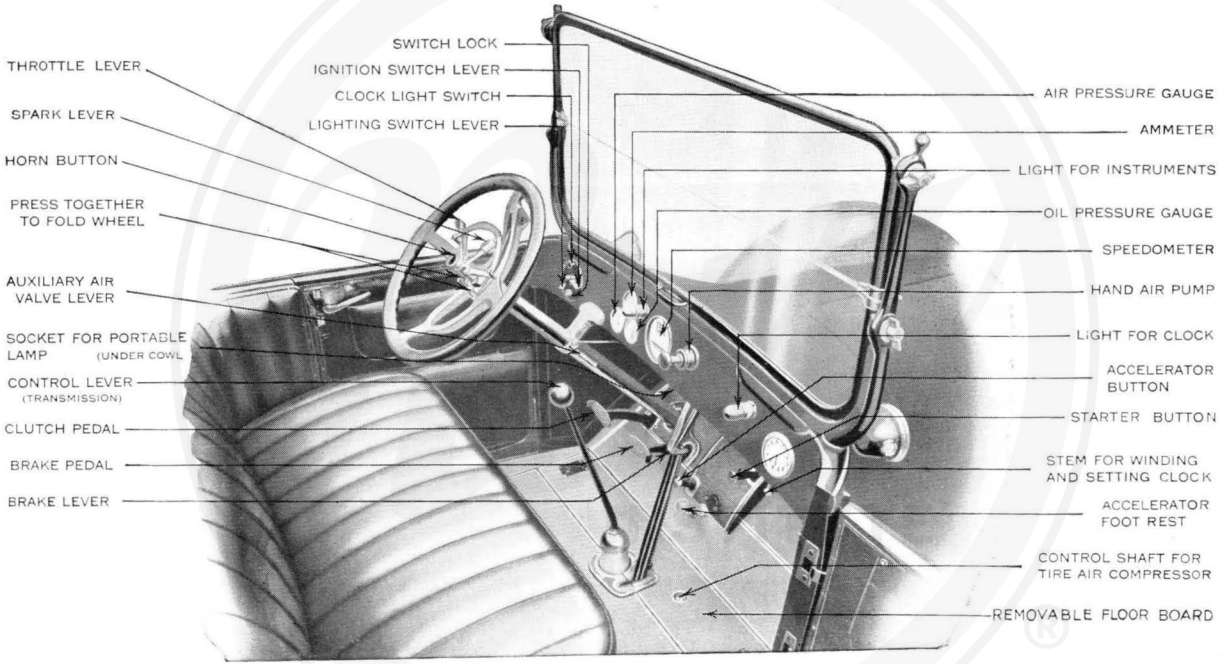

Fig. 1. Instruments, Control Levers and Pedals on Standard Seven Passenger Car.

DRIVING AND CARING FOR A MOTOR CAR

Driving an automobile does not mean simply starting, steering, applying the brakes and stopping. Pushing a wheelbarrow is one thing. Driving a more or less intricate piece of mechanism like an automobile necessarily is, to some extent, and doing it right, is quite another. To drive an automobile properly requires an understanding of the principles involved and the exercise of some intelligence and judgment.

We believe that we are safe in saying that, with well designed and correctly built automobiles, 95 per cent. of so-called troubles are directly traceable to lack of lubrication, abuse, carelessness, a lack of understanding of the principles involved and improper handling generally.

Some drivers seem to think that so long as the car "goes" that is all there is to it. It is not.

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 automobile and the superficial knowledge possessed by many drivers is the difference between having troubles and not having them.

The old adage, "A stitch in time saves nine," applies with special significance to the motor car. Intelligent care and proper attention will often correct a needed adjustment or lubricate a part that is becoming dry, but which, if neglected, may cause serious and possibly expensive damage.

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 properly lubricated and that all bolts, nuts and screws are tight, your 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 service station.

The most important thing in the care of an automobile is its proper lubrication. It will be readily understood that where one part moves or works upon another, there is always more or less friction and these parts must be oiled more or less frequently. Part Two of this Manual gives detailed instructions regarding lubricating. Be sure to read and observe them carefully.

Care is also necessary to see that all nuts, bolts and screws about the car are kept properly tightened. Most important parts subject to wear are, wherever possible, provided with adjustments for taking up such wear and these should be inspected occasionally and receive attention whenever required.

By far the greater portion of "automobile troubles" is the result of negligence and carelessness, while the reasonable care to which any piece of machinery is entitled will insure long life and satisfactory service.

TO PLACE ENGINE AND CAR IN RUNNING CONDITION

Before cars are shipped from the factory the gasoline tank and cooling system 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 the cooling system should be filled with an anti-freezing solution instead of water. (See under "Anti-Freezing Solution," page 14.)

The car should also be thoroughly lubricated in accordance with the instructions contained in this Manual. (See under "Lubrication," page 33.)

TO FILL THE COOLING SYSTEM

Fill the cooling system with clean water during warm weather and with a suitable anti-freezing solution during freezing weather.

To fill the cooling system, replace the drain plugs "H," Fig. 24, in the water pumps, close the drain cocks "K" in the cylinder blocks and turn the shafts "L" so that the indicators on the ends of the shafts point up. The shafts may be turned in either direction.

Then remove the filler cap "W" from the top of the radiator and fill the cooling system. Replace the filler cap and screw it down firmly. **This is important.** (See under "Condenser," page 52.)

After the cooling system is filled, turn the shafts "L" on the water pumps so that the indicators on the ends of the shafts point down.

TO FILL THE CONDENSER

Take out the removable floor board just forward of the control lever and replace the drain plug "R," Fig. 24, in the pipe leading from the bottom of the condenser which is attached to the right hand side of the frame.

Then remove the filler cap "V" at the top of the condenser and fill the condenser one-half full, using the same liquid as in the radiator. Replace the condenser filler cap making sure that the vent hole in the side of the cap is open.

ANTI-FREEZING SOLUTION

A condenser in connection with the cooling system makes it possible to use with safety an anti-freezing solution of denatured or wood alcohol and water. Do not use a solution containing calcium chloride as this is injurious to the metal parts of the cooling system.

The capacity of the cooling system is five and one-quarter gallons. The condenser should contain an additional three quarts, making a total of six gallons.

The following are the freezing temperatures of denatured alcohol and water solutions of various proportions.

Denatured Alcohol (% by volume)	Water (% by volume)	Freezing Temperature (degrees Fahr.)	Specific Gravity (Hydrometer reading)
20%	80%	+13°	.974
30%	70%	— 3°	.964
40%	60%	—20°	.953
50%	50%	—34°	.936

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

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.

Note:—A solution of refined (chemically pure) glycerine and water is recommended for use in cars not fitted with a condenser. The following are the freezing temperatures of glycerine and water solutions of various proportions.

Glycerine (% by volume)	Water (% by volume)	Freezing Temperature (degrees Fahr.)
35%	65%	+10°
40%	60%	+ 6°
45%	55%	+ 3°
50%	50%	0°
55%	45%	— 2°
60%	40%	— 4°

TO FILL THE GASOLINE TANK

The gasoline tank is at the rear of the car. (See Fig. 16.) The filler cap may be removed after loosening the thumb screw on the top of the cap.

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 carefully tighten the thumb screw. This is necessary to prevent leakage of the pressure by which the gasoline is forced to the carburetor.

STARTING AND OPERATING

TO START THE ENGINE

Be sure that the transmission control lever is in neutral position and that the hand brake is set. (See Fig. 1.)

Note the pressure of air in the gasoline tank. (This is indicated by the gasoline pressure gauge on the instrument board.) If the pressure is less than one pound, it should be increased to that pressure by means of the hand air pump. After the engine is started the pressure is automatically maintained.

Place the spark lever in the driving range on the sector (in extremely cold weather place the spark lever at the extreme right on the sector), and the throttle lever about two inches from the extreme left. (See note below). Move the ignition switch lever down, thereby switching on ignition. Then push down on the starter button. This will bring the starter into operation and will cause the engine to "turn over." (See below under "Caution.")

In cool weather, also in warm weather if the engine has been standing for some time, pull back the auxiliary air valve lever before you press the starter button.

As soon as the engine fires and commences to run under its own power, which should be in a few seconds, remove your foot from the starter button.

If the auxiliary air valve lever is pulled back when starting the engine, it should be pushed forward about one-half the way immediately the engine starts, and all the way forward as soon as the engine is warm enough to permit doing so. It is important that the lever be left back no longer than is absolutely necessary.

Note:—If you crank the engine by hand always place the spark lever at the extreme left on the sector. If this caution is not observed a "back kick" may occur, resulting in injury to the person cranking.

NOTE THIS PARTICULARLY

If the engine does not start in thirty seconds, do not continue to crank, but look for the cause. You may have forgotten to turn on the switch, or maybe you have no gasoline, or there may not be sufficient air pressure in the gasoline tank to force gasoline to the carburetor. No matter how sure you feel, look and see.

You should bear in mind that the starter will crank the engine only. Ignition and gas must be present to make it run.

CAUTION

The action which causes the engine to "turn over" is produced by a gear of the electric motor sliding into mesh with teeth on the flywheel; similar to the meshing of the gear teeth in the transmission. When pushing down on the starter button to throw these gears into mesh, if it should 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 on the flywheel instead of the teeth of one sliding between the teeth of the other, do not force them. Simply remove your foot from the starter button and again push down on the button. In the meantime the gears will probably have changed their relative positions sufficiently to allow the teeth to mesh.

CAUTION:—Do not press the starter button while the engine is running.

COLD WEATHER SUGGESTIONS

STARTING THE ENGINE IN COLD WEATHER

1. In **extremely** cold weather, if the engine is not started in 30 seconds, remove your 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.

2. Except in extremely cold weather, the spark lever should be placed in the position marked "driving range" when starting. In extremely cold weather, it should be fully advanced when starting. (If the engine is to be cranked by hand, the spark lever should be placed at the extreme left on the sector.)

3. The throttle lever should be open about two inches on the sector for starting.

4. The car should not be started on second or high gear. Start the car on low gear.

5. 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.

Opening and closing the throttle operates the throttle pump on 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. If, as a result of extreme cold, it is necessary to prime the carburetor, **do not open and close the throttle more than twice.**

It is the practice of some drivers to place the spark lever at the extreme left on the sector when starting the engine. While this is the proper position for the spark lever if the engine 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 to the "driving range." In extremely cold weather there is no reason why the spark lever cannot be placed in the fully advanced 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.

Many drivers also 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.

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.

If the clutch is engaged during the cranking operation the starter turns the jackshaft in the transmission in addition to cranking the engine. While at ordinary temperatures the additional energy thus required is almost negligible, in extremely cold weather the lubricant in the transmission may offer enough resistance to the gears to increase considerably the demand upon the battery during the cranking operation. It is obvious that with the clutch in the released position while the starter button is pushed down, less work is done by the starter and the battery charge is conserved.

ADDITIONAL SUGGESTIONS

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.

Be careful to use an oil having a low cold test. In other words, use an oil which flows freely at low temperature. (See under "Lubricants," page 35.)

Water may accumulate in the crank case of the engine during cold weather as a result of condensation. It is necessary, therefore, to drain the oil frequently and replace it by clean, fresh engine oil. (See under "Replace Oil Frequently During Cold Weather," page 38.) If water is allowed to accumulate in the crank case, serious damage to the engine may result.

It may be found necessary frequently to remove the strainers in the gasoline line in order to prevent an accumulation of water at these points which would freeze and prevent the gasoline from going to the carburetor.

If the car is stored during cold weather instructions should be followed under "Preparing the Car for Winter Storage," page 29.

TO START THE CAR

As the Cadillac transmission is of the selective type, the operator may shift from any gear to any other gear without "going through" a third. It must be borne in mind, however, that the clutch must be released before the gears can be shifted. The clutch pedal is the left pedal.

Referring to Figure 2, the ball at the top of the transmission control or gear shifting lever is shown at "N" in the neutral position, "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.

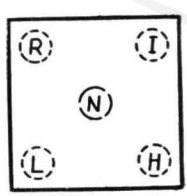

Fig. 2.

Control Lever Positions.

To start the car after starting the engine, push forward on the left pedal which is the clutch pedal, thereby releasing the main engine clutch. Then disengage the hand brake by means of the hand lever—still holding forward on the clutch pedal. If the car is standing on a grade it will be necessary to hold it with the foot brake until ready to start. Next place the control lever in the low gear position. (Fig. 3.)

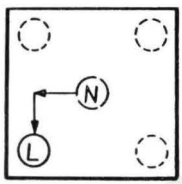

Fig. 3.

Neutral to Low Gear.

To do so, move the lever as far as possible to the left and then pull it back as far as it will go. (See Note.) Then open the throttle slightly by means of the accelerator pedal or the throttle lever at the steering wheel, and engage the main clutch gradually by allowing your foot to come towards you.

Note:—If it should so happen that the transmission gears which mesh to make low gear 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 instead of the teeth of one sliding between the teeth of the other, do not force them, but place the transmission control lever back in the neutral position, engage the clutch by allowing the clutch pedal to come all the way towards you, again release the clutch and again attempt to shift into low gear as above directed.

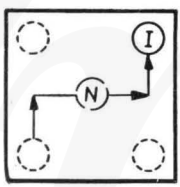

Fig. 4.

Low Gear to Intermediate Gear.

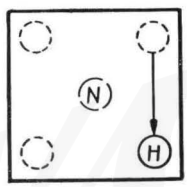

Fig. 5.

Intermediate to High Gear.

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

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

If you desire to start the car backward, release the clutch and place the lever in the reverse gear position. (Fig. 6.) To do this from the neutral position, move the control lever to the left and push it forward as far as it will go. The throttle should then be opened slightly and the clutch allowed to engage slowly as directed when starting on low gear.

If, when ascending steep grades or pulling through soft mud roads or deep sand, the speed of the car is reduced until the engine labors, release the clutch and shift the control lever into the intermediate gear position. To do this 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 the lever quickly.

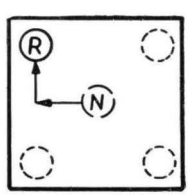

Fig. 6.

Neutral to Reverse Gear.

An experienced driver may find it more satisfactory to shift from the high gear position to the intermediate gear position in the following manner: Release the clutch, place the control

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

This entire change may be made in less time than it takes to read these instructions by one who becomes familiar with the method. Shifting in this manner may be accomplished satisfactorily at a higher speed than is allowable when the control lever is shifted directly into the intermediate gear position in the usual manner. However, it is not recommended that the operator shift from high to intermediate gear in this manner until he has had considerable experience in making this shift in the ordinary way.

NOTE CAREFULLY

Do not attempt to shift from neutral to any gear, or from one gear to another gear without first releasing the clutch.

Do not attempt to shift from the reverse gear to any other gear when the car is moving.

Do not attempt to shift from any forward gear to the reverse gear when the car is moving.

Do not attempt to shift from the high gear to the low gear when the car is moving.

Do not shift from the low to the high gear. This is mechanically possible but is not advisable.

Do not 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 before shifting from the intermediate gear to the low gear.

Do not attempt to shift from the high gear to the intermediate gear when the car is running at a high rate of speed. Allow the car to slow down before shifting gears.

Do not drive with your foot resting on the clutch pedal. The operation of the clutch has purposely been made extremely easy and even a slight pressure may release it sufficiently to cause it to slip.

Do not engage the main clutch suddenly. This causes excessive strain on the entire driving mechanism. Always allow the clutch to engage gradually.

TO STOP THE CAR

First close the throttle and then release the engine clutch by pushing forward on the left pedal.

Next shift the transmission control lever to the neutral position. The clutch may then be allowed to re-engage. Then stop the car by pushing forward on the right pedal which applies the foot brake. After the car has been brought to a stop by the foot brake, apply the hand brake by means of the hand brake lever. Move the ignition switch lever to the horizontal position and at the same time pull back the auxiliary air valve lever. Pulling back the auxiliary air valve lever when stopping the engine "enriches" the mixture which is drawn into the cylinders and makes it easier to start the engine next time.

OPERATION OF ENGINE

The Cadillac 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 cycle.

Gasoline is forced by air pressure from the tank to the carburetor. The carburetor is the instrument by the action of which the gasoline is mixed with air and forms a vapor or gas. The gas thus formed is drawn through the intake pipe and through the inlet valves into the cylinders of the engine, where it is compressed and ignited by electric sparks.

The quantity of gas supplied to the engine is regulated by the throttle lever at the steering wheel (the throttle lever is the longer of the two), or by the accelerator button.

Moving the throttle lever to the right increases the supply of gas and consequently increases the power and speed of the car. Moving this lever to the left decreases the supply and consequently reduces the power and speed.

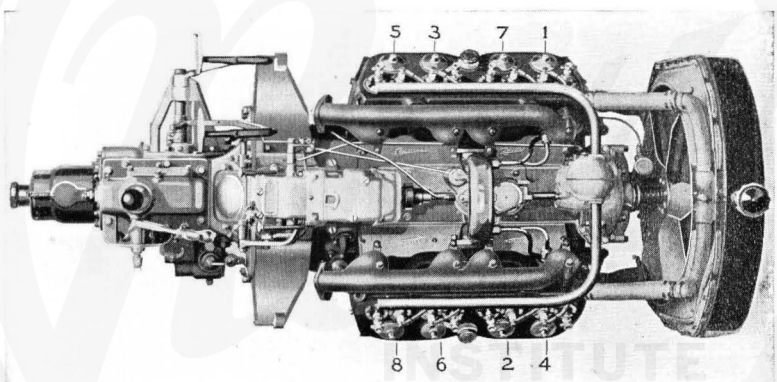

Fig. 7. Firing Order.

The action of the engine is as follows: Starting, we will say, with a piston up, that is, at its highest point in the cylinder, it first goes down. As it does so, the inlet valve opens and through this valve a charge of gas is drawn into the cylinder. This movement of the piston is called the suction stroke. Then the inlet valve closes and the piston goes up and compresses the charge. This is called the compression stroke. At the completion of this compression stroke, the electric spark takes place at the spark plug. This spark ignites the compressed charge of gas and explodes it, driving the piston downwards. This is what produces the force or power and is called the working stroke. Just before the piston reaches its lowest point the exhaust valve opens,then when the piston goes up again it forces the burned gas out through the exhaust valve. By the time the piston has reached its highest point, it has forced out practically all of the burned gas and, having completed the four operations, it is now ready to commence all over again by going downward and drawing in a new charge.

All of the cylinders work in the same way but they do not all do the same thing at the same time. In the Cadillac Eight Cylinder V-type engine the impulses are so timed that an impulse is delivered to the crankshaft for each quarter turn of the shaft. In other words, there are four impulses to each revolution of the crankshaft, these impulses being equally spaced and overlapping. The order in which the cylinders fire is shown in Fig 7.

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. and that when the engine is running 3000 R. P. M. it is necessary to start the ignition process earlier.

In the Cadillac this is accomplished by means of a ring governor located directly under the ignition timer. (See Fig. 33.) As the speed of the engine increases the ring in the governor assumes a position more nearly horizontal, forcing the timer contact 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 piston. When the engine slows down, the ring in the governor assumes a position more nearly vertical, forcing the contact 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 stroke 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. The spark lever is the shorter lever just above the steering wheel.

Ordinarily the spark lever should be carried in that portion of the sector marked "Driving Range." To get the best results, however, the spark lever 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 which the speed of the engine will permit.

Advancing the spark too far for a given engine speed 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 lever in the "Driving Range" on the sector except during extremely cold weather when it should be placed at the extreme right or in the fully advanced position. If the engine should be cranked by hand, the spark lever should be placed at the extreme left on the sector or in the fully retarded position. If this caution is not observed a "back kick" may occur, probably resulting in injury to the person cranking.

TO COAST

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 allow the engine to do the holding back as much as possible. This saves much wear on the brake band lining.

When descending steep grades, the resistance offered by allowing 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 further checked by applying the foot brake.

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

The principle of this method will be understood when you realize that the same combination of gearing which changes the ratio between the engine shaft and the rear axle, which makes it easier for the engine to drive the car, will, when the car is compelled to drive the engine, have exactly the opposite effect, which is the case when the above method is used in descending a hill.

RULES OF THE ROAD

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

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

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

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

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

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

Do not cross street car or steam railroad tracks without making sure that it is absolutely safe to do so.

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

On wet asphalt streets or slippery roads do not apply the brakes suddenly unless it is absolutely necessary. If the brakes are applied suddenly under these conditions disastrous skidding is apt to occur.

In crowded traffic it is a good plan to signal cars at the rear, before turning, slowing down or stopping.

It is a good plan to 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."** You will find that the more experienced drivers never permit themselves to take a chance.

DON'TS FOR OPERATING

Don't fail to change the engine oil frequently.

Don't fail to push the auxiliary air valve lever forward as soon after starting as possible.

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

Don't neglect to keep the tires properly inflated.

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

Don't put oil in the engine without first straining it through cheese cloth or fine wire mesh and making sure that it is free from dirt and lint.

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 before shifting from the intermediate gear to the low gear.

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.

Don't fail to investigate any unusual sound which may develop in the car. The car should be inspected at a Cadillac dealer's Service Station.

Don't neglect to inspect the level of the acid in the storage battery every 500 miles.

Don't turn corners at high speed.

Don't neglect to keep the cooling system filled with water and with a good anti-freezing solution in cold weather.

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 fill the lubricating system in the engine only and neglect to lubricate all other parts of the car.

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

BODY OF CAR

CARE OF FINISH

The best materials are used in finishing Cadillac cars. These are applied in the most expert manner. In spite of these facts, it cannot be expected that the finish will stand up unless it is given proper attention.

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.

You should be particularly careful to keep mud from the body and hood of the car while new. Have the car washed immediately in case mud spatters on it.

The following instructions should be followed very carefully when the car is washed:—

Always use clean water. Never use water containing alkali. In parts of the country where the regular water supply consists of "alkali" water, rain water should be used for washing the car.

Never use water colder than forty degrees or warmer than sixty degrees. If a hose is used in washing, never have a greater pressure than will carry the water six inches beyond the end of the hose. Water under greater pressure will drive the grit and dirt into the varnish.

A soft Rock Island natural sheep wool sponge is the best for washing the body and hood of the car. Begin at the top of the body panels and thoroughly wet the surface all over with water from the sponge. Continue this until the accumulation of road dirt softens up and gives way.

Use clean water continually, and plenty of it. Go over the surface with plenty of water two or three times until the surface is perfectly clean.

Do not wash the hood while it is hot. The effect is the same as washing it with hot water. Unless the hood is allowed to cool before washing the luster will soon disappear.

Dry off with a clean soft chamois. Do not rub the finish or use hand pressure more than sufficient to dry off the water. The water evaporates quickly and leaves the finish in good condition.

