Hupmobile

INSTRUCTION MANUAL

Series R

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Series R

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Hupp Motor Car Corporation
Jackson Detroit Windsor

Illustrations

Illustrations Showing Part Numbers

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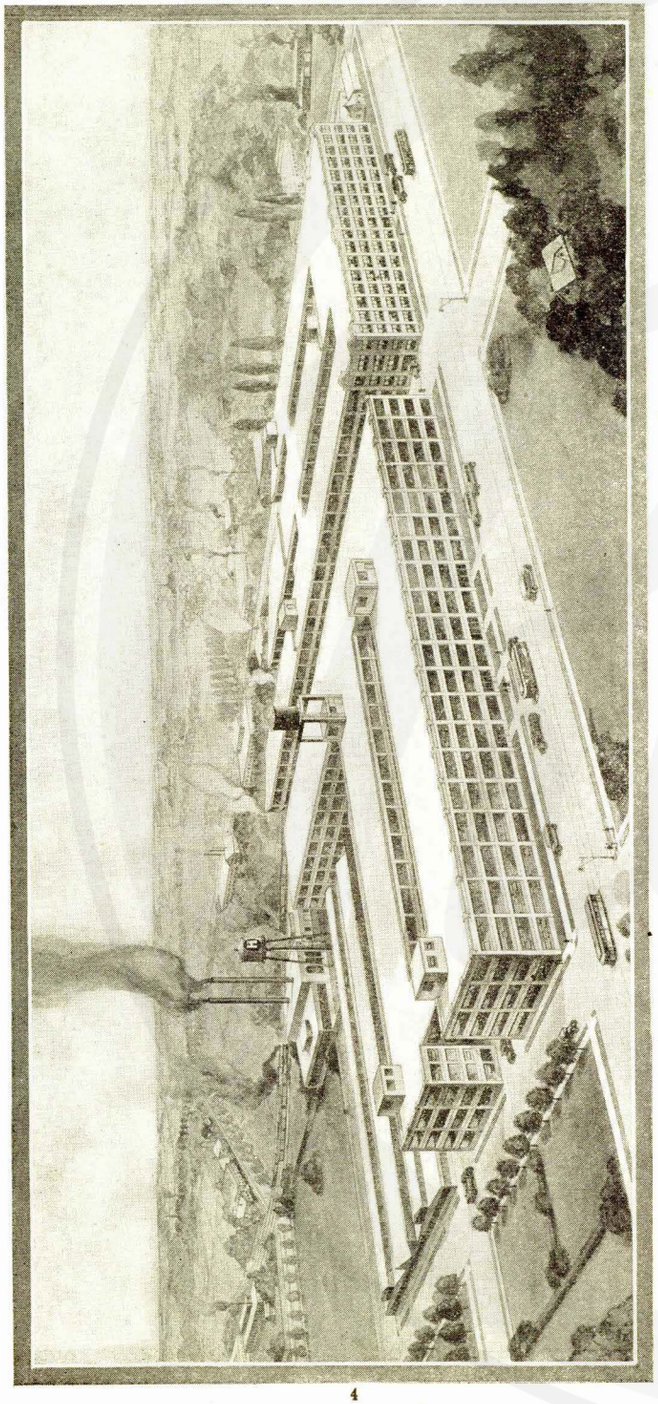


Main factory of the Hupp Motor Car Corporation at Detroit; other plants at Jackson, Michigan, and Windsor, Canada

WE BUILT and you bought your Hupmobile in the belief that it is the best car of its class in the world. And your daily experience with your car will soon convince you that the Hupmobile deserves this belief, for sound engineering, special processes and materials, and thirteen years perfection of the four-cylinder principle have combined to make your Hupmobile as perfect mechanically as it is possible for rigid inspection tests to determine.

We take great pride in the fact that thousands of Hupmobiles now nine and ten years old, are still giving satisfaction in constant hard service. These cars have received that intelligent care which it is possible for you to give your new car, if you will follow the instructions contained in this manual.

We have endeavored by illustrations and diagrams to make these instructions perfectly clear to everyone. The various adjustments which should be made occasionally, and the schedule of lubrication, which should be followed *regularly,* are explained in detail.

To make certain of your satisfaction with your new Hupmobile is the most important duty of ourselves and our dealers. Our dealers stand always ready to provide full service on inspection and adjustments, that your experience with your Hupmobile may be wholly enjoyable.

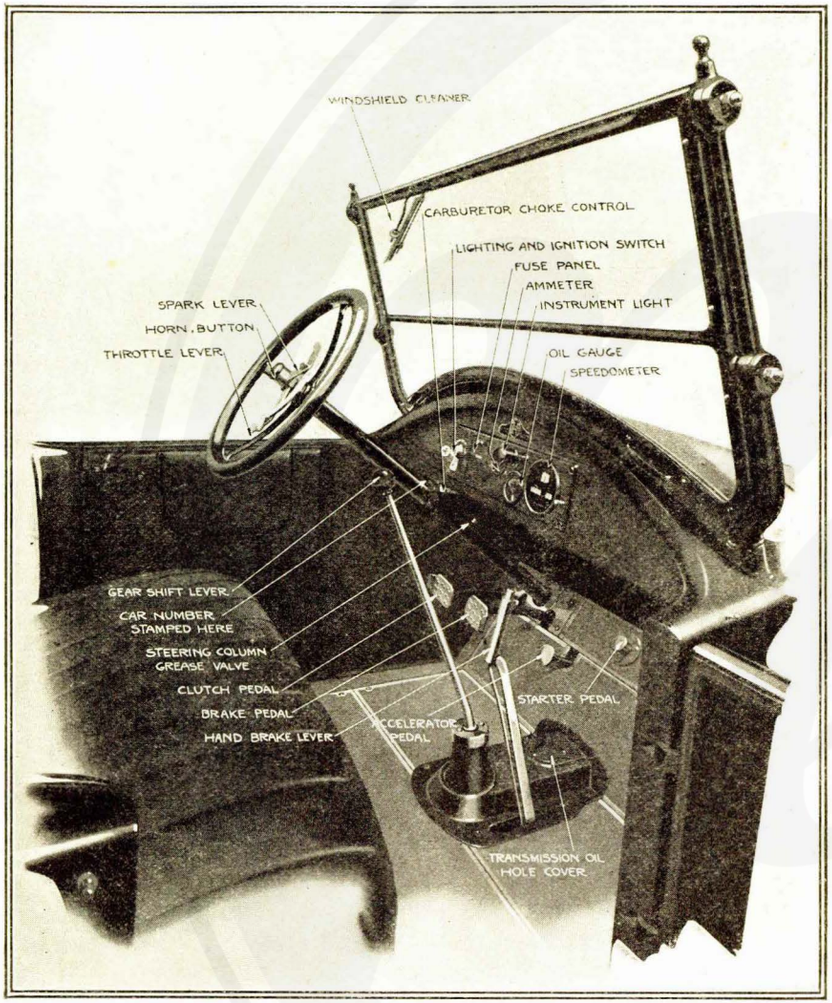


Fig. 2. Driving Compartment

As you occupy the driver's seat, you will notice the ease and convenience of all controls and the readability of all gauges, etc. Before starting the motor and putting the car in motion, refer to the opposite page for a brief explanation of these controls and gauges, and read page 8 to make certain that your car is in complete readiness to run.

You can now commence your experience as a satisfied Hupmobile owner—a satisfaction which can be made even more complete by adherence to the suggestions and instructions in this manual.

Controls and Gauges

Spark Lever

The short lever on the quadrant controls the position of the ignition distributor, and enables you to change the spark timing in accordance with the requirements of the motor, which vary with its speed. See page 11 for further details.

Throttle Lever and Accelerator Pedal

The speed of the motor and car is controlled by advancing the throttle lever or depressing the accelerator pedal, both of which cause the carburetor to feed more vaporized gasoline to the motor. See page 11.

Carburetor Control

See page 15 for complete information regarding use to facilitate starting, and to secure economy.

Ignition and Lighting Switch

Markings on switch are self-explanatory. More information is given on pages 8 and 40.

Fuses

Panel contains fuses which protect various electrical circuits in car. See page 42.

Instrument Light

Gauges are easily read at night by using this light, controlled by independent switch.

Ammeter

Charge and discharge of battery are recorded by this gauge. Refer to page 44.

Oil Pressure Gauge

Circulation of oil throughout motor is indicated by pressure reading on this gauge. Consult pages 8 and 20.

Speedometer

Driven from transmission, the speedometer shows miles per hour, trip and season mileage.

Gear Shift Lever

Different speeds are controlled by this lever, which should be in neutral position when starting. Page 9 gives more information on its use.

Clutch Pedal

Depress this soft operating pedal, when shifting gears. For use, see page 9; for adjustments, see page 29.

Brakes—Hand or Emergency

Use hand brake for sudden stops, and when car is unattended. Operates easily. See page 35.

Brakes—Foot or Service

Brake pedal should be used most. Use and adjustments explained on pages 10 and 35.

Starter Pedal

Accessible and conveniently located, but so placed that it cannot be touched accidentally. Before pressing this pedal when starting, check position of spark, throttle, and gear shift levers. See page 41.

To Place the Motor and Car in Running Condition

Gasoline, oil and water are drained from the car before being shipped from the factory, and must be supplied before placing the car in service. It is also necessary to thoroughly lubricate or grease the car, which should be done according to instructions in this book. Also check air pressure in tires.

Cooling System

See that the drain valve under the radiator outlet pipe is closed, then pour into the radiator approximately 5½ gallons, the capacity of the entire cooling system. The water should never be allowed to fall below the level of the radiator inlet hose, as the water will not circulate if below this level. A good anti-freeze solution should be used in the cooling system during freezing weather. See page 50 for winter driving instructions.

Oiling System

Oil should be put into the motor through the oil filler hole on the side of the motor as shown in figure 27, page 41. Approximately 4 quarts of oil is sufficient to bring the oil level up to the proper height. For ordinary driving it is not desirable to fill more than to the ¾ full point, except during first 500 miles of a new car, when it shou'd be filled to "full" mark. Never fill above the "full" point. See detailed instructions regarding reading of oil gauge and the proper amount to carry, on pages 18 and 19.

Make sure oil pressure gauge on instrument board shows pressure after motor is started. If oil is not circulating, see page 20 for further instructions. Do not allow motor to run if gauge does not register.

Gasoline System

Remove filler cap on the gasoline tank, located at the rear of the car, and pour in approximately 15 gallons, which will fill the tank, including the 2-gallon reserve. Refer to figure 5, page 13, and note that the outlet valve is in "running" position. Also see figure 4, page 12, for both "running" and "reserve" positions of valve.

Tires

See that tires are fully inflated as specified in tire inflation table on page 48.

To Start and Operate

Before starting the motor, check the position of the spark and throttle levers on the steering post, and the gear shifting lever. The spark lever should be advanced only about one-half on the quadrant, as a too early explosion might damage the starter motor, the engaging mechanism, or the gear teeth on the flywheel. Advance throttle lever about one inch on quadrant, to furnish sufficient gasoline for motor to operate. The gear shifting lever must be in neutral position.

The ignition switch key should be inserted in the lock, located in the center of the lighting and ignition switch, and turned either to the right or left to position marked "ign" to form the ignition contact.

The starter pedal is located in the center of the upper floor board. After following the above instructions regarding the position of spark lever, depress the starter pedal, which permits the starter pinion to engage with the flywheel gear. This causes the motor to turn over until an explosion occurs in one of the cylinders, after which the motor will run under its own power, and the foot should be removed instantly from the starter pedal. If the motor has been standing for some time, it is advisable to pull out slightly the control button alongside the steering column. (Complete information on this control is given on page 15.) Then the motor will start readily, avoiding excessive strain on the battery and starter motor. Immediately upon hearing one or two explosions of the motor, push the control button partly in. Run with the control button in this position for a few minutes until the motor has become sufficiently warm to run without missing any explosions. Always push control button in after motor is warm.

Should the battery become discharged so that the starter motor will not crank the engine, use the hand crank. Retard the spark lever more when cranking by hand than when using starter. To remove starting crank cap, press in on the cap as far as it will go; turn one-quarter to the right or left, and it can be removed. The hexagon type cap can be unscrewed with the hub cap wrench.

To Shift Gears

The clutch must be disengaged by the use of the left pedal before the gears can be shifted. The diagrams below illustrate the neutral position when starting, and also show the location of low, intermediate, high, and reverse gear positions.

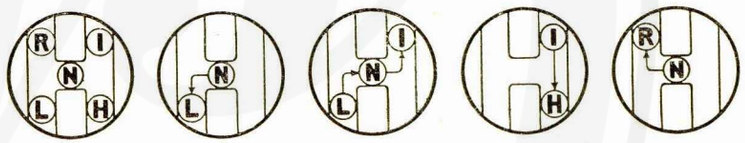


Fig. 3. Gear Positions

To Put the Car in Motion

Depress the left pedal, which releases the clutch and stops the spinning of transmission gears. Next, place the gear shift lever in the low gear position, as shown in the diagram, and slowly relax pressure on the clutch pedal until the clutch discs have become engaged, and the car has gathered momentum. At the same time gasoline should be fed for an instant by the hand, or preferably the foot throttle, to increase this momentum; then the clutch should be depressed and the lever moved from low gear through the neutral position into intermediate gear position. The car should have enough momentum, before making this change so that it will not slow down when gears are being shifted. Then the clutch should again be engaged gradually by allowing the clutch pedal to come back and the car will go forward on intermediate gear. Before changing from intermediate to high gear it is necessary that the car should have secured greater momentum by increasing the gasoline feed through the foot or hand throttle. After the car has gained sufficient momentum in intermediate gear, depress the clutch pedal and move the gear shifting lever from intermediate position straight back on the right side into high gear position. Before shifting gears, the pressure on foot throttle should be relaxed entirely.

Never try to shift from one gear to another without first depressing the clutch pedal, and never place the lever in the reverse gear position until the car has been brought to a complete stop.

If, when first starting, the gears which mesh into low gear are not in proper relation, the ends of the gears will come together. In this case, place the lever in neutral position and allow the clutch to engage again for an instant, thus changing the gear positions, and allowing the proper shift to be made by following these directions.

In shifting from low to intermediate gear or from intermediate to high it is advisable to pause for a moment in the neutral position before shifting to the next gear in order to give the car and motor speed time to synchronize. This should be done, particularly, if you notice a tendency of the gears to clash when making a quick shift. If you remember that these gears must be running at the same speed to make a quiet and proper shift, considerable trouble will be avoided.

Do not allow the clutch to engage too quickly after changing speeds. The soft clutch action allows slow and careful engagement. Extreme pressure on the clutch pedal is not necessary and should be avoided.

To Stop the Car

First close the throttle by retarding the throttle lever or releasing the foot pressure on the accelerator pedal, and disengage the clutch by pushing down on the left pedal. At the same time, apply the service or foot brakes by pushing forward on the right pedal, holding both pedals in this depressed position until the car has come to a full stop. Before removing the left foot from the clutch pedal, place the gear shifting lever in the neutral position.

To stop motor, turn the ignition key to the off position, and then remove it from the switch. Acquire the habit of removing the key from the switch every time the motor is stopped, as this habit, in addition to preventing theft of the car, may prevent damage to the battery.

Before leaving the car set the hand or emergency brake lever to prevent the car from moving. Do this at every stop and you will soon acquire the habit, and not neglect to set the hand brake when leaving the car on a grade.

Important

When starting the car do not press the starter pedal a second time unless you are positive that the motor is not running. Do not try to shift gears when the motor is racing. Reduce the motor speed when bringing the car to a stop. Do not apply the brakes too suddenly—soft action is better. Judge the distance in which you wish to stop and apply the brakes accordingly.

Operation on Hills

The driver should remember that greater motor power is required in accordance with the percentage of the grade which the car is climbing.

If the grade is steep and the motor should start to labor and consequently slow up, it is a warning to retard the spark lever sufficiently to bring the spark at the proper time with the action of the motor. In hill climbing most power is obtained by retarding the spark lever to a position where no "spark knock" can be heard. Do not retard the spark too far, however, as power can also be lost in that way. The driver should be guided by the sound and action of the motor and retard the spark lever just enough so that the motor does not pound, and at the same time does not have that sluggish feeling which will occur if the spark is retarded too much.

Some drivers sometimes shift from high to intermediate gear on hills, when entirely unnecessary. Remember when making this shift, the car should be running at intermediate driving speed.

To Start on a Grade

Advance the hand throttle lever to increase the motor speed, and then hold the car on the grade with the foot brake while the emergency brake is released. Do not use the foot accelerator when starting on a grade, but hold

the car in place with the foot brake, and operate the clutch at the same time. The feet should be gradually removed from the clutch and brake pedals at the same time.

Descending Grades

Going down long grades it is possible to use the motor as a brake, instead of the rear wheel brakes which, if applied for a considerable length of time, have a tendency to burn the brake lining or cause excessive wear. Consequently in descending very steep grades it is sometimes advisable to first shift to low gear, thus using your motor and transmission gears as brakes. When doing this close the throttle, but leave the ignition switch *on.*

Power Production

The Hupmobile motor is of the four-cycle type, that is, four movements or strokes of the piston and two revolutions of the flywheel are necessary to complete each power producing cycle.

The gasoline is fed to the carburetor from the tank at the rear of the car. The carburetor is the instrument by which the gasoline is mixed with the air in correct proportions. Vaporization is caused by air velocity and heat as mixture passes through intake manifold, and the fuel enters the cylinders as a dry gas. Compressed by the pistons, it becomes highly explosive, and is ignited by electric spark passing across spark plug points.

Throttle

The quantity of gas supplied to the motor is regulated by the throttle lever on the steering wheel quadrant, and by the foot accelerator which is directly connected to the throttle valve in the carburetor. Advancing the throttle lever on the quadrant or pressing down on the accelerator pedal increases the supply of gas to the motor, and consequently increases the power and speed of the car. Moving this lever toward the bottom of the quadrant decreases the gas supply, and reduces both power and speed.

Spark

A lapse of time occurs from the instant the electrical circuit is broken in the igniter until the charge is ignited in the cylinder. This lapse of time is a small fraction of a second, but it must be taken into consideration on account of fast piston travel at higher speeds. Therefore, when it is desired to run the motor at high speed it is necessary to start the ignition process earlier by advancing the spark control lever.

Advancing the spark lever too far, however, is apt to be injurious because bearings, crankshaft, connecting rods and pistons are then required to withstand stresses greatly in excess of those produced when the ignition occurs at the proper moment. It also causes overheating of the motor.

When the spark is not advanced far enough it is called a "retarded spark." With this condition the charge in the cylinder is not exploded until after the piston has reached its highest point, has compressed the charge, and has started again on its downward movement, permitting the gas to expand. When the gas is ignited in this condition, the force of the explosion is materially reduced and much more gasoline is required to produce a given amount of power than when the charge is exploded at the right instant. With a retarded spark and late explosion, the combustion or burning of the charge of gas is not complete and carbon is deposited on piston heads, spark plugs, etc. When the ignition is late, the charge is still burning when it passes through the exhaust valve opening, and tends to heat, burn, or cause pits in the valves and valve seats. *When the gas charge is ignited at the right instant the combustion is practically complete, so that when the exhaust valves open, a thoroughly burned charge passes out.*

Fuel System

The fuel system consists of main gasoline tank, gasoline pipe, auxiliary vacuum tank, carburetor, and intake manifold.

Gasoline Tank

Is supported by a frame crossmember at the rear of the car. It is of 15 gallons capacity, including a 2-gallon reserve, which is obtained by turning the gasoline outlet valve one-half turn toward the front of the car. A gasoline gauge of the float and gear type, shows at all times the quantity of gasoline in the tank. A drain plug in the bottom of the tank allows it to be drained from its lowest point, thus removing any sediment or water that may collect there. See winter driving, page 50. Refer to figure 4 for positions of outlet valve.

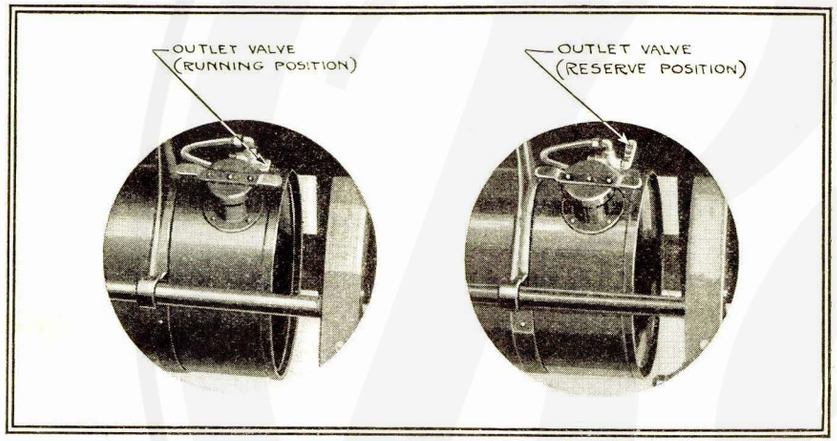


Fig. 4. Gasoline Tank Valve Positions

Vacuum Gasoline Tank

Is mounted on the front side of the dash under the hood. This tank is connected by pipes to intake manifold, gasoline tank, and carburetor.

The vacuum gasoline tank consists of two chambers; the upper one or filling chamber, and the lower or emptying chamber. Between these two chambers is a partition in which is placed a valve. The suction of the pistons on the intake strokes creates a vacuum in the upper tank, which vacuum closes the valve between the two chambers, and also sucks, or pumps up, the gasoline from the main gasoline tank into the upper chamber. As the gasoline flows into this chamber, it raises a float valve. When the float valve has risen to a certain point, it operates another valve which shuts off the suction, and at the same time opens an air valve. This admission of outside air releases the vacuum suction, thus causing the valve leading into the lower chamber to open, the gasoline immediately flowing through this valve into the lower or emptying chamber. The lower chamber is always open to the outside air so that nothing can ever prevent the gasoline in the lower chamber from feeding by gravity to the carburetor in an even flow.

To fill the tank, should it ever become empty, close the throttle, and turn the engine over several times with the starter, which will create enough vacuum in the tank to fill it. If the tank has been allowed to stand empty for any great length of time, and does not easily fill when the engine is turned

over with the starter, remove plug in top of the vacuum tank and pour a little gasoline in. If, at any time, you should find it necessary to remove the carburetor, first, drain the gasoline from the vacuum tank by opening drain valve in bottom. Note figure 5.