Wash the car frequently, especially when it is new, as often, in fact, as the car returns from the road with a soiled appearance. This practice in the case of a new car, heightens the brilliancy of the finish, hardens it, keeps it from spotting and adds greatly to the general appearance of the car.

SEAT CUSHIONS

The easiest and best way to replace a seat cushion is to first place the front side of the cushion against the retaining strip on the seat and then to force the rear end of the cushion into place.

BODY BOLTS

As the body bolts become more firmly seated after the car has been operated, it is a good plan to tighten all of the body bolts at the end of the first 1,000 miles of travel.

CLOCK

The clock is set and wound exactly as a stem winding watch. When setting or winding the clock use reasonable care.

With reasonable care the clock will stand the hard usage automobile service gives and to meet which the clock is constructed.

CLOCK LIGHT SWITCH

The light on the instrument board for illuminating the dial of the clock is controlled by a separate push button switch located at the top of the ignition and lighting switch. To turn on the light pull out on the switch button. To extinguish the light, push in.

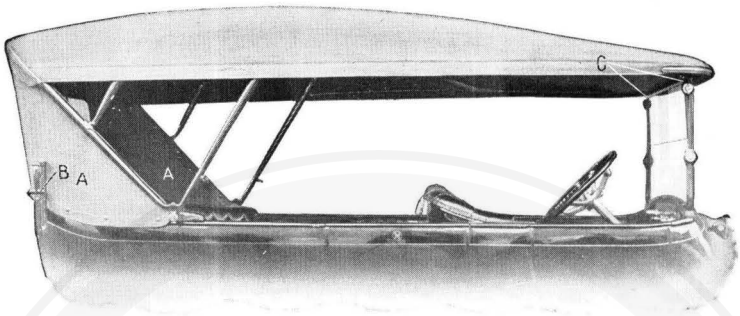

Fig. 8. Top in Raised Position.

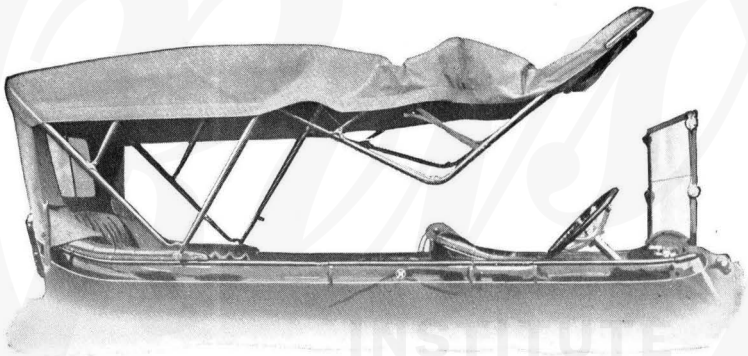

Fig. 9. Top Partially Folded, 1st Position.

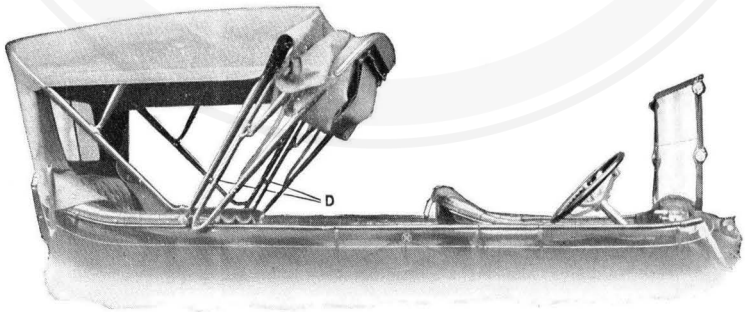

Fig. 10. Top Partially Folded, 2nd Position.

TOP

TO FOLD TOP

Unbutton the rear curtains "A," Fig. 8, from the rear bows and also from the top of the body. Fold in the curtains. Open the top rest clamps "B."

Release the front end of the top from the windshield standards at "C" by loosening the clamps. After the top is released, tighten the clamps again to prevent them from rattling. "Break down" the joints at each side of the horizontal bow, Fig. 9, and push the front part of the top back until it closes. (Fig. 10.) Then insert the pins in the holes at "D."

Carefully lower the top into the top rests, being careful to tuck in the material between the bows so that it rests smoothly and is not pinched. Then close and lock the top rest clamps "B," Fig. 8.

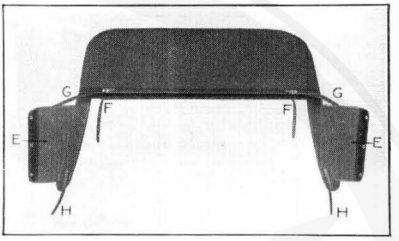

Fig. 11. Dust Hood.

Unfold and open up the dust hood so that the flaps, "E," Fig. 11, are at the top. Draw the hood on over the folded top and tuck the flaps "E" down between the bows and the body. You should be careful to draw the hood up evenly on both sides.

Loop the straps "F" on the under side of the dust hood around the lower bow on each side, draw them tight and buckle. Pass the straps "G" through the top rest clamp "B," Fig. 8, on each side and buckle them.

Fig. 12. Top Partially Raised, 1st Position.

Pass the straps "H" through the loops on the nuts on the top supports just back of the rear doors and buckle them. Button the fasteners on the lower edges of the flaps under the bows.

TO RAISE TOP

Unbutton the fasteners along the lower edges of the parts of the dust hood protecting the bows at the sides. Unbuckle all the dust hood straps and pull off the dust hood from the rear.

Open the top rest clamps "B," Fig. 8. Step inside the tonneau, take hold of the second bow from the front, Fig. 12, and raise the top until the front part balances so that it does not fall back. (Fig. 10.) Then loosen the pins "D" and by pressure on the second bow from the front (Fig. 13), push the top forward until it is in position to clamp to the windshield. Pull down the front end of the top until the ball on each windshield standard is well into the socket and then tighten each clamp.

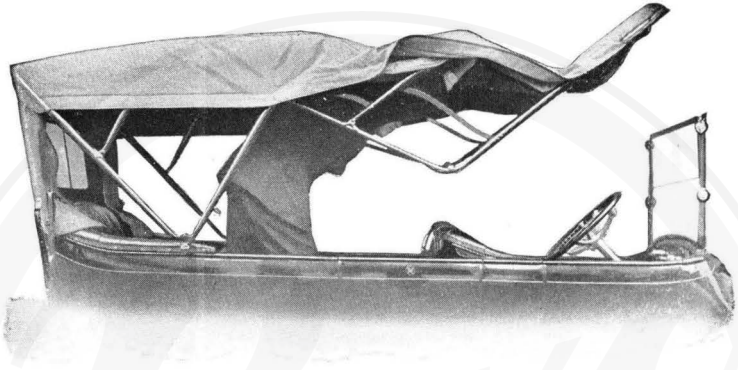

Fig. 13. Top Partially Raised, 2nd Position.

Place the rear curtains "A," Fig. 8, in position and button the fasteners on the body and on the rear bows.

LUBRICATION

It may be found, after long use, that the joints of the top require lubrication. When lubricating the joints you should be very careful not to get oil on the top material and not to put too much oil on the joints, which will afterwards run out onto the top material. Wipe the joints off carefully after lubricating.

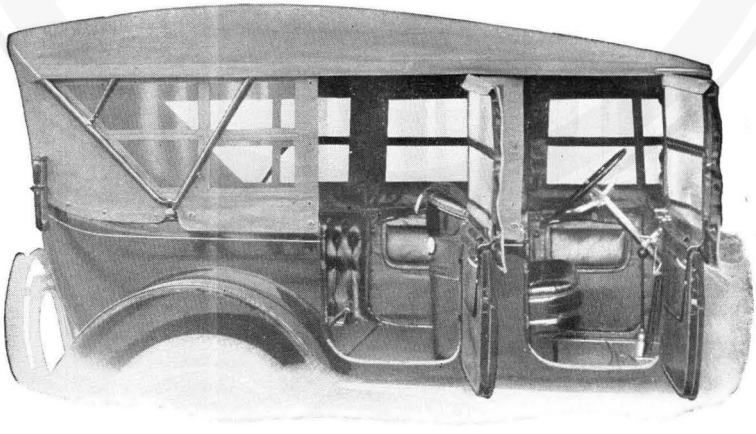

Fig. 14. Side Curtains in Place.

SIDE CURTAINS

The front curtains are ca ried in the top just back of the windshield, the center curtains and the rear curtains in the extreme rear part of the top.

Irons are provided for the doors to carry the side curtains when the doors are opened. (Fig. 14.)

Do not stow away the curtains while they are wet or if there is sand or grit on them. Thoroughly dry and dust them before stowing them away.

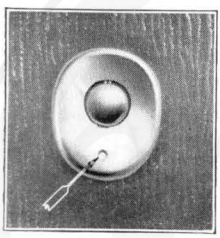

Fig. 15.

Curtain Fastener.

CURTAIN FASTENERS

When a curtain fastener is snapped together it becomes locked on three sides. To release a fastener it must be lifted on the side which is not locked. This side is indicated by a small projection on the fastener as shown by the arrow on Fig. 15.

Curtain fasteners cannot be released by lifting them at any other side.

WINTER STORAGE

TO PREPARE CAR FOR WINTER STORAGE

ENGINE

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 49.) 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, shut off the flow of gasoline to the carburetor by closing the gasoline valve at the tank and immediately the engine starts to slow down from a "lean mixture" inject from three to four tablespoonfuls of clean fresh engine oil into the primary air inlet at the right-hand side of the carburetor. This will stop the engine.

Open the compression cocks. Inject from one to two 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 one, two and three.

COOLING SYSTEM

Drain the cooling system. You will find complete instructions in this book under "To Drain the Cooling System," page 53.

TIRES

During winter storage it is best to remove the tires from the rims and keep the casings and tires in a fairly warm atmosphere away from the light. It is best to slightly inflate the tubes 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 for the winter 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.

STORAGE BATTERY

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," page 72.) If water is added it should be added just before the last time the car is used so that it will be thoroughly mixed with the acid solution. When the car is stored, the specific gravity of the acid solution should register from 1.270 to 1.290. In this condition there is no danger of the acid solution freezing. 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 battery should be charged every two months during the "out of service" period, either by running the engine or charging from an outside source (Fig. 38). If either of 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.

COVER TOP AND CAR

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

PREPARING ENGINE FOR STARTING WHEN CAR IS TO BE TAKEN OUT OF STORAGE

Open the compression cocks and inject one or two tablespoonfuls of clean, fresh engine oil into each cylinder.

Close the compression cocks. Turn the engine over slowly a few revolutions by hand with ignition switched off. This will tend to distribute the oil over the cylinder walls.

Turn on the gasoline at the tank and start the engine in the usual manner.

Immediately the engine starts, inject one or two tablespoonfuls of clean, fresh engine oil into the carburetor through the primary air inlet.

GASOLINE SYSTEM

The supply of gasoline is carried in a tank at the rear of the car and is forced to the carburetor by an air pressure of from one to two pounds. A valve is provided by which the gasoline may be shut off at the tank. (See Fig. 16.) The handle of the valve is just at the left of the gasoline gauge. A float controlled needle valve in the carburetor maintains the gasoline at the proper level in the carburetor bowl.

The pressure is indicated by a gauge on the instrument board. A hand pump 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 the pressure is automatically maintained by a pump on the engine driven by an eccentric on the front end of the cam shaft.

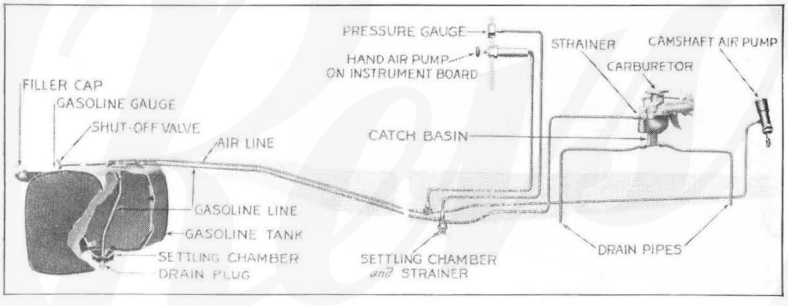

Fig. 16. Gasoline System.

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

TO FILL THE GASOLINE TANK

The gasoline tank is at the rear of the car. The filler cap may be removed after loosening the thumb screw on the top of the cap.

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 carefully tighten the thumb screw. This is necessary to prevent leakage of the pressure by which the gasoline is forced to the carburetor.

SETTLING CHAMBERS AND STRAINERS IN THE GASOLINE SYSTEM

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 should be removed and the plug in the settling chamber underneath the gasoline tank should be unscrewed several turns, to drain the settling chambers of any dirt or water which has accumulated.

Before unscrewing either of the plugs the gasoline system should be relieved of all air pressure by removing the gasoline filler cap on the tank.

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. 16.)

The strainers should be removed and cleaned every one thousand miles or oftener. Shut off the gasoline at the tank before removing either strainer. In cold weather it may be found necessary to remove the strainers more frequently in order to prevent an accumulation of water at these points which would freeze and prevent gasoline from flowing to the carburetor.

SPEEDOMETER

The speedometer on the instrument board registers on its three dials the rate at which the car is traveling, the total number of miles traveled by the car and a trip reading which may be reset to zero. The total mileage dial cannot be reset.

CAUTION

Do not under any circumstances attempt to lubricate the speedometer head. Any parts requiring lubrication were amply supplied with lubricant before they were assembled.

A repair man should never be allowed to attempt to adjust or repair the speedometer head. Repairs or adjustments are impossible without a special calibrating machine. The guarantee on the speedometer head does not hold good if the head is disassembled or tampered with.

If the speedometer head is removed for any reason, handle it as you would a fine watch. The speedometer head may very easily be damaged by rough handling.

If a new glass is necessary, or repairs or adjustments, remove the speedometer head, pack it carefully, and return it to the makers or one of their service stations or branches.

PART II

LUBRICATION

LUBRICATION

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 and the parts are carefully assembled. In order to maintain the splendid running qualities of the car it becomes necessary to systematically introduce suitable lubricants between all surfaces which move in contact with one another.

The special object of this chapter is to point out the places in the Cadillac which require oiling. While it is manifestly impossible to give exact instructions in every instance as to just how frequently each individual point should be oiled or exactly how much lubricant should be applied we give this approximately, based on average use.

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, and oil is much cheaper than metal. 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 in this chapter 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.

Oil holes sometimes become stopped up with dirt or grease. When they do, clean them out and be careful not to overlook them. Also be careful not to allow dirt or grit to get into any bearings.

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 dealers and Cadillac users has induced us to provide suitable lubricants which may be obtained from Cadillac dealers.

CADILLAC MOTOR OIL

Cadillac Motor Oil is recommended and may be used both summer and winter. In the absence of Cadillac Motor Oil, Veedol Zero Light Oil may be used summer and winter; Mobiloil A, Monogram Medium, or Amalie Non-Carbon Oil may be used during summer weather and Moboiloil Arctic Oil during winter weather.

The oil used should be a filtered one and not an acid or alkali treated oil. It should be refined from Pennsylvania crude or its equivalent.

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

Engine oil should be strained through cheese cloth or fine mesh wire cloth before using.

CADILLAC REAR AXLE AND TRANSMISSION LUBRICANT

Cadillac Rear Axle and Transmission Lubricant is recommended for the rear axle and transmission or in its absence 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.

CADILLAC CUP GREASE

Cadillac Cup Grease is recommended for use in the grease cups or, in its absence, number three cup grease.

CADILLAC WHEEL BEARING GREASE

Cadillac Wheel Bearing Grease is recommended for the wheel bearings or, in its absence, number one cup grease.

CADILLAC 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.

CADILLAC STEERING GEAR GREASE

Cadillac Steering Gear Grease is recommended for the steering gear or, in its absence, a mixture consisting of seventy-five per cent 600 W. lubricant, and twenty-five per cent number one cup grease.

ENGINE LUBRICATION

The lubrication of Cadillac eight-cylinder engines is by oil under pressure. A supply of oil is carried in the oil pan "A," Fig. 17. Oil is drawn from the oil pan by the oil pump "C" through the pipe "B" and forced to the main bearings "E," "F" and "G," through the supply pipe "D."

The pressure of the oil is regulated by an overflow valve or pressure regulator "M," containing a valve under spring tension. When the pressure is reached for which the valve is set, the valve is forced open and the oil overflows past the valve. A small hole 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 are carried to the camshaft bearings and power pressure pump in the gasoline system through the pipe "R" above and parallel to the camshaft. The forward end of this pipe is fitted with two nozzles from which oil flows into the camshaft sprockets and to the chains through holes drilled in the camshaft sprockets.

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

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

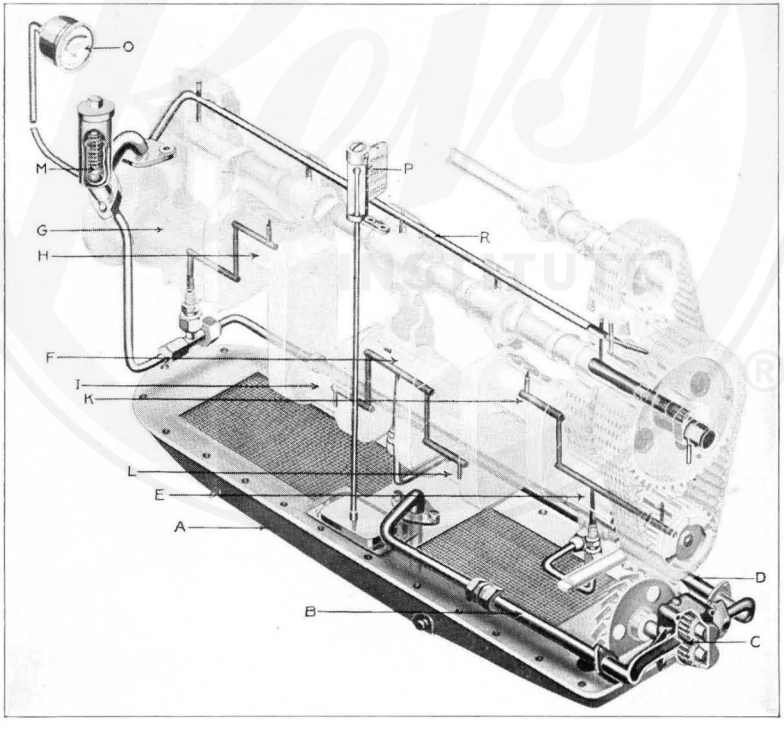

Fig. 17. Engine Lubricating System.

TO FILL LUBRICATING SYSTEM

Cadillac Motor Oil is recommended. It is of the utmost importance that the oil be free from dirt and lint, and that it be of a suitable quality.

A filling hole is provided in each block of cylinders.

Whenever the oil level indicator between the cylinder blocks reaches the line marked "Fill," oil should be added.

Do not risk running the engine after the oil level indicator has dropped down to the line marked "Fill."

If the oil level indicator should point to "Empty," the engine should be stopped immediately and supplied with oil.

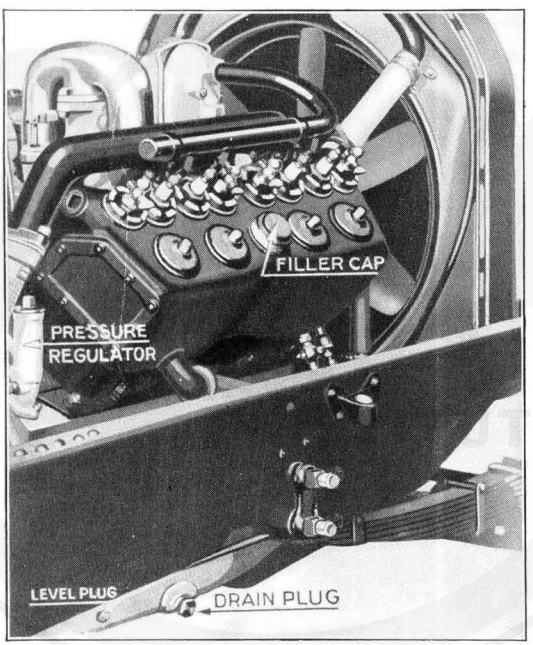

Fig. 18. Oil Filler Cap, Pressure Regulator, Level Plug and Drain Plug.

There is an oil level plug in the right hand side of the oil pan shown in Fig. 18. If the oil level gauge on the engine should become inoperative from any cause or fail to register correctly, remove the oil level plug before starting to add oil, then add oil as above directed until it just starts to flow from the hole left by the removal of the plug. Then replace the plug and filling cap.

When adding oil with the level plug removed, the oil level indicator should register "Full" when the oil just starts to flow from the hole left by removing the plug. The oil pan then contains approximately one and one-half gallons of oil.

LUBRICATION CARD

A lubrication card is supplied with the tool kit. The card is intended to be hung in the garage as a reminder.

REPLACE OIL IN ENGINE

At the end of the each 500 miles of travel, remove the drain plug located at the right side of the oil pan and drain out all of the oil. Then replace the drain plug and add one and one-half gallons of fresh engine oil. (See below under "Replace Oil Frequently During Cold Weather.")

At the end of the first 1,000 miles of travel and at the end of every 4,000 miles of travel thereafter, drain the oil pan and refill it with a mixture consisting of three quarts of kerosene oil and one quart of engine oil. The mixture must be entirely free from dirt and lint. Then run the engine at a speed of between 600 and 1,000 R.P.M. for about one minute. Then drain the oil pan, remove it and the screen from the engine and thoroughly clean the oil pan and screen. Fill the oil pan to the proper height with clean, fresh engine oil after replacing it.

It is a good plan to clean the overflow valve (see note) and valve seat, as well as the housing in which they are contained, after forcing the mixture of kerosene and engine oil through the lubricating system. It is also important to make sure that the small by-pass hole is clean and free from any obstruction. A clean cloth, free from lint, should be used in cleaning the overflow valve.

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

Note:—The housing, containing the overflow valve (pressure regulator), is located at the side of the crankcase just back of the right hand block of cylinders.

REPLACE OIL FREQUENTLY DURING COLD WEATHER

The mileages given at which the oil should be drained and the oil pan and screen removed are those at which the work should be done during summer weather.

During cold weather a certain amount of water may accumulate in the crank case of the engine as a result of condensation. The water thus formed either freezes, preventing the pump from drawing oil, or mixes with the oil, forming a thick substance which the pump cannot draw. It is necessary, therefore, during cold weather 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 work during cold weather 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 in the oil pan remain cold it will be found necessary to drain the oil pan and 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.

The car that is constantly making very short trips in cold weather should have the oil drained every 350 miles 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 enough in cold weather, serious damage to the engine may result, particularly on cars in short trip service.

OIL PRESSURE

Oil is fed under pressure to the main and connecting rod bearings of the engine. To prevent the pressure of the oil from rising too high, a spring controlled overflow valve known as a pressure regulator is provided. The pressure regulator is set when the car is assembled and requires no further attention except that it may be necessary occasionally to remove the valve from the regulator and clean the valve and its seat, as well as the by-pass hole.

The amount of pressure indicated by the pressure 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 Motor Oil or oil of approximately the same viscosity, the pressure as indicated by the gauge should be from five to seven pounds when the car is travelling at the rate of ten miles an hour in high gear. 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 auxiliary air control lever pulled back will cause the oil to be thinned more rapidly, due to the condensation of gasoline from the rich mixture.

If after starting the engine, it is found that the oil 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 with the oil gun furnished in the tool kit. 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 Oil in Engine," page 38.)

GENERAL LUBRICATION

EVERY 125 MILES

ENGINE

7

Every 125 miles of travel, or oftener, determine the quantity of oil in the engine and add oil if necessary (see under "Filling Lubricating System," page 37, and under "Replace Oil in Engine," page 38.)

EVERY 500 MILES

OIL CUPS

Fill the oil cup "O*" with engine oil every 500 miles or once a week. To reach this oil cup it is first necessary to open the small cover on the aluminum floor board generator cover.

Note: On some Type 55 cars, instead of an oil cup at this point there is a connection which fits the oil gun. On these cars, remove the screw plug and inject Cadillac Rear Axle and Transmission Lubricant every 500 miles.

GREASE CUPS

Turn down grease cups "G" and "G*" every 500 miles. Turn down the grease cup on the instrument end of the speedometer cable.

On some of the Type 55 cars the spring shackle bolts are provided with oil cups instead of grease cups. These oil cups should be filled with engine oil every 500 miles or once a week.

NOTE:—To reach grease cups "G*" it is first necessary to open the small doors in the dust shields directly under each rear door.

OIL HOLE FOR FAN BEARING

3

The fan is driven by a spring and is free to oscillate slightly on the fan shaft.

3 indicates the oil hole through which the bearing at the fan hub may be lubricated.

This oil hole is placed just back and at the base of the flange on the fan shaft against which the spring presses. You may find it necessary to crank the engine in order to bring this hole to the top.

A few drops of engine oil should be applied every 500 miles.

REPLACE OIL IN ENGINE

Replace oil in the engine at the end of each 500 miles of travel. (See under "Replace Oil in Engine" and "Replace Oil Frequently During Cold Weather," page 38.)

SPRINGS

2, 15, 18, 30, 31

It is recommended that the springs be lubricated once every 500 to 1,000 miles by painting the edges and ends of the spring leaves with cylinder oil. A small stiff brush should be used. After applying the oil to the springs, the car should not be washed until it has been driven some distance to allow the lubricant to work in between the leaves.

WATER IN STORAGE BATTERY

Every five hundred miles or at least every two weeks 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 72.)

EVERY 1000 MILES

OIL CUPS

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

BEARING AT UPPER END OF DISTRIBUTOR SHAFT

4

This is an oil cup for the bearing at the upper end of the distributor shaft. A few drops of engine oil should be applied every 1,000 miles.

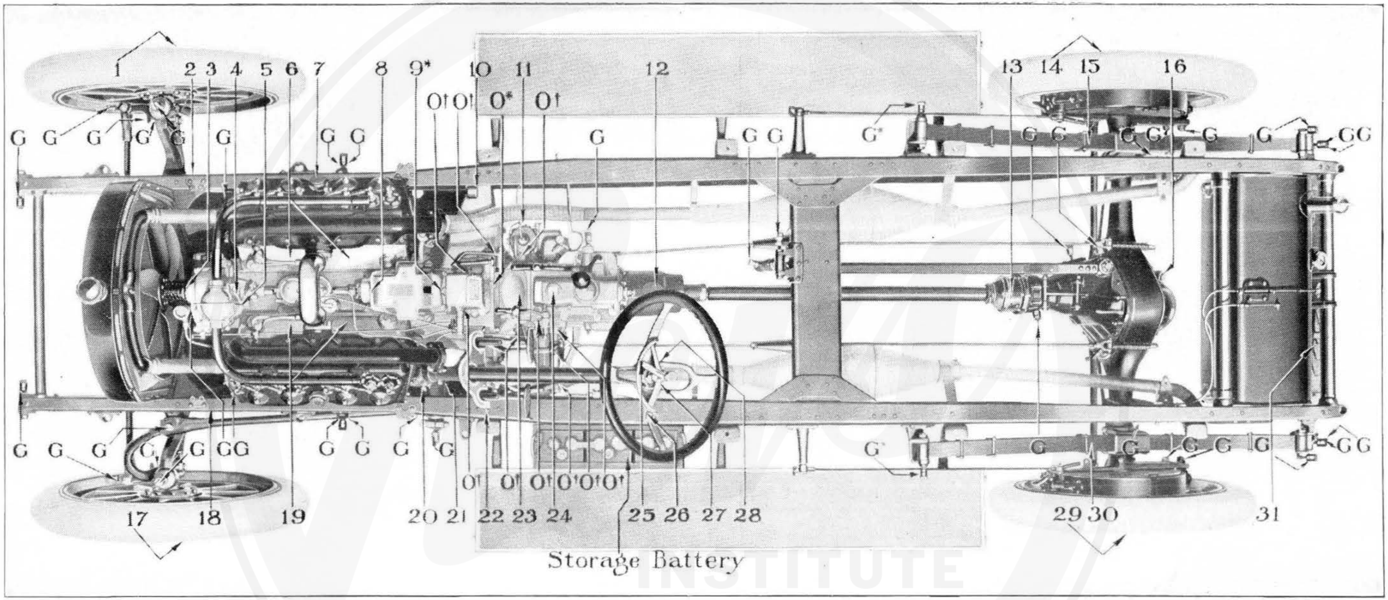

Fig. 19. General Lubrication Diagram.

EACH "G" INDICATES A GREASE CUP. EACH "O" INDICATES AN OILING POINT.
EACH NUMBER INDICATES A LUBRICATING POINT.

Open small cover plate on aluminum floor board generator cover to reach point "O*"
Remove aluminum floor board generator cover to reach point "9*"
Open doors in dust shields to reach points "G*"

DRIVE SHAFT

12, 13

Fill the forward and rear universal joints on the drive shaft with Cadillac Universal Joint Grease every 1000 miles. A special connection to fit these places is furnished with the oil gun which is a part of the tool kit.

The forward universal joint is covered with a cylindrical shield to prevent grease from being thrown on the floor boards. The shield is fitted with a small cover on the upper side. To fill the universal joint it is necessary first to remove this cover. It is also necessary sometimes to move the car forward or backward in order to bring the screw plug at the top so that the joint may be filled.

BEARINGS ON GENERATOR

8, 9*

These are oil cups for the bearings on the armature shaft of the motor generator. A few drops of engine oil should be applied every 1,000 miles.

Note:—It is necessary to remove the aluminum floor board generator cover to lubricate the bearing at 9*.

OIL HOLES IN THE STEERING WHEEL HUB

27, 28

One of these oil holes is above the steering wheel and the other is accessible after folding the wheel. A few drops of engine oil should be applied at each point every 1,000 miles.

ENGINE REAR SUPPORTS

10, 22

There is a slight movement between the side bars of the frame and the engine rear supports when the car is traveling over rough roads. It is necessary, therefore, to apply lubricant at these points.

There is an oil hole with a felt wick in each engine support where it is bolted to the side bar of the frame. Engine oil should be applied at these points every 1,000 miles or oftener if found necessary.

CLEAN ENGINE LUBRICATING SYSTEM

At the end of the first 1,000 miles of travel and at the end of every 4,000 miles of travel thereafter, drain the pan and clean the lubricating system with kerosene. Then remove the oil pan and clean the pan and the screen. Replace the oil pan and refill it to the proper height with clean engine oil. (See under "Replace Oil in Engine" and "Replace Oil Frequently During Cold Weather," page 38.)

CLUTCH THRUST BALL RACE

23

Every 1,000 miles remove the cover plate shown at 23, turn the clutch thrust ball race so that the small filler screw is at the top and remove the screw with a screw driver. Care must be exercised not to drop the screw into the clutch case. With the oil gun furnished in the tool kit inject suitable lubricant. Cadillac Rear Axle and Transmission Lubricant is recommended. A connection furnished with the oil gun fits the threaded hole left by the removal of the screw plug.

EVERY 2000 MILES

TRANSMISSION

24

The transmission case should always contain sufficient lubricant to bring it up to the level of the level plug in the left side of the case. It should be inspected every 2,000 miles and lubricant added if necessary. Cadillac Rear Axle and Transmission Lubricant is best for this purpose.

In the absence of Cadillac Rear Axle and Transmission Lubricant 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.

REAR AXLE

16

The rear axle should contain enough lubricant to bring it up to the level of the filling hole. It should be inspected every 2,000 miles and lubricant added if necessary. The best lubricant for this purpose is Cadillac Rear Axle and Transmission Lubricant.

In the absence of Cadillac Rear Axle and Transmission Lubricant 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.

TIMER AND DISTRIBUTOR

5

Every 2,000 miles of travel remove the small breather by unscrewing it and pack number two cup grease around the gears by which the timer and distributor are driven.

LUBRICATION OF VALVE STEMS

6, 19

The valve stems are lubricated by oil vapor conducted to the valve compartment through ports in the crank case and cylinder blocks. It is good practice to supply additional lubrication every 2,000 miles in the following manner:

Remove the cap screws holding the valve compartment cover plates in position. Move the cover plates toward the rear, except the right front plate, and the left rear plate, which should be moved forward. Then move the upper edges of the plates out from the cylinder blocks, leaving a space between the cylinder blocks and the cover plates through which an oil-can spout can be inserted. Fill the oil can which is carried on the dash with engine oil and lubricate each valve stem and cam slide.

It is well to run the engine a few minutes immediately after following these instructions, and then to repeat the operation.

In addition to the above it is well to thoroughly lubricate the valve stems and cam slides whenever the cover plates are removed for any other purpose.

EVERY 3000 MILES

WHEELS

1, 14, 17, 29

Every 3,000 miles all the wheels should be removed, the bearings thoroughly washed and cleaned in either gasoline or kerosene and the bearings examined to determine whether any foreign substances have gotten into them that might damage them. The bearings should be thoroughly lubricated with a thin grease. Cadillac Wheel Bearing Grease is recommended for this purpose. Do not use heavy grease, as it will roll away from the path of the rolls and will not return. Then the wheels should be replaced and adjusted as per instructions on this subject.

There is an oil cup in the hub of each rear wheel. Inject some engine oil here whenever you are oiling the car. Wipe the dirt from the cups first so that it will not get into the bearings.

STEERING GEAR

20, 21

The internal mechanism of the steering gear should be lubricated about every 3,000 miles. This can be done by removing the screw plugs, one in the side and the other in the rear of the steering gear housing. Cadillac Steering Gear Grease mixed with two or three per cent of flake graphite is a good lubricant for this part.

EVERY 4000 MILES

REPLACE OIL IN ENGINE AND CLEAN LUBRICATING SYSTEM

At the end of every 4,000 miles of travel drain the oil pan and clean the lubricating system with kerosene. Then remove the oil pan and clean the pan and screen. Replace the oil pan and refill to the proper height with clean, fresh engine oil. (See under "Replace Oil in Engine" and "Replace Oil Frequently During Cold Weather," page 38.)

TRANSMISSION

24

At the end of every 4,000 miles of travel drain all of the lubricant from the transmission and refill with clean, fresh lubricant to the oil level plug in the left side of the case. The best lubricant for this purpose is Cadillac Rear Axle and Transmission Lubricant.

In the absence of Cadillac Rear Axle and Transmission Lubricant 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.

REAR AXLE

16

At the end of every 4,000 miles of travel drain all of the lubricant from the rear axle and refill with enough clean, fresh lubricant to bring the level up to the level of the filling hole. The best lubricant for this purpose is Cadillac Rear Axle and Transmission Lubricant.

In the absence of Cadillac Rear Axle and Transmission Lubricant 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.

ADDITIONAL

TIRE AIR COMPRESSOR

11

One filling of the compressor will provide sufficient lubrication for inflating six or eight tires, provided they are all inflated within one month. If a month or more elapses between the times the compressor is used it should be lubricated before it is used.

To lubricate the compressor proceed as follows: Lift the cap on the lubricator and with the oil gun furnished in the tool kit force in Cadillac Rear Axle and Transmission Lubricant until the level of the lubricant is even with the level hole in the side of the crank case of the compressor. The level hole is opened by pushing down on the upper end of the small shutter.

Caution:—You should bear in mind that the compressor will not stand up and give good service unless it receives proper lubrication.

SPARK AND THROTTLE LEVERS

25, 26

The plungers in the spark and throttle levers should be lubricated occasionally. If the spark and throttle levers stick, rub a little oil on the sector where the friction shoes come in contact with it.

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. The joints of the internal brakes may be lubricated after removing the small cover "F," Fig. 48, on each brake drum. Care should be taken not to apply too much oil to the internal brake joints as it may get on the brake band linings and impair the efficiency of the brakes.

Remember that wherever one part moves in contact with another, the ease of movement will be assisted and wear will be reduced to the minimum by lubrication.

CARBON DEPOSIT

A rapid formation of carbon in the cylinders of the engine may be the result of using an oil of inferior quality, or not suited to the engine, or to the addition of too much oil to the oil pan.

When the accumulation of carbon becomes great enough it will cause the engine to pound and lose power. The pounding is usually first noticed in pulling and when the throttle is open for hill climbing or acceleration.

When the accumulation of carbon becomes great enough to cause the engine to pound it should be removed.

The spark plug cores should be kept clean. A good method of cleaning them is to wash them in alcohol.

Carbon deposited on the spark plug cores forms a circuit which offers less resistance to the high tension current than the gap between the spark plug points. The current therefore follows the path of least resistance instead of jumping between the points, and causes the engine to miss fire.

This is particularly true when the throttle is open for hill climbing or acceleration as under these conditions the compression of the gas, through which the spark must jump, is increased. A spark which will jump in the neighborhood of 3/8" in the open air will not jump more than 1/16" in gas under compression.

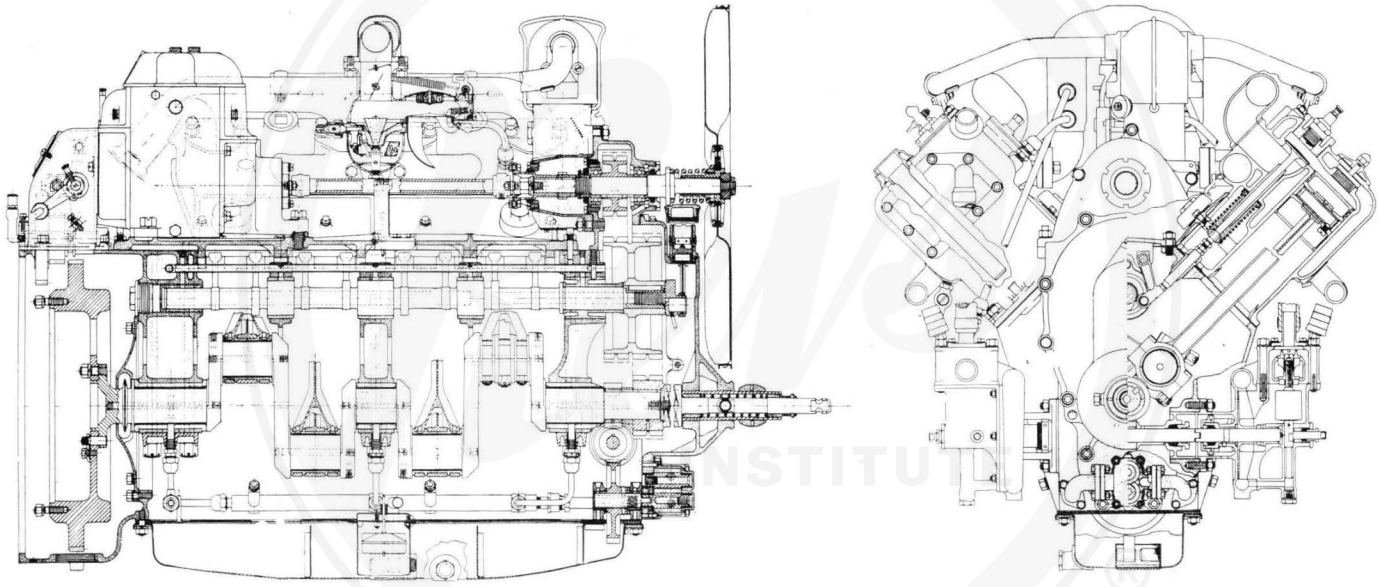

Fig. 20. Sectional Front and Side Views of Type 55 Engine.

PART III

ADJUSTMENTS

CARBURETOR

ADJUSTMENT OF CARBURETOR

The carburetor should not be tampered with unless it needs adjustment. Good carburetor action cannot be expected until the motor is thoroughly warmed up. This is particularly true during cold weather. Imperfect carburetor action while the engine is cold does not indicate that the carburetor requires adjustment and carburetor adjustment should not be made under these conditions.

Before changing any of the carburetor adjustments be sure it is the carburetor which requires attention. It is possible that the ignition system requires adjustment.

Before making any carburetor adjustments be sure that the points on the spark plugs are .028 inches apart, that the spark plug cores are clean, that the timer is properly set and that the timer contact points are clean and in proper adjustment. In fact, see that the entire ignition system is in good working order.

When it is certain that the carburetor requires adjusting, proceed as follows:

Open the throttle about two inches on the sector at the steering wheel. Place the spark lever in the "Driving Range" on the sector and start the engine. If the engine is cranked by hand the spark lever should be placed at the extreme left on the sector.

Run the engine until the water jacket on the intake pipe is hot.

Move the spark lever to the extreme left on the sector and the throttle lever to a position which leaves the throttle in the carburetor slightly open. Adjust the air valve screw "A," Fig. 21, to a point which produces the highest engine speed. Turning the screw "A" in a clockwise direction increases the proportion of gasoline to air in the mixture and vice versa.

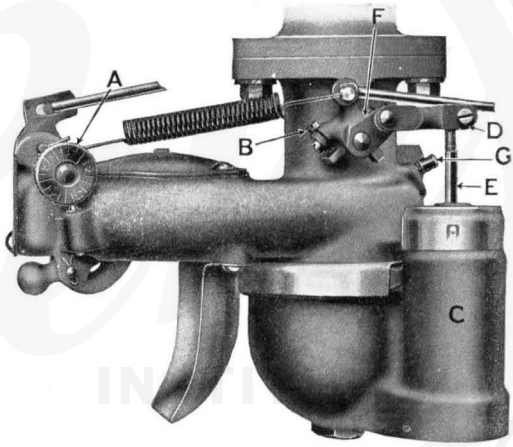

Fig. 21. Carburetor, Side View.

Close the throttle (move it to the extreme left on the sector) and adjust the throttle stop screw "B" to a point which causes the engine to run at a speed of about 300 revolutions per minute. The spark lever should be at the extreme left on the sector when this adjustment is made.

With the spark and throttle levers at the extreme left on the sector adjust the air valve screw "A" to a point which produces the highest engine speed.

Open the throttle until the shutter attached to the right hand end of the throttle shaft just covers the slot in the carburetor body. Then adjust the screw "G" to a point which produces the highest engine speed or to a point

where the engine slows down slightly from a lean mixture. Turning the screw "G" in a clockwise direction increases the proportion of gasoline to air in the mixture and vice versa.

During very cold weather when a slightly richer mixture is desirable it may be found best to turn the adjusting screw "G" further in a clockwise direction.

PERSONAL DANGER IN 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 at the exhaust pipe.

Because of the presence of carbon monoxide it is very dangerous to run the engine for any length of time while the car is in a small, closed garage. If the doors and windows are open the danger is very much 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.

LEANING DEVICE

A leaning device, sometimes called a "gas-saver," is provided which may be adjusted to cause, for ordinary driving speeds, a mixture in which the proportion of gasoline to air is cut down. The mixture is not affected by the leaning device at the closed or nearly closed position of the throttle, or at the open or nearly open position.

The leaning device is adjusted at "G," Fig. 21. When the adjusting screw "G" is screwed in as far as it will go the leaning device has no influence on the mixture at any throttle position.

The leaning device consists of a shutter, attached to the right hand end of the throttle shaft, which covers a slot in the carburetor body when the throttle is opened slightly, again uncovering the slot when the throttle is opened wide or nearly so. A hole is drilled through the carburetor body from the mixing chamber to the slot and another hole is drilled from the carburetor bowl to the slot.

When the slot is covered by the shutter a passage is formed from the mixing chamber to the carburetor bowl. The partial vacuum in the mixing chamber causes a lowering of the atmospheric pressure in the carburetor bowl resulting in less gasoline being fed through the spray nozzle. When the shutter uncovers the slot the partial vacuum in the mixing chamber has no effect on the atmospheric pressure in the carburetor bowl and the amount of gasoline fed through the spray nozzle is not affected.

AUTOMATIC THROTTLE

The carburetor is equipped with an automatic throttle, Fig. 22, controlled by a spring. Its purpose is to prevent pulsations of air in the intake manifold from causing the air valve to flutter when the engine is running slowly with the throttle fully opened. The automatic throttle is adjusted when the carburetor is assembled and requires no further attention.

THROTTLE PUMP

The object of the throttle pump is to force gasoline through the spraying nozzle when the throttle is opened quickly for acceleration. When the throttle is opened slowly the throttle pump has practically no effect on the amount of gasoline passing through the spraying nozzle.

The cylinder "C," Fig. 21, on the carburetor bowl contains a plunger which is operated by the throttle by means of the connecting rod "E."

When the throttle is opened the plunger is forced into the gasoline in the carburetor bowl. The plunger is drawn out of the gasoline when the throttle is closed.

The rod "E" is adjusted at the factory and should require no further adjustment. If the adjustment is changed the rod should be readjusted so that its upper end is flush with the upper face of the arm "D."

TO SET CARBURETOR FLOAT

After the carburetor has been in use for some time, there may be a slight amount of wear at the point of the inlet needle and its seat. If this should occur, the height of the gasoline in the carburetor bowl will rise.