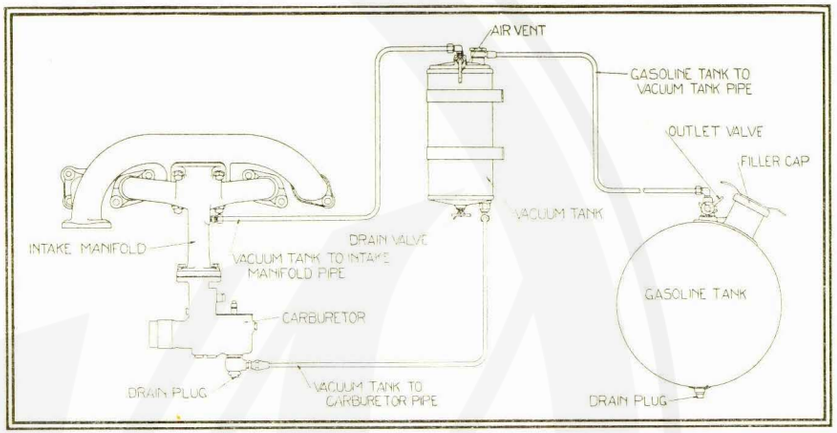


Fig. 5. Fuel System

Faulty Gasoline Feed

In case the gasoline does not feed properly to the carburetor, the following suggestions may be useful. Inspect the vent hole in the gasoline tank filler cap, and the gasoline line from the vacuum tank to the carburetor, to see that they are not clogged with dirt or sediment. Also inspect the line from the vacuum tank to gasoline tank. If the fault is traced to the vacuum tank, the pipe line should be disconnected. After taking out screws, run the blade of a knife around the top, between cover and body of tank, to separate gaskets without damage. Inspect the float and the flapper valve. A small particle of dirt may have lodged under the valve, or on the seat, which might prevent it from closing. Inspect the connections in the vacuum tube from the intake manifold to the vacuum tank to see that they are not leaking air and destroying the vacuum. See that outlet valve on gasoline tank is in proper position, as shown in figure 4.

The strainer is located in top of vacuum tank where pipe from tank is connected, and any particles from the tank may lodge on the strainer. Clean strainer once a month and always look there first for any trouble, due to faulty feed. Note drain valve in bottom of vacuum tank, figure 5, page 13. Drain tank occasionally in cold weather—see page 50.

Carburetor

The carburetor is provided with two adjustments. The main adjustment on the carburetor controls the gasoline supply from the float chamber, and regulates the mixture through the whole driving range. Turning the main adjustment nut (figure 6) anti-clockwise, or to the left, raises the needle and

gives more gas. Turning it in a clockwise direction gives less gas. If an entirely new adjustment is necessary, turn the main adjustment nut clockwise, or to the right, until needle just seats, then open it three complete turns to the left, which should give a mixture approximately correct. After starting and warming up the motor, this adjustment may be regulated as necessary, for the best driving mixture.

The gasoline for "idling" is taken in above the throttle and controlled by dilution with air from the inside of the carburetor, as regulated by the idling adjusting screw which should be between one and one and a half turns to the left, or anti-clockwise from the seating position. After the motor is warm, this may be regulated as necessary, turning to the right or

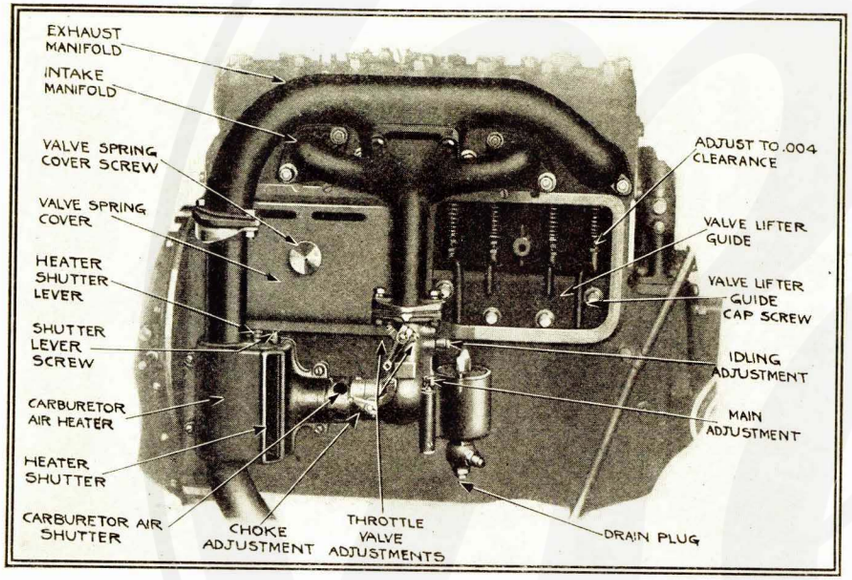


Fig. 6. Carburetor and Intake Manifold

clockwise for more gas, and to the left or anti-clockwise when less gas is required. Idle adjustment is affected only when the throttle is nearly closed. A too rich mixture on the idling adjustment causes considerable leakage of gasoline when motor is stopped. By screwing in the adjusting screw, the desired idling speed may be obtained, after which the clamping screw should be closed down, to hold the adjustment in a rigid position.

The throttle valve control adjustments are on a lever on the side of the carburetor.

The carburetors are adjusted at the factory as "rich" enough to perform satisfactorily, but "lean" enough to obtain maximum economy. The high speed or vertical needle is set approximately 20 notches open or two and a half turns, and the idle adjusting screw is adjusted as lean as could be to get good "idling" with retarded spark on a thoroughly warm motor. This adjustment should be used when perfect performance is of great importance, and exceptional economy is of secondary consequence. To obtain maximum power, the high speed needle should be set with three turns open.

A further increase in economy can be obtained very readily, as follows: Turn the high speed adjusting screw down one notch, making it 19 notches open, check up the idling adjustment, and drive the car on the road. If this setting is entirely satisfactory, try 18, 17, or even 16 notches.

The leanest setting that is satisfactory from a performance point of view will be the most economical. This setting will seldom need to be greater than 20 notches, or less than 16 notches.

Some mechanics are in the habit of adjusting the carburetor without driving the car. It is not usually possible to obtain as correct setting in this way as will result from following these instructions.

Dash Controls

Two different types of carburetor dash controls have been used on the Series R. Cars numbering from R 55001 to R 61468 were equipped with double dash controls. Cars bearing serial numbers before and after those given, are furnished with the single dash control only.

The following instructions cover both types, as the single control corresponds to the "choke" control in every particular.

The driving control on the dash should be in normal closed position for ordinary running and continuous use of the motor; and the previously mentioned adjustments of the carburetor should be made so that the motor when warm will operate properly at all speeds with the control in.

For starting and warming up with the present day fuel, it is absolutely necessary to use the dash control. Ordinarily the motor will start readily with the control pulled out one-half to three-quarters of the way. In very cold weather it may be necessary to pull the control out all the way, but this should be done only for an instant, as it cuts off all the air and delivers only raw gasoline.

In starting, the throttle should be set to give the motor just enough gas to run on after the starter turns the motor over. Having started, the control should be adjusted as necessary, after allowing the motor a moment to steady itself. It should be placed at a point where the motor will have full power, and yet not too rich a mixture for smooth running. Instead of setting the mixture permanently rich at the carburetor, it is better to use a moderate setting, and then give intelligent attention to the operation of the control.

On double control type, the "choke" control button operates a valve in the air entrance of the carburetor. Its action is very powerful and requires careful regulation. When using this control to start, pull out the button all the way for an instant only, then return control ⅛ inch, or whatever position is necessary to keep the motor running best. It is usually best to first pull out the "adj" control all the way before using the "choke" control. Then after the motor has run a moment or so, it will be possible to push in the "choke" button and obtain the proper regulation from the "adj" control alone.

The present low grade gasoline contains a percentage of kerosene, which does not evaporate in the intake manifold but remains in liquid form. After shutting off the motor, particularly in cold weather, this kerosene which has been held in the intake manifold, will sometimes drain back out of the carburetor. This is unavoidable and should not be taken as an indication that the carburetor is "flooding" or "leaking."

Carburetor Air Heater

The carburetor is supplied with hot air, which is heated by the exhaust as it is drawn through the heater. This heated air prevents gasoline condensation, and assists in maintaining proper mixture at all times. It also increases the mileage per gallon of gasoline. The temperature of the incoming air may be regulated by the adjustable shutter in the heater. The heater shutter lever as shown in figure 6, page 14, is in winter position. Removing the shutter

lever screw and moving the position of the heater shutter to the opposite hole places the shutter in summer position.

Carburetor Air Shutter

The carburetor air shutter may be turned to suit various climatic conditions. As shown in figure 6, it is in summer position and is adjustable by loosening the set screw and turning the shutter to closed or winter position. Tighten the adjusting screw after moving position of shutter.

Cooling System

The Series "R" Hupmobile is provided with the efficient thermo-syphon cooling system, governed by the natural laws which make hot water rise above cold water.

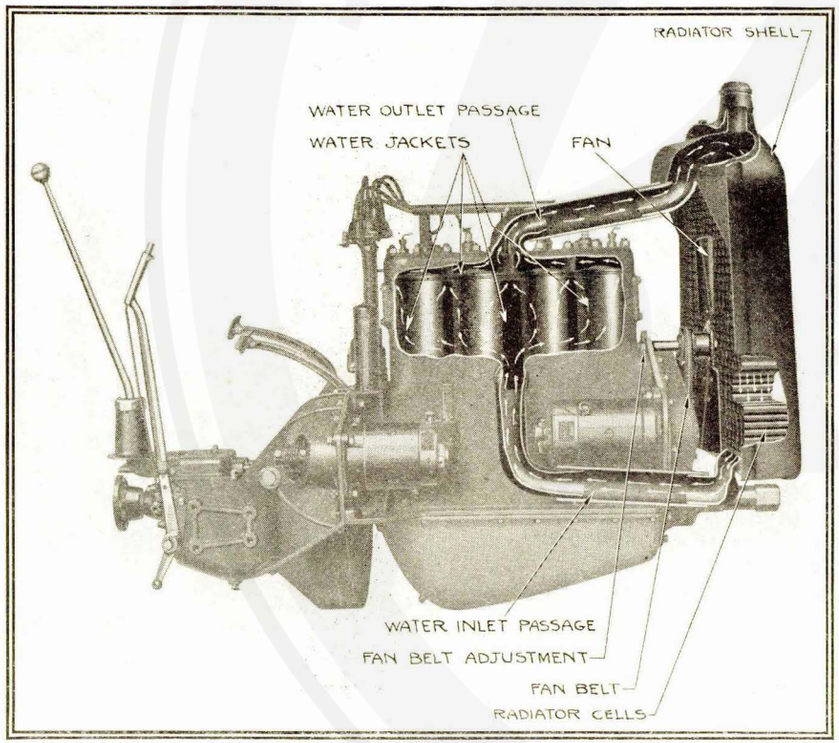


Fig. 7. Complete Cooling System

The water flows from the cylinder block through the water outlet header and radiator inlet hose into the upper part of the radiator. This circulation causes the cold water to flow in from the lower part of the radiator. The hot water that has circulated from the cylinder block into the upper part of the radiator flows down through the core, and is cooled by coming in contact

with the very large cooling surfaces of the cells. The efficient two-blade, or aeroplane type fan draws the air through the cells of the radiator.

In cold weather the thermo-syphon system also heats the water up to proper temperature more quickly than the force-feed system, because the water does not start to circulate until it has reached a certain degree of temperature. This system will maintain a unifom temperature, giving maximum flexibility and power to the motor. It also has the advantage of having no parts to get out of order. The only precaution to be taken is to see that the system is clean and free from sediment or obstruction of any kind.

See that all connections are kept properly tightened, so that the cooling solution is not wasted. Trouble might be caused if the level of the water was to fall to such an extent that the warm water could not flow up through the inlet hose into the upper part of the radiator.

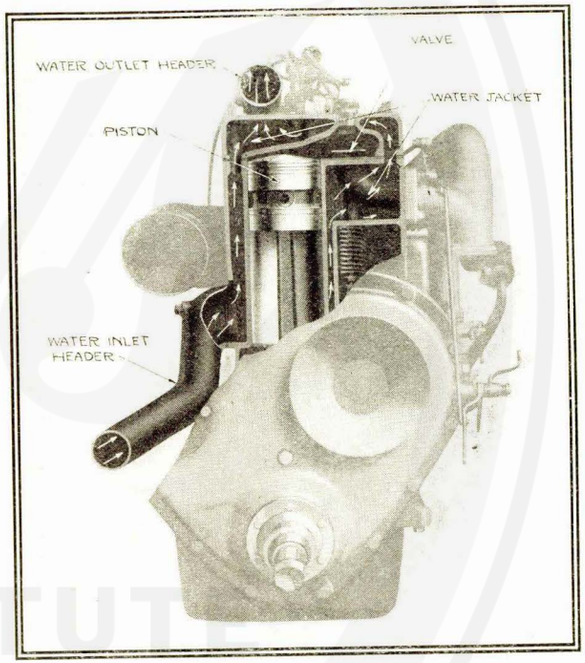


Fig. 8. Cross Section Showing Piston and Valve Cooling

To Drain Radiator

Open the drain valve, located under the radiator on the water outlet pipe which is at the lowest point of the cooling system, and drain off all of the water. It is good practice to wash out the cooling system occasionally. Put in a sal-soda solution, and let the motor run for a time until the solution is warmed up and circulates through the entire system. Drain this solution from the cooling system entirely, and if possible, connect up a hose under pressure, and flush the system from the bottom. The sal-soda solution will loosen scale and particles which may have lodged on the walls of the radiator and cylinder block. The pressure of the water will remove all these particles and thoroughly clean the system. If the walls of the cylinder block should become cor-

roded, and this method does not remove the heavy scales, it is possible to clean the walls by removing the cylinder end plate (See figure 10, page 19).

Avoid pouring cold water into an empty or nearly empty water system when the motor is very hot.

Oiling and Lubricating Systems

The Hupmobile oiling and lubricating systems are so efficient that a minimum amount of wear is experienced if the instructions are followed. Proper lubrication is the motorist's best ally. An owner should see that all points provided by the manufacturer are at all times well supplied with lubricant in accordance with the specified schedule and his own good judgment. Remember to drain crankcase every 800 miles and refill with fresh lubricant. See drain plug, figure 9.

Motor Oiling

Oil is supplied to the interior of the motor through the filler hole in the right side of the engine base, figure 10. To pour in oil, loosen the screw and remove the filler hole cap. Four quarts of oil are required to bring the oil level in the engine oil pan to nearly full position. The oil float gauge shows the oil level at all times. When adding oil to the motor from time to time, it is advisable to push down the oil float rod to make sure that it is operating properly and that it gives the correct reading, so that too much oil will not be added. The oil pressure gauge, figure 10, shows the oil pressure throughout the motor oiling system at all times. The oil pressure relief valve should be adjusted so that pressure gauge registers at least 4 to 6 pounds when a car speed of 20 miles per hour is obtained.

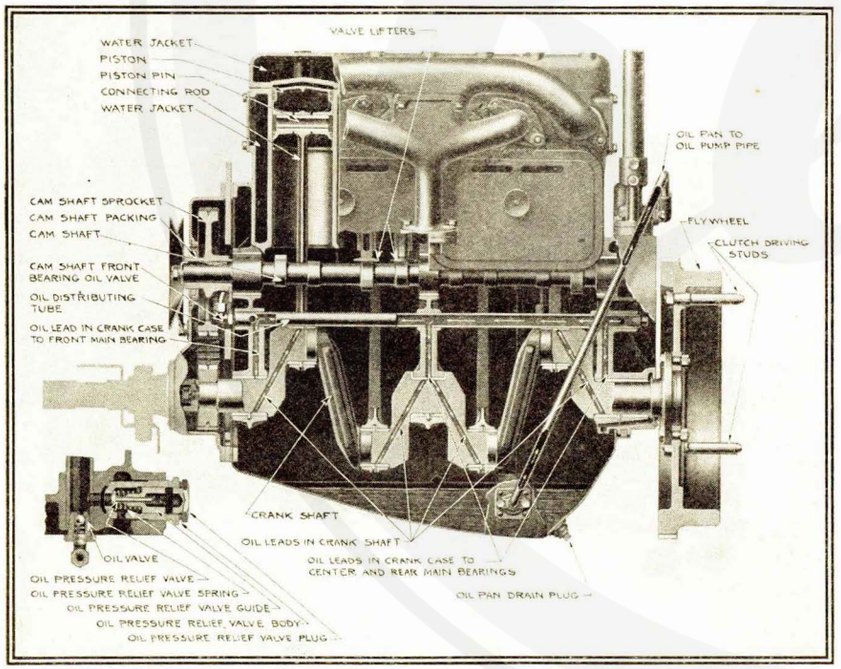


Fig. 9. Complete Oiling System and Oil Pressure Relief Valve

Oil Pump

The oil is circulated by a gear pump, driven by spiral gears from the rear end of the cam shaft. This pump is located on the top of the crankcase at the rear of the cylinder. It can be readily inspected and is easily accessible.

Oil Level Gauge

The oil supply is carried in the bottom of the crankcase. The amount of oil is indicated by a wire upon the right hand side of the motor, which rises along a nickel-plated scale. This is attached to a cork which floats in the crankcase oil. The exact level is shown when the motor is not running, and car is on level ground. (Note figure 10.)

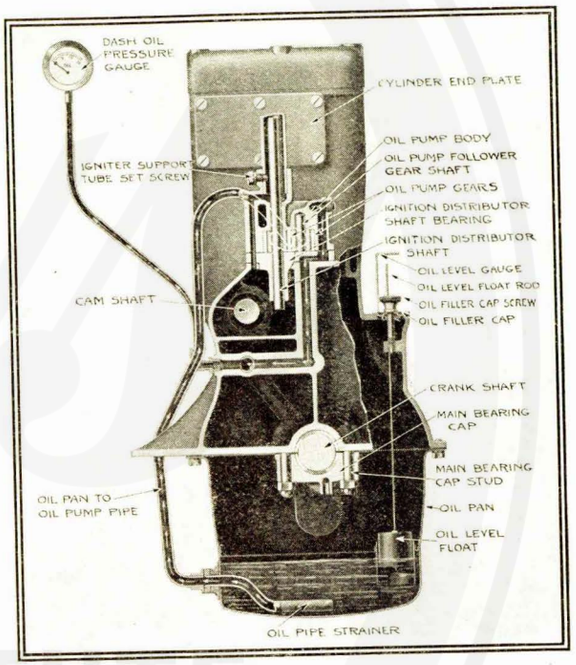


Fig. 10. Oiling System—end view

Crankshaft and Connecting Rod Bearing Lubrication

The oil is drawn from the bottom of the crankcase oil pan and distributed to the main crankshaft bearings through an oil distributor pipe. It is carried from these bearings through the holes in the crankshaft to the connecting rod bearings. Oil is supplied to the pistons and cylinder walls by spray from the connecting rod bearings. Connection from the crankcase to the pump is made through a large diameter metal tube, which rises above the level of the pump so that the pump is always kept primed by the oil remaining in the tube. The outlet from the pump also rises above the pump gears, and connection is made by interior drilling in the crankcase casting, and through a tube which runs lengthwise of the crankcase. Three leads extend downward from this tube, one to each of the crankshaft bearings. (Note figure 9, page 18). The oil pressure maintained by the pump forces the oil directly through these

bearings. The pressure varies with the running speed of the motor and the adjustment of the relief valve.

Camshaft Bearings, Chain and Valves

The overflow from the oil pressure relief valve discharges into the camshaft chain compartment and lubricates the chain. The two rear camshaft bearings are lubricated by the oil spray, which is collected in large pockets cast on top of the bearings. Oil under pressure is supplied to camshaft front bearings. The valve lifter guides and bottom faces of the lifters are lubricated by oil spray.

Generator and Starter Motor Bearings—Fan

The front bearing of the generator is lubricated by oil which flows down the side of the chain case, through oil holes provided. The rear bearing of the generator should be lubricated from time to time with an oil can. (Note right side of motor, figure 27, page 41.) As the bearings are of the self-oiling type, such oiling is needed only at infrequent intervals. This is also true of the starter motor bearings. The fan will need lubrication only occasionally. (Note figure 7, page 16.)

Oil Screens

The oil returning from the engine drains down upon two very fine mesh screens of large area, which divide the compartment from which the oil pump takes its supply. These screens remove the objectionable dirt and sediment, and are so large that ordinarily they require cleaning only once a season. Another screen is provided at the end of the oil suction pipe in the bottom of the oil pan. This latter screen should be cleaned at least every two to three thousand miles by unbolting from the side of the oil pan (see figure 9) and by moving oil pump pipe out of the way so that the oil pipe and strainer assembly can be removed. After this is thoroughly cleaned particular care should be taken that the oil pipe strainer is inserted downwards as shown in figure 10. Carefully examine the gaskets that are used at this joint, and if necessary, replace with new ones when reassembling.

Oil Pressure Gauge

The pressure of the oiling system is indicated by a gauge upon the dash. As long as this gauge indicates the proper pressure, the owner may be sure that the oil is reaching all parts of the motor, unless dirt has gotten into the system in such manner as to clog one of the oil holes. This, however, is very unusual trouble. The oil pressure gauge should register at least 4 to 6 pounds when going 20 miles per hour.

Failure of the oil pressure gauge to register is usually an indication of trouble and should be looked into at once. The most common cause is that the oil supply is nearly exhausted, which can be ascertained by looking at the oil level gauge on the engine. If sufficient oil is in the oil pan there may be a leak in some of the piping connections, or some foreign substance may have become lodged under the oil pressure relief valve; or dirt has accumulated upon the screen, so that the oil is not being returned to the lower part of the crankcase as fast as the pump draws the oil from the pan. A fluctuating oil pressure gauge may be traced to lack of oil in the crankcase or dirty oil screens. In the latter case see information on page 20 under oil screens.

If, for any reason, the oil has been drained from the crankcase, make sure after re-filling that the oil is circulating properly through the motor. This can be determined by watching the oil pressure gauge. If the gauge does not register remove the ⅛" pipe plug at the top of the oil pump and prime by using a hand oil can, filling the oil hole until full.

Failure of the oil pressure gauge to register until after the oil pump is primed may be due to too much vertical clearance between the pump gears and the pump cover plate, which can be corrected by removing one or more of the gaskets of about .006 to .008 in thickness. The amount of end play or

vertical clearance in the main pump gear, as well as the follower gear, should be about .003 of an inch.

By removing the oil line tube from the pump and unscrewing the four slotted hexagon cap screws from the crankcase, the entire assembly can be readily removed. In order to do this in the easiest possible manner without disturbing the motor timing, first remove the distributor cap on the igniter head and crank the motor by hand very slowly until the distributor block points directly towards the radiator. Then, remove the distributor head assembly by backing off the small retaining screw mounted on the support tube directly underneath. After the oil pump has been removed, the base may be bolted together and the amount of end play accurately determined. It is possible to determine the approximate amount of end play without disassembling the pump, by first removing the igniter head assembly, then placing a pair of long nose pullers, and catching hold of the igniter driving shaft and pulling the shaft upwards and then pushing it downwards.