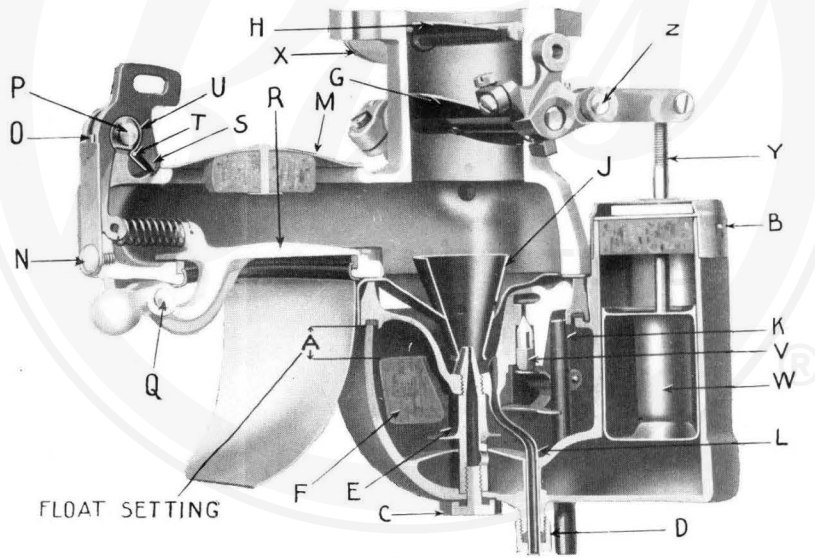

Fig. 22. Carburetor, Sectional View.

To determine if the float is properly set, remove the carburetor from the engine, and the bowl from the carburetor. Raise the float until the inlet needle valve is just closed. The dimension "A," Fig. 22, should then be one-half inch.

The setting may be corrected by bending slightly the arm to which the float is attached.

ENGINE BEARINGS

If a good grade of lubricating oil is used, if the oil is replaced and the oil pan removed and cleaned out at frequent intervals as recommended in this book under "Replace Oil in Engine," page 38, the engine bearings should give many thousands of miles of use without attention. If, as a result of improper lubrication or long use, the bearings require adjustment, these instructions should be followed carefully.

The connecting rods to which the pistons in the left hand block of cylinders are attached are forked at their lower ends. Bronze backed babbitt lined bushings clamped in these rods have their bearings on the crank shaft.

The connecting rods to which the pistons in the right hand block of cylinders are attached are straight and have their bearing on the outer surface of the bushings clamped in the forked rods.

ADJUSTMENT OF CONNECTING ROD BEARINGS

The bearings at the lower ends of the straight connecting rods are adjustable. Liners varying in thickness from .002 to .006 of an inch are placed between the caps and the rods when the engine is assembled. To readjust, remove these liners and substitute thinner ones of the proper thickness. To get the best results, these bearings should have from .0025 to .0035 play.

CAUTION:—Do not under any condition adjust these bearings closer than .002, as this amount of clearance is necessary to allow for the greater expansion of the bronze backed bushings than the steel connecting rods when the engine is heated.

The bronze backed bushings in the forked connecting rods are not adjustable. If, as the result of long use or improper lubrication, these bushings have too much play on the crank shaft, they should be replaced by new ones.

ADJUSTMENT OF MAIN BEARINGS

There are three main crankshaft bearings. These bearings are provided with liners which are clamped between the crank case and the bearing caps.

To tighten a main bearing, proceed as follows: Remove the oil feed pipe connecting the bearing cap with the oil manifold. Remove the aluminum bearing cap with the lower half of the bearing and the liners.

Replace the liners with liners which are less in thickness by an amount equal to the amount of "take-up" necessary. Liners can be obtained varying in thickness by .001 of an inch. Each liner is stamped indicating its thickness.

Carefully reduce the upper edges of the lower half of the bearing **just enough** to allow the aluminum bearing cap to clamp the new liners. This work must be done very accurately, as clearance between the halves of the bearing will cause an oil leak which may prove disastrous to the bearing.

Thoroughly clean the bearing, bearing cap and liners and oil the bearing surface before replacing.

In replacing the bearing cap tighten the bearing nuts firmly and lock with cotter pins. Also make sure that the union nuts on the oil pipe are tightened sufficiently to prevent leakage.

The upper edges of the lower half of the bearing may be reduced by rubbing the bearing on a piece of fine emery cloth stretched tightly over a flat, machined, iron surface.

If more than one bearing is removed at a time care should be taken not to mix the liners, as they may not all be the same thickness.

COOLING SYSTEM

The cooling system is of the water forced circulation type. Two water pumps are provided, one for each block of four cylinders.

CONDENSER

A condenser, the purpose of which is to prevent the loss of the cooling medium by evaporation, when an alcohol solution is used, is attached to the right hand side of the frame just beneath the front floor boards. A pipe "S," Fig. 24, connected to the overflow tube of the radiator leads to the condenser.

The action of the condenser is as follows: The vapor given off from the liquid in the radiator when it is heated passes through the overflow tube to the condenser. As it passes into the liquid in the condenser the vapor is condensed.

When the engine has stopped, the cooling of the radiator and its contents results in the contraction and condensation of the vapor left in the upper part of the radiator. The vacuum thus caused allows the atmospheric pressure in the condenser to force condensed vapor back into the radiator in liquid form.

The proper operation of the condenser requires an air tight joint 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 filler cap which causes a leak at the cap or which makes necessary the elimination of the steel washers or cutting a hole through the rubber gasket.

TO FILL THE COOLING SYSTEM

Fill the cooling system with clean water during warm weather and with a suitable anti-freezing solution during freezing weather. (See under "Anti-Freezing Solution," page 14.)

WHEN COOLING SYSTEM IS EMPTY

To fill the cooling system after it has been drained, replace the drain plugs "H," Fig. 24, in the water pumps, close the drain cocks "K" in the cylinder blocks and turn the shafts "L" on the water pumps so that the indicators on the ends of the shafts point up. The shafts may be turned in either direction.

Then remove the filler cap "W" from the top of the radiator and fill the cooling system. Replace the filler cap and **screw it down firmly.** This is necessary, to insure the proper operation of the condenser.

After the cooling system is filled, turn the shafts "L" on the water pumps so that the indicators on the ends of the shafts point down. These indicators should point up when filling or draining the cooling system and down at all other times.

WHEN COOLING SYSTEM IS NEARLY FULL

The radiator should be full or nearly so. If it is not, the necessary liquid to fill it may be added after removing the radiator filler cap.

It is not necessary to turn the shafts "L" on the water pumps if only a small amount of liquid is necessary to fill the cooling system.

TO FILL THE CONDENSER

Normally when the cooling system is cold, the condenser should be one-half full of the same liquid as used in the radiator. To add liquid to the condenser, take up the removable floor board and remove the filler cap "V" at the top of the condenser. Any excess liquid which may accumulate in the condenser should be drained off at "R," Fig. 24, and poured back into the radiator.

TO DRAIN THE COOLING SYSTEM

To drain the cooling system, remove the drain plugs "H" from the water pumps and turn the shafts "L" on the water pumps so that the indicators on the ends of the shafts point up. The shafts "L" may be turned in either direction. Then open the drain cocks "K" in the cylinder blocks.

TO DRAIN THE CONDENSER

To drain the condenser remove the drain plug "R" in the pipe leading from the bottom of the condenser.

TO CLEAN THE COOLING SYSTEM

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

Run the engine with the radiator covered until the liquid in the cooling system is boiling hot. Then turn the shafts "L" on the water pumps so that the indicators on the ends of the shafts point up.

Shut off the engine and immediately remove the drain plugs "H" from the water pumps and open the drain cocks "K" in the cylinder blocks. (Bear in mind in removing the drain plugs "H" that the liquid is scalding hot.) Remove the drain plug "R" in the pipe leading from the bottom of the condenser.

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 again its specific gravity should be tested with an hydrometer, after it has thoroughly cooled.

When the liquid has drained off, replace the drain plugs "H," close the drain cocks "K" and fill the cooling system with clean, hot water. Then repeat the operations outlined above.

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 cooling system flushed again with clear water.

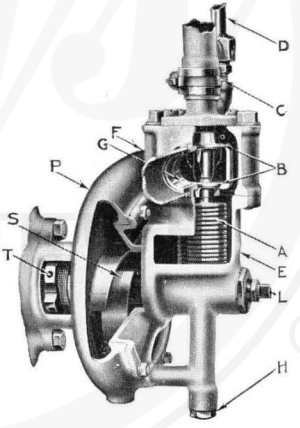

Fig. 23. Water Pump, Sectional View

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

During freezing weather be sure to refill with a suitable anti-freezing solution.

THERMOSTATIC CONTROL OF COOLING SYSTEM

The purpose of the thermostatic control is to permit water circulated through the water jackets on the cylinders and carburetor intake manifold 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.

THERMOSTATS

A housing containing a Sylphon thermostat and a valve controlled by the thermostat, are located on the cover of each water pump.

The thermostat "A" (Fig. 23) is accordian shaped. It contains a liquid which is driven into gas when heated. The resulting pressure elongates the thermostat, forcing the valve "B" from its seat. A drop in temperature changes the gas back to a liquid reducing the pressure in the thermostat and allowing it to contract, thereby bringing the valve "B" back to its seat.

When the temperature of the water in the water jackets on the cylinders and intake manifold is below a predetermined point the valve "B" is held tightly closed by the thermostat. When the temperature of the water tends to rise above the predetermined point, the valve "B" is forced open by the thermostat, permitting the water pump "P" to draw water from the radiator.

No adjustments are provided in the thermostatic control. Provision is made, however, for forcing the valves operated by the thermostats from their seats. This is necessary to drain the radiator.

There is a horizontal shaft "L" extending from the cover of each water pump. There is an indicator on the end of each of these shafts. By turning the shafts until the indicators point directly up, the valves operated by the thermostats are forced and held from their seats. By turning the shafts until the indicators point down, as shown in Fig. 23, the valves are returned to their seats and the thermostatic control is again brought into operation.

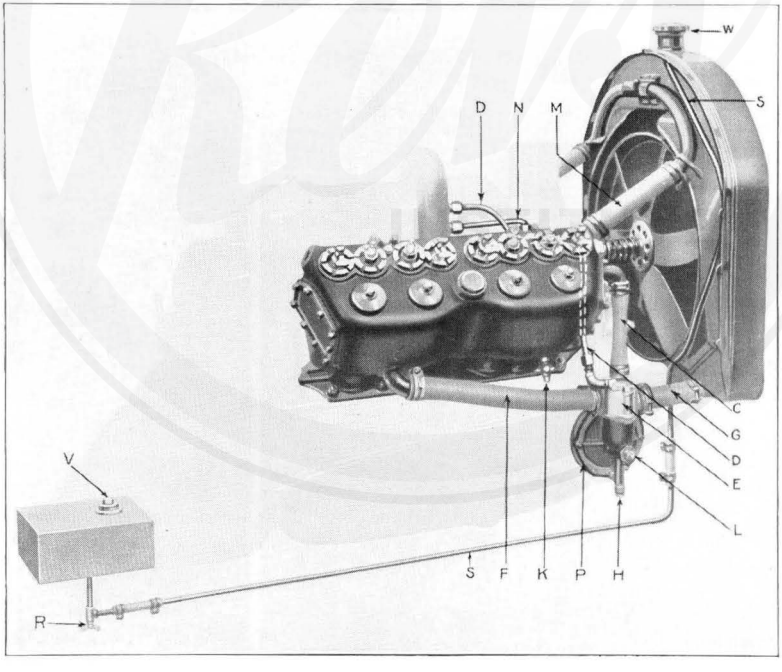

Fig. 24. Cooling System, Showing Path of Circulation.

PATH OF CIRCULATION

When the engine is first started and is cold the valves operated by the thermostats are held tightly on their seats. This prevents the water pumps from drawing water from the radiator. Under these conditions the water is circulated as follows:

From the water pump "P," Figs. 23 and 24, through the hose "F" to the water jackets on the cylinders. From the water jackets on the cylinders some of the water returns to the pump "P" through the hose "C" and the thermostat housing "E." The remainder is carried by a small pipe "N" to the water jacket around the intake manifold and from the intake manifold to the pump "P" through the pipe "D" and the thermostat housing "E."

After the engine has become warm and the thermostats have forced from their seats the valves between the pumps and radiator the circulation is as follows:

Water is drawn from the radiator through the hose "G" and forced to the water jackets on the cylinders through the hose "F." From the water jackets the water returns to the radiator through the hose "M" connecting the cylinder block and radiator.

Water is still forced to the water jacket on the intake manifold through the small pipe "N" and from the intake manifold to the pump "P," through the pipe "D" and the thermostat housing "E." Some of the water still flows back to the pump through the hose "C" and the thermostat housing "E."

As the temperature of the water returning to the pump through the pipe "D," hose "C" and thermostat housing "E," rises or falls, the thermostat expands or contracts, opening or closing the valve thereby admitting a larger or smaller amount of cooled water from the radiator.

TO TIGHTEN AND REPACK GLANDS ON WATER PUMPS

If leaks should appear at the water pump packing glands, remove the splash shield protecting the front end of the engine and turn the packing gland nuts "T," Fig. 23. To tighten, turn the gland nuts in the direction in which the wheels turn when the car moves backward. As one gland nut has a right hand thread and the other a left hand thread, both are turned in the same direction to tighten. Tighten the gland nuts only sufficiently to prevent leaks.

If a water pump gland requires repacking remove the pump from the engine and remove the gland nut by unscrewing it in the direction opposite to that in tightening it. Remove the gland and renew the packing. Then replace the gland and tighten the gland nut. Replace the water pump and splash shield.

We strongly urge that you use only Cadillac packing, which may be obtained from any Cadillac dealer.

ENGINE VALVES

POSITIONS OF CAMS FOR ADJUSTMENT OF CAM SLIDES

In poppet valve gasoline engines it is necessary for a cam roll to be on the circular surface of the cam when the cam slide operated by that cam is being adjusted. The shape of the circular portion of the cams in the Cadillac eight-cylinder engine is such that it is not sufficient for a cam roll simply to be on the circular surface of the cam. The cam roll must be on a certain small arc of the circular surface of the cam when the cam slide is being adjusted.

As no two cams on the camshaft are in the same position at the same time, it is necessary, before adjusting each cam slide, to place the corresponding cam in the proper position by cranking the engine by hand as described below. The cam slides cannot be properly adjusted with the cams in any but the correct positions.

PLACING CAM IN POSITION

To place a cam in position for properly adjusting the cam slide, proceed as follows:

Open the compression relief cocks on the cylinder blocks and with the ignition switch off crank the engine slowly by hand in the direction in which it runs until the piston in the cylinder in which the valve is located is at the end of the compression stroke, or in other words, on firing center. This may be determined by placing a finger over the compression relief cock while cranking the engine. When the piston is exactly on firing center the pointer attached to the crankcase will then be directly over the mark on the flywheel indicating "center" for that cylinder.

Inlet Valve. If the valve operated by the cam slide is an inlet valve, select the first "IN|S" to the left of the center mark and mark it with a piece of chalk.

Crank the engine further by hand in the direction in which it runs until that "IN|S" is directly under the pointer. It will be necessary to crank the engine nearly a complete revolution.

The cam is then in the correct position for adjusting the cam slide operating that inlet valve. (See under "Adjustment of Cam Slide.")

Exhaust Valve. If the valve operated by the cam slide is an exhaust valve, after cranking the engine to the proper firing center, select the first "EX|S" to the right of the center mark and mark it with a piece of chalk.

Crank the engine further by hand in the direction in which it runs until this "EX|S" is under the pointer.

Then crank the engine further one complete revolution until this "EX|S" is again directly under the pointer.

The cam is then in the correct position for adjusting the cam slide operating that exhaust valve. (See under "Adjustment of Cam Slide.")

ADJUSTMENT OF CAM SLIDE

When the cam is in the proper position (see under "Positions of Cams for Adjustment of Cam Slides"), the clearance between the end of the valve stem "A," Fig. 25, and the adjusting screw "B" in the cam slide "D" should be from .002 inch to .003 inch when the engine is cold.

To adjust a cam slide, loosen the locking nut "C" and turn the adjusting screw "B."

Tighten the locking nut "C" when the proper clearance has been obtained, taking care that in so doing the adjustment of the screw "B" is not disturbed.

Remove the valve.

GRINDING VALVES

It is a good plan to wrap soft string around the stem of the valve near the head. This will tend to prevent the grinding compound getting into the valve guide.

In the absence of a good prepared grinding compound, make a paste of powdered glass or flour of emery, mixed with thin oil.

Place the grinding compound on that portion of the valve which bears on the valve seat. Then replace the valve, and with a screw driver, or other suitable tool, rotate it back and forth about one-third revolution, with only a slight pressure on the tool. Lift the valve occasionally and turn it to a new position. Continue the grinding operation only until the valve and its seat show perfect bearing.

Then thoroughly wash the valve, the valve chamber and the valve guide with kerosene or gasoline. Be very careful to leave none of the grinding compound in any part of the cylinder, as it will cause serious damage if it works into the cylinder bore or other parts of the engine; also remove the string from the valve-stem. Replace the valve.

After replacing the valve, retime it. (See under "Adjustment of Cam slide.") Retiming is necessary as the amount of clearance between the valve and the adjusting screw in the cam slide is necessarily reduced during the grinding operation.

ENGINE CHAINS

The camshaft is driven from the crankshaft and the fanshaft is driven from the camshaft by silent chains.

TO REMOVE CAMSHAFT DRIVING CHAIN

Remove the headlights and the radiator.

Remove the fan.

Remove the elbows attached to the sides of the oil pump, directly under the starting crankshaft.

Remove the cap from front engine support.

Remove the front splash pan.

Remove the four forward screws on each side of the engine base, holding the side splash shield. (It is not necessary to take the shield entirely off.)

Remove the bolts connecting the exhaust pipes to the manifolds on the engine.

Block the car so it will not roll on the floor.

Carefully jack up the front end of the engine.

Disconnect the pipe at the air pump.

Remove the cap screws holding the front cover plate to the crankcase of the engine.

Draw the threaded dowel pins.

Remove the front cover.

Cut off the riveted head of one of the seat pins on the camshaft driving chain and remove the seat pin and rocker pin.

Remove the camshaft driving chain.

TO REMOVE FANSHAFT DRIVING CHAIN

To remove the fanshaft driving chain the camshaft chain must first be removed. (See page 57.)

Cut off the riveted head of one of the seat pins on the fanshaft driving chain and remove the seat pin and rocker pin.

Remove the fanshaft driving chain.

TO REPLACE FANSHAFT DRIVING CHAIN

Place the chain on the fanshaft and camshaft driving sprockets with the arrows, which are stamped on the outside links, pointing in the direction in which the chain is to run. If the chain is so placed on the sprockets that it runs in the opposite direction, **it will very quickly destroy itself.**

Bring the ends of the chain together, preferably on the larger sprocket. Insert pins and rivet. (See under "Directions for Riveting Engine Chains," page 59.)

It is unnecessary when installing a fanshaft driving chain to pay any attention to the relative positions of the sprockets upon which the chain operates, but the ignition must be re-timed after both chains have been replaced. (See under "To Time Ignition," page 67.)

TO REPLACE CAMSHAFT DRIVING CHAIN

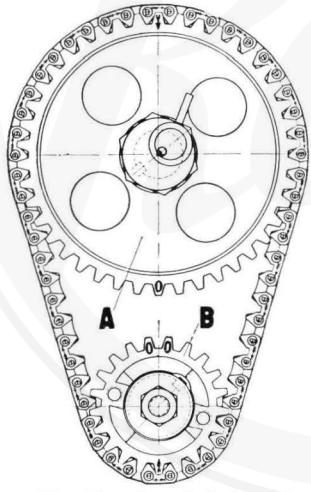

Fig. 26. Crankshaft and Camshaft Sprockets with Chain.

If the fanshaft driving chain has been removed, it will be necessary to replace it before replacing the camshaft driving chain. (See above under "To Replace Fanshaft Driving Chain.")

In replacing the camshaft driving chain care must be used to see that the chain is so placed on the sprockets that the valve timing is correct.

One tooth of the camshaft driven sprocket "A," Fig. 26, is marked with an arrow and the tooth diametrically opposite with an "O." A tooth on the crankshaft sprocket "B" has a similar arrow upon it and the two teeth opposite each have an "O" mark.

Turn the camshaft and crankshaft to bring the sprockets into the positions shown (Fig. 26). The arrows on the two sprockets must point towards each other and the tooth of the camshaft sprocket marked "O" must be directly opposite the space between the two similarly marked teeth on the crankshaft sprocket.

Without turning either of the sprockets, place the chain on the sprockets with the arrows, which are stamped on the outside links, pointing in the direction in which the chain is to run. If the chain is so placed on the sprockets that it runs in the opposite direction, **it will very quickly destroy itself.**

Bring the ends of the chain together, preferably on the larger sprocket. Insert pins and rivet. (See below.)

DIRECTIONS FOR RIVETING ENGINE CHAINS

Each joint of the chain contains two pins, as shown in Fig. 27; a seat pin "A," which is ribbed, and a rocker pin "B," which is plain. If a chain is removed, be very sure in replacing it that the joint pins are inserted as shown.

Bring the ends of the chains together on the larger sprockets. (See under "To Replace Camshaft Driving Chain" and "To Replace Fanshaft Driving Chain," page 58.) Insert the rocker pin and a used or extra seat pin to align the links. Clamp the new seat pin in a vise and rivet the small washer "C" on one end.

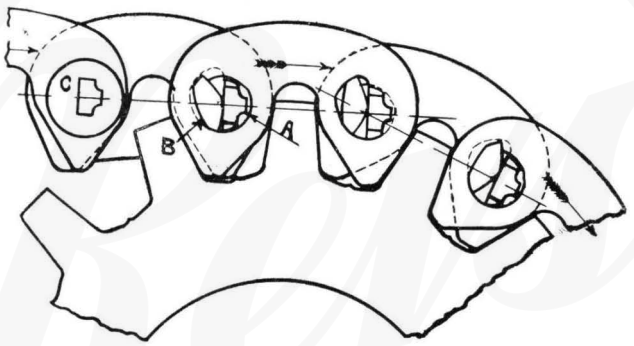

Fig. 27. Correct Positions of Rocker and Seat Pins in Riveting Chains.

Force the used seat pin out by inserting the new seat pin. Insert the new seat pin from the rear. In doing so be careful not to force out the rocker pin. Be sure to recover the used seat pin so that it will not get into the mechanism of the engine.

After the new seat pin is in place turn the engine so that the connection is mid-way between the sprockets. Then insert a riveting block between the crank case wall and the inner end of the seat pin to be riveted, place the small washer on the end of the seat pin and carefully peen over the end of the pin.

Remove the riveting block.

If, in installing a chain the rocker pin is inserted backwards it will cause a knock on the small sprocket which will quickly destroy the chain.

It is absolutely essential that the joint pins be assembled correctly if the chain is to live and give quiet and satisfactory service.