Oil Pressure Relief Valve

The oil pressure relief valve (note lower left hand corner, figure 9, page 18,) is located at the front end of the tube, and is set at the factory so that the oil pressure gauge shows 4 to 6 pounds pressure at a car speed of 20 miles per hour. If adjustment of the relief valve is necessary, unscrew the hexagon plug of the relief valve body, by turning it to the left or anti-clockwise. When this operation is completed, it exposes the slotted adjusting plug. The pressure may be regulated by screwing in or out on the oil pressure relief valve plug. (See figure 9, page 18). Turning to the right or screwing in on the oil pressure relief valve plug, increases the spring tension of the valve and raises the pressure of the oiling system. Turning the plug to the left or screwing it out, relieves the spring tension on the valve and lowers the oil pressure. If it is necessary to remove the complete relief valve, before replaceing put a small quantity of grease on the copper gasket, so that it will remain on the taper end of the body when it is replaced.

Quality of Oil to Use

Use a medium weight oil of some well known brand the year round. In the case of very hot climate, an oil of somewhat heavier body may be used. It will usually be found that the heavier oils deposit more carbon on the top of the pistons than do the lighter oils. For cold weather, oil having a zero test, such as Polarine Light, Sunoco, Texaco or Sinclair Motor Medium should be used. Oils not having zero cold test become so thick when the temperature reaches 10° Fahrenheit or less, that it maybe impossible to turn over the motor. In some cases these oils actually freeze so solidly before this degree is reached that they may shear the pump driving pin, or clog the pump suction pipe.

Transmission Lubrication

One and one half pints are sufficient to bring the oil level in the transmission case to the center of the countershaft. The transmission is designed to use a fluid lubricant only—therefore no heavy grease should be used. There are oil leads and grooves for the distribution of the oil to the various bearings, which heavy grease will not flow through. The use of such heavy lubricant will clog the leads and cause destruction of the bearings which depend upon the oil supply. 600-W should only be used in the summer. Lubricants that will stand a zero cold test must be used in the transmission and rear axle during cold weather. Badger Gear Compound, made by Wadham's Oil Co. of Milwaukee; Cataract 10-A, made by the Swan-Finch Co. of Buffalo, and Winter Transmission Oil made by the Standard Oil Co., have proven satisfactory. They are also suitable for summer use.

Transmission Care

If the instructions on gear shifting on page 9 are observed, the transmission will require no mechanical adjustment and the only attention necessary will be to drain and refill the case with proper lubricant, once every 3000 miles. In shifting gears, small metallic particles are worn off by the gear teeth and these particles are destructive to the bearings when mixed with the oil. Drain off the entire amount of dirty oil before putting in the fresh supply. (Note transmission drain plug, figure 27, page 41). After draining it is always advisable to flush out the interior of the transmission case with kerosene. This will wash out the gritty oil and particles of metal which may be in the case.

Universal Joints Lubrication

Universal joints at ends of the propeller shaft are enclosed in a casing which should periodically be filled with non-fluid heat-resisting grease. Use only a small quantity and thus avoid forcing grease into leather dust cover. (See schedule of lubrication, figure 40, insert).

Rear Axle Lubrication

The rear axle should be lubricated with a good grade of heavy lubricant and filled to the level of the plug in the housing. Remove the small plate on top of the pinion shaft housing and add cup grease when needed. (For details, see schedule of lubrication, figure 40, insert).

Do not fill the rear axle housing with grease above the proper level as certain road conditions might cause the grease to run out into the housings and consequently leak at the rear wheels.

Wheel Bearings

Wheel bearings should be lubricated with cup grease. (See schedule of lubrication, figure 40, insert).

Ignition Distributor Oiling

Ignition distributor should be lubricated with motor oil on the working parts every 1,000 miles. Only a few drops are necessary on the central shaft to insure against wear. Oil should not get on the contact points and hinder the correct operation of the instrument. (See page 24 for further information).

Chassis Lubrication

The spring shackles, etc., as shown on figure 40, insert, are equipped with grease valves. A grease gun or compressor having a 500 pound maximum pressure is furnished with each car.

The following instructions for this system are recommended:

To fill the compressor, disconnect the hose from the grease cylinder and remove head. Use a paddle to fill with whatever cup grease or lubricant you usually use. Jar or shake grease down by gently tapping cylinder on convenient box or bench. In replacing screw head and piston plunger be sure that leather plunger is drawn all the way back into metal cup inside of head.

To lubricate bearing you should see that the valve is reasonably clean—press hose coupling over valve and turn to lock on. Turn handle to right until grease is forced through bearing. Keep hose in as near a straight or horizontal position as possible when in use. Before disconnecting coupling turn handle back to relieve pressure, so grease will not flow from coupling when disconnected.

Use your hands only when operating the compressor. A maximum pressure of 500 pounds to the square inch can be obtained by use of your hands alone; which, under ordinary circumstances, should be sufficient power to force the old grease out and the new grease in. If you cannot obtain results

from this pressure, it is because the bearing has become clogged and caked with old grease so that no amount of pressure would suffice to dislodge it. In such cases, take bearing apart and clean.

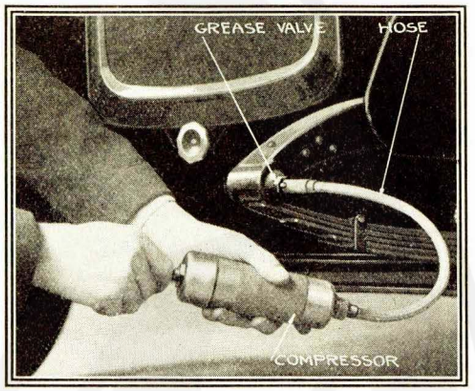


Fig. 11. Grease Compressor and Valve

The outfit and hose will last indefinitely if not abused. Do not try to disconnect by twisting the hose, but use a wrench when separating the hose from the compressor. Don't kink or bend the hose too short as this will open seams and cause leakage. Don't put the compressor away unless hose is disconnected. Any parts of this outfit that bear evidence of abuse by use of wrench or other means will not be replaced by their manufacturer.

Adjustments

It is reasonable to suppose that from time to time adjustments are necessary in such a fine piece of mechanism as the Hupmobile. For this reason we have provided certain adjustments, which can easily be made.

Yet adjustments are of little value unless the reason for and result of the adjustment is known. The difference between good and poor repair work can generally be traced to the fact that the repair man in question was not familiar with the adjustments which the manufacturer had provided.

These suggestions will assist you to make the proper adjustments, but unless the result of the adjustment is thoroughly understood in advance, it is much better to take the car to "someone who knows," which means the Hupmobile dealer.

Ignition System Adjustments

See also "Ignition Testing," page 46.

Gap Gauge Assembly

A three blade gauge assembly can be secured from the Hupmobile dealer. The blade marked "AK CC" measures the proper gap between the contact points of the ignition distributor which is between .006" and .008". The "SP" blade measures the spark plug gap, and is approximately .020" to .022" thick. The "VT" blade is for the valve lifter adjustment, for which proper clearance is .004".

Spark Plugs

Should be adjusted with .020″ to .022″ gap in accordance with the leaf of the gap gauge, marked "SP." It has been the natural tendency to set spark plug gaps wider than this dimension, but this adjustment specified is very essential with the Hupmobile motor, as spark plug electrodes set too far apart will not give such good results at higher speeds. See figure 12.

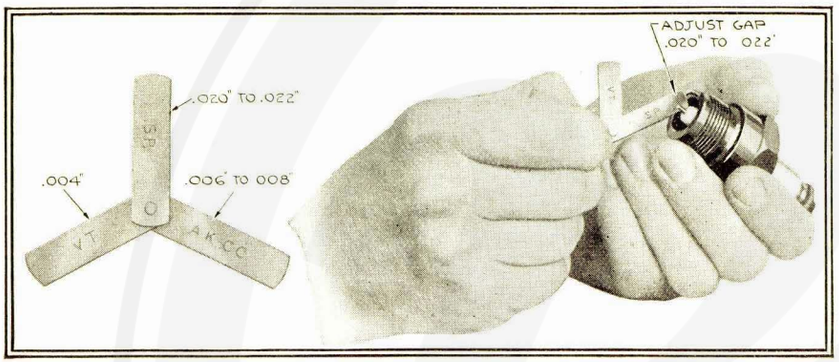


Fig. 12. Gap Gauge Assembly in Use.

Ignition Distributor

The only part of the ignition distributor to adjust is the contact holder, which is adjustable only for natural wear of the contacts.

Adjustment of the igniter contact points should be made in accordance with the leaf of the gap gauge, marked "AK CC." (Note figure 13). The standard gap is .006″ to .008″ between the points when the circuit is open, and the dimensions given should be strictly adhered to.

When the contact points are working properly small particles of tungsten will be carried from one point to the other, sometimes forming a roughness and a dark gray color on their surfaces. This roughness does not in any way effect the proper working of the point, owing to the fact that the rough surfaces fit into each other perfectly. It is seldom necessary to "dress down" these points. If it is suspected that they are causing missing explosions, because of dirt, they should be removed and very carefully "dressed" on a fine oil stone.

Remember, that although the contact surfaces may be very rough, they may be in perfect working condition—the dark gray appearance being the natural color of the tungsten. Every 1,000 miles, remove the distributor cap and put a drop or two of cylinder oil around the igniter shaft. (Note oil hole, igniter header, figure 13.) Be careful not to allow oil to get on the interrupter contact points as it will render the system inoperative. The contact points do not require filing or cleaning unless oil gets on them. However, frequently wipe out the interior of the ignition distributor top with a soft cloth moistened with a little clean cylinder oil. This prevents condensation of moisture in cold weather, and facilitates starting on frosty mornings.

Use Genuine Parts

Do not use "imitation" parts or parts catalogued merely "to fit" Atwater Kent equipment. No matter how closely they resemble in appearance the genuine parts, they lack the quality and exact spring tension required for proper operation and will not give satisfaction. Purchase parts from a reliable source and make sure they are genuine. Consult the Hupmobile dealer.

Distributor Cap

The cap of the igniter is easily removed by the slightest thumb pressure against the clamps on either side. However, when placing distributor cap in position and fastening with clamps, care should be exercised to place the thumb on the center of the clamp spring as shown in figure 13. Only a very slight pressure is necessary, if the thumb is placed at this point; but it is a very simple matter to break the spring if you should try to force it into position by pressing at the extreme top.

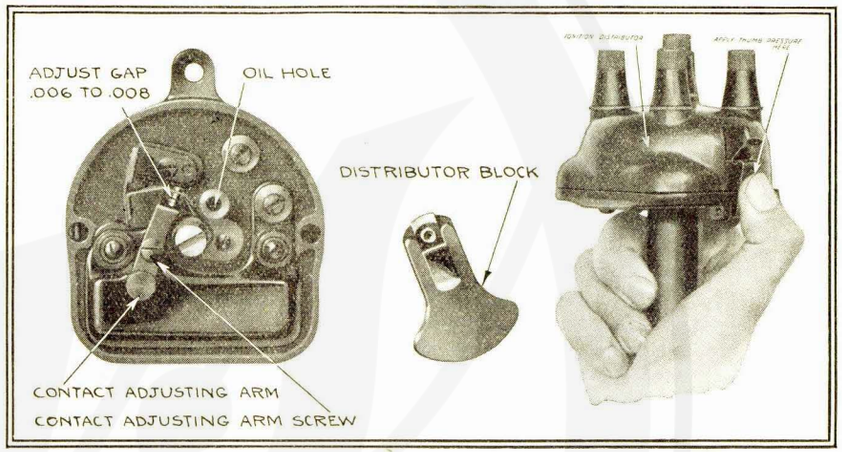


Fig. 13. Ignition Distributor

Valve Adjustments and Grinding

So that the valves may seat properly, a space must be maintained between the end of the valve stems and the adjusting screws in the valve lifter. This space or clearance, as it is called, should be maintained at .004″. Correct clearance can be obtained by using the blade marked "VT" of the gap gauge assembly. If the clearance is greater than the blade, the motor may be noisy; and if less, the lifter will not allow the valve to seat tightly, causing lack of compression.

Valve Lifter Adjustment

Valve adjustment should be made when the engine is hot, and when the particular valve to be adjusted is closed, that is, when the lifter is resting on the back of the cam so no upward pressure is exerted.

To make this adjustment, remove the cover from the left side of the cylinder block, thus exposing the lower end of the valve stems and the upper end of the valve lifters (see figure 6, page 14, showing cover removed from valve lifter guide.) Loosen the lock nut, and screw the lifter adjusting screw up or down as desired. When you have determined the correct clearance by the aid of the gap gauge, hold the adjusting screw perfectly stationary with one wrench, and tighten the lock nut with another. Always test the clearance after completing the adjustment, to make sure that the screw has not moved in setting up the lock nut. If a lifter should become noisy and it becomes necessary to install a new part, this may be done by removing the four valve lifter guide cap screws shown in figure 6, page 14. When installing the valve lifter guide assembly, be sure and tighten the cap screws securely.

Grinding Valves

If the valves leak compression after the lifters are properly adjusted, it will be necessary to reseat them. This operation is greatly simplified by the detachable cylinder head, which, when removed, exposes the valve head, and allows ample space for working. Disconnect radiator hose, spark plug wires and cylinder head stud nuts. Be very careful not to break the cylinder head gasket. Remove valve spring cover. Hold down on one of the valve heads, and compress the valve spring with any standard valve lifting tool until the little horseshoe shaped spring washer retaining collar can be slid off the stem, allowing the valve to be pulled out of the top. Clean the valve and its seat in the cylinder with a piece of cloth moistened in gasoline. Be very careful not to scratch the valve seat when cleaning.

Valve grinding may be done with any good valve grinding compound. A spring should be placed underneath the head of the valve, having just enough tension to raise the valve off its seat when the pressure is removed from the grinding tool. Valves should be rotated in alternating directions when being ground, using very little pressure on valve, as this will guard against the possibility of a groove being ground in the seat. With a spring underneath the head of the valve to raise it off the seat as the direction of rotation is being changed, the grinding compound will have a chance to flow evenly over the surface, and the result will be satisfactory.

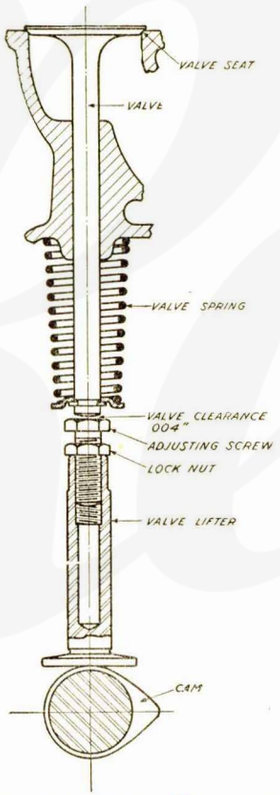


Fig. 14. Valve Adjustment

Having secured a good valve seat, remove all traces of the grinding compound, being careful that none gets into the cylinders, valve pockets or valve guides. Replace the valve spring, washer and retainer collar, and then adjust the lifter clearance as previously instructed. It is always a good plan to remove any rust from the valve stem by polishing with fine emery cloth, and then to coat the stems with kerosene before replacing.

Before replacing the cylinder head, examine the gasket carefully. If it is broken or cracked, a new one should be used. Do not use shellac on gasket. In replacing the cylinder head, great care must be exercised to see that it is pulled down evenly and tightly to prevent leakage of water or compression. Put the gasket in place on top of the cylinder block, and then set the cylinder head on top, being careful not to move the gasket. Start all of the stud nuts evenly, tightening first one and then the other. When all of the nuts are slightly tightened, go over them again, turning each nut a little at a time until the head is worked down perfectly tight. After motor reaches normal running temperature, again tighten each nut.

Carbon Removal

After considerable service a deposit of carbon may accumulate on the piston heads, valve heads, and walls of the combustion chamber. Should the motor overheat or knock when the spark is fully retarded, or continue to fire

after the spark is cut off and does not develop its usual power, the indications are that there is an excessive deposit of carbon in the cylinders, which becomes incandescent through heat and ignites the mixture prematurely.

Carbon formation is increased by running the motor on a too rich mixture, as well as by the use of excessive or inferior quality lubricating oil. The best way to remove the carbon is to take off the cylinder head and scrape the interior. Some garages are equipped with the oxygen process of burning out the carbon. This method when properly done is satisfactory.

Motor Bearing Adjustments

Crankshaft and Connecting Rod Bearings

Crankshaft main bearings are fitted with laminated shims between the bearing caps. When it is necessary to adjust main bearings, the cap should be taken off and a thin section of the laminated shim removed. Then put the cap back in place. It may be necessary in such cases to slightly scrape the bearing to get a proper bearing surface. See that the same amount is taken off the shims on both sides, in order to equalize the bearing, and have it drawn up true.

Connecting rod bearings are adjusted in the same manner as main bearings. Thin shims should be pulled off the laminated shims on each side until the bearing fits snug on the crankshaft.

Locating Need for Adjustment

The adjustment of the connecting rod and main bearings should preferably be done in a Hupmobile service station and this work should always be done by an expert mechanic. The need for adjustment of a connecting rod or main bearing is indicated by the motor knocking or pounding when it is speeded up. If the pound is due to a loose connecting rod bearing, the particular bearing may be located by removing the spark plug wires, one at a time so the motor is firing on only three cylinders. The knock will cease when the plug wire is disconnected from the cylinder whose connecting rod bearing is loose, or scored. It may also cease if the looseness is in the main bearing next to the cylinder, which is cut out. If the knock continues after all four cylinders have been tested in this way, the trouble is probably due to one of the three crankshaft main bearings. The connecting rod and main bearings can be reached by removing the bottom half of the crankcase.

Re-timing the Motor

If for any reason it is necessary to re-time the motor proceed as follows:

The center line is marked on the flywheel shown on the timing diagram. The markings at the center line mean inlet opening, exhaust closing on No. 1 and No. 4 cylinders. In setting the timing, place this line on center. In order to do this, it should be set 2½ inches from the side of the long stud at the rear of the engine base, just above the flywheel. (This is, however, not necessary if cylinder head is removed—see timing diagram.) *Note carefully* that the measurement is to be taken from the side of the stud to the center line marked on the flywheel, which is approximately the center of the opening in the transmission case. With the flywheel in this position, the camshaft should be set so that the intake valve is just opening and the exhaust valve just closing. With the crankshaft and the camshaft in the proper position, the chain should be put on. Then set the spark so that it will fire on No. 1 cylinder with the spark lever on steering wheel quadrant one-third of the way up. Note position of distributor block in timing diagram.

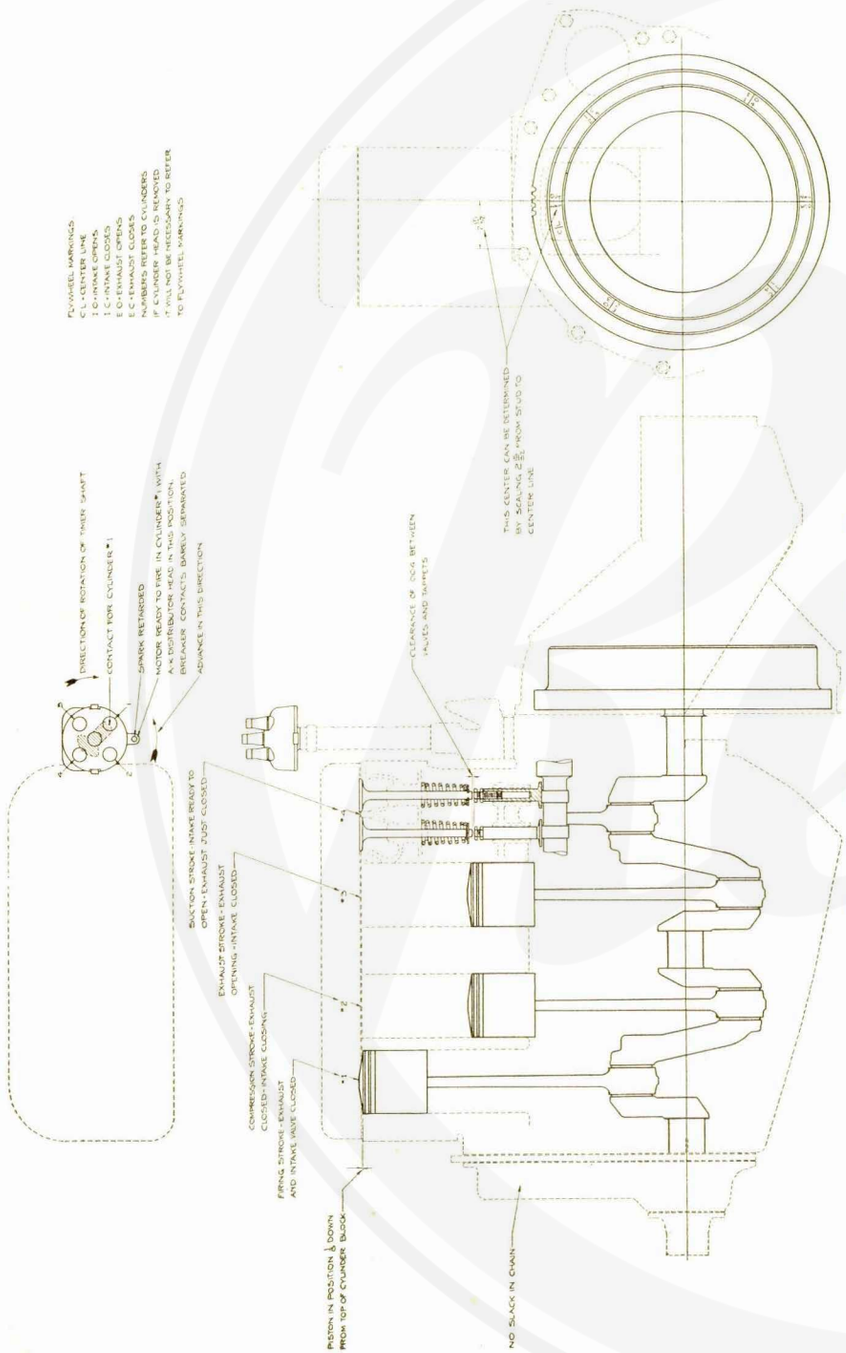


Fig. 15. Valve and Ignition Timing Diagram

Clutch Adjustments

Clutch adjustment is made by placing the clutch spring retaining washer and key in different notches on the clutch spring studs. (Note figure 16, page 29, clutch spring collar and clutch spring collar lock.) If such adjustment is ever found necessary all springs should be set the same; as otherwise the clutch operation would not be satisfactory. In order to tighten the clutch, the spring should be compressed and the key removed from the groove in which it is at that time, and placed one notch forward. This adjustment may be made after unbolting the flywheel pan. If this adjustment is made on all clutch spring studs, it will be even and give good results. There should be ⅜" clearance between the end of the clutch release shaft stop screw and the boss on the transmission case when the clutch pedal is at rest. (See figure 23, page 36.)

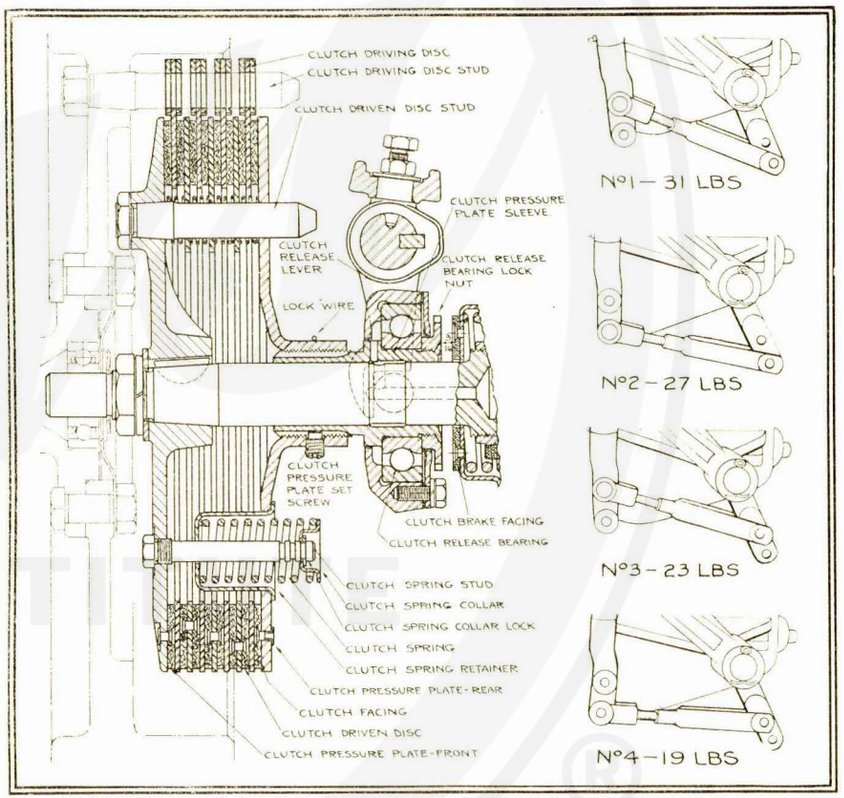


Fig. 16. Cross Section Showing Clutch Details, and Method of Adjustment

Clutch Brake

The clutch is provided with a clutch brake. When the clutch is released by the full throwout of the clutch pedal, the clutch brake assists in stopping the transmission gears and allows the change of gears to be made without

clashing. The clutch release collar on which the clutch release ball bearing is mounted, is screwed on the rear clutch pressure plates, and locked by a set screw. This construction allows adjustment of the distance between the clutch release collar and the clutch brake. When the car leaves the factory, the distance between the clutch collar and the clutch brake is 3/16", but as the clutch facing wears, this distance increases, so that it will be necessary to make adjustments occasionally in order to retain a short clutch throwout, as this distance should never be greater than ¼". This may be done by removing the release collar (figure 16, page 29); then turn the clutch release collar to the left until the desired clearance of 3/16" between the release collar and the clutch brake facing is obtained. After obtaining correct clearance, drill ¼" hole in clutch release collar to a depth of approximately ⅛". (Note—this drilling is only necessary on a few cars, as in most cases release collar is grooved.) Exercise extreme care and do not drill hole entirely through clutch release collar. When replacing release collar set screw, be sure and lock with wire as originally found.

Clutch Pedal

The normal position of the clutch pedal in reference to the toe-board, may be varied by changing the position and length of the clutch pedal adjusting link between the pedal arm and the clutch release shaft lever. (Note figure 16, page 29.) Excessive foot pressure should be avoided, as owing to the great leverage provided by which soft clutch action is obtained, too much pressure causes strains on all parts.

A change of pedal pressure changes the length of the travel of the clutch pedal. The lighter the pedal pressure, the longer the travel required.

The clutch pedal may be adjusted to obtain four different pressures as follows: 1—31 lbs. Place the link between lower hole in clutch pedal arm and upper hole in clutch release shaft lever.

2—27 lbs. Place link between lower hole in clutch pedal arm and lower hole in clutch release shaft lever.

3—23 lbs. Place link between upper hole in clutch pedal arm and upper hole in clutch release shaft lever.

4—19 lbs. Place link between upper hole in clutch pedal arm and the lower hole in clutch release shaft lever.

Timing Chain Adjustments

A very simple adjustment makes it possible to maintain proper chain tension at all times. The timing chain may lengthen especially when new, and might create a slight noise by hitting on the bottom of the chain cover. The chain adjustment is controlled by the position of the generator. The generator is secured to the front plate by three bolts, the lower being fixed, and the two upper bolts having slotted or elongated holes, allowing for 5/16" movement of the generator sprocket. To tighten the chain, the generator bolts should be loosened a few turns, and the generator moved out from the crankcase by hand, and the bolts tightened. (Note elongated holes, figure 17, page 31.)

If the chain is set too tight, it may cause a humming or grinding noise at high motor speed. In this case the generator must be loosened again, and moved a trifle nearer the crankcase, and the bolts tightened.

If the chain should lengthen to such an extent that no more adjustment is available, it is advisable to install a "hunting" or offset link section. To do this, proceed as follows: Crank the motor by hand until the distributor block in the ignition distributor points directly towards the front of the car. Remove front motor bolts and loosen the rear motor bolts. Remove hood, radiator, fan driving pulley and fan assembly.

Place a jack under the bottom of the oil pan near the front end, and raise the motor just enough to remove the chain housing, after it has been unbolted. Unbolt front chain housing, removing the cap screws which hold timing sprocket cover to crankcase, also remove the cap screws which hold the oil

pan to housing. The front chain housing can then be lifted free from the motor.

Cut a block of wood approximately 2½ or 2¾ inch square for the purpose of driving it between the crankshaft sprocket and the camshaft sprocket. Before this is driven between the teeth, make sure there is no slack in the chain between these two sprockets. This block should not be removed until after the chain has been approximately adjusted. Now loosen the three bolts which hold the generator in place and allow the instrument to swing toward the crankcase. When cutting chain be careful that each severed washer is at head of an arrow, as otherwise leaf plates of three length section will not mesh in regular order with chain. Compare offset link with section to be removed. After removing the four links, insert the three-link section in place of the removed section, making sure that the arrows point in the direction of rotation. Insert seat pin with washer riveted on one end from far side of chain, taking care that the ribbed side of the pin points in direction of rotation of the chain as shown by the arrows marked thereon. Insert rocker pin from near side of chain with segmental or pointed side of pin against flat side of seat pin; also toward direction of rotation of chain. Place washer on end of seat pin and after backing up with bar or wedge, rivet over the end with a few sharp blows of a hammer.

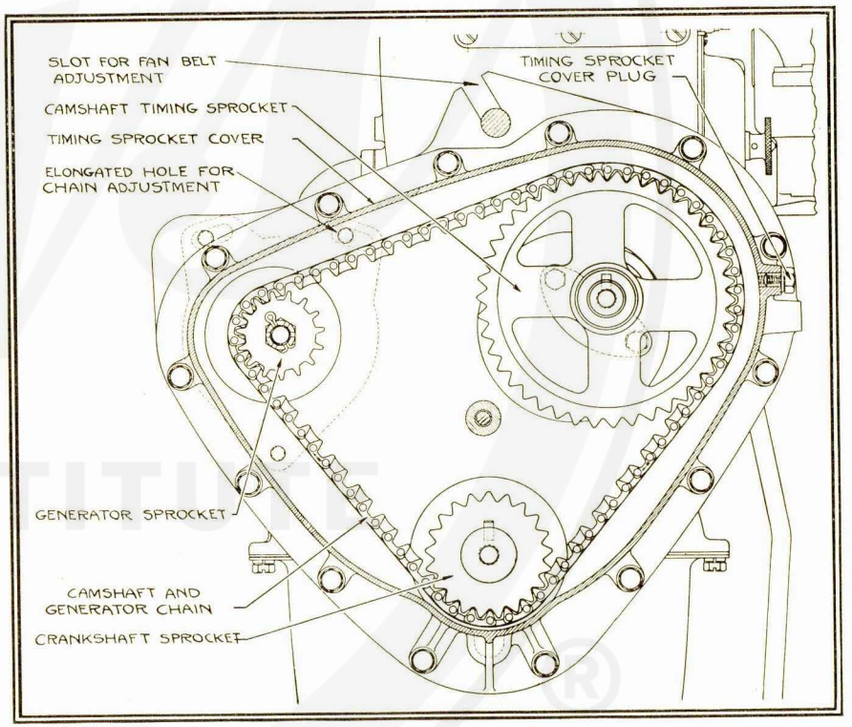


Fig. 17. Timing Chain Adjustment

After the chain with the offset or "hunting" link installed reaches the limit of adjustment, it will then be necessary to replace with a new chain.

The construction of the timing chain is such that in order for the chain to operate freely it is necessary that enough clearance be left on the back face

of the link so that the pins will be free to rock against each other, and will not bind against the link. For this reason the clearance is left at each joint in order to permit free movement of the pins. Thus if a new chain is laid upon a bench it will show a back and forth movement more than ½ inch. This is the proper condition of the chain when new, and the distance slightly increases with service. The chain of 72 links should have an extended length of 36 inches when new. After long service with a "hunting" link installed, the chain should not be replaced unless it shows an extended length of 38 inches, or in other words, has reached the limit of adjustment the second time.

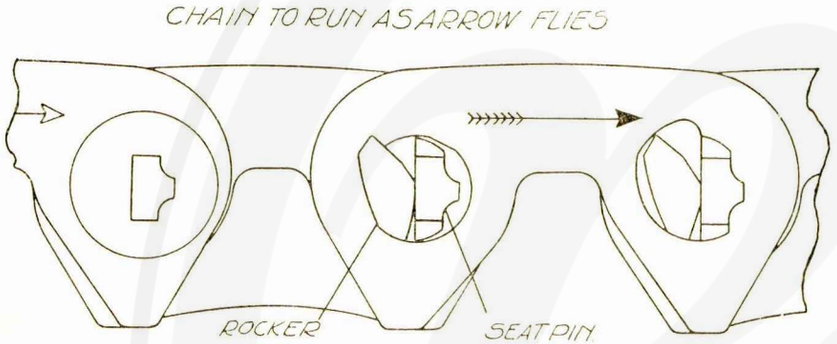


Fig. 18. Chain Direction Diagram

Front Axle Adjustments

Steering Gear

Adjustment of the steering gear is very simply and easily made. If excessive "lash" or lost motion develops, it can be taken up by loosening the adjustment nut clamp bolt nut (refer to figure 19), and screwing down on steering gear adjusting nut threaded with right-hand thread. The proper way

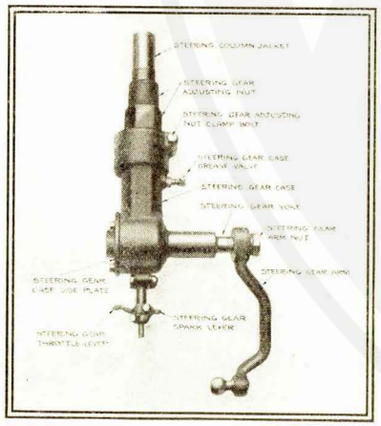


Fig. 19. Steering Gear Assembly

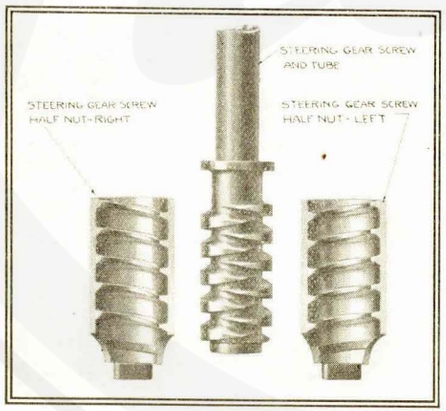


Fig. 20. Steering Gear Screw and Half Nuts

to make this adjustment is to raise the front axle up so that both wheels are clear of the ground, and then test the amount of backlash by turning the wheels as far as they will go in both directions. After the proper adjustment is secured, the clamping bolt must be tightened.

After work is completed, be sure that the steering cross tube clamp bolt is securely fastened; also that the yokes are in such position on the steering cross tube, so that the clamps will hold them securely.

The proper steering of a car is essential to the safety of the occupants, so the owner should inspect the parts of the steering gear at regular intervals, to make sure that none of the fastening nuts have become loose. Hard steering is not always due to the gear itself; inspect drag link connections, and keep the ball sockets lubricated. The gear is filled with a heavy cup grease or graphite when it leaves the factory. However, this should be thinned occasionally by inserting a little engine oil through the oil hole at the top of the gear housing. (Note steering gear grease valve, figure 19).

Front Axle Lubrication

The front axle is equipped with four grease valves, one on each steering knuckle, and one on each end of the steering cross tubes, which should be lubricated every 300 miles. (See schedule of lubrication, figure 40, insert.)

Front Wheel Alignment

To make steering easy, the front wheels are "toed in" approximately ¼" to 5/16", that is, the inner edges of the rims are approximately ¼" closer together at the front than at the rear. The measurements are to be taken in line with the hubs at diametrically opposite points—see diagram—line A being ¼" shorter than line B. The "toe-in" is adjusted by lengthening or shortening the steering cross tube. To do this, loosen the cross tube yoke bolt nuts on both sides and use a pipe wrench to grasp tube, turning the tube either to the right or left to obtain proper adjustment. Make certain the clamp bolt and nuts are securely tightened.

See the Hupmobile dealer at regular intervals, and have him test your wheel alignment.

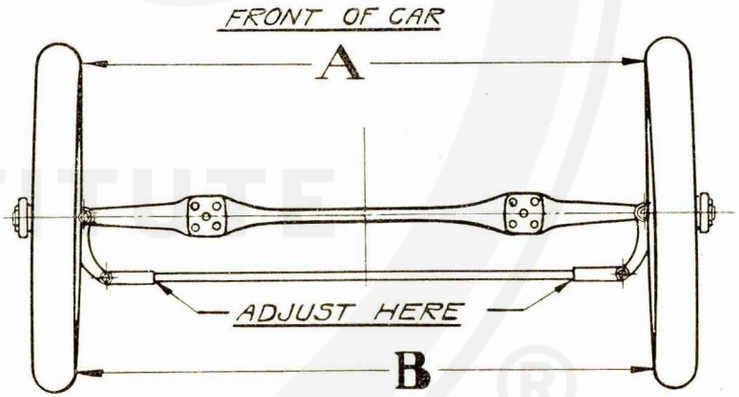


Fig. 21. Front Wheel Alignment

Front Wheel Bearings

Front wheel bearings are adjustable, thrust being taken both ways. They should not be adjusted too tight.

To lubricate the front wheel bearings properly, jack the wheels up clear of the ground, and remove the hub cap. After taking out the cotter pins, unscrew the front wheel nut by turning the nut of the right wheel to the left, and

the left wheel nut to the right. The wheels can now be pulled straight off of the steering knuckle spindles, and the bearings repacked with grease. If this is done once every 2500 miles, the bearings will give excellent service; when neglected they may wear excessively.

Front Wheel Bearing Adjustment

When a wheel is removed, the bearing is removed with it; consequently, the bearing must be properly adjusted when the wheel is replaced. The best method is to turn the bearing up tight, and then revolve the wheel a few times by hand, which overcomes any tendency to backlash. Then back off the adjusting nut very slightly so that by grasping the two spokes in a perpendicular line, one above and one below the hub, you begin to feel a very slight movement of the wheel. If this is more than barely perceptible, it is too much, and the adjusting nut should be a little tighter. When you have adjusted it right, lock the nut with cotter pin. The wheel should swing to and fro by the weight of the valve stem, and finally stop with the valve stem at the extreme bottom.

Rear Axle Adjustments

The rear axle is of the three quarter floating type, in which the weight of the car is carried by the axle housing, thus leaving the axle shafts free to do the driving without carrying the weight. The wheels are mounted on high duty roller bearings, which run between hardened steel sleeves, fitted to both the axle housing and the inside of the wheel hub. The bearing is located in the center of the wheel, directly in line with the load, which insures long life and the minimum wear.

The rear axle gears are of the spiral bevel type. There is an adjustment (see figure 22, page 35, differential thrust bearing adjuster lock) for moving the large gear, or what is termed the ring gear, to and from the pinion, and also an adjustment (see drive pinion bearing adjuster lock, figure 22, page 35) for moving the pinion in and out. The gear should be set so that the back face of large end of the teeth of the pinion are flush with the outside face of the teeth of the ring gear. The side adjustment of the ring gear should then be set so that there is just enough backlash between the two gears to allow them to move freely at any point in their rotation. Differential gears are properly adjusted at the factory and should require very little attention other than to receive proper lubrication. If for any reason the differential gears have been dis-assembled, readjustment should be made in an authorized Hupmobile service station.

Should a noise develop in rear axle it may indicate that the gears are slightly out of mesh. To correct this, remove the drive pinion bearing adjuster lock on the side of the pinion housing. This exposes two large nuts with prongs. Turn these prongs so that both nuts move together, to the right or left, according to the way in which you have determined to move the pinion, either in or out. Be sure the drive pinion bearing adjuster lock is in place and tightened before running the car. Should the car be run without the adjuster lock properly placed, the adjustment may move, and destroy the drive pinion and ring gear. Try axle with new adjustment, and continue process until gears are quiet.

Rear Wheel

The rear wheel is secured to the axle driving shaft by means of a taper, key and nut. The wheel can be removed by use of a wheel puller, after taking off the hubcap, and then removing the rear wheel nut on the end of the axle shaft. A wheel puller may be obtained through your dealer at nominal price. The wheel should always be placed first on the axle shaft, then the key should be driven flush with the outside of the hub. Axle shaft nuts should be securely tightened and cotter pinned.

For lubrication of rear axle, see figure 40, insert.

Brake Adjustments

Each external brake consists of one continuous steel band lined with a special heat resisting material. External brakes are of the contracting type, and are operated on the rear wheel brake drums by the brake pedal.

The adjustment of the service brakes is obtained by means of the external brake adjusting link nut (see figure below, adjustment on the front of the brake band). The length of the external brake connecting rod should not be changed. All adjustments should be made at the end of the brake band.

In making adjustments on the external brake it is essential that the clearance between the lower half of the brake band and the brake drum should be as much or a trifle more than the clearance on the upper side. In order to obtain this, you may find it necessary to unloosen the locking nut holding the external brake support (see figure 22) and move the support downward until the desired adjustment is secured. Be sure and lock securely.

The emergency brake operated by the hand lever, also acts on the rear wheel brake drum. Each brake consists of a continuous band, faced with heat resisting material, and is expanded by a cam at the forward end of the brake band.

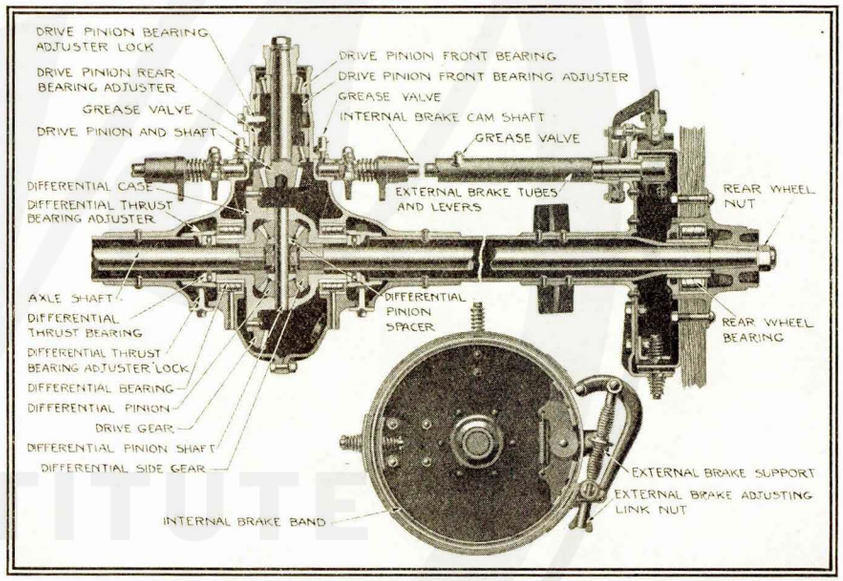


Fig. 22. Rear Axle and Brakes

Adjustment of the emergency brake is obtained by shortening or lengthening the rods, which are connected to the levers on the brake shafts on the rear axle. In adjusting brakes, care should be taken to see that each set of brakes are adjusted equally. These should be adjusted so brake pressure is equal on each wheel, in order to avoid "skidding" and resulting excessive wear of tires.

Apply the brakes gradually.

If the brakes slip and do not hold, remove the rear wheels and examine the brake lining before adjusting the rods. The brake lining may be either saturated with oil or worn so badly that the lining rivets make contact with the brake drum. In the former case, wash the lining thoroughly with gasoline; in the latter, have the brake bands relined, using only brass or copper rivets.

Brake Pedal

The normal position of the brake pedal in reference to the floor-board may be varied by adjusting the clevis brake rod to the pedal, and setting the stop screw which limits the upper position of the pedal to suit the convenience of the driver. (Note figure 23, page 36, brake pedal stop screw.)

Miscellaneous Adjustments

Motor Bolts

The motor is supported by a bracket on the front cross member which connects with the timing chain case cover, and by two brackets set in the frame channel at the rear of the motor. The bolts which hold the front bracket and the two rear brackets should be kept properly tightened at all times, as a loose bolt may cause excessive vibration. The front motor support is lined with asbestos brake facing soaked in graphite. If this has worn so that the motor touches the metal of the support, the lining should be renewed. A worn support lining or a loose motor will cause an irregular thumping noise when driven over rough roads.

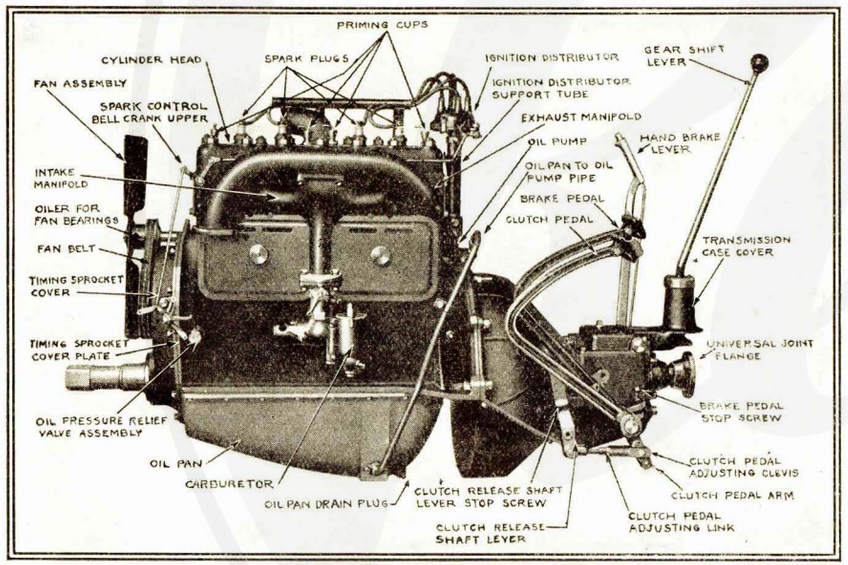


Fig. 23. Motor—left side

Body Bolts

The body bolts go through the sill of the body and down through the frame of the car. If these are not kept properly tightened, an annoying squeak may result. A periodical inspection of these bolts is recommended.