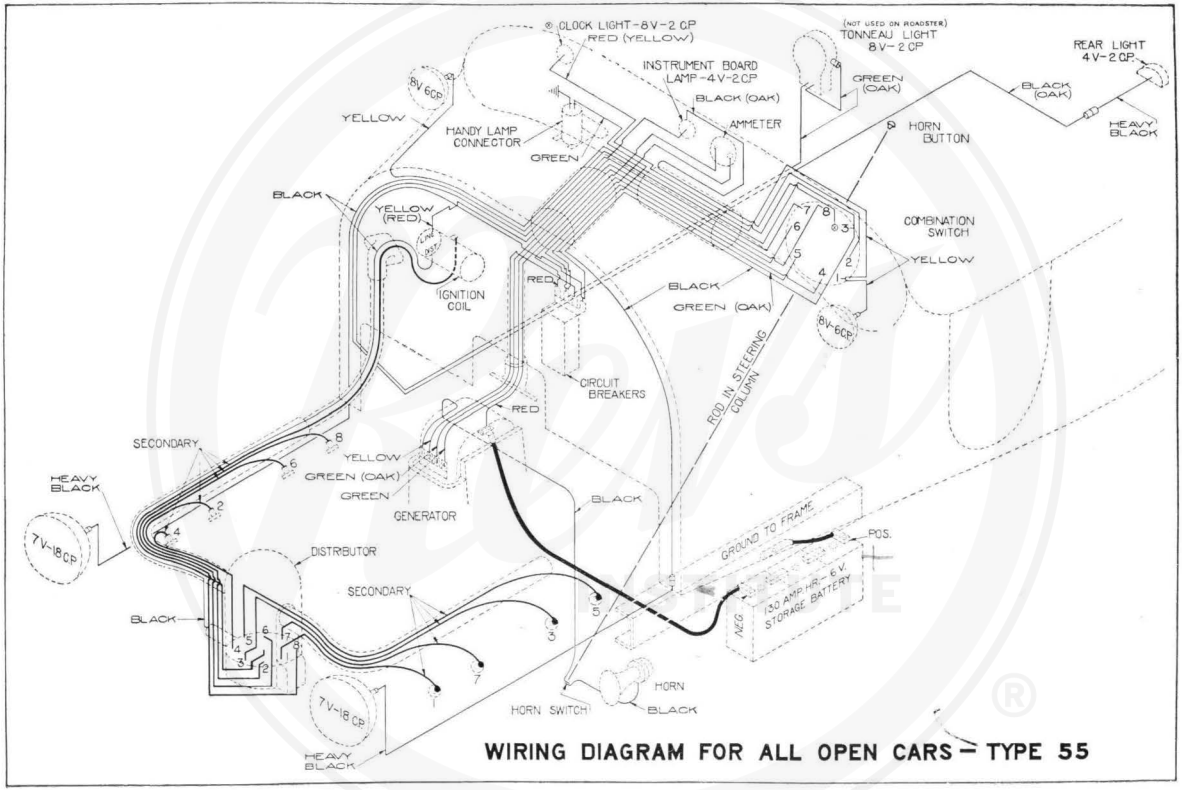

Fig. 28. Wiring Diagram.

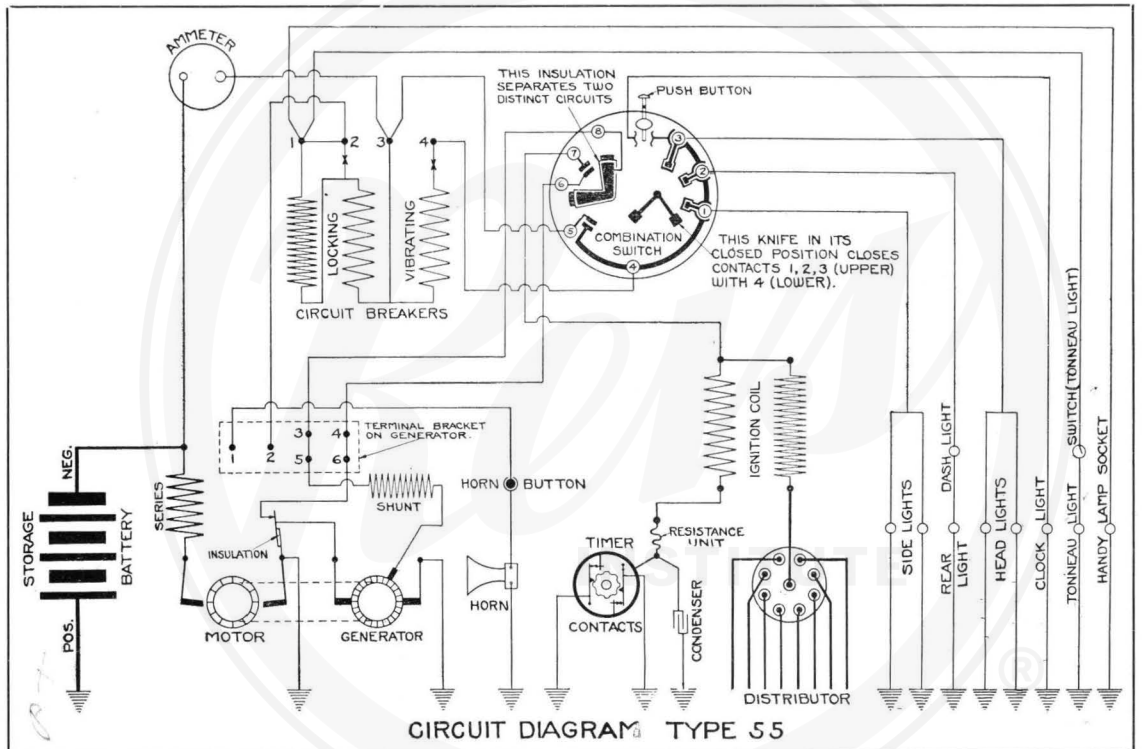

Fig. 29. Circuit Diagram.

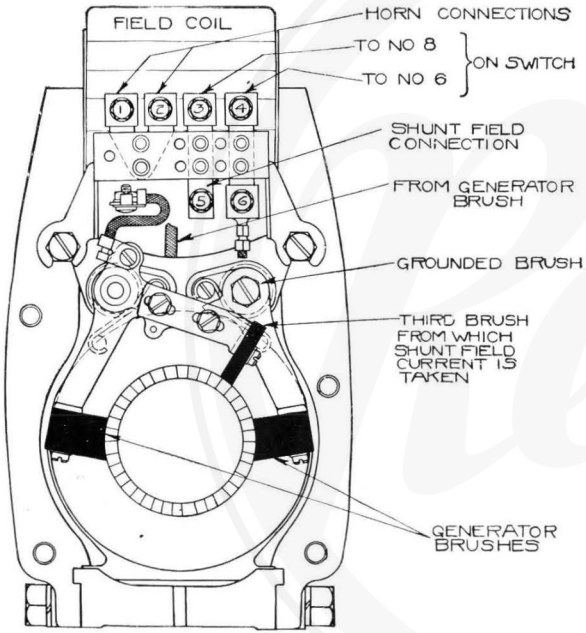

Fig. 30. Motor Generator, Front View.

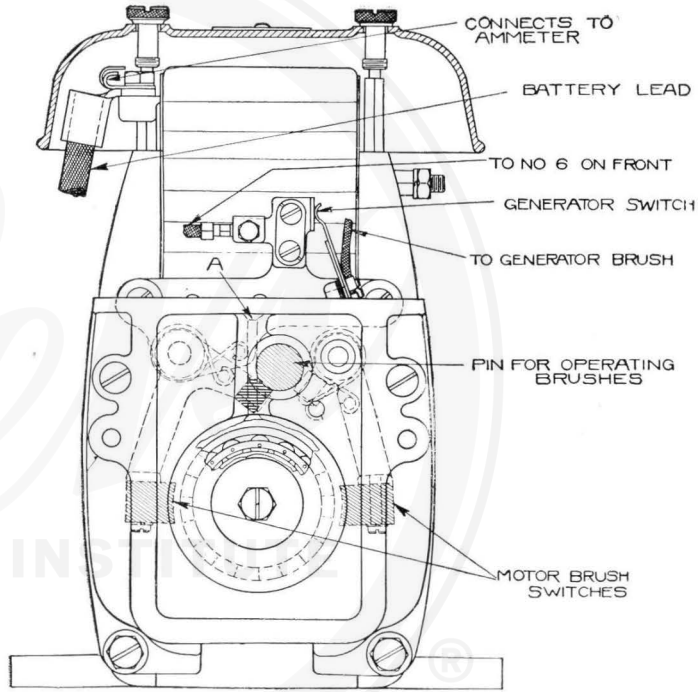

Fig. 31. Motor Generator, Rear View.

CADILLAC-DELCO ELECTRICAL SYSTEM

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 on the field are used when the motor generator is used as a generator and the other windings when it is used as a motor.

The motor generator, when acting as a generator, is driven at engine speeds by the fan shaft which in turn is driven by a silent chain from the cam shaft at the front end of the engine. Thus driven, it delivers electrical energy for charging the storage battery and for operating the lights, ignition apparatus and horn. To prevent the voltage of the current generated from rising too high when the engine is running at high speeds, the third brush system of current regulation is employed.

When acting as a motor the sole function of the motor generator is to crank the engine. In starting, the first thing the operator does is to push down the ignition lever on the combination switch. This closes the ignition circuit and the circuit between the storage battery and the generator windings on the motor generator causing the armature to revolve slowly.

A ratchet clutch in the front end of the generator allows the armature to rotate ahead of the driving shaft. The clicking noise that is heard when the ignition switch is turned on comes from this clutch.

Next the operator pushes down the starter button. The first movement causes the starter gears to mesh with the teeth on the fly-wheel. The probability of the ends of the teeth striking and failing to mesh is overcome by the slow rotation of the armature which began as soon as the ignition was turned on.

As the starter button is pushed further down the current between the storage battery and the generator windings of the motor generator is broken. Upon the last movement of the starter button the circuit is closed between the storage battery and the motor windings on the motor generator causing it to act as a powerful electric motor which rapidly cranks the engine.

As the gear ratio between the armature shaft and the crank shaft is approximately 25 to 1 the armature would be driven at an excessively high rate of speed after starting the engine and before the operator let the starter button back if it were not for an over-running clutch in the hub of the idler gears between the fly-wheel and the armature shaft. The electric motor cranks the engine through this clutch but after the engine has started and begins to run faster than the electric motor, the clutch slips.

When the starter button is let up, as soon as the engine is running under its own power, the first movement of the button breaks the circuit between the electric motor and the storage battery, a further movement causes the starter gears to slide out of mesh and the final movement completes the circuit between the generator and the storage battery, which was broken when the starter button was pushed down. The engine running and the circuit being closed between the storage battery and the generator windings of the motor generator, the generation of current begins.

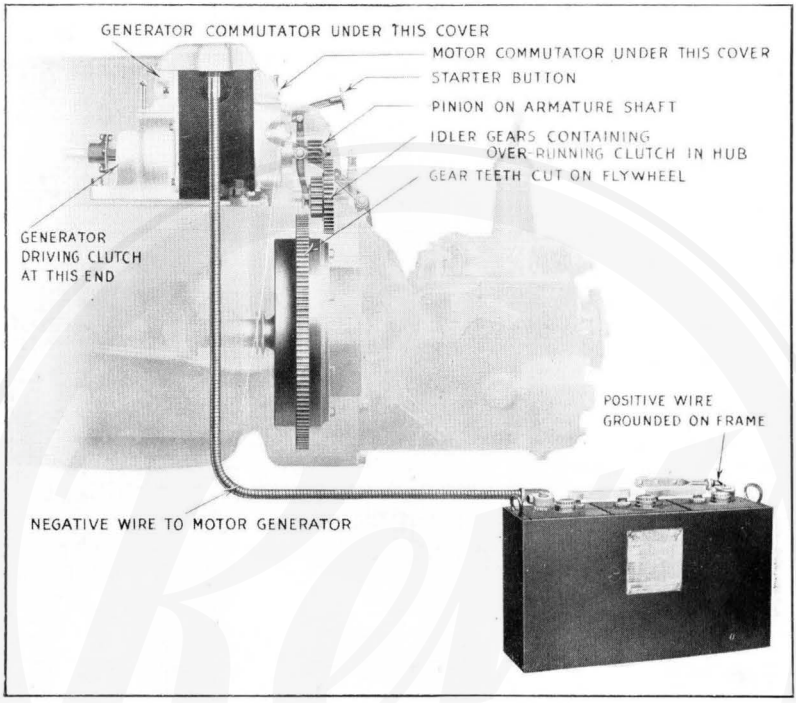

Fig. 32. Motor Generator and Starting Mechanism.

COMMUTATORS

Do not under any condition put oil of any kind on the commutators of the motor generator.

IGNITION AND LIGHTING SWITCH

This switch makes the necessary connections for ignition and for all lights. In addition, the ignition switch lever controls a switch in the circuit between the generator and the storage battery. This circuit is closed when the ignition switch is on, thus allowing current to flow from the storage battery to the generator and causing the armature to rotate slowly. This facilitates the meshing of the starter gears. After the engine is started and the generator is driven by the engine the circuit remains closed, thus allowing current to flow from the generator to the storage battery for charging.

LAMPS

LAMP BULBS

We recommend that you purchase bulbs from a Cadillac dealer.

In any event you should use bulbs having the correct voltage and candle power. (See wiring diagram, Fig. 28.)

CLOCK LIGHT SWITCH

The light on the instrument board for illuminating the dial of the clock is controlled by a separate push button switch located at the top of the ignition and lighting switch. To turn on the light pull out on the switch button. To extinguish the light, push in.

SOCKET FOR PORTABLE LAMP

A socket for the portable lamp is attached to the back of the instrument board just to the right of the hand air pump.

TO FOCUS HEAD LAMPS

The adjustment for focusing the headlamp bulbs is near the top of the lamps and is accessible after removing the lamp door.

To make the adjustment, run the car head on towards, and at right angles to, a high fence or building, and stop when within from fifteen to twenty feet from it. Then throw the adjustment back and forth until the bulb is in the proper position.

If in turning the screw to the right, the rays of light appear to spread out, it indicates that the bulb is too far back in the reflector and that it should be brought forward. To do this, turn the adjusting screw to the left until the proper rays are shown.

If the adjusting screw be turned to the left and the rays appear to spread out, it indicates that the bulb is too far forward and it should be brought back. To do this, turn the adjusting screw to the right until the proper rays are shown.

TO CLEAN THE REFLECTORS OF THE HEAD AND SIDE LAMPS

The reflectors in these lamps are plated with pure silver. In polishing extreme care must be used in selecting materials which will not scratch the silver.

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

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

DISTRIBUTOR AND TIMER

The distributor and timer (Fig. 33) are carried on the fan shaft housing, and are driven through a set of spiral gears attached to the fan shaft. The distributor consists of a cap or head of insulating material, carrying one contact in the center with eight additional contacts placed at equal distances about the center and a rotor which maintains constant communication with the center contact.

The rotor carries a contact button which serves to close the secondary circuit to the spark plug in the proper cylinder.

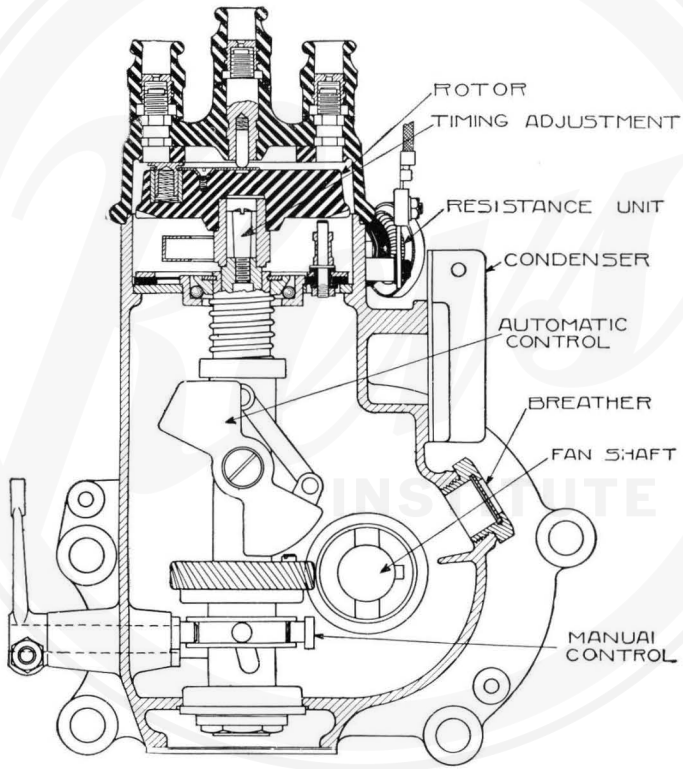

Fig. 33. Distributor and Timer, Sectional View.

Beneath the distributor head and rotor is the timer. The timer cam is provided with a lock screw in the center of the shaft. (See Fig. 34.)

An 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. (See under "Manual Spark Control," page 22.)

TIMER CONTACT POINTS

The distributor head is protected by an aluminum cap, to which are attached the conduits which carry the high tension wires to the spark plugs. The timer contact points are accessible after removing the aluminum cap, the distributor head and the rotor. To do this proceed as follows:

Remove the screws holding the high tension conduit brackets to the aluminum cap. Slip the bail on the cap to one side and remove the cap. Press back the finger of the clip on the left side of the distributor head and rotate the head until both clips are opposite the flat places on the head. Then lift the head straight up. Remove the rotor by carefully lifting it straight up. The contact points are then accessible, appearing as shown in Fig. 34.

Two sets of timer contact points are provided. The object is to distribute over two sets of points the current which would otherwise pass through one. This greatly lessens wear and burning of the points.

TO SET CONTACT POINTS

To set contact points proceed as follows:

Turn the engine over until the contact arms "D" and "C" are directly on top of lobes of the cam "B." Then adjust the contact points at "E" and "F" so that they stand twenty thousandths of an inch apart on a new car and fifteen thousandths if the car has been run more than 2000 miles.

Both sets of contact points should be adjusted exactly alike.

Do not file or grind the contact points. To clean the points remove them and simply rub them over an oil stone two or three times. Then replace and adjust, following instructions given.

It is a good plan after adjusting the timer contact points to check the ignition timing. See below under "To Time Ignition."

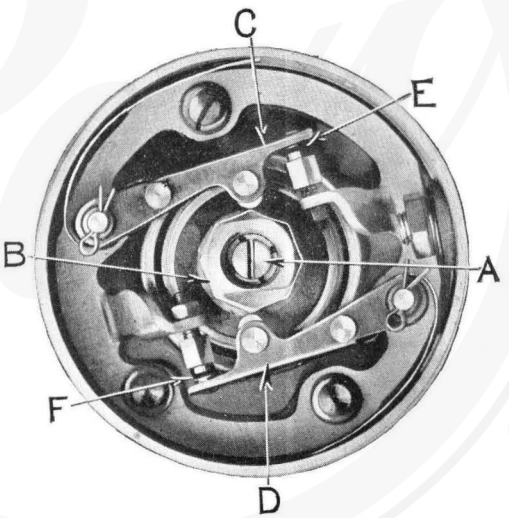

Fig. 34. Timer Contacts, Distributor Cap and Rotor Removed.

TO TIME IGNITION

Unless the timer contact points are in proper adjustment they should be re-adjusted before proceeding to time the ignition.

To time the ignition proceed as follows:

Move the spark lever to the extreme left on the sector; open the compression relief cocks on the cylinder blocks, and crank the engine by hand until the piston in No. 1 cylinder is on firing center. (No. 1 cylinder is the one nearest the radiator in the left hand block of cylinders.)

Next remove the distributor cap and head; also the rotor, and loosen the lock screw "A" just enough to allow the cam "B" to be turned by hand after the rotor is fitted. (The lock screw should not be loosened enough to allow the cam to turn on the shaft when the engine is cranked by hand.)

Then replace the rotor and turn it by hand until the distributor brush in the rotor is directly under the terminal marked No. 1 on the distributor head.

Replace the distributor head, and move the spark lever to the extreme right on the sector.

Then switch on ignition; hold the high tension wire to the spark plug in No. 1 cylinder about one-eighth of an inch away from the cylinder casting and turn the engine slowly by hand in the direction in which it runs. Stop turning immediately a spark occurs between the wire and the casting. (It will be necessary to turn the engine nearly two complete revolutions before the spark occurs.)

If the cam "B" is properly set a spark will occur when a point on the fly wheel one and twenty-one thirty seconds inches in advance of the center line for No. 1 cylinder is directly under the pointer attached to the crank-case of the engine. This point for each cylinder is marked on the fly-wheel by the letters "IG|A." (See Fig. 35.)

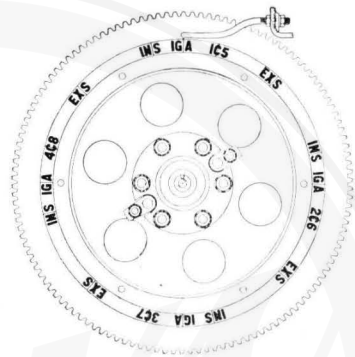

Fig. 35. Flywheel, Showing Timing Marks.

If the spark occurs before this, rotate the cam "B" slightly in a counter clockwise direction to correct the adjustment. If a spark occurs later than this, rotate the cam slightly in a clockwise direction.

After the adjustment has been properly made, lock the cam securely to the distributor shaft by the lock screw "A."

After locking the adjustment it is a good plan to check the timing by fully retarding the spark lever; in other words moving it to the extreme left on the sector, holding the high tension wire to the spark plug in No. 1 cylinder about one-eighth of an inch away from the cylinder casting, and again turning the engine slowly by hand in the direction in which it runs, stopping immediately a spark occurs.

If the ignition is properly set the spark will occur under these conditions when the center line on the fly wheel for No. 1 cylinder is directly under the pointer attached to the crankcase, or has passed the pointer.

Caution—Do not set the ignition so that the spark occurs before center with the spark lever at the extreme left on the sector.

RESISTANCE UNIT

The resistance unit is a coil of resistance wire wound on a porcelain spool as shown in Fig. 33. Under ordinary conditions it remains cool and offers little resistance to the passage of current. If for any reason the ignition circuit remains closed for any considerable length of time with the engine not running, the current passing through the coil heats the resistance wire, increasing its resistance to a point where very little current passes, and insuring against a waste of current from the battery and damage to the ignition coil and timer contacts.

IGNITION COIL

The ignition coil is mounted on the inner face of the dash.

It serves to transform the low voltage current in the primary circuit to a current of high voltage in the secondary circuit. The coil consists of a primary winding of coarse wire wound around an iron core in comparatively few turns, and a secondary winding of many turns of fine wire, also the necessary insulation and terminals for wiring connections. No attention is necessary except occasional inspections to insure that there are good connections between the wires and terminals.

SPARK PLUGS

Spark plugs should be kept clean. When carbon or soot is permitted to collect on them, it causes a short circuiting of the current and prevents the proper ignition of the charge in the cylinder. A good method of cleaning plugs is to wash them in alcohol.

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

If the points are too close together, the engine will miss under a light load and when idling. If the points are too far apart, it will miss under heavy loads, and when the throttle is opened quickly for acceleration.

CIRCUIT BREAKERS

The circuit breakers are mounted on the inner face of the dash. These are protective devices which take the place of fuses.