Fan Belt Adjustment

Particular care should be given to correct adjustment of the fan belt. Certain type fans and radiators are built to operate in conjunction, and the fan is designed to give a maximum volume of air at a given speed. Overheating in many cases is the direct result of a loose fan belt, as although the fan may

turn, it may be running at a speed not correct for its design. To get the proper speed, the fan belt must be perfectly tight. A simple rule for proper adjustment is to try to spin the fan by taking hold of the blade. If the fan spins, the belt is too loose and should be tightened. (Note slot for fan belt adjustment, figure 7, page 16.)

Spring Clips and Bolts

The spring bolts should be kept properly lubricated and drawn up tight to guard against rattles. If continued use of the car should develop rattles at that point where the spring shackles are attached to the spring horn, thin shims should be inserted to take up the wear. These shims can be obtained from any Hupmobile dealer.

Do not attempt to tighten the spring bolts so much that spring shackles will be drawn in and bind against the edge of the spring. This will produce a stiff spring, and is liable to cause broken springs, owing to the heavy friction. The car may also ride hard if springs are bound at spring eye.

Be sure to keep spring clips tight.

Important

The following adjustments should be made after your new car has been driven from 500 to 800 miles.

Tighten as much as possible the nuts on the clips which hold the front and rear springs to axle bed.

Tighten front and rear motor bolts, and adjust and tighten fan belt and timing chain, if necessary.

Tighten body bolt nuts, and front and rear universal joint bolt nuts.

Remove rear wheel hub caps and with a large strong wrench, raw up axle shaft nuts as tight as possible.

Electrical System

Storage Battery

The Willard storage battery is the reservoir into which the electrical energy produced by the generator is stored for ignition, lighting, and starting the motor. A storage battery is an electro-chemical apparatus entirely different from the mechanical parts of the car, and its life depends on the care it receives and the kind of service demanded from it.

Proper Battery Care

1. When a car is purchased the owner should go to the nearest Willard service station immediately, and have the battery registered in order to take advantage of the Willard 90-day insurance policy and gratis service. Also he should ask for a service card on which the registration date will be given.

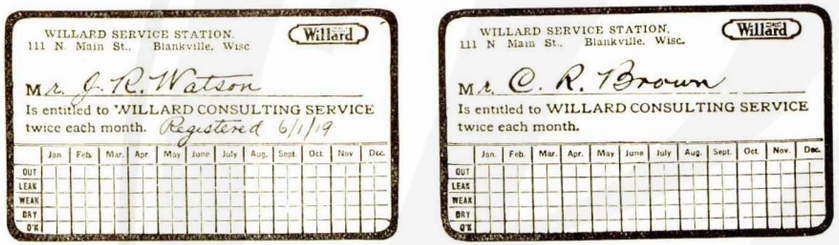


Fig. 24. Registration Cards

2. If your car is not new, call at a Willard service station and get a Consulting Service Card good at any station which will entitle you, without charge, to testing and filling service twice a month. At the same time you will be given advice which will help you to get the best possible service from your battery.

3. Test all cells with a Willard Hydrometer on the 1st and 15th of every month. Fully charged cells should read between 1.280 and 1.300. If any cells are below 1.275 on two successive testing dates, have battery fully charged at a Willard service station. In taking these readings care should be exercised to return the electrolyte from the hydrometer syringe to the same battery cell from which it was taken.

4. Keep all cells filled with distilled water to a level ½" above the top of the plates. Never fill ABOVE this level.

5. Keep the battery and the battery compartment clean and dry.

6. Keep the terminals clean and tight and well covered with vaseline to prevent corrosion.

7. Never allow the battery to become heated in service above 100° F. Frequently watch the battery for overheating in warm weather. If the top connectors feel too warm to the touch, take the temperature with a special thermometer. If the temperature registers over 100°, burn all the lamps while driving, until you can consult a Willard service station who will prescribe what is necessary. If the temperature reaches 120° F., the battery may be ruined.

8. In order to prevent freezing in cold weather, test your battery frequently and see that the specific gravity is kept up to at least 1.275. A discharged battery will freeze at a little below the freezing point.

9. When filling, if one cell takes considerably more water than the others, this indicates a leaky jar and the battery should be taken to a Willard service station. Unless repaired immediately, the battery may be ruined.

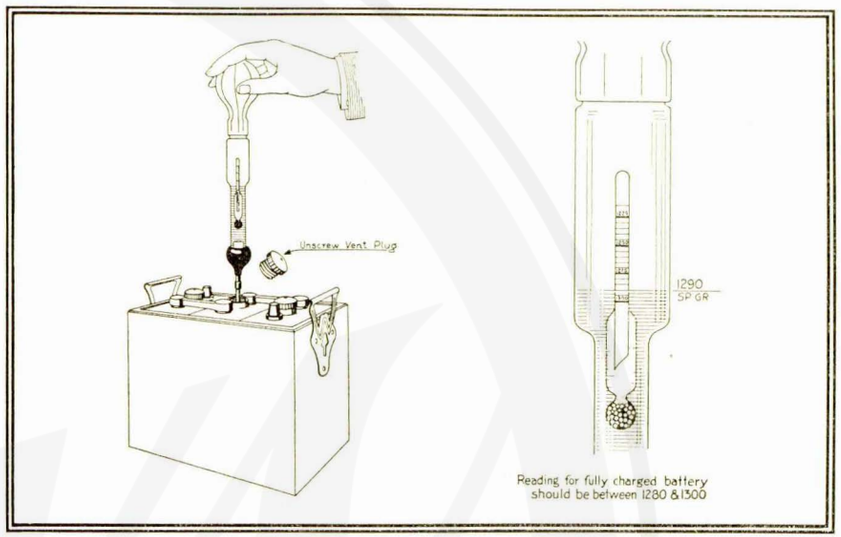


Fig. 25. Hydrometer In Use

10. If you lay up your car, the battery should be removed and placed in storage with a Willard service station, who will take care of it, as otherwise a battery will slowly discharge when standing idle.

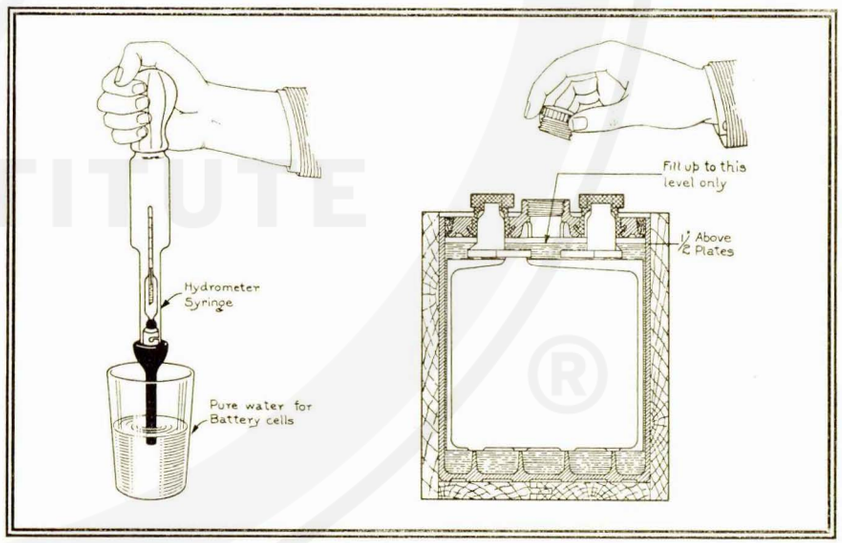


Fig. 26. Filling Battery Cells

Ignition

The current for ignition is derived from the storage battery, and is distributed by means of the ignition distributor. The entire system consists of a storage battery, coil, igniter and igniter switch with connecting wires.

Coil

Cylindrical type coil is located on that part of the crank case adjacent to the oil pump, in rear of cylinders on right side. Its purpose is to transform the low tension primary current to a high tension secondary current for distribution to the spark plugs. The coil requires no attention or adjustment, other than to see that all terminal nuts are tight.

Ignition Distributor

Located at the rear of the motor near the center, the distributor is mounted on a vertical shaft which is driven by helical gears from the rear end of the camshaft. The igniter has two functions—to make and break the primary circuit from the battery to the coil—and to distribute the high tension current delivered from the secondary coil winding to the spark plugs.

Action of Current

The current of the battery is low tension current, which flows through the low tension winding of the coil, and is interrupted by the contact arm, operated against the square shaft of the ignition distributor. During the time that the contact is made by the contact points in the ignition distributor, which action is so fast that it is not perceptible to the eye, the battery current is allowed to flow through the primary winding of the coil. As the contact points are opened, the primary circuit is broken, causing a high tension current to be induced into the secondary winding of the coil. This current is carried to the ignition distributor block, from which it is distributed to the spark plugs in the proper order according to the timing of the motor. The rotation of the timer ignition distributor shaft operates the breaker points at the time when the high tension current or spark is required successively in the cylinders.

Primary Circuit

This circuit is from the battery to the ignition switch, to the primary winding of the coil; then to the contact in the ignition distributor, back to the coil, and then again to the ignition switch and from there it is grounded; thus completing the circuit, as one side of the battery, or the positive terminal, is grounded or connected to the frame of the car.

Secondary Circuit

Secondary, or high tension circuit, originates in the high tension windings of the coil, as the primary circuit is broken, and passes through the high tension wire leading to the ignition distributor. From there it is distributed to the spark plugs in the proper order, and returned to the grounded end of the high tension wire from the secondary winding of the coil.

Firing Order

The firing order of the Hupmobile motor is 1, 2, 4, 3.

Ignition and Lighting Switch

The ignition and lighting are combined in one switch located to the right of the steering column on the instrument board. Care should be exercised to see that the switch connections are kept properly tightened, as a loose connection at this point will cause trouble all through the electrical system, and would have a tendency to burn the contact points in the ignition distributor. When the switch key is turned to the "ign" position, the low tension current flows continuously through the points should they happen to be closed. The car should never be left with the switch key in this "ign" position as the battery would be rapidly discharged if the ignition breaker points should be closed.

Starting System

The starting system consists of an electric starter motor with pinion attached, a storage battery (also used for lighting and ignition), a switch and wiring. Its purpose is to utilize the electric current stored in the battery by the generator, for cranking the gasoline engine until it starts under its own power. Pressing the starter pedal on the toe-board (note figure 2, page 6) brings tow heavy contacts together in the starting switch and closes the electric circuit between the battery and the starter motor. The current causes the starter motor armature shaft to revolve rapidly. An arrangement for automatically connecting or disconnecting the starter motor to the engine is mounted on an extension of the starter motor shaft. The starter motor is in operation only during the period of starting, and remains idle at all other times.

Do not use the starter for propelling the car. Always disengage the clutch or place the gear shift lever in neutral position, before pressing the starter pedal. The instant the gasoline motor begins firing, release the starter pedal.

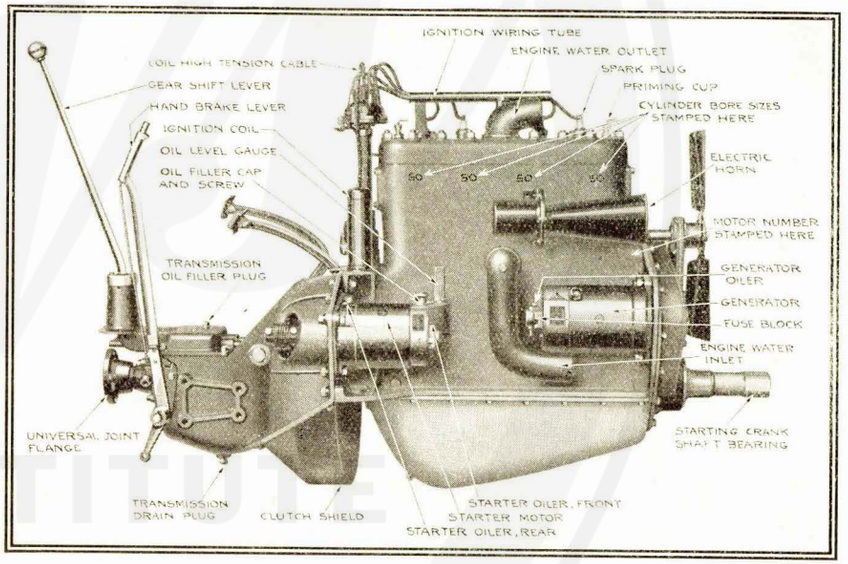


Fig. 27. Motor—right side

Starting Switch

The starting switch under the toe-board is of such rugged design that trouble is very unlikely. Quick contact and separation are desirable; so press the pedal firmly and quickly, and when releasing do not retard its outward spring. The pedal should only be pressed when the flywheel is at complete rest.

Generator

The generator is chain driven from the crankshaft, and is in operation when the gasoline motor is running. Whenever the gasoline motor runs faster than the equivalent of 10 miles per hour on high gear, an automatic

switch located on the inside of the generator closes the circuit between the generator and storage battery, and the generator begins to supply current for the electrical system and will continue to do so at all higher speeds. At excessive speed, however, the current output will slightly decrease, as shown by ammeter.

On the top of the front head of the generator (near the terminal) is a glass enclosed fuse, which is connected in the field winding of the generator. This fuse protects the generator in case the circuit between the generator and battery is accidentally interrupted or broken when the gasoline motor is running. Repeated burning out of this fuse indicates that there is a loose or open connection in the circuit between the generator and the battery. In making fuse replacements, nothing but standard 5 ampere fuses should be used on Westinghouse equipment. Do not substitute fuses of incorrect capacity.

Lighting System

All electric lights derive their current from the generator and battery when the gasoline motor is running, and from the storage battery only when the motor is not running. The accompanying wiring diagram shows the electrical system.

The single wire six-volt system is used. The automatic circuit breaker, placed in circuit between the generator and the battery, prevents the latter discharging back to the generator, when the engine is stopped or running at such a low speed, that the voltage of the current generated is less than that of the battery.

Lamps

The headlights are dimmed through a resistance coil mounted on the instrument board, and which is connected to the switch. When the switch is on the "dim" position the resistance is thrown in series with the headlamps.

The voltage and candlepower of the bulbs are as follows:

Headlamps—15 C. P.—8 volts—single contact bulb.

Rear Light—2 C. P.—8 volts—single contact bulb.

Instrument Light—2 C. P.—8 volts—single contact bulb.

If standard bulbs are not available for making replacement, the headlamps may be supplied with bulbs of 7 to 8 volts and any candlepower from 15 to 20. The instrument and rear light may be supplied with bulbs of 8 volts and any candlepower from 2 to 4. However, high candlepower bulbs take more current from the battery and should be avoided.

Fuses

All current for the lamps and horn passes through fuses, located on the instrument board, just to the right of the lighting switch behind the fuse panel. (Note figure 2, page 6.)

If a fuse blows it should be replaced. Should the fuse continue to blow out, it indicates a ground or short circuit, which should be located and eliminated at once. Fuses are of the cartridge type of 10 ampere capacity, and are held by metal clasps, making removal easy. One spare fuse is carried in panel with lighting fuses.

Electrical Troubles and Remedies

Should the gasoline motor be running at a speed equivalent to 10 miles or more per hour with no lights in use, and the ammeter fails to show charge, it is possibly due to loose or high resistance connection in the circuit between generator and battery; inoperative ammeter; generator field fuse blown; inoperative generator, or weak battery.

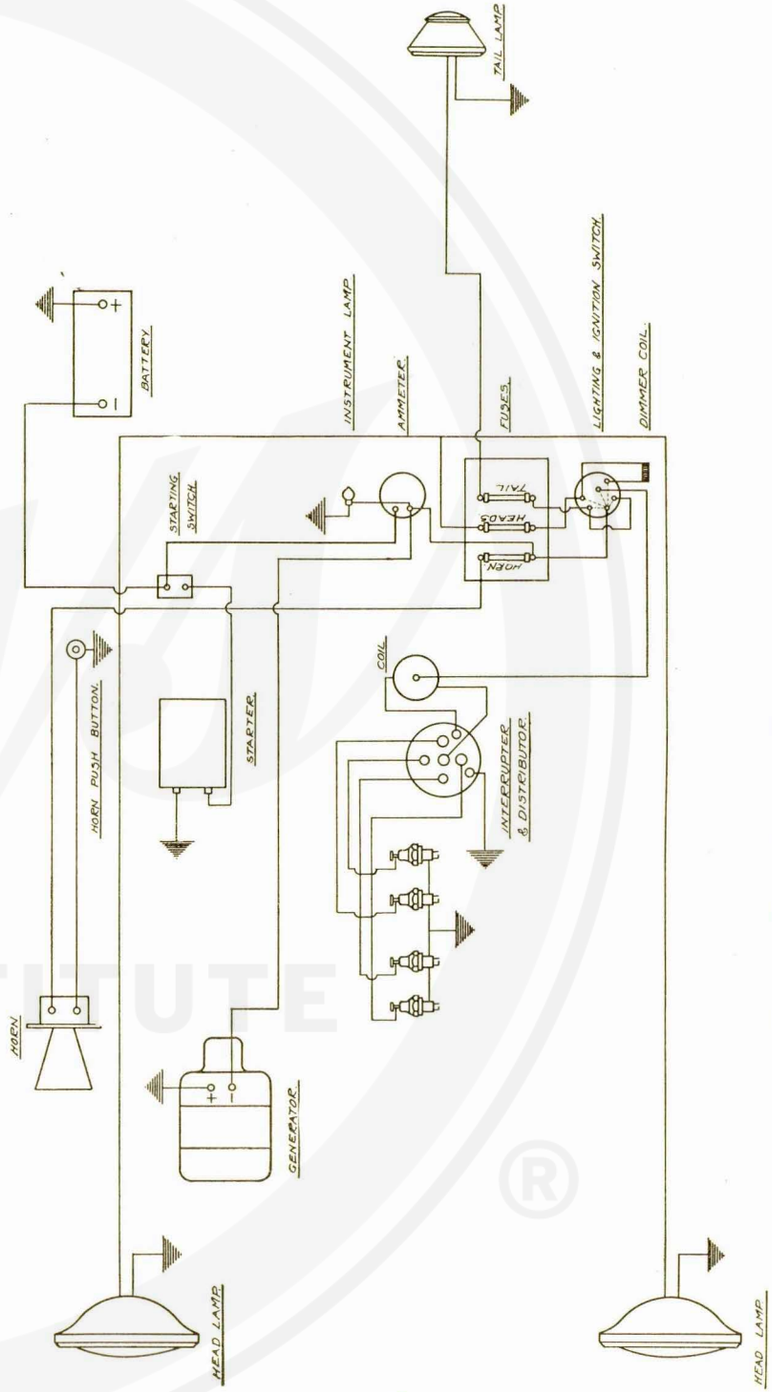


Fig. 28. Wiring Diagram—Westinghouse or Remy Equipment

Loose or high resistance connections between generator and battery will cause the generator field fuse to blow. To test for an open circuit or high resistance between generator and battery, remove the generator cable, taking care that the uninsulated end does not touch any part of the car. Next, remove one of the large headlamp bulbs, and hold the cable terminal to the center contact and the outside of the bulb base against the frame. Be sure that the surface to which contact is made is free from paint or dirt, so as to make good contact. If the bulb lights to full brilliancy, and the ammeter does not show a discharge, the fault is with the ammeter. If the lamp fails to burn, there is a high resistance or an open circuit between generator and battery, or else the battery is completely discharged.

If none of the lamps on the car can be lighted and the specific gravity of the battery is low (see battery instructions), the trouble is due to the battery. A leaky battery cell which permits all of the solution to escape will not be able to operate the lights, and the ammeter will not show a charge when the gasoline motor is running. A leaky cell will also cause a generator field fuse to blow.

If the battery is fully charged, and the headlamp bulb is connected according to above instructions, and yet fails to burn, this shows that the circuit between generator and battery is open, or the connections in the circuit are making poor contact. Examine the grounded cable contact from the battery to the right side of the cross member. See that this connection is free from paint, and that the two touching metal surfaces are clean and making good electrical contact. Inspect the connections on the fuse and see that the generator and ammeter leads are held firmly in place. The connections at the ammeter should be inspected to see that they are fastened securely.

Battery terminals should also be inspected to see that they are tight and free from any corrosion. Should any corrosion exist, the battery connections should be removed and cleaned.

A blown generator field fuse indicates a dead battery, or open or loose connections in the generator battery circuit, and should not be replaced until the trouble causing the fuse to blow has been found and remedied. Never replace a generator field fuse with anything except a similar fuse—5 ampere. Substituting metal plugs or wire will not afford proper protection for the generator.

Inoperative Generator

Examine the field fuse on front head of the generator and see if it is blown; also examine the fuse clips to see if same are making good contact on both ends of fuse. If the fuse is not blown, the generator brushes should be inspected to see that they are bearing properly on the commutator and do not bind in their respective holders. A slight pressure applied to the top of the brushes with the fingers while machine is running, will cause the brushes to seat properly, and will be indicated by the ammeter showing a charge.

Dirty Commutator

Oil or grease on the commutator will cause foreign material and brush dust to collect between commutator bars, preventing efficient operation of generator, and in a short time cause the machine to become inoperative on account of short circuited armature. Never put lubricant of any kind on the commutator or brushes. If there is any accumulation of oil or other foreign matter on the commutator, it should be removed and the brushes washed in gasoline.

If the fuse is not blown, and brushes are seated properly on the commutator, and if all the connections between generator and battery are correctly made with good contact, and the ammeter still fails to show a charge when the

gasoline motor is running, the generator is inoperative and should be removed and referred to the manufacturer's service station for attention.

Never run the generator, unless it is connected to the storage battery, without first removing the field fuse.

To Remove the Generator

Disconnect cable leading to the generator, and be sure to insulate with tape so that this cable will not ground on the frame, and short circuit battery. Remove the circular cover plate on the front end of the chain case and take out the three bolts holding the generator to the rear side of the chain case. The driving chain should be supported through the opening at the front in order to prevent it from falling to the bottom of the chain case, and should be held by a screw through side of case to prevent change in motor timing. (Note timing cover sprocket plug, figure 17, page 31.) In doing this it is not necessary to remove the pin connecting the chain links together.

In making any repairs to the wiring, or before removing the starter motor, the generator, or the starting switch, the positive cable should be disconnected from the battery. (See figure 28, page 43.)

Starter Motor

Starter motor failing to operate may be caused by weak or dead battery; loose connections or open circuit; switch not making proper contact; inoperative starter motor; dirty or greasy commutator; or inoperative starter drive.