The circuit breakers prevent the discharging of the storage battery, damage to the wiring to the horn, lights and the ignition apparatus, or to any of these parts in case any of the circuits to or in these parts become grounded.

As long as only a normal amount of current is used for horn, lights and ignition the circuit breakers will not open. In the event of a ground, an abnormally heavy current is conducted through one of the circuit breakers thus producing strong magnetism which attracts the armature and opens the contact. This cuts the flow of current.

The circuit breaker protecting the horn, handy lamp and tonneau lamp circuit is known as a lockout circuit breaker. In case of a ground in any of these circuits, the breaker opens and remains open until the ground is removed.

The circuit to the ignition apparatus and remainder of the lights is protected by a vibrating circuit breaker. In case of a ground in any of the circuits protected by the vibrating circuit breaker, the breaker will start to vibrate and will continue to vibrate until the ground is removed.

AMMETER

When the car is standing with lights turned on, the ammeter, which is located on the instrument board, indicates on the "Discharge" side of the dial the amount of current being drawn from the storage battery for this purpose. When the ignition switch is turned on the ammeter indicates, in addition, the current used in slowly rotating the armature of the motor generator. When the starter button is pushed down current is no longer required for slowly rotating the armature of the motor generator. The ammeter then indicates only the current used for the ignition and lights (if turned on). The ammeter does not indicate the amount of current used in the cranking operation.

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

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

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

REGULATION OF CURRENT GENERATED

The generating capacity of the generator is regulated by means of a third brush on the generator commutator. (See Fig. 30.) The position of this brush relative to the other two generator brushes determines the maximum output of the generator, the length of the brush arm being adjustable. The brush arm is properly adjusted when the car is assembled and should not require readjustment unless its position is altered. To determine whether readjustment is necessary proceed as follows:

Start the engine in the usual manner. With all the lights turned off slowly increase the speed of the engine by means of the hand throttle lever, meanwhile observing the hand of the ammeter on the instrument board. **(Do not race the engine.** There is no worse abuse and it is unnecessary in this adjustment to run the engine faster than 1500 revolutions per minute.) The current indicated by the ammeter will increase with the speed of the engine to a point between 950 and 1200 revolutions per minute, and will then decrease. If the amount of current indicated by the ammeter at the maximum point is greater than 18 amperes, stop the engine and readjust the third brush as follows:

Remove the generator front end top cover. Loosen the two screws which hold together the two parts of the third brush arm and shorten the brush arm. After moving the third brush to an approximately correct position, press the brush down so that it makes even contact with the commutator, and hold it down while tightening the screws in the brush arm. The purpose of this is to have the curvature of the end of the brush conform as closely as possible to that of the commutator.

After setting the third brush, sand it in with a strip of No. 00 (fine) sandpaper slightly wider than the brush. Pass one end of the strip of sandpaper down between the right hand side of the front casing of the generator and the pin on which the third brush arm pivots, then over to the left and between the third brush and the commutator. The sand side of the sandpaper should be up. Then pressing down firmly on the third brush, draw the sandpaper from under the brush by pulling on the free end of the sandpaper. Repeat this operation until there is even contact between the brush and commutator. Usually five or six times will be sufficient.

Start the engine. Again slowly accelerate the engine and check the maximum current. If it is still greater than 18 amperes, reset the third brush and sand it in again.

If the maximum current indicated by the ammeter is less than 18 amperes and the specific gravity of the battery repeatedly shows that the battery is not being properly charged, lengthen the brush arm. Do not, however, lengthen the brush arm unless the condition of the battery makes it necessary and under no circumstances adjust it so that the ammeter indicates a maximum current of more than 18 amperes with all lights turned off. A greater amount of current may result in serious injury to the motor generator.

STORAGE BATTERY

The storage battery consists of three cells, each containing thirteen plates—six positive and seven negative—contained in a wooden box, which 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 unscrewing the two nickle-plated, knurled thumb nuts.

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

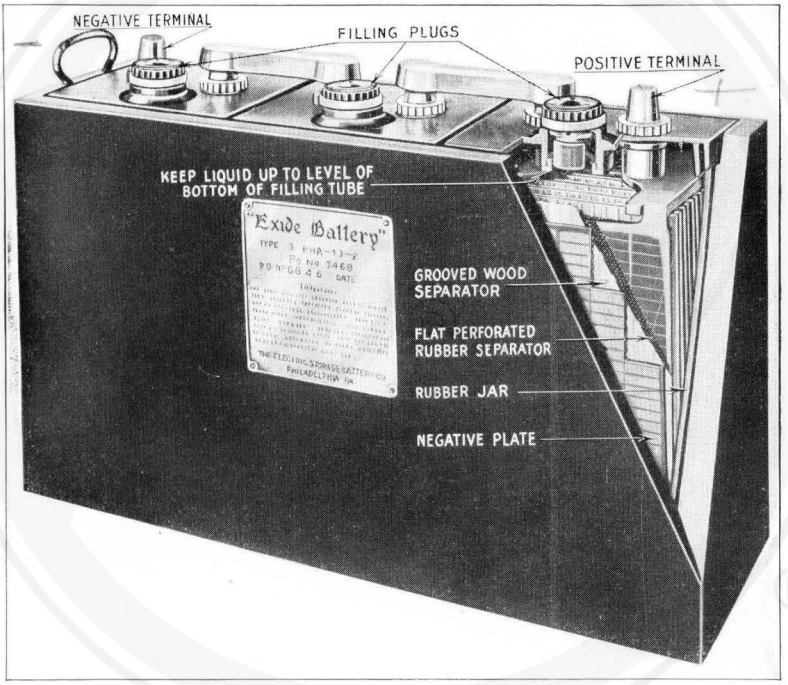

Fig. 36. Storage Battery, Sectional View.

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

Caution:—Never run the engine with the storage battery disconnected or while it is off the car. Very serious damage to the motor generator may result from such action. 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.

ADDING WATER

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 frequently enough to keep the level up to this point. **Do not add acid.** Ordinarily water should be added every 500 miles, but it should be added more frequently if found necessary. Usually it will require only a teaspoonful or so of water; 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, hold it so that the large arrow is perpendicular to the center line of the car, set the plug in place and turn it in the clockwise direction until tight.

If a plug is left out or is loose, the acid solution will escape from the cell, especially when the battery is being charged. If a plug is lost or broken, you should 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 immediately be replaced by a new one.

WATER FOR STORAGE BATTERY

The 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.

TO REPLACE ACID LOST BY SPILLING

If any of the acid solution has been spilled or has leaked from a cell, replace the loss with freshly mixed solution and follow with an overcharge by running the engine for several hours or by charging the battery from an outside source. (See Fig. 38. Also see under "Personal Danger in Running Engine in Closed Garage," page 49.)

The specific gravity of the acid solution used for replacing the loss should be the same as that of an adjacent cell. This can be determined by the use of an hydrometer syringe (Fig. 37).

The acid solution may be prepared by mixing chemically pure sulphuric acid, which has a specific gravity of 1.840, and distilled water. The proportion for an acid solution having a specific gravity of 1.280 is one part of chemically pure acid and three parts (by volume) of distilled water. **The acid must always be poured slowly into the water. Do not pour the water into the chemically pure acid.**

If, after mixing the acid solution as described above, a solution of a lower specific gravity is desired, it may be prepared by adding additional water to the mixture. But do not under any conditions pour water into the chemically pure acid.

A glass, earthenware or other acid-proof vessel, should be used for mixing. After mixing, the acid solution should be allowed to cool thoroughly before using.

HYDROMETER SYRINGE

An hydrometer is an instrument for testing the specific gravity of a liquid. An hydrometer syringe is an 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" service station.

DIRECTIONS FOR USING

After removing the filling plug from the cover of the cell, compress the rubber bulb of the syringe and insert the pipette in the solution of the cell to be tested. Holding the instrument as nearly vertical as possible, gradually lessen the pressure on the bulb until acid solution rising in the barrel causes the hydrometer to float. In general, only enough acid solution should be drawn to float the hydrometer free of the bottom by about one-half to three quarters of an inch. The specific gravity reading is taken on the hydrometer at the surface of the acid solution in the glass barrel.

Fig. 37. Hydrometer Syringe.

If the acid solution is below the top of the plates, or so low that enough cannot be drawn into the barrel to allow of a proper reading of the hydrometer, fill the cell to the proper level (see Fig. 36) by adding pure water, then do not take a reading until the water has been thoroughly mixed with the acid solution. This can be accomplished by running the engine for several hours.

CHARGING FROM AN OUTSIDE SOURCE

(Battery Removed From the Car.)

It is necessary that the charging be done with **direct current.** The simplest method when there is 110 or 120 volt direct current available, is to connect eight 110 volt, 32 candlepower, 100 watt carbon lamps in parallel with each other and in series with the battery to be charged, this combination giving approximately the proper charging rate—8 amperes. The positive terminal of the battery must be connected to the positive side of the charging circuit, and the negative terminal to the negative side. **Very serious injury to the battery will result if connected in the reverse direction.** The terminals of the battery are stamped "Pos." and "Neg."

To determine the polarity of the charging circuit, if a suitable voltmeter is not at hand, dip the ends of the two wires "A" and "B" (Fig. 38) into a glass of water in which a teaspoonful of salt has been dissolved, care being taken to keep the wires at least an inch apart. When the current is turned on, fine bubbles of gas will be given off from the negative wire.

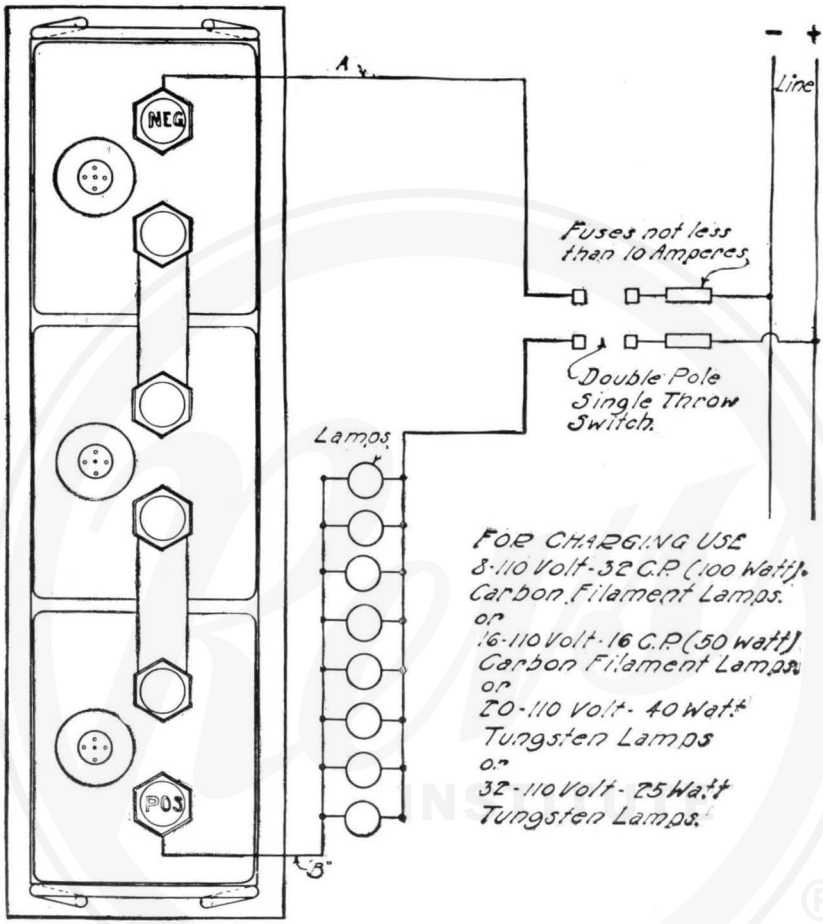

Fig. 38. Diagram of Connections for Charging Battery from 110 Volt D. C. Circuit.

The diagram (Fig. 38) illustrates just how the connection should be made. The charge should be continued until all the cells have been "gassing" or bubbling freely for five hours, and there is no further rise in the voltage of the battery or specific gravity of the acid solution over the same period. A battery in good condition in a discharged state will require about ten hours of re-charging. If it has stood in a discharged condition for several weeks, it will require from twenty-five to fifty hours' charging—all depending upon the condition of the battery and the length of time it has stood discharged.

If only alternating current is available, a current rectifier must be used. Consult your city electrician regarding this matter.

Caution—Never run the engine with the storage battery disconnected, or while it is off the car. Very serious damage to the motor generator may result from such action.

PREPARING THE 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," page 72.) If water is added it should be added just before the last time the car is used so that it will be thoroughly mixed with the acid solution. When the car is stored, the specific gravity of the acid solution should register from 1.270 to 1.290. In this condition there is no danger of the acid solution freezing. 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, either by running the engine or charging from an outside source (Fig. 38). If either of 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.

PUTTING THE BATTERY INTO SERVICE AGAIN

Before putting the battery into service again, inspect and add water, if necessary. In placing the battery on the car, care should be taken not to tighten the hold down bolts too tight. If the battery has not been kept charged during the winter, it will be advisable to give it a fifty-hour charge at a four-ampere rate from an outside source before putting it into service again. Make sure that the terminals are free from corrosion and that good connections of the wires are made.

The corrosion, which is a greenish deposit, can be removed from the bolts and terminals by placing them in a solution of water and bicarbonate of soda (cooking soda).

The corrosion can be removed from the posts by saturating a piece of cloth with the solution and wiping them off. Do not allow any of the solution to get into the cells of the battery.

After the parts are free from corrosion they should be washed in warm water, and a light coat of heavy grease or vaseline applied.

If the battery has received periodic charges, it will not be necessary to give it any special attention other than to fill it to the proper height with distilled water. After the car has been driven for a number of hours, read the specific gravity of the acid solution with the hydrometer syringe. It should register from 1.270 to 1.290 if the battery is fully charged.

SEDIMENT

The sediment which gradually accumulates in the bottom of the jars, should be removed before it reaches the bottom of the plates, as it is very harmful to the battery. The need of cleaning may be determined by inspection. Its necessity is indicated by lack of capacity, excessive evaporation of the acid solution and excessive heating when charging. When a battery requires removal of sediment, better results follow if the work is done at a place where they are thoroughly familiar with storage battery practice. If a battery is in need of cleaning or repairs, it is best to communicate with a Cadillac dealer or with the nearest Exide Depot, who will advise you where to ship the battery. **Do not ship batteries without receiving instructions.**

EXIDE BATTERY DEPOTS AND SALES OFFICES

The Electric Storage Battery Company, whose general offices and works are at Alleghany Avenue and 19th Street, Philadelphia, Pa., has service 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 depot or service station write the local Cadillac dealer or, if preferred, the Electric Storage Battery Company, at Philadelphia.

STEERING GEAR

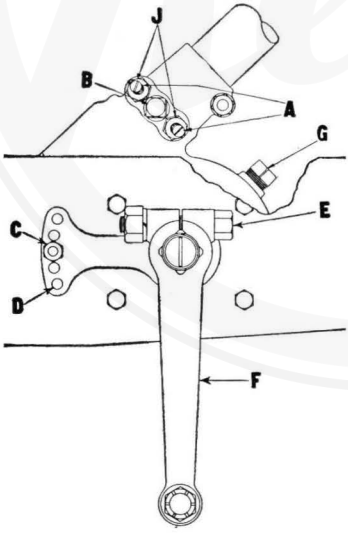

Fig. 39. Steering Gear Housing and Arm.

The internal mechanism of the steering gear may be lubricated at "B" and "G," Fig. 39, after taking out the screw plugs. Cadillac Steering Gear Grease is a good lubricant for this part.

Two principal adjustments are provided. The first is to take up the end play in the worm "K" (Fig. 40). When this occurs, loosen the jamb nuts "J" (Fig. 39) and lock screws "A." Then with a screwdriver or something else suitable, screw down the adjusting collar "L" (Fig. 40), which can be seen through the hole from which the plug "B" (Fig. 39) was removed, until the proper adjustment is made.

Lock screws "A" are positioned in the steering gear housing so that when one is directly over a slot in the adjusting collar the other is between two slots. Therefore after adjusting the collar it will be necessary to select the proper screw for locking the adjustment. Both lock screws should be held from turning by locking the jamb nuts.

The second adjustment is for taking up wear on the teeth of the worm "K" and sector "W," Fig. 40. The sector "W" has its bearing in an eccentric steel bushing and should wear occur, it may be taken up by turning this bushing so that it throws the sector towards the worm.

To do this proceed as follows: First turn the steering wheel so that the front wheels point straight ahead. Remove the locking screw "C," Fig. 39. As the bushing is assembled at the factory it is necessary to move the arm "D" down to tighten the adjustment.

If the wear on the teeth of the worm and sector is very great, it will be necessary to remove the steering arm "F" and to place the arm "D" in a different position on the hexagonal end of eccentric bushing in order to bring the arm "D" in position so that it can be locked by the screw "C."

After the adjustment is made properly be sure that the lock screw "C" is replaced and properly tightened.

An adjustment is provided on the inner face of the steering gear housing for taking up end-play in the sector shaft.

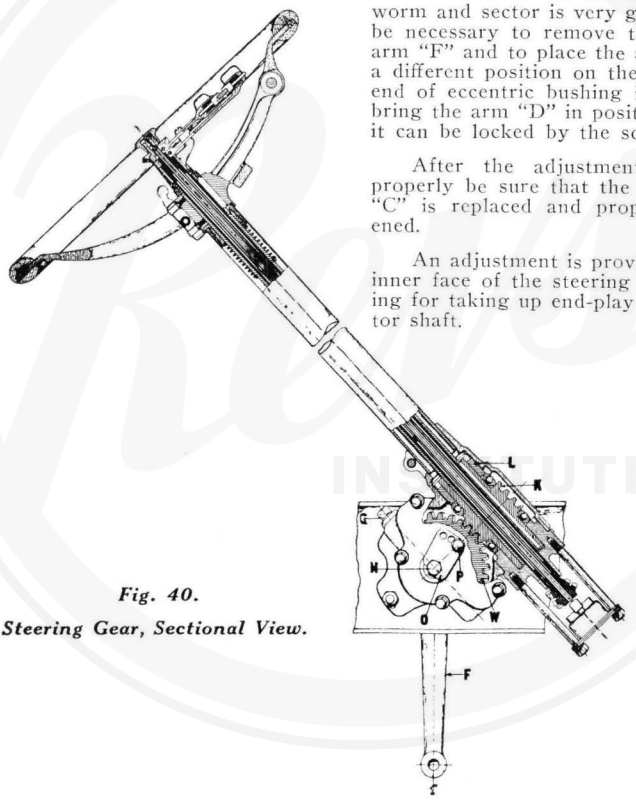

Fig. 40.
Steering Gear, Sectional View.

To make this adjustment remove the locking arm "O" (Fig. 40) and turn the adjusting screw in until the proper adjustment is made, after which the locking arm "O" should be replaced and the lock screw "P" replaced and tightened.

Do not turn the steering gear when the car is standing. This is not only unnecessary but is also bad practice.

MAIN CLUTCH

The main clutch is of the multiple disc dry plate type.

The eight driving discs "A," Fig. 41, are covered on both sides with a friction material, composed largely of asbestos, and are driven by gear teeth in the clutch ring "H" which is bolted to the engine fly-wheel "G."

The nine driven discs "B" are not covered. These discs are carried on the clutch hub "E" and drive it through six keys on the hub. The clutch hub is keyed to the transmission shaft "F."

When the clutch is engaged by allowing the clutch pedal to come towards you, the spring "C" forces all of the discs together. The resulting friction between the discs "A" and "B" drives the transmission shaft "F" and the car, when the transmission control lever is in other than the neutral position.

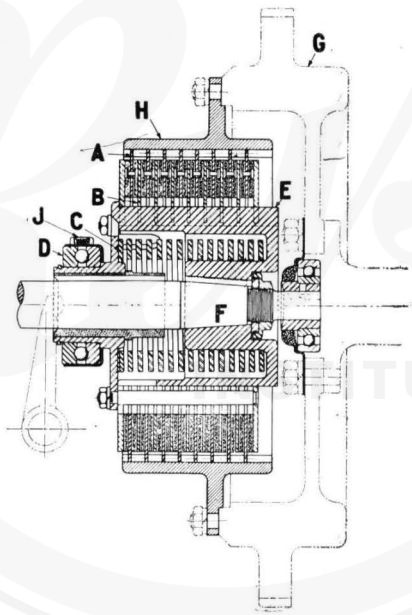

Fig. 41. Main Engine Clutch, Sectional View.

There are no adjustments on the clutch proper.

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

There is but one point on the clutch for lubrication. This is the clutch release ball race "D." Instructions for lubricating this part will be found under "General Lubrication" on page 43 in this book.

ADJUSTMENT OF CLUTCH PEDAL

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 "N," Fig. 42, and adjust the yoke "P," which is threaded on the rod "O," so that when the pin "N" 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 "N" with a cotter pin and tighten the lock nut "V."

ADJUSTMENT OF CLUTCH PEDAL STOP

The clutch pedal stop screw "S" is adjusted when the car is assembled and requires no further attention. If the adjustment has been changed, it may be readjusted in the following manner:

Remove the pin "N" from the yoke "P," loosen the lock nut "R" and adjust the stop screw "S" so that the pedal arm "U" is held one-half inch from the under side of the toe board at "T" when the pin "Y" is against the stop screw. Tighten the lock nut "R."

Then adjust the yoke "P" so that when the pin "N" 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 "N" with a cotter pin and tighten the lock nut "V."

TO SHORTEN OR LENGTHEN CLUTCH PEDAL

The clutch pedal is made in two parts slidingly adjustable to accommodate different drivers.

To change the length of the clutch pedal remove the bolts "K" and "L," Fig. 42, and slide the forked piece "M" in the desired direction. Do not pull "M" out so far that it is possible to put in only one bolt; two bolts are required properly to hold the parts.

There are four possible positions in this adjustment, Fig. 42 showing the extreme shortened position.

The brake pedal may be lengthened or shortened in the same manner.

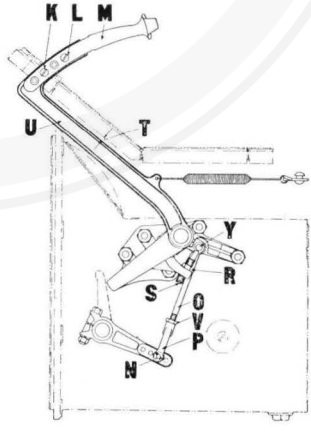

Fig. 42. Clutch Control.

TRANSMISSION

Keep sufficient oil in the transmission case to bring the level up to the overflow plug in the left side of the case. The best lubricant for the transmission is Cadillac Rear Axle and Transmission Lubricant. 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.

The transmission is the selective type of sliding gear. The main transmission driving shaft "D" (Fig. 43), also the jack shaft "N," revolve on ball bearings.

There are three forward speeds and one reverse. The speed changes are accomplished by means of a hand lever in the center of the car. The construction is such that a shift may be made from any gear to any other gear without "going through" a third.

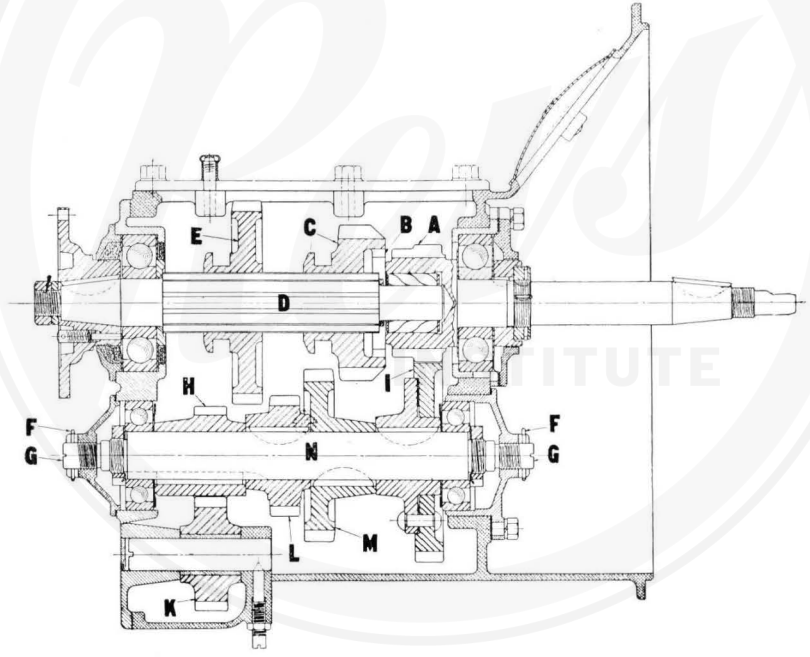

Fig. 43. Transmission, Sectional View.

The illustration shows the transmission in the neutral position. When the transmission is in this position the car will not be driven even with the main clutch engaged.

High gear is obtained by moving the transmission control lever so that the teeth at "B" interlock, thereby connecting the main transmission shaft to the shaft to which the main clutch is attached. The drive is then direct.

Intermediate gear is obtained by shifting the gear "C" into mesh with the gear "M."

Low gear is obtained by shifting the gear "E" into mesh with the gear "L."

Reverse gear is obtained by shifting the gear "E" into mesh with the gear "K." (In the illustration the gear "K" is misplaced in order that it may be shown.)

When stopping the car always be sure to shift the control lever to the neutral position.

ADJUSTMENT OF TRANSMISSION GEARS

The teeth of the transmission gears should mesh so that the sides of the two gears in mesh will be flush, or at least not to exceed 1/32" of being flush. These gears are not liable to require readjustment.

If for any reason it becomes necessary to alter the position of the gears in order to make them mesh properly, proceed as follows:

Move the control lever to the low gear position, being careful not to move it beyond the low gear position. Then loosen the lock nut "K" (Fig. 44) and turn the adjusting nut "L," thereby moving the shaft "M" endwise, until the sides of the teeth of the two gears in mesh are flush. Then tighten the lock nut "K."

If the transmission has been totally dis-assembled, the jack shaft "N," Fig. 43, should be positioned so that the sides of the teeth of the gear "A" are flush with the sides of the teeth of the gear "I" before the above adjustment is made. Adjusting screws "G" are provided by which the jack shaft may be positioned endwise. After making this adjustment a clearance of about ten thousandths of an inch should be left at each end between the end of the shaft and the adjusting screw.

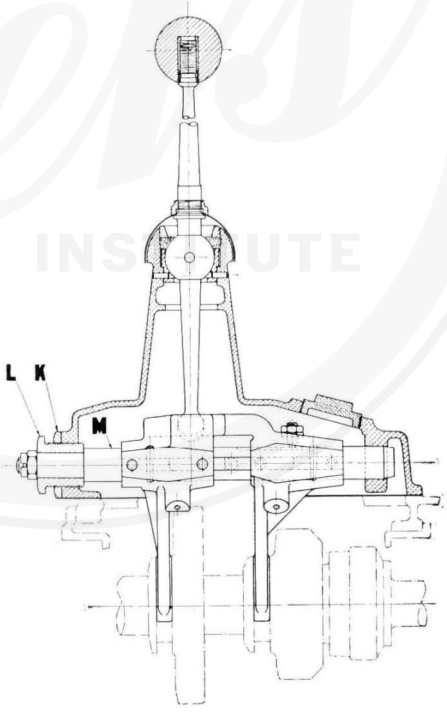

Fig. 44. Transmission Control.

AIR COMPRESSOR FOR TIRES

TO USE THE COMPRESSOR

The air compressor for the tires is bolted to the right hand side of the transmission case. It is driven by a sliding gear from the constant mesh gear on the jackshaft. The sliding gear may be thrown into or out of mesh with the transmission gear by a shaft extending up through the front floor boards at the right of and just ahead of the transmission control lever and hand brake lever. (See Fig. 1.) The head of this shaft has a screwdriver slot in order that it may be turned easily.

To use the compressor first attach the air hose to the air connection in the tool box concealed in the right hand dust shield. Then bring the compressor into operation. To do this proceed as follows:

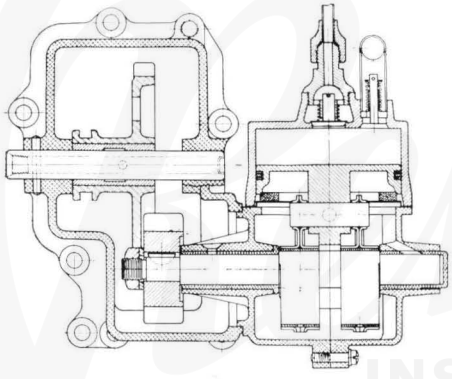

Fig. 45. Tire Air Compressor, Sectional View.

First either stop the engine or release the clutch and hold the clutch pedal down until you are sure that the transmission gears have ceased to rotate. Then, with the engine not running or with the clutch pedal still held down, turn the slotted head of the shaft in a clockwise direction as far as it will go. This will throw the sliding gear into mesh with the constant mesh gear on the jackshaft.

Then start the engine, or in case the engine is running, engage the main clutch, first being sure that the transmission control lever is in the neutral position.

The engine should be run at a speed between 400 and 500 R. P. M. when the compressor is in operation.

Do not turn the slotted head of the shaft to mesh the compressor gears when the engine is running and the clutch engaged. If this is attempted, it will probably result in stripping the compressor driving gears.

To throw the compressor driving gears out of mesh, turn the slotted head in a counter clockwise direction.

FOREIGN CARS

On foreign cars with right hand drive, the slotted head on the rod by which the air compressor gears are meshed is located to the left of the control lever and hand brake lever.

On these cars the slotted head must be turned in a counter clockwise direction to bring the compressor into operation and in a clockwise direction to stop it.

LUBRICATION OF TIRE AIR COMPRESSOR

Do not neglect the lubrication of the tire air compressor.

One filling of the compressor will provide sufficient lubrication for inflating six or eight tires, provided they are all inflated within one month. If a month or more elapses between the times the compressor is used it should be lubricated before it is used.

To lubricate the compressor proceed as follows: Lift the cap on the lubricator and with the oil gun furnished in the tool kit force in **Cadillac Rear Axle and Transmission Lubricant** until the level of the lubricant is even with the level hole in the front face of the crank case of the compressor. The level hole is opened by pushing down on the upper end of the small shutter.

UNIVERSAL JOINTS ON DRIVE SHAFT

The tubular drive shaft that transmits the power of the engine from the transmission to the rear axle is fitted with a Spicer universal joint at each end.

The purpose of the joints is to provide a flexible drive which is made necessary by the constantly changing alignment due to the play of the springs.

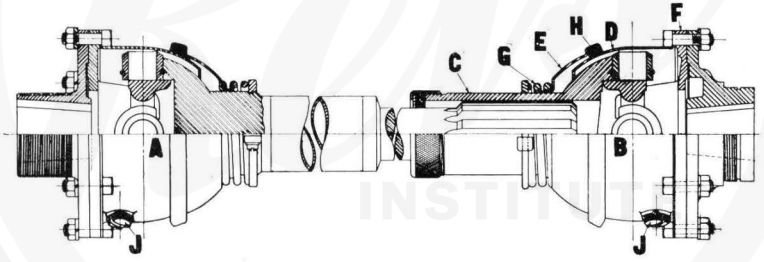

Fig. 46. Drive Shaft and Universal Joints.

The general arrangement of the joints is shown in Fig. 46. The joints "A" and "B" differ only in that joint "B," which is attached to the transmission shaft, is provided with a sliding connection or slip sleeve "C," while joint "A" is welded to the drive shaft. A sliding connection is necessary to take care of the endwise motion of the drive shaft due to variation in the distance between the transmission and the rear axle caused by the action of the springs.

The joints are protected by an inner housing "D" and an outer housing "E," both of pressed steel. The inner housing is bolted to the flange "F" and the outer housing fits over the end of the inner housing and is held in place and kept tight by means of a spring "G." The felt washer "H" is for the purpose of preventing grease from working out and dirt from getting in.

The joints are lubricated by grease contained in the housings. Filling holes "J" are provided. (See page 42 under "General Lubrication.")

As the construction of the joints is such that adjustments are unnecessary, no adjustments are provided.

If for any reason the drive shaft is dis-assembled, care should be taken in assembling it to have the "O" on the splined end of the shaft correspond with the "O" on the sleeve of the forward universal joint.

REAR AXLE

The rear axle of the Cadillac is of the full floating type. The wheels rotate on the axle housing. The axle shafts do not carry the weight of the car, but simply transmit the power from the differential to rotate the wheels.

The level of the oil in the differential housing should be up to the filling plug.

The best lubricant for the rear axle is Cadillac Rear Axle and Transmission Lubricant. 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.

TO REMOVE AND REPLACE REAR WHEEL AND ADJUST BEARINGS

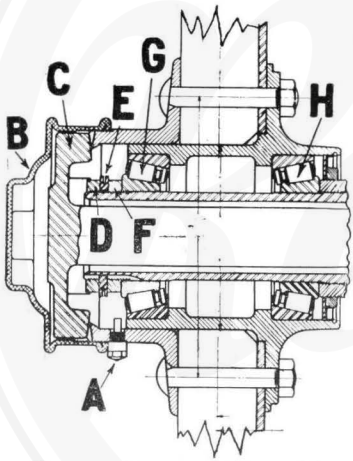

Fig. 47. Sectional View of Rear Hub, Showing Bearings.

Remove lubricator "A," Fig. 47.

Remove hub cap "B" by unscrewing it.

Withdraw axle shaft "C."

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

Remove the lock nut "D," the washer "E" and the adjusting nut "F."

The wheel can then be taken off.

Before putting the wheel on again see that the bearings "G" and "H" are clean and filled with light grease which is free from dirt and grit.

In putting the wheel on again set the adjusting nut "F" very carefully. (See below under "Caution in Adjusting Timken Bearings.") Place the washer "E" in position, and tighten the lock nut "D."

Both the front and rear wheels should be removed every three or four thousand miles or at least every six months, the bearings examined and carefully lubricated with light grease. Cadillac Wheel Bearing Grease is recommended for this purpose. A few drops of lubricating oil should be put in occasionally through the oil holes in the rear wheels.

CAUTION IN ADJUSTING TIMKEN BEARINGS

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

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

BRAKES

There are two pairs of brakes. The regular service brakes, which are operated by the right pedal, contract upon the outside of the drums. The hand brakes, operated by a hand lever, expand within the drums.

Connections from the right pedal and hand lever are made through equalizing bars so that each drum will be gripped with practically the same pressure. While these equalizing bars compensate for a certain amount of inequality in the tension, it is desirable to adjust the brakes as nearly alike as possible.

The brake band linings can be renewed when necessary.

If the brake band linings become too dry and grip the drums too suddenly, apply a very small amount of a mixture of graphite and oil.

When the brake band linings are wet and muddy they are less effective than at other times. Hence more care must be exercised in driving at such times.

The brakes and all parts relating thereto should be examined and tested occasionally to be sure that they are in serviceable condition.

The joints and all working parts should be oiled occasionally to avoid any possibility of the parts rusting and sticking together. The internal brake joints are accessible after removing the small covers "F," Fig. 48, from the brake drums. Care should be taken not to apply too much oil to the internal brake joints as it may get on the brake band linings and impair the efficiency of the brakes.

If brakes are in good condition, either pair will offer sufficient resistance to lock and slide the wheels, but doing this is bad practice excepting in case of emergency, as it is very injurious to the tires.

The brake band linings should not be allowed to drag on the drums when released, as that will cause unnecessary wear.

The length of the brake pedal is adjustable to accommodate different drivers. To adjust it see "To Shorten or Lengthen Clutch Pedal," page 79.

It is necessary that the rear wheel bearings be in proper adjustment before an adjustment of the brakes is made.

Do not attempt to adjust the brakes by the pull rods, as that will not properly compensate for wear on the linings.

TO ADJUST FOOT BRAKES

(External Contracting)

Provision is made in each brake for its adjustment. Do not attempt to adjust the brakes by the pull rods. The brakes cannot be properly adjusted in this manner. To adjust each foot brake, proceed as follows:

Remove the cotter pin in the adjusting screw "A," Fig. 48, and turn the screw "A" until that part of the brake band lining opposite the screw just clears the drum. Adjust the two nuts "B" on the yoke bolt so that the lower part of the brake band lining just clears the drum.

Then adjust the nut "C" on the upper end of the yoke bolt so that the lever "D" is brought into the position shown in Fig. 48 when the brake is fully applied, i. e., so that the lower edge of the pin "T" and the upper edge of the pin "S" are tangent to an imaginery horizontal line shown at "X."

TO ADJUST STOP SCREW "E"

The position of the stop screw "E," Fig. 49, is adjusted when the car is assembled and requires no further attention unless its adjustment is altered. Adjustment for wear on the lining should be made as described above by the nuts "A," "B" and "C," Fig. 48; the stop screw "E" should not be adjusted to compensate for wear. If the stop screw "E" should be moved from its original position, it may be readjusted in the following manner:

First adjust the brake as explained above so that the lever "D," Fig. 48, is in the correct position when fully applied. Then release the brake. Remove the pin "A" in the yoke "B," Fig. 49, loosen the clamping screw "C" and push the stop "G" forward out of the way. Then adjust the stop screw "E" and the nuts "B," Fig. 48, so that the upper and lower parts of the brake band lining clear the drum by 1/32 of an inch.

Then pull the rod "H," Fig. 49, as far forward as it will go without moving the rods "K" and "L." Holding the rod "H" in this position, push the stop "G" down against the bracket "F" and tighten the clamping screw "C." Then adjust the yoke "B" so that when the pin "A" is replaced the brake pedal arm "U" is held 3/8 of an inch away from the under side of the toe board.

After the adjustments are completed, be sure to lock all adjusting screws and nuts and to insert and spread all cotter pins.

TO ADJUST HAND BRAKES

(Internal Expanding)

Provision is made in each brake for its adjustment. Do not attempt to adjust the brakes by the pull rods. The brakes cannot be properly adjusted in this manner. To adjust each hand brake proceed as follows:

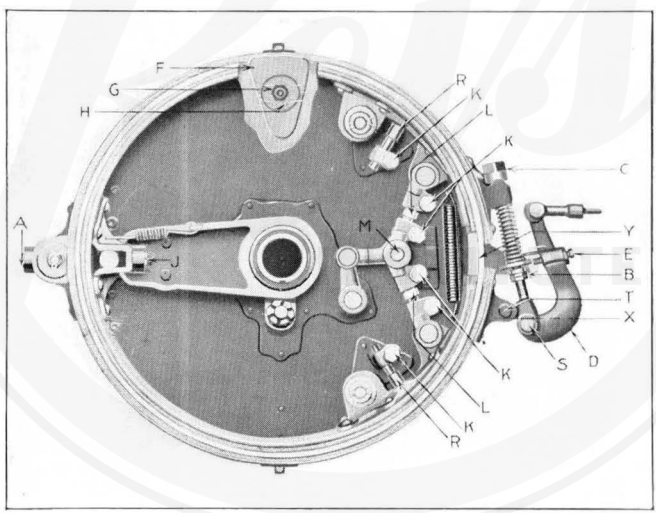

Fig. 48. Internal and External Brakes.

Place a jack under the rear axle housing and raise the axle so that the wheel can be turned by hand. Remove the cover "F," Fig. 48; this may be done by loosening the lock nut "G" and turning the bolt to the left about one-quarter of a turn, which releases the clamping bar "H."

Rotate the wheel until the opening gives access to the screw "J." Turn the screw "J" until that part of the brake band lining opposite the screw just clears the drum.

Rotate the wheel and through the opening loosen the six locking screws "K." Then turn the two adjusting screws "L," which have right hand threads on one end and left hand threads on the other, so that when the brake is fully applied, the center of the pin "M" stands 3 3/16 inches to 3¼ inches away from the inside of the brake drum at "Y." The screws "L" should be turned equally and in the same direction.

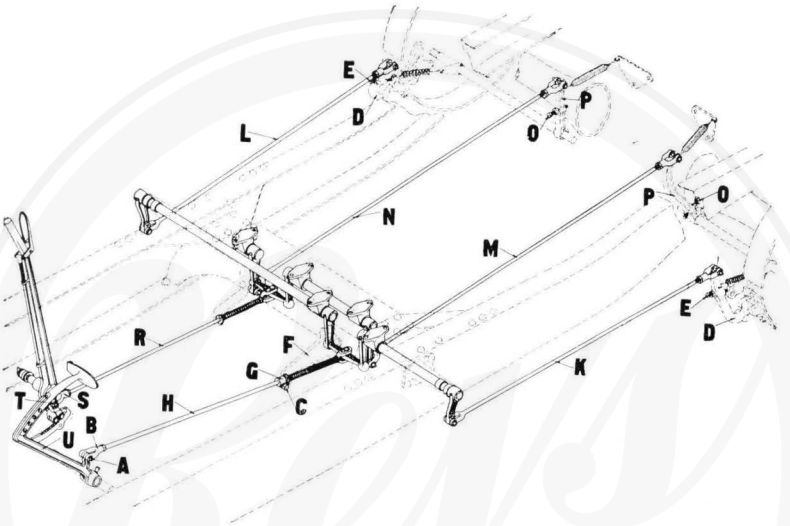

Fig. 49. Brake Rods.

Release the brakes and adjust the stop screws "R" so that the upper and lower parts of the brake band lining are equidistant from the brake drum. Tighten the six locking screws "K" and replace the cover "F."

TO ADJUST STOP SCREW "O"

The stop screw "O," Fig. 49, is adjusted when the car is assembled and requires no further attention unless its adjustment is altered. Adjustment for wear on the linings should be made as described above by the screws "J," "L" and "R," Fig. 48; the stop screw "O" should not be adjusted to compensate for wear. If the original adjustment of the stop screw "O" has been altered, it may be readjusted in the following manner:

First adjust the brake as described above by the screws "J" and "L," Fig. 48, but screw the stop screws "R" away from the brake band.

Then remove the pin "T" in the yoke "S," Fig. 49, and adjust the stop screw "O" so that when the brake is released the center of the pin "M," Fig. 48, stands 3 9/16 inches away from the inside of the brake drum.

Adjust the stop screws "R" so that the upper and lower parts of the brake band are equidistant from the brake drum.

Then adjust the yoke "S," Fig. 49, so that when the pin "T" is replaced the upper end of the handle on the hand brake lever may be moved back one and one-quarter inches from its extreme forward position without moving the rods "M" and "N."

After the adjustments are completed, be sure to lock all adjusting screws and nuts and to insert and spread all cotter pins.

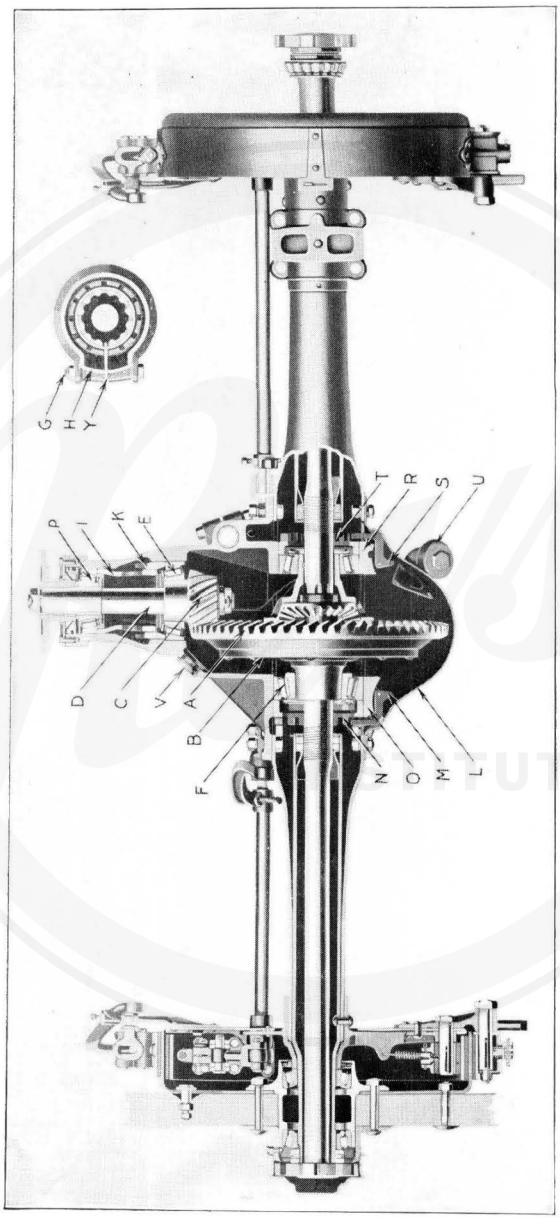

Fig. 50. Rear Axle, Sectional View.

TO ADJUST AXLE PINION AND DRIVING GEAR

In the design of the axle, provision is made for adjusting the pinion and gear so that the teeth may be correctly meshed, and for locking all the adjusting nuts securely in position.

The large bevel gear "A," Fig. 50, on the gear mount "B" and the bevel pinion "C" on the driving shaft "D" are correctly meshed when the car is assembled, but after it has been in use for several thousand miles, it may be found that the bearings "E" and "F" which take the end thrust of the gears have become more permanently seated, causing end play in the pinion shaft "D" and side play in the gear mount "B." When this condition exists, bearings "E" and "F" should be readjusted.