First, examine and clean battery terminals by scraping thoroughly. A weak battery will not be able to supply sufficient current to crank the gasoline motor. If the lights are burning dim and low, and the specific gravity shows that the battery is charged, look for loose connections between the battery and starter motor which will not permit sufficient current to flow to the motor to operate it. An open circuit will also prevent any current from flowing, so examine the connections at the motor, the starting switch and the battery, to see that they are clean, tight, and making good contact. Remove the band covering the brush windows, and see that all brushes are bearing on the commutator, and that the brushes do not bind in the respective holders, but are free to move.

If the battery is charged and all connections are in good condition, failure of the starter motor to operate may be due to switch not making proper contact. To determine this, connect to a volt-meter across the battery terminals and note the voltage. Then depress the starter pedal. If, with the pedal all the way down, the voltage across the battery does not drop below its former voltage, the switch is inoperative and should be repaired.

To remove the starter motor, disconnect the cable leading from the positive terminal of the battery to the frame, shown in wiring diagram, figure 28, page 43. This will break electrical circuit between the battery and starter motor, and prevent the short circuiting of the battery in case one of the starter motor leads should in moving touch the car frame. Disconnect the cable attached to the starter motor, and the three bolts holding the starter motor to the flywheel housing can then be loosened, and the motor removed.

Inoperative Lamps

Failure of either set of headlamps or the instrument board and rear lamps to burn, usually indicates a blown fuse. If the fuse is not blown, examine the connections at the fuse box to see that they are tight and making good contact. If the fuses are intact, and the connections tight, the trouble may be due to the fingers of the lighting switch not making good contact. The trouble causing a fuse to blow should be found and remedied before replacing a blown fuse with a new fuse of proper capacity.

Failure of a single light to burn may be due to burnt out bulb; lamp making poor contact in its socket; or loose connection at the lamp. Failure of all lights to burn may be due to completely discharged battery, or a leaky battery cell, permitting all the solution to leak out and open the battery circuit.

Operating With Dry Cell Batteries

If, for any reason, the storage battery becomes exhausted, the gasoline engine may be operated by connecting four dry cells in series. One end of wire should be attached to top binding post on coil and the other end of wire should be grounded. When using dry cells it is necessary to crank the engine by hand in order to start it. After installing dry cells, be sure and remove the field fuse, located on generator head. Should dry cells be used for ignition, horn and headlights will be inoperative.

Ignition Testing

In case of motor missing explosions, do not immediately decide that ignition is at fault. If this does prove to be the case, start at the spark plugs and make sure that they are properly set, and clean.

Next, examine the wiring from the plugs to the distributor. If you remove the contact points for examination and cleaning, do not disturb the adjustable contact, but remove the screw which holds the contact arm in position. This can be removed by taking out the one screw, and replacing, without disturbing the contact adjustment in any way. The following general directions may be followed to advantage in locating the cause of any irregular behavior of the motor.

If engine misses at all speeds, test each cylinder separately by holding the plug wire off each plug in regular order one at a time. Hold the wire near the plug terminal letting the spark jump to the plug about ¼". If all plug wires show a regular spark, the trouble is not in the ignition system.

If any one cylinder sparks regularly, this will indicate that the system is in working order so far as the igniter and coil are concerned, and the trouble is probably in the high tension wiring between the distributor and plugs, or in the plugs themselves. Examine carefully the plugs and wiring, as leaking secondary wiring may be the cause of missing and back firing.

If irregular sparking is noted at all plugs, examine the battery and connections therefrom. If the trouble commences suddenly, it is probably due to a loose connection in the wiring; if gradually, the batteries may be weakening, or the contact points may require attention. See that any moving parts are not gummed with oil or rust.

Remy and Bijur Equipment

A number of Series "R" cars have been equipped with Remy or Bijur starting and lighting systems. The same instructions regarding the electrical system apply almost without change to these cars, but the few exceptions are listed below.

Page 42, under heading "Generator"—Bijur fuse is 12 ampere, short length.

Page 46, under heading "Operating with dry cell batteries"—the field fuse location described is the same on Bijur equipment. If Remy equipment is used, disconnect wire fastened to third brush, and carefully tape end of wire.

Page 44, under heading "Inoperative Generator"—instructions in first sentence apply to both Bijur and Westinghouse.

The wiring diagram on page 43 is the same for both Westinghouse and Remy equipment. The Bijur equipment wiring diagram is shown opposite.

Tires

By becoming familiar with the following suggestions and detailed instructions tire changing will be simplified. In case of a puncture, or tire change, the following suggestions will make this task very easy. Raise the wheel with

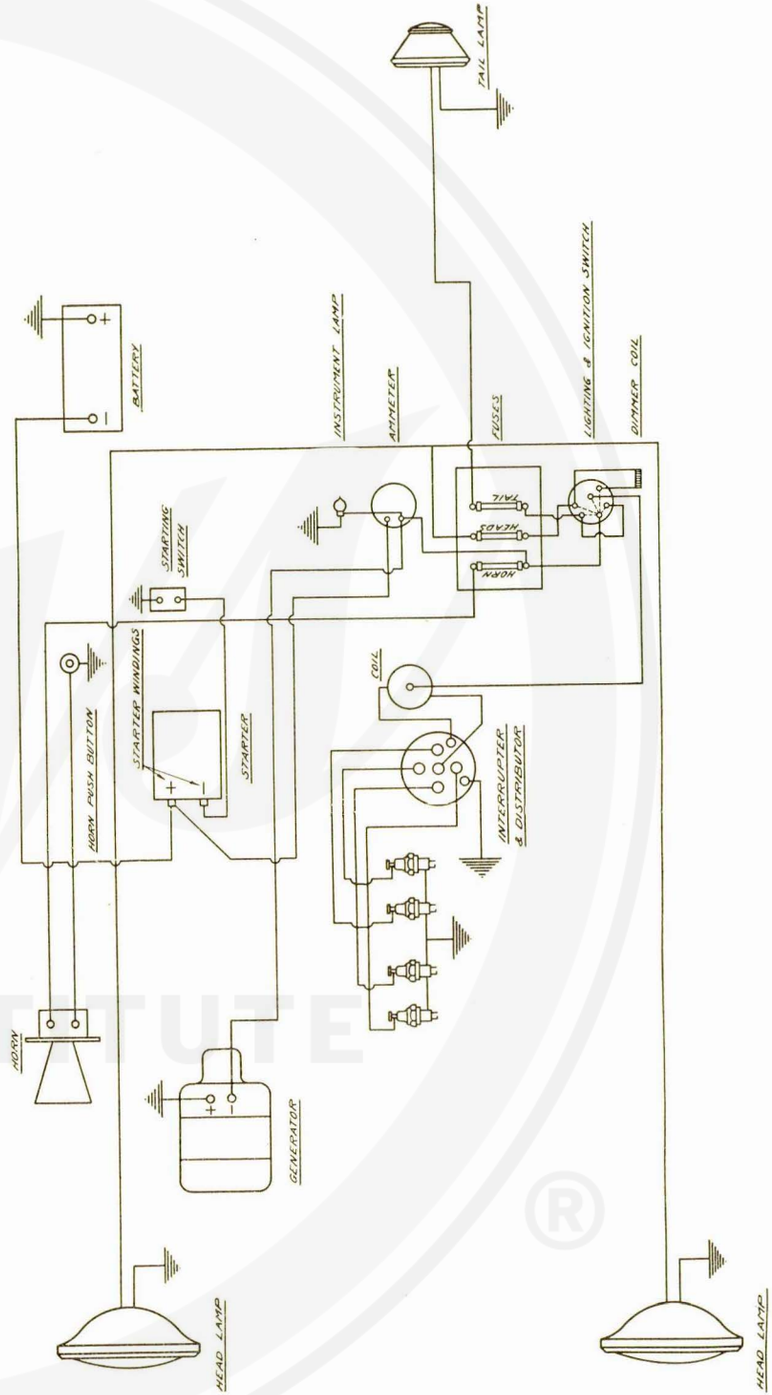


Fig. 29. Wiring Diagram—Bijur Equipment

a jack. Next, loosen the rim wedge nuts with the demountable rim tool, and unscrew the nut on valve stem. Remove rim wedge nuts, and lift tire and rim off wheel.

To Remove Tire from Rim

Lay the rim and tire on the ground, unscrew valve cap and valve, letting air out of tube—use top of valve cap for this purpose. Insert screw-driver in slot at the joint of the rim, and pry one end up over the other until the joint is broken. The rim will then contract so that the tire may be easily removed. Remove the tire carefully from the rim, and avoid injury to the tube or valve stem.

To Replace Tire on Rim

Slightly inflate tube to hold it out round. Carefully place the tube in casing after dusting thoroughly with talc. Be sure flap fits smoothly between tire beads. With the rim laying flat on the side, insert valve stem through the hole in the rim. Press down over the rim with the foot. It may be necessary to force end of rim into place with tire iron.

After the tire has been put onto the rim, it is necessary to insert a screw driver between the ends at the joint, and bring the locking device back into place.

To Replace Tire and Rim on Wheel

Grasp the tire at sides near the bottom. Then with the valve stem at the top, lift tire and rim, and insert valve stem into the hole of the felloe. Replace all rim wedges and tighten nuts gradually. Do not tighten the wedge nuts in rotation, but alternate from one side to the other, and repeat the tightening operation at least twice. This will insure a perfectly adjusted rim. Always inflate the tire before tightening the wedge nuts. Keep all wedge nuts properly tightened at all times to insure against squeaking rims.

Inflation

Keep the tires fully inflated. Remember the car rides on air, and not on the side walls of the tires. To protect against stone bruises and blow-outs, tires should contain enough air to support the car's weight, yet to insure easy riding, they should not be too hard. The best average pressures for the Series "R" are given in the following table:

	32 x 4 Fabric Tires Front	Fabric Tires Rear
Touring	60	65
Roadster	60	65
Coupe	65	70
Sedan	70	75
	32 x 4 Cord Tires Front	**Cord Tires Rear**
Touring	55	60
Roadster	55	60
Coupe	60	65
Sedan	65	70

These pressures are recommended when the car carries five passengers. If extra weight or equipment is added, the tire pressure should be increased accordingly. Tires should usually be tested about twice a week.

Do not reduce pressure on account of hot weather. Heat has comparatively little effect on air pressure and you will not have trouble from undue expansion. One common result of under-inflation is what tire experts call a stone bruise or fabric break as a stone that happens to strike the tire squarely may rupture the fabric, if the tire is not sufficiently inflated. Occasionally under-inflation is good practice when traveling in deep sand. Better traction is thus secured and you may find it possible to travel on your own power by deflating

the tires to approximately 30 to 35 lbs. pressure. After leaving the sand and reaching harder road surface, be sure to inflate the tires to the proper pressure immediately.

Keep tires away from oil or grease. Oil rots the rubber quickly and causes the tread to peel off. If necessary to drive over oiled roads, it is a good plan, on returning, to wipe the tires with a piece of waste soaked in gasoline. This cuts the oil and leaves the tires clean.

Tires should be protected from extreme temperatures, dampness and bright lights. Keep spare tires fastened tightly in place to avoid chafing against tire carrier.

Inner Tubes

As tubes are protected by the casings, they do not usually require much care. A few simple precautions will insure excellent results.

In inserting tubes in casings, always be sure to dust the inside of the casing thoroughly with tire talc. Before applying a new tube, examine the rim carefully, and, if rusty, sandpaper it smooth, and treat with a coat of rim paint or graphite. Always keep the tube sufficiently inflated to hold it out round. This will prevent the tube from folding under or being pinched between the head and rim. When tires are inflated, test the valves occasionally to make sure they do not leak by putting a drop of water in the valve stem. If the valve leaks, bubbles of air will show at the top of the stem. Leaky valves are frequent causes of under-inflation. If the valve is leaky, either tighten the valve core with the reverse end of the valve cap, or, if this is not sufficient, insert a new core.

Spare tubes should be carried in the box in which they come, or be carefully wrapped to prevent chafing, or coming in contact with oil or grease.

Tire Mileage

Weight of the Series "R" is well distributed. Hupmobiles are equipped with 32"x4" cord tires, oversize considering weight of car, so that easy riding and long tire mileage can be expected. A little care will add many hundreds of miles to the life of the tires.

Care of Body and Top

Washing the Car

The fine finish on your new car can be affected by improper or careless washing. Soap should never be used for washing the car, except for removing grease, and then only the purest is recommended; but if it is necessary to use soap, also use plenty of water and rinse the body thoroughly. Never use extremely hot or cold water for washing the body.

Mud, grease, or oil should not be allowed to remain on the car longer than is absolutely necessary, as they are particularly injurious to the finish. Mud should be soaked off with plenty of water, not rubbed off. The rubber hose without the nozzle, commonly used in garages, is probably the best method of cleaning the body, but at no time should the water be directed against the body with any force. The hose is also the best method of cleaning the lower parts of the car, such as wheels, axles, springs, fenders, etc.

Don't rub the body with a sponge or other material until you are sure that the mud and sand particles are entirely removed from the body. Also don't use a sponge or chamois on the body that has been used on the running gear and has collected dirt or grit. After washing, dry the body immediately with a clean chamois skin. Be sure to soak the water out of all recesses where it could cause rust.

It is better to remove heavily accumulated dust by washing rather than by dusting. For ordinary light dusting, a woolen duster is preferable to one made of feathers.

Care of Top

Dust on the outside of the top should be removed with a cloth. Do not use gasoline or naphtha, as these may eat into the fabric and cause leaks. Grease spots or stains may be removed with a sponge and castile soap suds. Use plenty of clean water to remove all traces of soap. The inside of the top should be dusted with a whisk broom or stiff brush and should be treated more carefully than the outside, as impure water or soap may change the color.

The curtains should not be folded or inserted in the envelope while moist.

Nickel Polish

To keep the nickel trimmings bright and clean, rub over daily with an oily rag. This will keep them in good condition without polishing except at long intervals. Should they become tarnished, a good silver polish is the best thing to use, but do not under any circumstances use brass polish on nickel, as the abrasive ingredients will scratch the surface.

Cold Weather Suggestions

As you will probably operate your Hupmobile all winter, you should give special attention to the following:

Cooling System

As the cold weather approaches, the use of an anti-freeze solution should begin. We recommend the use of *denatured alcohol or alcohol and glycerine mixed, as an anti-freeze solution,* as follows:

ALCOHOL-WATER			ALCOHOL-GLYCERINE Equal parts of glycerine and denatured alcohol.		
Freezing Point Degrees Fahr.	Alcohol Percent	Water Percent	Freezing Point	Alcohol Percent	Water Percent
			15	20	80
10	28	72	5	27	73
0	40	60	0	29	71
—10	52	48	— 5	30	70
—20	63	37	—15	32	68

For determining the low temperature capacity or freezing point of denatured alcohol and water anti-freezing solutions, automobile accessory houses sell a special type of hydrometer commonly known as a freezometer, having 5° graduation over a scale range of from plus 50° Fahrenheit to 30° minus; together with a temperature correction scale that permits of getting accurate test reading, whatever the temperature of the solution may be. The frequent use of such an instrument is an excellent substitute for guess work.

Oil

Drain and refill the motor with a lubricating oil that stands a zero test—see page 21.

Use a lubricant in the transmission and rear axle that will not congeal see page 21.

Drain any water from gasoline system—see page 13.

Fuel

Any difficulty in starting during cold weather will be eliminated if proper adjustment of carburetor, air heater, and air shutter is made, and the driver makes proper use of the carburetor controls and adjustments described on pages 13 to 17.

Battery

A slightly longer period of motor cranking, and the fact that the lights will be used more during the winter, makes the drain upon the storage battery proportionately more than during summer driving. It is highly important therefore that the generator charging rate for the winter months be sufficiently high to maintain the battery fully charged—see page 38.

Storing the Car

If you store your car for any period of time, during either the summer or winter months, the following suggestions should be followed:

The building in which the car is stored should be weather-proof and free from any dampness.

Before putting up the car see that it is washed perfectly clean; rub a small amount of vaseline over all nickel plated parts, and at the points where the fenders join the running board, body or frame.

Drain all water from cooling system, and all oil from motor base. Place a small amount of oil in each one of the spark plug holes, after which the motor should be turned over by hand a few times.

Remove battery, and if possible take it to your nearest Willard service station where it will be kept fully charged until you are ready to use it again.

Drain off all water and sediment from gasoline tank, vacuum tank and carburetor. Block or jack up both axles to entirely relieve the tires of any weight, after which let the air out of tires. Then wrap the tires thoroughly with brown paper, and adhesive tape, in order to exclude light and air.

Cover the car with either a canvas tarpaulin or linen car cover, but do not draw it in too close about the body or fenders, so it will come in contact with the finish.

License Information

Serial or car number—See plate attached to steering column at dash—figure 2, page 6.

Motor number—See number stamped on right front side of motor above generator—figure 27, page 41.

Number of cylinders—Four.

Diameter of Bore—3.25 inches.

Stroke—5.5 inches.

S. A. E. or N. A. C. C. horsepower rating—16.9 horsepower.

Shipping weights of present production:

R Touring Car,	2590 pounds.
R R Roadster,	2490 pounds.
R P Roadster-Coupe,	2600 pounds.
R K Coupe,	2745 pounds.
R Q Sedan,	2965 pounds.
R Chassis,	2000 pounds.

Hupmobile Warranty

We warrant each new motor vehicle manufactured by us, whether passenger car or commercial vehicle, to be free from defects in material and workmanship under normal use and service, our obligation under this warranty being limited to making good at our factory any part or parts thereof which shall, within ninety (90) days after delivery of such vehicle to the original purchaser, be returned to us, with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on our part, and we neither assume nor authorize any other person to assume for us any other liability in connection with the sale of our vehicles.

This warranty shall not apply to any vehicle which shall have been repaired or altered outside of our factory in any way so as, in our judgment, to affect its stability or reliability, nor which has been subject to misuse, negligence, or accident, nor to any commercial vehicle made by us which shall have been operated at a speed exceeding the factory-rated speed, or loaded beyond the factory-rated load capacity.

We make no warranty whatever in respect to tires, rims, ignition apparatus, horns or other signaling devices, starting devices, generators, batteries, speedometers, or other trade accessories, inasmuch as they are usually warranted separately by their respective manufacturers.

To protect ourselves in our constant endeavor to make the Hupmobile even better than it is, we reserve the right to make changes and improvements from time to time without being under obligations to make such changes gratis on cars previously built, and to add, change or omit equipment at our discretion, and without notice.

Accessory Manufacturers

The following list indicates the manufacturers supplying accessories to the Hupp Motor Car Corporation for use on the Series R.

For quick and direct service, all inquiries involving the replacement or repairing of these various units, or their parts, should be taken up direct with their manufacturers, who separately warrant their products, or with their branches or service stations.

To maintain uninterrupted production, more than one make of certain units have been used. These units are marked and you can thus decide which manufacturer is interested.

STARTER MOTOR AND GENERATOR
- Westinghouse Electric & Mfg. Co., Springfield, Mass.
- Remy Electric Co., Anderson, Ind.
- Bijur Motor Lighting Co., Hoboken, N. J.

IGNITION DISTRIBUTOR AND COIL
- Atwater Kent Manufacturing Works, Philadelphia, Pa.

IGNITION AND LIGHTING SWITCH
- Briggs & Stratton Company, Milwaukee, Wis.

STORAGE BATTERY
- Willard Storage Battery Company, Cleveland, Ohio.

AMMETER
- Westinghouse—Westinghouse Electric & Mfg. Co., Springfield, Mass.
- Clark—National Gauge & Equipment Co., Lacrosse, Wis.

SPARK PLUGS
- Champion Ignition Company, Flint, Michigan.

HORN
- Sparks Withington Co., Jackson, Mich.
- United Electrical Manufacturing Co., Adrian, Mich.

STEWART VACUUM TANK
- Stewart-Warner Co., Chicago, Ill.

CARBURETOR
- Stromberg Motor Devices Company, Chicago, Ill.

GASOLINE GAUGE
- National Gauge & Equipment Co., Lacrosse, Wis.

OIL PRESSURE GAUGE
- National Gauge & Equipment Company, Lacrosse, Wis.

SPEEDOMETER
- Stewart-Warner Speedometer Corporation, Chicago, Ill.

WIRE WHEELS
- Hayes Wheel Company, Jackson, Mich.
- Houk—Wire Wheel Corporation of America, Buffalo, N. Y.

SNUBBERS (Closed Cars)
- Gabriel Mfg. Co., Cleveland, Ohio.

TIRES
- Goodyear Tire & Rubber Company, Akron, Ohio.
- Firestone Tire & Rubber Company, Akron, Ohio.

ALEMITE LUBRICATOR
- Alemite Die Casting & Mfg. Co., Chicago, Ill.

Specifications

Motor

The Hupmobile four-cylinder motor—3¼" bore by 5½" stroke—is of the L-head type, having intake and exhaust valves on the same side. The cylinder displacement is 183 cubic inches. The compression is 70 lbs. gauge pressure to the square inch at 1000 R. P. M. The power curve of the Hupmobile motor is such that the point of maximum power is sustained over a wide range of motor speeds without loss.

Cylinders and crankcase are cast together in a block of noticeable symmetry and rigidity. The cylinder head is detachable, giving easy access to combustion chamber and valves.

Aside from its performance and durability, this motor is characterized by its clean-cut appearance, simplicity and the uncommon accessibility of all its parts.

Crank Shaft

The crankshaft, drop forged from 40-50 point carbon steel, is tested for static and dynamic balance. It is of ample diameter, extra heavy, and of short length between bearings, giving rigidity. It runs in three large bearings of the best grade phosphor bronze with special high speed babbitt lining. Main bearing sizes are: front, 1⅞" long by 1 13/16" in diameter; center, 1⅞" long by 1 25/32" in diameter; rear, 2⅞" long by 1¾" in diameter. These bearings are exceptionally large for a motor of this size and for a crankshaft of this length, making the crankshaft unusually rigid and reducing motor vibration.

All bearings are carefully fitted in crank case after which they are bored to insure true alignment. Following this they are fitted to crankshaft by an exact and careful process of hand scraping. They are split and provided with laminated shims, which makes them easy of adjustment.

Flywheel

The flywheel of the best grade semi-steel is attached to the crankshaft by six bolts of 3½% nickel steel. The flywheel is tested for dynamic balance, then attached to the crankshaft, and the whole assembly is again tested for perfect rotating balance. The gear teeth, which the starter pinion engages, are cut integral with the flywheel.

Connecting Rods

The maximum thrust per explosion on each piston is approximately 2,500 lbs. The connecting rods transform this force into the even power and smooth running of the crankshaft. The connecting rods are 11⅞" between centers, of I-beam shape, drop forged from 35-45 point carbon steel, and carefully machined for lightness and balance. The material and construction of the connecting rods give maximum rigidity and strength with the necessary lightness in weight. The bearing caps are fastened by two 7/16" bolts made of 3½% nickel steel. The connnecting rod bearings, 1⅝" long by 1¾ diameter, are of phosphor bronze, babbitt lined, and are scraped and fitted by hand with the same care as crankshaft bearings. The length of the connecting rod compared with the stroke—11⅞" to 5½"—deserves attention, as this unusual length reduces the pressure or thrust of the piston against the cylinder walls, by reason of the small angle with the center line.