If undue end play exists in the pinion shaft "D," the bearing "E" should be adjusted as follows:

Remove the two clamp bolts "G," then remove the key "Y" and the cap "H." Hold the adjusting nut "I" from turning and turn up the adjusting nut "K" as far as possible without making the bearing "E" too tight. (See under "Caution in Adjusting Timken Bearings," page 84.) After the adjustment has been made replace the key "Y," the cap "H" and the clamp bolts "G."

If, after removing the rear cover plate "L," undue side play is found in the gear mount "B," the bearing "F" should be adjusted as follows:

Move the key "M" entirely out of the slots in the adjusting nut "N," loosen the cap screws holding the cap "O" and turn the adjusting nut "N" as far as possible without making the bearings too tight. (See under "Caution in Adjusting Timken Bearings," page 84.) After the adjustment has been made, make sure that the key "M" is replaced in one of the slots in adjusting nut "N" and that the cap screws holding the cap "O" are tightened and locked.

If after adjusting the bearings "E" and "F" it is found necessary to move the pinion "C" endwise or the bevel gear "A" sidewise in order to bring the gears into proper mesh, it must first be determined whether it is necessary to move the pinion, the large bevel gear, or both, and in which direction the gear or gears must be moved.

Bevel gears should be so adjusted that the large ends of the teeth of one gear are practically flush with the large ends of the teeth of the other gear, which can be determined by removing the peep hole cover "V." Extreme care must be used in adjusting, as the tooth forms of the most accurately cut gears may be easily ruined by running them when not properly meshed.

In order to adjust the gears to the best advantage, a crank should be attached to the forward end of the pinion shaft "D" so that the gears can be turned by hand and the adjustment tried until positions are found for the gears where they run smoothly and do not bind at any point.

If the bearings "E" and "P" on the drive shaft "D" are in proper adjustment and if it is found necessary to move the pinion "C" endwise, proceed as follows:

Remove the clamp bolts "G," the key "Y" and the cap "H." Move the adjusting nuts "I" and "K" **together,** moving the pinion in either direction as required. If the adjusting nuts "I" and "K" are moved in the same direction and exactly together the relative adjustment of the bearings "P" and "E" will not be altered.

When the proper position for the pinion has been found, replace the cap "H," the key "Y" and the clamp bolts "G."

If it is found necessary to move the large bevel gear sidewise, proceed as follows:

First loosen the bolts holding caps "O" and "R." Then move the keys "M" and "S" out of the slots in the adjusting nuts "N" and "T." The adjusting nuts "N" and "T" can now be turned, moving the gear mount with the gear in either direction as required. Be careful not to adjust the bearings too tight. (See under "Caution in Adjusting Timken Bearings," page 84.)

After the correct position for the large driving gear has been found, be sure that the keys "M" and "S" are replaced in the slots in the adjusting nuts "N" and "T" and that the bolts holding the caps "O" and "R" are tightened and locked.

Replace the cover "L" and fill with Cadillac Rear Axle and Transmission Lubricant, bringing the level up to the top of the filling hole "U."

FRONT AXLE

The stop screws "H," Fig. 51, at each end of the axle are for the purpose of limiting the angle at which the front wheels can be turned. The stop screw at the left end of the axle is for the purpose of limiting the angle at which the wheels can be turned to the right. The stop screw at the right end of the axle is for the purpose of limiting the angle at which the wheels can be turned to the left.

The illustration shows the construction of the front wheel hubs and bearings; the spindle bolts and the upper and lower bearings for the spindles.

The spindle bolt "C" is forced into the spindle "N" and is held from rotating in the spindle by the taper pin "A."

TO REMOVE A SPINDLE

First jack up the axle until the wheel is clear of the floor. Remove the wheel. (See under "To Remove and Replace Front Wheels and Adjust Bearings," page 91.) Then remove the adjusting nut "B," drive out the taper pin "A" and drive out the spindle bolt "C."

TO REPLACE A SPINDLE

To replace a spindle proceed as follows: Place the bearing "D," the retainer "E" and the key "M" in position in the axle yoke. Place the spindle in position and carefully drive in the spindle bolt "C," being careful that it is so turned that the flat place on it will be in the correct position to receive the taper pin "A" when driven in. Drive in the taper pin "A." Replace the adjusting nut "B" and adjust properly.

TO ADJUST ROLLER BEARING AT UPPER END OF SPINDLE

The bushing "G" is pressed into the axle forging. If there is too much end play in the bearing "D" draw up on the adjusting nut "B", pulling the bushing "G" up against the under side of the spindle. Then back off the adjusting nut "B" just enough to free the adjustment. (See under "Caution in Adjusting Timken Bearings," page 84.)

TO REMOVE AND REPLACE FRONT WHEEL AND ADJUST BEARINGS

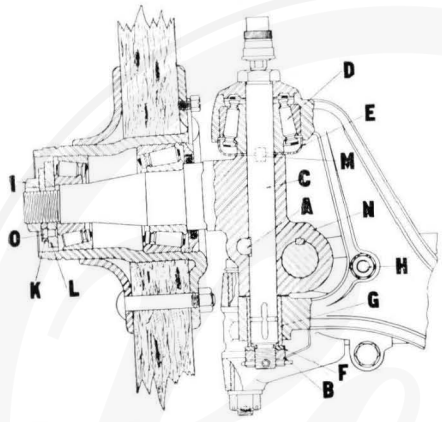

Fig. 51. Front Left Spindle and Hub, Showing Bearings.

Jack up axle until wheel is free from the ground.

Remove hub cap by unscrewing it.

Remove lock nut "I," Fig. 51.

Remove washer "K."

Remove adjusting nut "L."

The wheel may now be removed.

In removing the right front wheel remove the speedometer driver "A" (Fig. 52) after removing the hub cap.

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

In replacing the wheel adjust the nut "L" very carefully. (See under "Caution in Adjusting Timken Bearings," page 84.) Replace washer "K" being sure that one of the holes in the washer fits over the stud "O." Replace the lock nut "I" and tighten carefully.

The thread on the right hand spindle is a right hand thread; the thread on the left hand spindle is a left hand thread. Therefore, in tightening the adjusting and lock nuts, "I" and "L," they should be turned in the same direction in which the wheels turn when the car moves forward.

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

Both the front and rear wheels should be removed once every three to four thousand miles, or at least every six months, the bearings examined and filled with light grease. Cadillac Wheel Bearing Grease is recommended for this purpose.

STRAIGHTENING PARTS WHICH HAVE BECOME BENT AS THE RESULT OF ACCIDENT

Modern automobile construction demands the use of the highest grades of alloy steels. A great advantage of alloy steels is that by properly heating and cooling and re-heating such steels great strength and durability are obtained. However, heat treatment must be given with full and accurate knowledge of the contents of the steel, which cannot be obtained in the ordinary repair shop. Therefore if any part is heated outside of this factory for the purpose of straightening or for other purposes, the part at once loses the advantage which the original heat treatment gave it.

If the average repairman undertakes to heat a piece and re-temper it, he is quite apt to leave it in an annealed condition. This makes it soft and weak. Or he gets it too hard. This makes it brittle, with the possibility of its breaking very easily in service.

If a part is straightened without heating, it usually results in weakening the part unless it was bent but very little from its original shape.

The Cadillac Motor Car Company cannot assume any responsibility for the action of any part of its cars that may have been heated for straightening or straightened cold after its cars have left the factory.

TO REMOVE SPEEDOMETER DRIVE IN RIGHT HAND SPINDLE

The flexible shaft to the speedometer is driven from the hub on the right hand front wheel through the driver "A," Fig. 52, the shaft "B" and the gears "C" and "E."

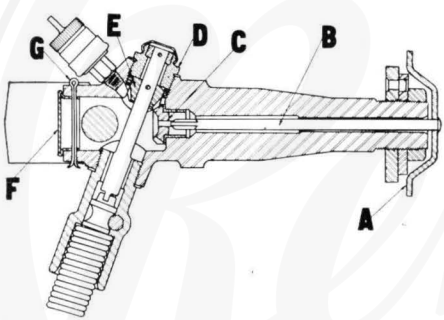

Fig. 52. Front Right Spindle and Speedometer Driving Gears.

To remove these parts from the spindle, proceed as follows:

Remove hub cap from the wheel.

Pull out driver "A."

Unscrew nut "D" and remove.

The gear "E" and the shaft to which it is attached will come out with the nut "D."

Remove the cotter pin "G."

Remove the cap "F."

The gear "C" may then be removed.

The parts may be assembled in the reverse order.

ALIGNMENT OF FRONT WHEELS

The ideal condition is to have the front wheels parallel to each other on horizontal lines passing diametrically through their centers. Under no condition should the wheels toe out. It is permissible to have them toe in, providing they do not toe in more than 3/8 of an inch in the diameter of the wheel. (See "Result of Faulty Alignment of Front Wheels," page 98.)

TO ALIGN FRONT WHEELS

Jack up the front axle until both wheels are clear of the floor and true up the demountable rims. (See under "To Mount Rim," page 94.)

Move the steering wheel to bring the left front wheel "A," Fig. 53, parallel with the frame "B." This may be determined by taking measurements "C" from the rim of the wheel to the frame.

Tie a string to a rear spoke of each front wheel directly back of the center of the wheel. Carry the strings inward between the spokes, back around the tires and then forward to points "D" as shown. Use strings that will extend exactly twelve feet in front of the tires. Bring the strings in until they just touch the forward edges of the tires at "E." The strings must be slightly above or below the hubs so as to clear them.

If the wheels are parallel, the distances "F" and "G" between the strings will be the same at points just ahead of the tires and at points at the ends of the strings.

Under no condition should the wheels toe in more than enough to allow the twelve foot strings to converge more than 1½ inches, that is, so that dimension "G" is not more than 1½ inches less than dimension "F."

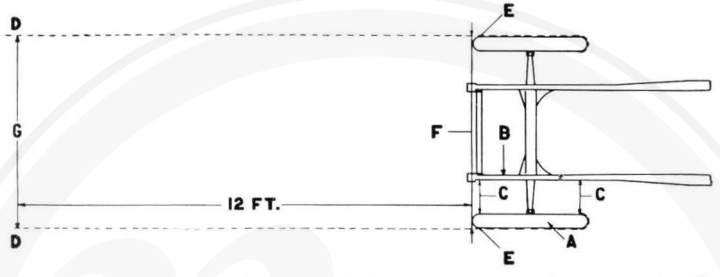

Fig. 53. Diagram Showing Method for Aligning Front Wheels.

Adjustment is provided in the parallel rod for aligning the front wheels. If adjustment is necessary and the left front wheel is disturbed, care should be taken to have this wheel parallel with the frame before readjusting the strings and taking measurements "F" and "G."

The front wheels camber about 1½ inches, that is, the measurement between the wheels at the top should be approximately 1½ inches greater than the corresponding measurement diametrically opposite at the bottom of the wheels.

DEMOUNTABLE RIMS

TO REMOVE AND REPLACE RIM WITH TIRE

TO DEMOUNT RIM

Jack up the axle until the wheel is free from the ground. Then remove the valve cap; loosen the eight clamp nuts, with the brace wrench furnished with the tool kit, and turn each clamp to the left until it strikes the stop pin in the felloe band. 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. (Figure 54.)

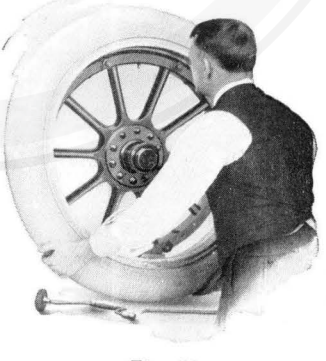

Fig. 54.

Demounting Rim from Wheel.

TO MOUNT RIM

Fig. 55. Mounting Rim on Wheel.

If the rim you are mounting has no split clamping ring, take the one from the rim you have 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 joint latch and the clamping ring are towards you. Insert the valve stem in the valve stem hole in the wheel and then push the bottom of the rim into place. (Fig. 55.)

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 clamp slightly. Then continue around the wheel, tightening each clamp firmly. Screw on the valve cap.

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

TO REMOVE A TIRE FROM A DEMOUNTABLE RIM

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.

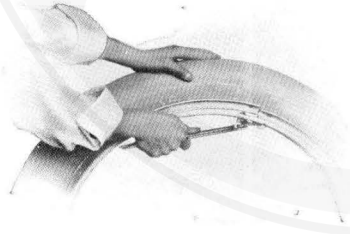

Fig. 56. Removing Tire from Rim, 1st Position.

Fig. 57. Removing Tire from Rim, 2nd Position.

Raise one end of the ring with the tool as shown (Figure 56) 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 57.)

Start at the end of the ring, which is out of the groove, and remove the entire ring from the rim. (Figure 58.) (See note.)

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

Note:—In removing the ring from the rim, care should be taken to avoid opening the ring beyond its elastic limit. When the ring is free from the rim the ends of the ring should overlap from ½ to 1½ inches, which it will not do if it has 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 properly engage the lugs on the ends of the ring, which might later be the cause of an accident.

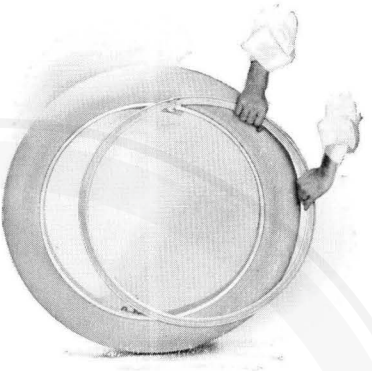

Fig. 58. Removing Tire from Rim, 3rd Position.

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

TO PUT A TIRE ON A DEMOUNTABLE 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.

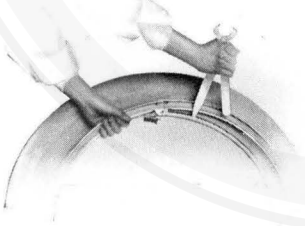

Fig. 59. Placing Tire on Rim, 1st Position.

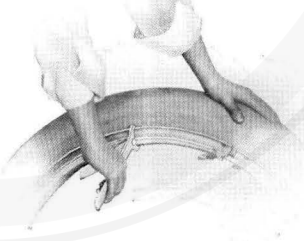

Fig. 60. Placing Tire on Rim, 2nd Position.

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.

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 59.)

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 60.)

Insert the flat end of the tool between the rim and the ring, and turn the tool up edgewise. (Figure 61.) 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 62.) Then swing the lock into place.

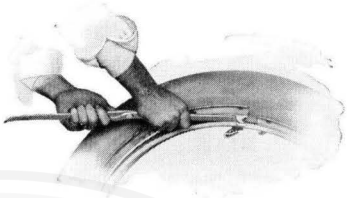

Fig. 61. Placing Tire on Rim, 3rd Position.

Then inflate the tire. (See under "Air Compressor for Tires," page 82.)

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.

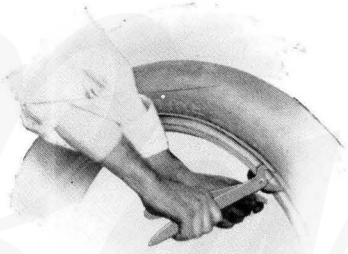

Fig. 62. Placing Tire on Rim, 4th Position.

TIRES

TIRE GUARANTY. Tires used on Cadillac automobiles are guaranteed by their respective makers. In case of claims, tires should be sent to the factory or any of the branches of the makers (not to us), transportation charges prepaid.

Each tire maker publishes a booklet with instructions for care and repair of tires and 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.

CARE OF TIRES

Probably 75% of so-called "tire trouble" is the result of misuse.

"Neglected trifles" is a fair summary of the whole question.

In the following we have illustrated some of the more common causes of tire breakdown.

INJURY FROM SMALL CUTS WHICH ARE NEGLECTED

Fig. 63 illustrates a tire damaged from the neglect of two small cuts extending to the fabric. (Note the two prominent "bumps," which show plainly.)

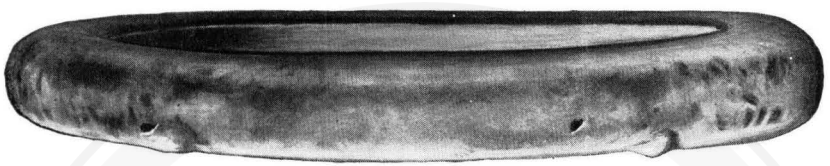

Fig. 63. Result of Small Tire Cuts which were Neglected.

If cuts extending to the fabric are neglected, fabric deterioration and blistering of the tread is bound to result.

It is unnecessary to remove a tire to treat a small cut of this nature. Tire companies furnish a plastic compound for filling cuts, thus preventing moisture and dirt from getting to the fabric.

INJURY RESULTING FROM IMPROPERLY ADJUSTED TIRE CHAINS

Fig. 64 illustrates a tire which has been badly damaged through the use of tire chains which were improperly adjusted or fastened to the spokes holding the chains tightly in one place.

You will note that the tread is cut through to the fabric, and in fact loosened up and torn badly in many places.

Fig. 64. Result of Improperly Adjusted Tire Chains.

The least injury results when chains are loosely applied, and have play enough to work themselves around the tire, distributing the chain on all points alike. Probably the greatest amount of injury comes from using chains unnecessarily on paved streets.

RESULT OF FAULTY ALIGNMENT OF FRONT WHEELS

Fig. 65 shows the result of running a car with the front wheels out of alignment. This usually affects both tires similarly, although sometimes one tire only is affected. An improper adjustment of the parallel rod in front of the axle, or a bent steering arm is responsible for this condition. Unless the wheels are kept in proper alignment, the tread of the front tires will wear away in a remarkably short time.

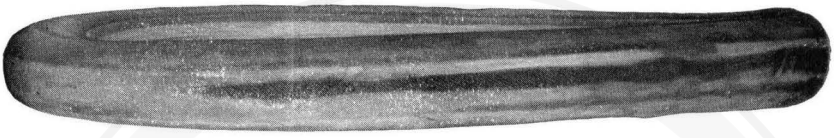

Fig. 65. Result of Improperly Aligned Front Wheels.

If the front wheels are badly enough out of alignment, the entire tread of both front wheels may be worn off in less than 100 miles. If the wheels are only slightly out of alignment, the result is the same, although the wearing off is slower. (See under "Alignment of Front Wheels," page 92.)

THE RESULT OF SUDDEN APPLICATION OF THE BRAKES

You will note from Fig. 66 that the tread and several plies of fabric have been worn or rather scraped off at one place. This has been brought about by sudden application of the brakes, which resulted in sliding the wheels.

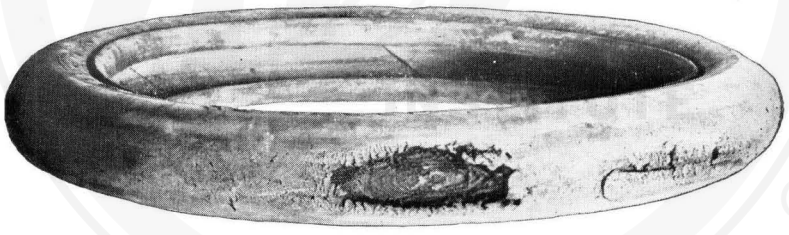

Fig. 66. Result of Suddenly Applying Brakes.

It is remarkable how soon a tire will give away from this severe treatment.

INJURY FROM UNDER-INFLATION

Fig. 67 shows the result of running a tire under-inflated. The wavy condition of the tread is due to its loosening from the fabric as a result of insufficient air pressure in the tire.

Another common result of under-inflation is rim-cutting. This is not shown in the illustration. There are unquestionably more tires ruined from under-inflation than from any other cause. 4½ inch tires, which are standard on the Cadillac, should be inflated to 75 pounds pressure.

ADDITIONAL SUGGESTIONS

The tires are constructed for the purpose of carrying up to certain maximum loads and no more. Owners should realize, therefore, 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 fabric, with the result that the further life of the tires will be limited. Remember that most tire troubles are the result of abuse more than use.

If a tire goes flat, see that the valve is not leaking. A little moisture on the tip will show bubbles if the air is escaping.

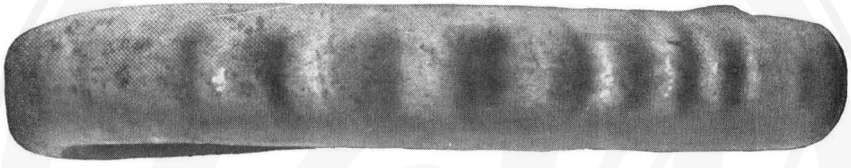

Fig. 67. Result of Insufficient Inflation of Tire.

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, because it would, if allowed to remain, continue to cut the inner tube. 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 fabric even though no external injury be visible.

Experience has taught the careful driver to carry one or more spare tubes, as a cemented roadside repair will not always hold, especially in warm weather, as the heat generated in the tire may loosen the patch. When touring, a spare casing should always be carried.

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 tires being oil and gasoline. These destroy the nature of the rubber, rendering it soft, so that it cuts and wears away quickly.

Tires that show wear on one side from use on rutty roads or from other causes may be turned around, thereby lengthening the life of the tire.

Spare tubes should be kept lightly inflated. This keeps them in good condition and prolongs their life. They should not be stored in a greasy tool box under any circumstances.

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.

TIRE HOLDER

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

To remove the tire with rim, remove the lock and then unscrew the clamp as far as it will go. Move the bottom of the tire back until it is entirely free from the holder. The tire then may be removed by slightly lifting it straight up.

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

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

SPRINGS

As a matter of life insurance for the springs, it is well to tighten all clip nuts at the end of the first 1,000 miles of travel and at the end of every 2,000 miles of travel thereafter.

SPRING LUBRICATION

When springs are not lubricated, water works its way in between the leaves and causes them to rust, often to such an extent that they become almost like solid pieces. This causes them to lose much of their spring action.

It is recommended that the springs be lubricated once every 500 to 1,000 miles by painting the edges and ends of the spring leaves with cylinder oil. A small, stiff brush should be used. After applying the oil to the springs, the car should not be washed until it has been driven some distance to allow the lubricant to work in between the leaves.

It is also a good plan, about once a year, to have all the springs taken apart, the surfaces thoroughly cleaned and coated with a thick mixture of oil and graphite.

TO ADJUST GABRIEL SNUBBERS

The snubbers should be readjusted after the first five hundred to eight hundred miles of travel. Further adjustment should not soon be necessary.

When the snubbers are adjusted there should be no passengers in the car, the radiator and gasoline tank should be full, the top up and there should be two spare tires in the tire holder. If no spare tires are carried it is best to have a light weight person sit in the middle of the rear seat during the adjustment.

To adjust the snubbers, pull the belt out of the housing as far as possible. Then allow two inches of the belt to return into the housing and insert a wedge between the belt and the housing to prevent more of the belt from being drawn in.

Remove the clamp on the belt at the axle and adjust the length of the belt so that all slack is taken out between the snubber housing and the axle. Replace the clamp, cut off the surplus belt and remove the wedge.