Pistons

The pistons are special light cast, and weigh but 20 oz. each. In shape they are of the hour glass, high speed type, and are carefully ground to less than .001 inch limits on bearing surface. They are fitted with three rings; two above the piston pin, and one below, which serve to keep oil out of combustion chamber. The piston pin is made of 15-25 point carbon steel carefully heat

treated, hardened and ground. These hollow pins are clamped in the rod, and turn in the piston, giving the advantage of extra large bearing surface, 1¾" long; the pins are ⅞" in diameter.

The reason why all reciprocating parts are of light weight and carefully balanced is evident when you consider that the pistons stop and start approximately 75 times per second when the motor is running at maximum speed.

Crankcase

The crank case and cylinders are in a single casting, of the best grade special analysis cylinder iron, remarkably rigid. The casting is "seasoned" for sufficient time, to relieve internal stress, and insure bearing alignment. The working parts of the motor are protected from dirt and mud by crankcase, and a two-piece shield, which has sections along the sides of the motor below the frame and across the front; the advantages of this construction are extreme motor accessibility, and more efficient cooling. The engine has three-point suspension.

Cylinder Block

The cylinders are ground on an internal grinder, a process more expensive but giving much more satisfactory results than reaming. This method gives a glass-like surface to the cylinder walls insuring long life, and preventing compression loss, because of closer fitting pistons.. It is used in the manufacture of high-priced cars—and in the Hupmobile. The detachable cylinder head gives access in manufacturing to both ends of the cylinder bore, and allows the use of internal dial indicators for measuring bore precisely to .0005 inch limits, at top and bottom; the cylinder block being open at both ends, renders the casting of the block more uniform, and inspection more exact.

Combustion Chamber

The combustion chamber of special improved shape, gives large mixture volume over the valves. This construction has been carefully designed to take full advantage of the inlet gas turbulence, and gives a power and efficiency hitherto obtained only with a complicated valve system.

Horsepower

S. A. E. horsepower rating is 16.9. This rating is acceptable for license purposes. The actual brake horse power developed is naturally much greater.

Valve Operation

Camshaft

The Hupmobile camshaft is drop forged, with integral cams, of 15-25 point carbon steel, carefully hardened and heat treated. It has three large bearings; front 2 1/16" diameter by 1½" long; center 2 1/32" by 1"; rear 1 13/16" by 1⅛" which makes the whole construction extremely rigid and reduces vibration to a minimum. The camshaft is driven by a chain, silent during the entire life of the car, and easily and quickly adjustable to compensate for wear. The cams, which are integral with the shaft, are case hardened and carefully ground to dimension.

Valves

The valves are forged of the best chrome nickel steel. They have a 1⅝" clear diameter, 5/16" lift and 45° seat, and are actuated by mushroom-type valve lifters of the best alloy steel. The valve lifters are assembled with the valves as two units, which makes adjusting and disassembling, or cleaning the

motor easy. Valve springs are of oil-tempered steel, secured to valve stem by split washer and collar. The valve covers, acting as "breathers" to the motor interior, assure the valves operating constantly in oil vapor. The ample valve area facilitates the inrush of gas, giving better combustion and greater power.

Fuel System

Positive Feed

The fuel is fed to the carburetor by the vacuum feed system, giving positive feed under all conditions and at all car angles.

Tank

The tank, located at the rear, is made of heavy, lead coated sheet steel, divided into three sections to minimize splashing. It has a capacity of fifteen gallons, two gallons of which are reserve. After warning has been given of diminished regular supply, this reserve can be called upon by simply turning the valve on tank. The gauge on the tank indicates the amount of fuel on hand at all times, and is accurate and easy to read. The gasoline is taken from the rear supply tank to the vacuum tank on the dash, and from thence by gravity to the carburetor, through copper tubing of ample size. The fuel is strained by special screens on the tank end of pipe line and also at the inlet connection on the vacuum tank.

Carburetor

Special carburetor of 1" diameter, has two needle valve adjustments; one for "idling"—the other for producing a lean mixture when high gasoline mileage is desired.

Preheated air is supplied by a special stove surrounding the exhaust pipe, which has adjustments for hot and cold weather operation. This stove is exceptionally large, and gives no restriction to incoming air under any conditions.

A driving control button placed on the dash alongside the steering column controls the choke valve, which is located between the air stove and the carburetor, giving the proper mixture for easy starting.

The throttle is operated by both foot accelerator and hand lever, the latter located at top of steering column.

Vaporization

Intake manifold is bolted directly to the exhaust manifold, allowing hot gases to be discharged from the exhaust valves directly against the intake manifold. This makes certain the most efficient preheating of fuel in a very short time, and complete combustion. A marked increase in efficiency from all grades of gasoline will be noticed as a result of this construction.

Exhaust

Burned gases are discharged quickly through large valve openings and a properly designed exhaust manifold to the muffler. Freedom of exit and muffler design reduce back pressure to the minimum.

Ignition

Igniter Distributor

Battery generator ignition, of the improved closed circuit type, provides a constant hot spark at all speeds. Igniter is driven by helical gears from the rear end of the camshaft. The spark control lever is located on the quadrant at top of steering column. Spark control is entirely manual. The coil and distributor are both located at the rear of the motor where they are well protected, yet accessible. The induction coil transforms the primary current of six volts to a high tension current of 10,000 volts of low amperage, which is transmitted to the spark plugs through heavily insulated wiring, carried from the distributor to the spark plugs in a metal container to prevent mechanical injury; all other wiring is carried in conduits. The ignition switch is combined with the lighting switch, and located on the instrument board.

Cooling

Thermo-Syphon

The thermo-syphon system of cooling utilizes the natural principle which causes hot water to rise above cold water. Cylinder block has extra large water space, especially around the valves, thus cooling the valves and valve seats and eliminating possibility of burning or pitting valves. The radiator and water jacket combined have the extra large capacity of six gallons. A two-blade fan is driven by a "V" belt with sliding tension adjustment. The radiator is so mounted that it is cushioned against road shocks.

The flow of water varies with the heat of the motor and maintains a uniform temperature throughout the motor, and prevents over-heating.

Lubrication

Circulating Pressure System

The force and spray system guarantees constant and adequate feeding of oil to the bearings. This system, by the way, is customarily considered too expensive for use on cars in the Hupmobile price class. A high pressure gear pump, driven by helical gears from the camshaft, draws oil from the deepest part of the oil pan, insuring an oil supply at any car angle. The oil is fed first to the crankshaft bearings under pressure; then, through the crankshaft to the connecting rod bearings. Cylinder walls, piston pins, camshafts and valve lifters are oiled by spray thrown by centrifugal force from connecting rod bearings. This system gives proper lubrication at low speeds and needs no adjustment for high speed work. The oil pressure rises as speed is increased, but is governed by the oil pressure relief valve which prevents excessive pressure and consequent oil waste. The oil pressure gauge on the instrument board is in plain view of the driver. The oil level gauge of the float type is mounted above the oil filler cap and accurately indicates at all times the amount of oil in the crank case reservoir. The capacity of the oiling system is three quarts. The camshaft chain is lubricated by overflow from the oil pressure relief valve. A large capacity strainer of very fine mesh is incorporated in the oil pan just below the connecting rods.

Chassis lubrication is provided for by special grease valves and a high pressure grease gun which makes easy and certain the thorough lubrication of spring shackle bolts, spindle bolts, etc.

Starting and Lighting

Generator

Generator is of third brush, regulated type, fuse protected. It is amply large and driven by the camshaft chain, on which tension is adjustable.

Starter

The starter motor is very compact, and mounted in the clutch housing. The starter pinion engages the flywheel gear and the disengagement is positive, automatic and immediate. The starter pedal, conveniently located, requires the very slightest pressure.

Lights

Equipment consists of two fifteen candle power headlights with non-glare lenses, the distinctive fan-shape rear light, and instrument board light. The instrument lamp has an individual switch so that it may be turned on and off independently. The fuse box is handily located on the instrument board, and a spare fuse is provided.

The headlight bulbs have a convenient focusing adjustment. Headlights can be deflected either sideways, and up or down, in a moment's time by special adjustments at the headlamp base and bracket.

Switch

The lighting switch has four positions—"Rear," "Dim," "Off," and "On." Rear lamp may be lighted independently for diagonal parking.

Battery

A 3 cell, 6 volt, 13 plate, 120 ampere-hour storage battery insures long battery life, and easier starting.

Driving Units

Clutch

The clutch is of the dry disc type, consisting of seven steel plates, 9¾" in diameter, faced with fabric lining, and having six springs. It is driven by three studs attached to the flywheel. The clutch requires no lubrication and is housed to protect friction surfaces from dirt and dust. The clutch pedal is adjustable for length of movement, position and pressure, making it very gentle in operation for people of all heights. Annular ball bearings are used on the main shaft; the front clutch gear shaft annular ball bearing is mounted in flywheel—an expensive construction; the clutch release bearing, annular ball type, is enclosed in dust-proof housing, and lubricated from the transmission, and by grease valve. A clutch brake helps synchronize gear speeds and avoids gear clashing.

Gear Set

The gear set is of the selective type, with three speeds forward and one reverse. Nickel steel (3½%) is used in gears and shafts, with both ball and roller bearings. Gears are chamfered on teeth ends to permit easy meshing. The gear shift lever is of the cane type, 24 inches long, with large comfortable ball grip. The knob is just where your right hand naturally falls from the wheel, and the lever operates with an exceptionally short easy throw. Intermediate and low gear ratios give unusual speed and acceleration.

Propeller Shaft

The propeller shaft is of splineless type with two large universal ball joints, grease packed in dirt-proof housings. Centrifugal action forces grease direct to bearing surfaces. A tubular shaft, 1¾"in diameter, reduces whipping and vibration to minimum at all speeds.

Rear Axle

The rear axle, of our own manufacture, is of the three-quarter floating type in which axle housing carries weight of rear end, and axle shafts drive. Engineers rate the Series "R" rear axle 30% stronger than the weight of the car demands. The drive shafts of chrome nickel steel, double heat treated, are 1¼" in diameter. Pinion and pinion shaft are integral; the drive gear and pinion, spiral bevel type, are double heat treated and case hardened —all made of 3½% nickel steel. The gear ratio is 4.875 to 1, providing remarkable climbing ability, without sacrificing speed. Hubs are drop forged steel. The pinion bearings are taper roller; drive gear and shaft bearings are high duty roller type; gear thrust is taken by ball bearings. The drive and torque are taken through the springs. Rear wheels are held on tapered axle shafts by means of key and nut.

Front Axle

The front axle is a rigid I-beam construction, drop forged from 25-35 point carbon steel, exceptionally strong.

Brakes

The emergency and service brakes act on the rear wheels. The former are internal expanding, operated by hand lever; the latter, external contracting operated by pedal. The external brakes are 12" in diameter by 2" wide, the internal 11 11/16" in diameter by 1¾" wide. This is a very exceptional braking surface for a car of this weight. The intermediate levers and rods are kept quiet by spring tension on all bearings. Brake adjustment and equalization are made easy and permanent by using strong drop forged rocker shaft levers. Either set of brakes will hold the car on any hill. They operate at a touch.

Springs

Semi-Elliptic

Both front and rear springs are semi-elliptic. The front springs are 1¾" wide and 36" long; the rear are 2" wide and 51" long. Hupmobile springs are carefully tested for deflection under given pressures. Spring eyes are phosphor bronze bushed, and spring bolts are lubricated by grease gun method. Both front and rear springs are unusually long for a car of the Series "R" wheel base. Closed cars are equipped with rebound snubbers. The rear springs are underslung, giving a low center of gravity to the car, which promotes smooth riding and greater safety on bad roads.

Frame and Running Gear

Frame

The frame of the Series "R" is straight tapered, a construction which gives strength and rigidity, and a short turning radius. The side members are channel shaped, 4⅝" deep with 2" flanges, made of 18-28 point carbon, cold

pressed steel, 3/16″ thick. There are four stout cross members, hot riveted by 3/8″ rivets to the side rails, and a tubular cross member at the rear supports the gasoline tank. Unusually wide metal running boards are firmly secured to the frame.

Wheels

The wheels are artillery type, with twelve spokes of best hickory. The front wheels run on annular ball bearings, and the rear on extremely large roller bearings of chrome nickel steel. The whole construction is extremely rigid and of unusual strength. The rims are straight side demountable type, and an extra rim is furnished on the pressed steel tire carrier. The four cord tires furnished are 32 by 4 inches straight side. Wire or disc wheels can be obtained at small extra cost.

Wheelbase

112 inches, long enough for comfort, and giving great maneuvering ability in traffic.

Steering

Screw and Half Nut Type

The steering mechanism is of the screw and half nut type, semi-irreversible, and easily adjustable. The half nuts are made of phosphor bronze with steel thrust blocks. The steering arm and yoke are drop forgings. The housing is malleable iron. Throughout, the construction is of great strength, and, therefore, absolutely safe. The steering wheel is 18″ in diameter, of high grade walnut. Steering column is placed at proper angle so that steering wheel sets just right for comfortable driving on long trips or in dense traffic. The turning radius is 20 feet in either direction.

Ordering Parts

Hupmobile owners are requested to consult Hupmobile distributors, dealers and service stations about all repairs, adjustments and replacements. All distributors are required to carry an adequate stock of repair parts, and if they should not have the particular part desired, they can immediately obtain it from the factory.

Orders from individual owners cannot be handled by the factory. The many thousands of Hupmobiles in daily use make it obviously impractical for us to deal direct with Hupmobile owners. We cannot open accounts with anyone except our regular distributors with whom we hold contracts. An order sent direct to us by an owner will be referred to the distributor in whose territory the car belongs. To save this unnecessary delay ORDER ALL PARTS FROM HUPMOBILE DISTRIBUTORS. Only where conditions are so unusual as to, in our judgment, warrant it, will we fill orders for parts direct, and then only at prices listed in our parts catalog, F. O. B. factory, providing cash accompanies the order.

Ordering Parts

When ordering parts from a Hupmobile distributor, it is necessary that the following information be given:

1. THE CAR NUMBER stamped on a plate, attached to the steering column at the dash.
2. QUANTITY DESIRED.
3. PART NUMBER—see pages 62 to 70.
4. NAME OF PART.
5. SHIPPING DIRECTIONS. State accurately the complete address, giving street and number, town or city, county and state; also indicate the method of shipment desired, whether via express, freight or parcel post; otherwise distributors will use their own judgment and assume no responsibility in connection therewith.

When in doubt as to correct part number of part wanted enclose sketch of part, or send our distributor the old part as sample.

All parcel post packages will be sent insured, unless specified to the contrary. Charge for insurance on packages valued up to $25.00 is 5c; on all values from $25.00 to $50.00 is 10c.

Terms

All prices are net F. O. B. the factory—Detroit, Michigan. Responsibility of distributor or factory ceases when goods are delivered in good condition to transportation company. All price quotations on parts supplied are subject to change without notice.

Ordering Accessories or Accessory Parts

If the distributor cannot supply them, the above information should be given and the order should be placed direct with the respective accessory makers, or their nearest branches.

Beware of "Imitation" Parts

In making replacement or repairs make sure you get genuine parts by ordering from our authorized distributors and dealers.

To Return Parts to the Factory

This must be done through our distributors who are supplied with forms, tags and instructions for use in returning such material. If parts are new, mark them so; if defective, it is not sufficient to state "defective—returned for credit," but the nature of the defect must be specified. Bear in mind that parts worn out through long service, likewise parts which have been broken or damaged by accident or abuse, are not necessarily defective.

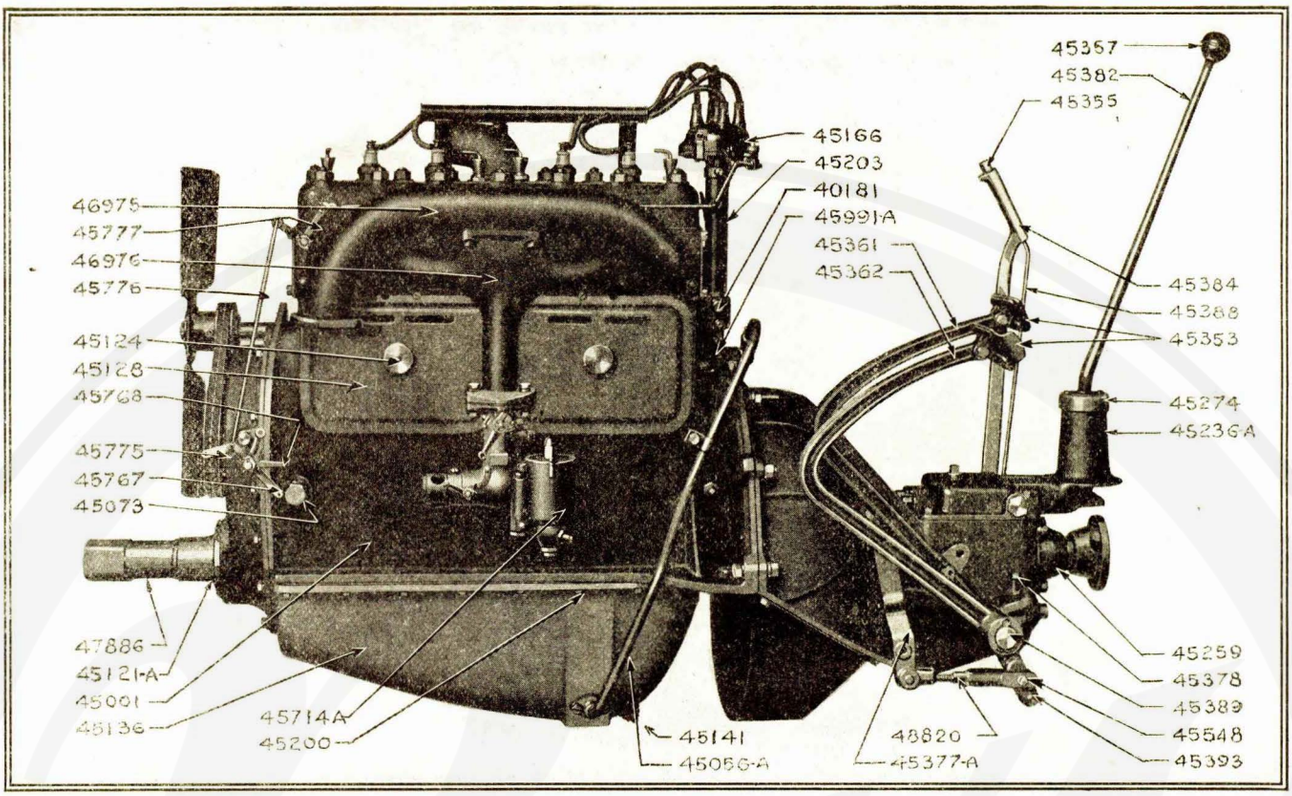


Fig. 30. Motor—Left Side.

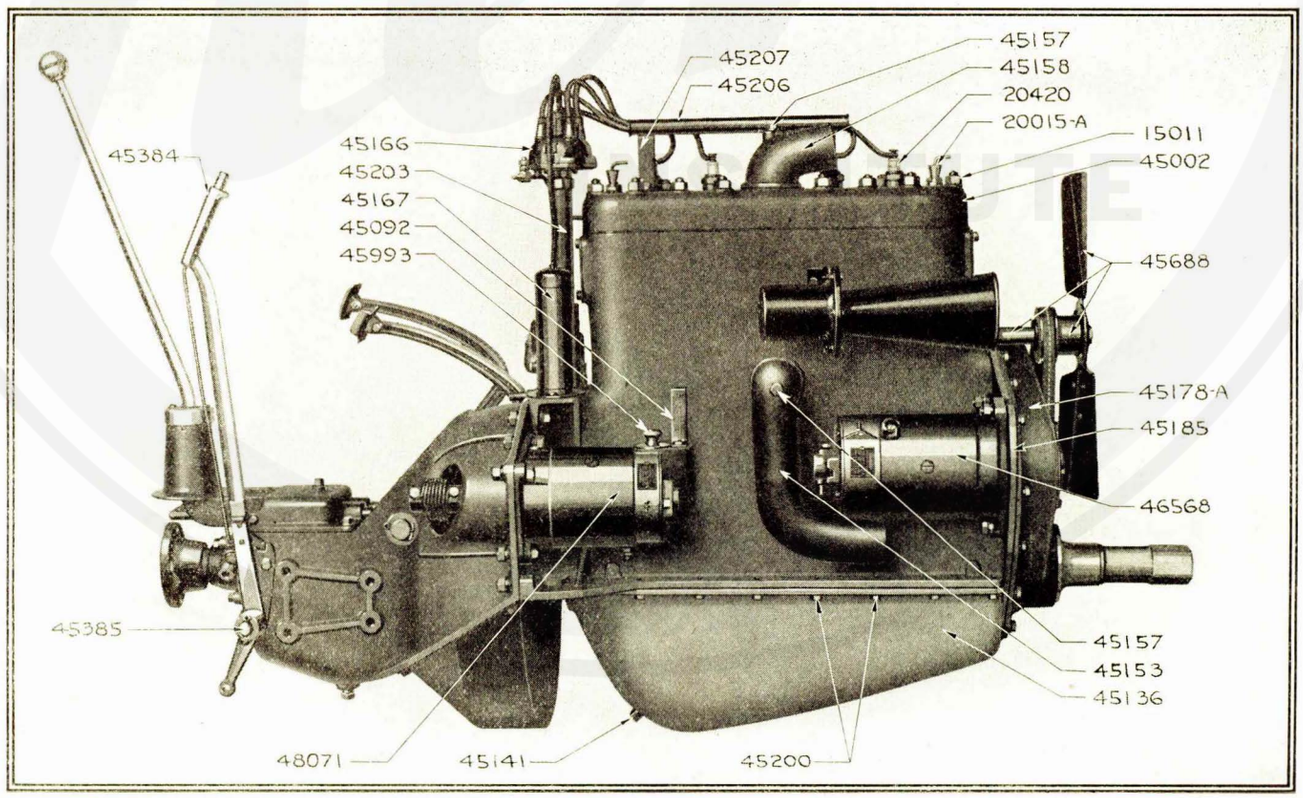


Fig. 31. Motor—Right Side

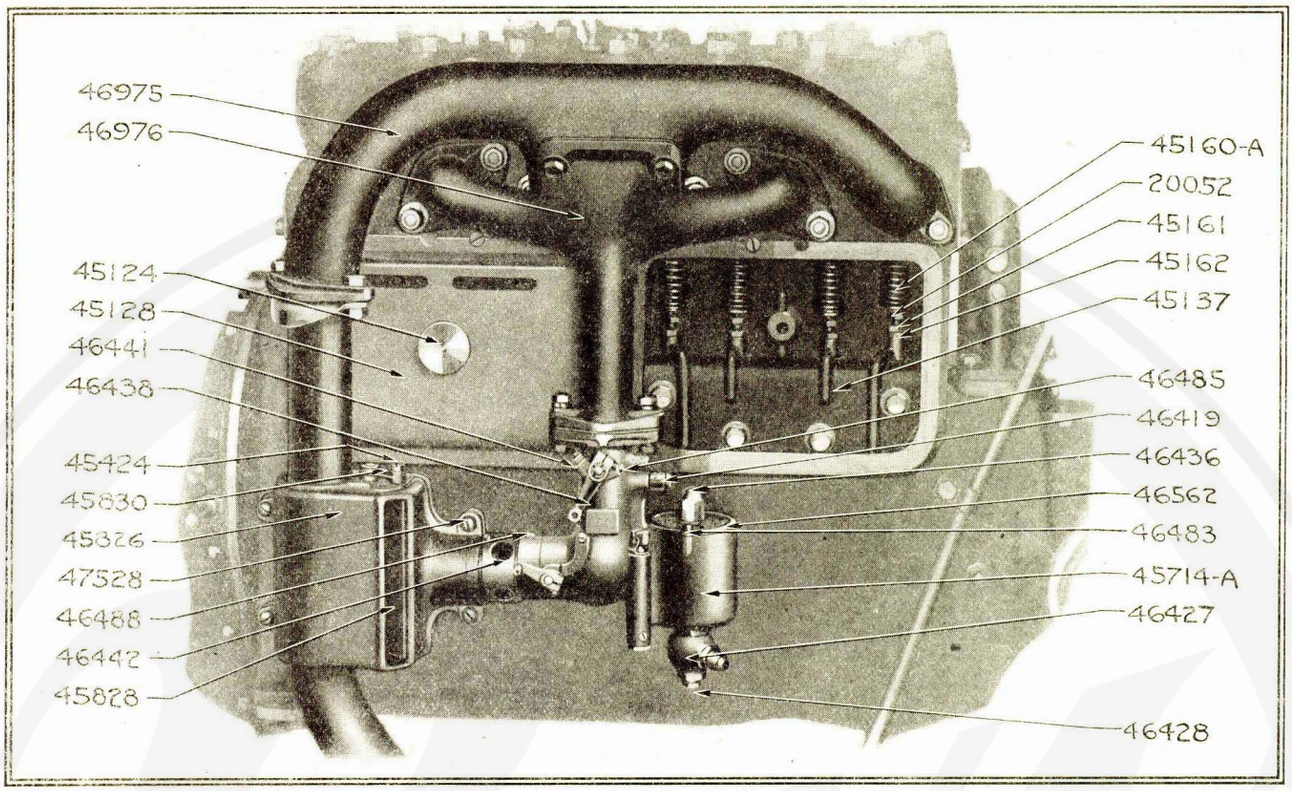


Fig. 32. Carburetor and Intake Manifold

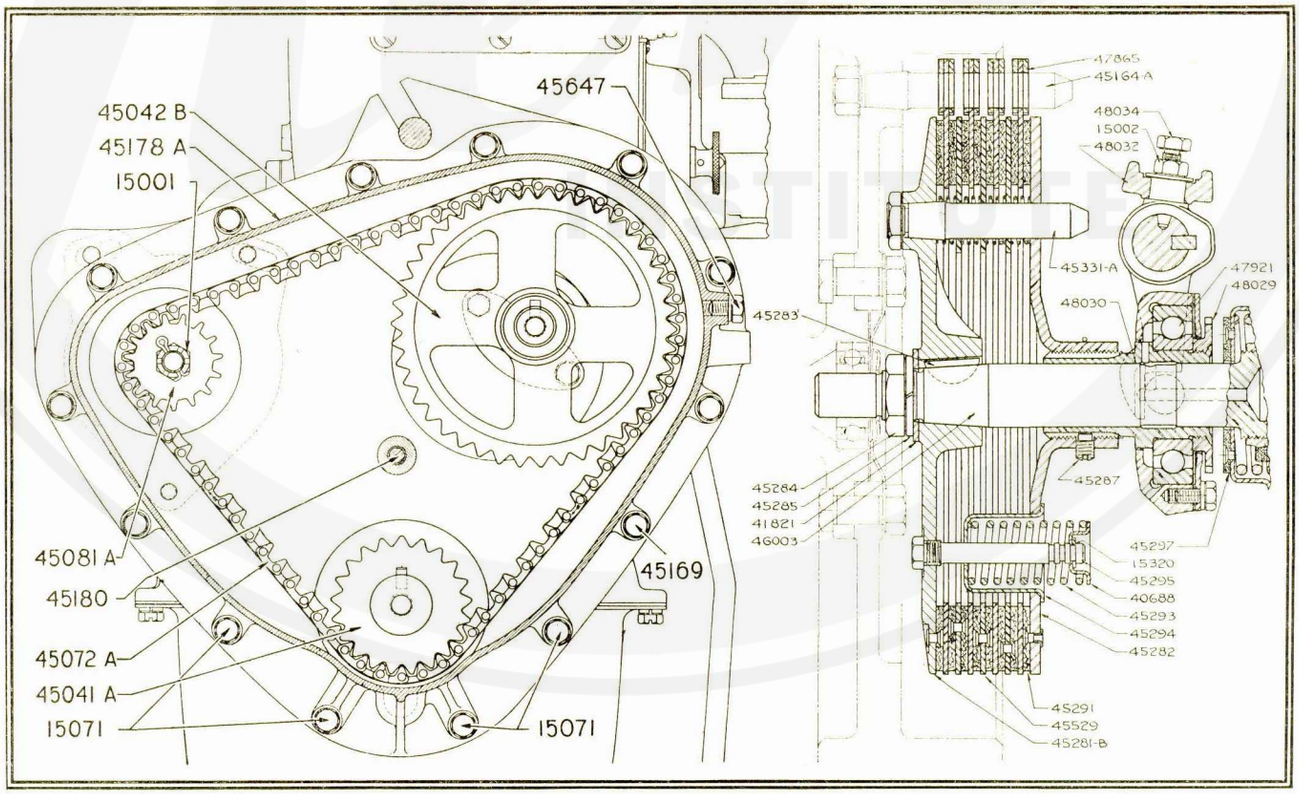


Fig. 33. Chain and Clutch Assemblies

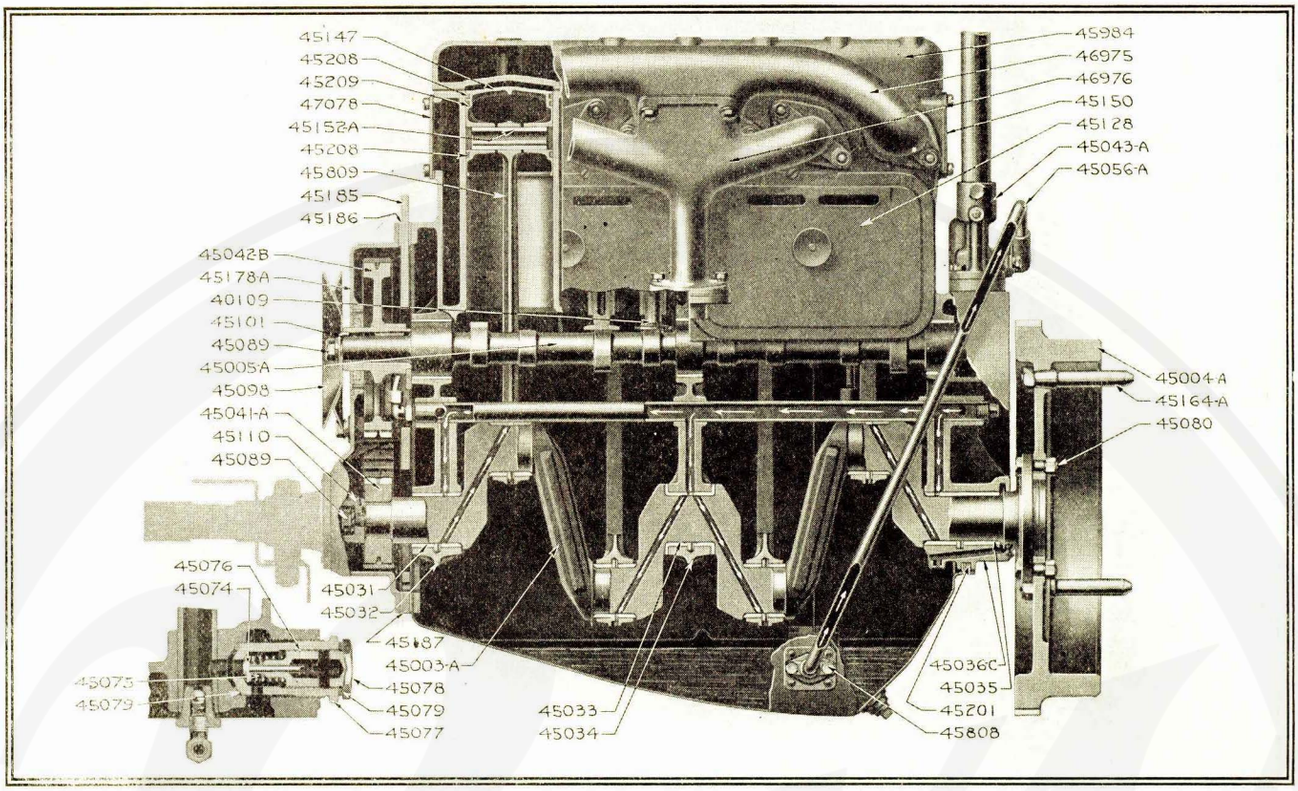
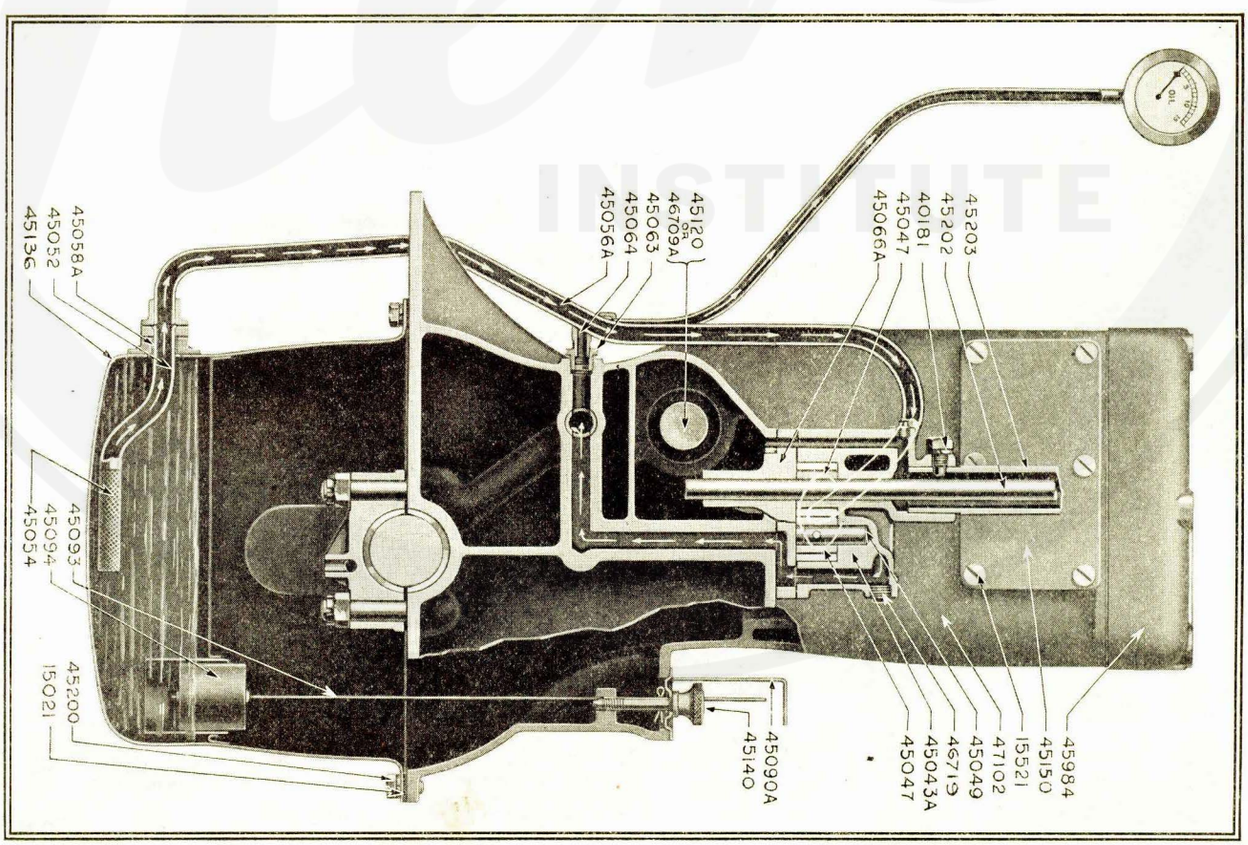


Fig. 34. Oiling System



No. 35. Oiling System—end view

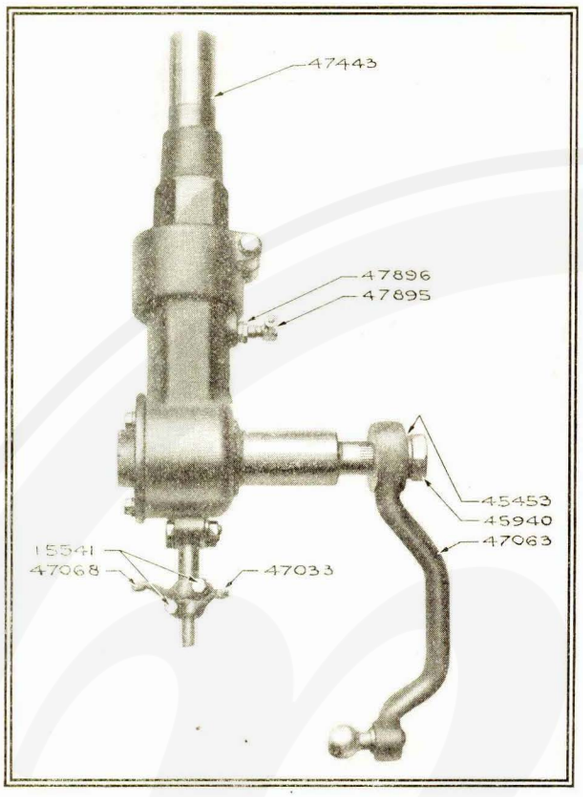


Fig. 36. Steering Gear Assembly

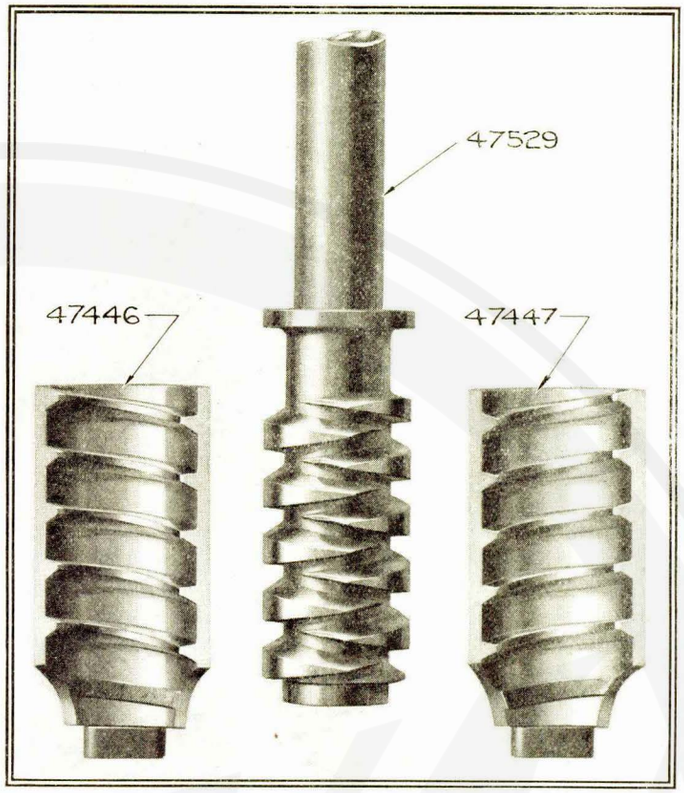


Fig. 37. Steering Gear Screw and Half Nuts

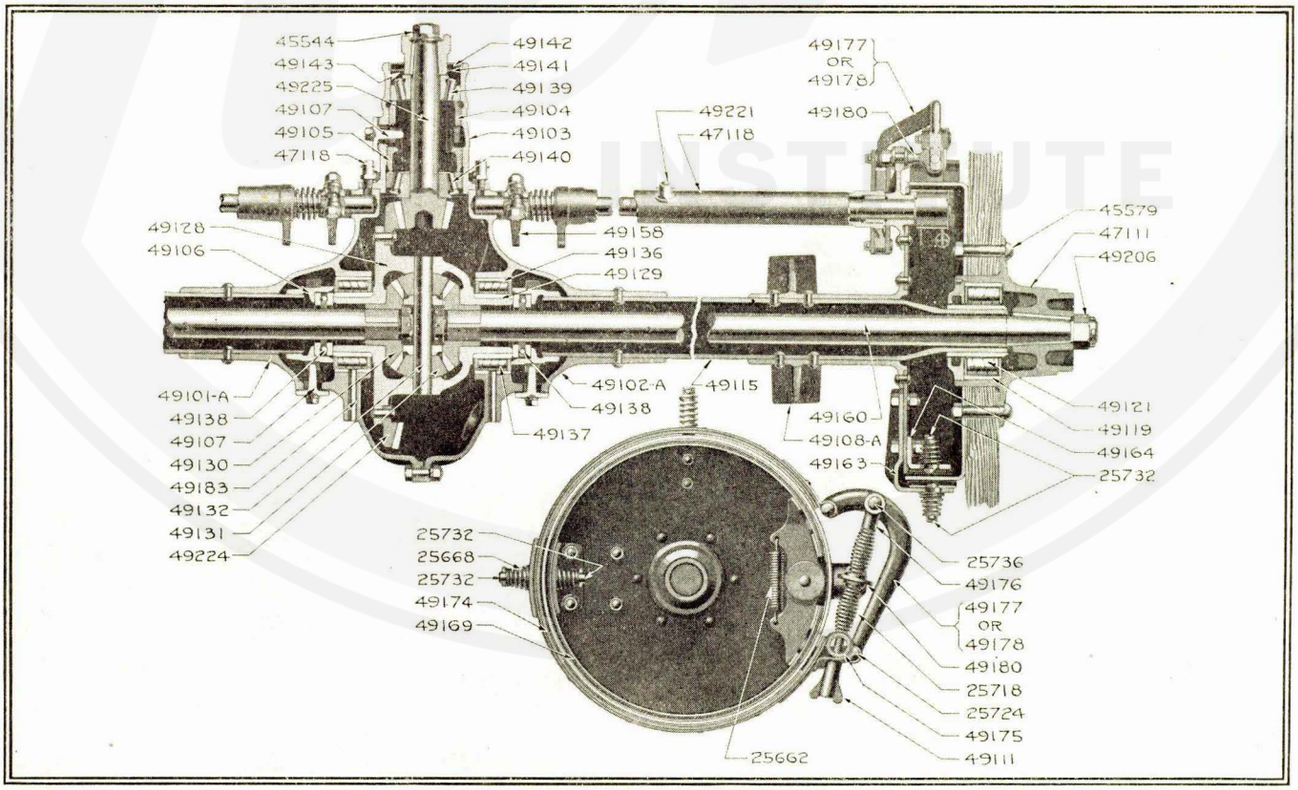


Fig. 38. Rear Axle and Brakes

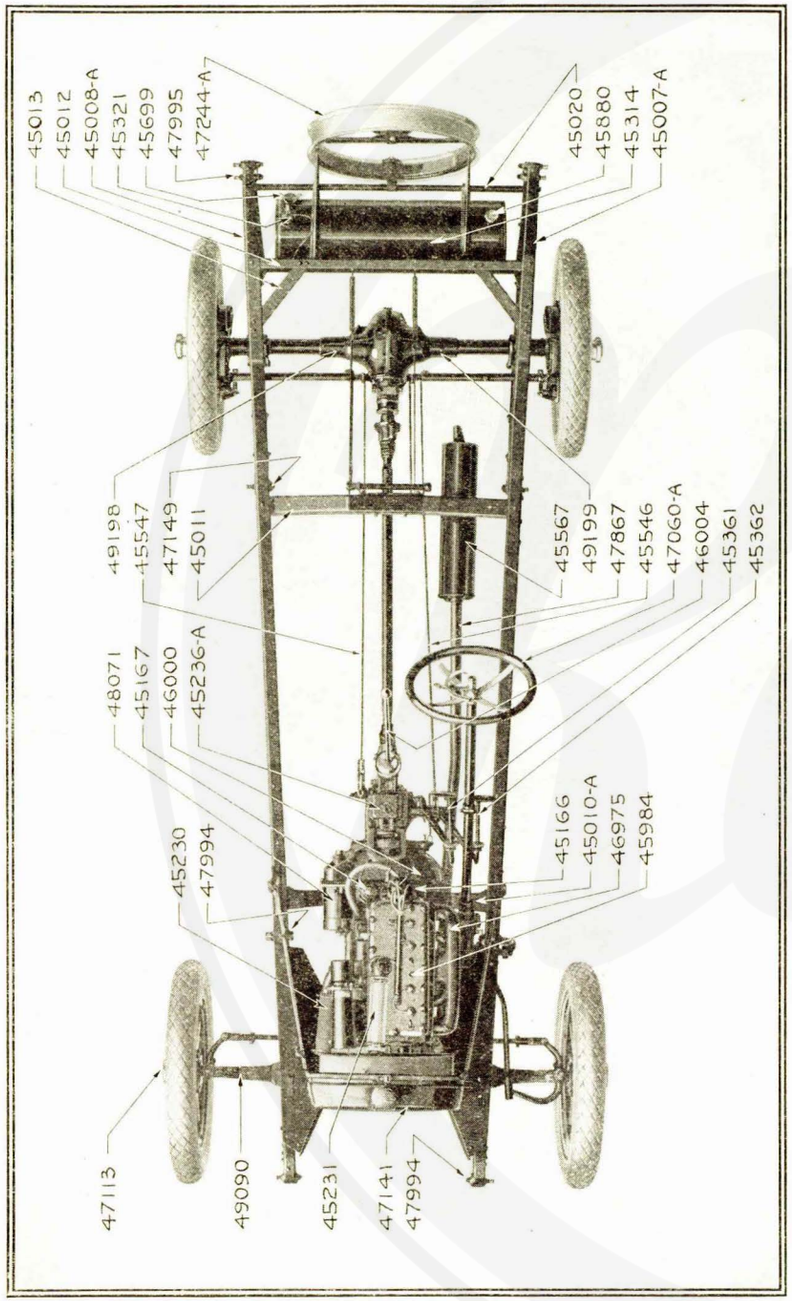


Fig. 39. Chassis

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