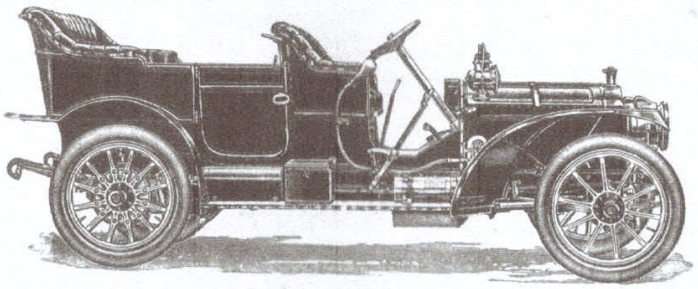
Packard

INSTRUCTION BOOK

FOR THE USERS OF THE
1909 PACKARD "30-B"
AND PACKARD "18"



"ASK THE MAN WHO OWNS ONE"

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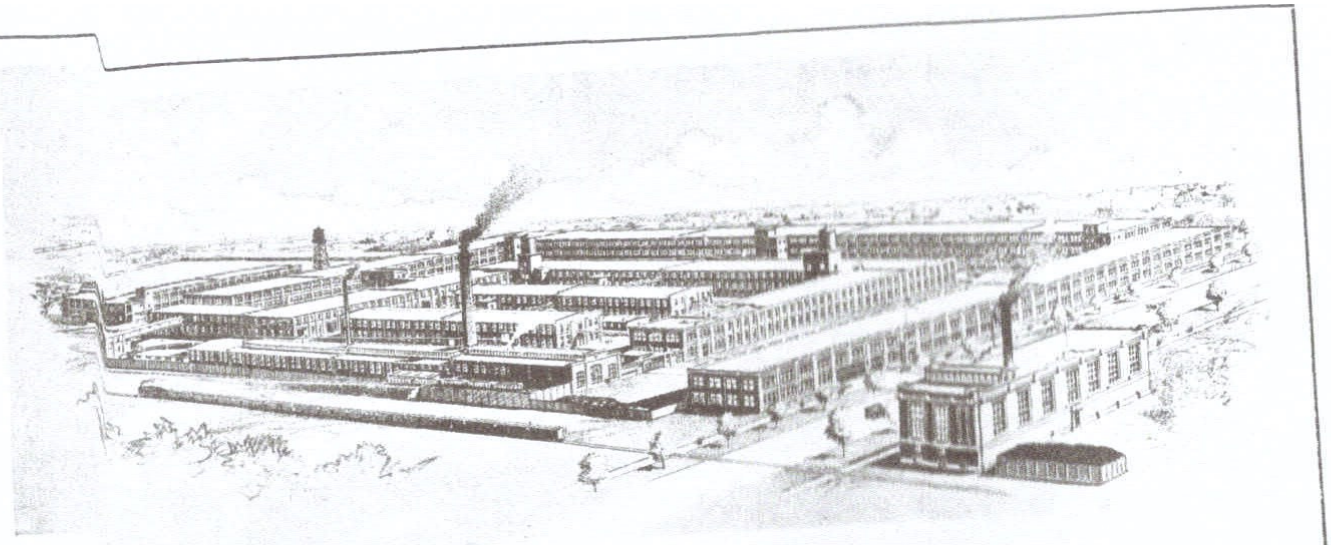

The Packard Factory

THIS Packard factory is the largest exclusive motor car factory in the world. It contains 12 acres of floor space and employs 2,500 men. The present factory is the outgrowth of a factory of 100,000 square feet completed where January 1, 1904, soon after the business of the Packard Motor Car Company was removed from Warren, Ohio, to its the manufacture of Packard cars commenced eleven years ago. The steady increase which brought the plant princip present immense size has not stopped. More additions are now under way and planned. The buildings are but a fully of reinforced concrete. The equipment not only includes the finest modern machinery for accurate work, large number of machines and appliances especially designed for the production of Packard parts.
turing Packard motor cars are built entirely in the Packard shops and are the sole product of an unrivalled manufac-

Announcement

This book is a reprint of the PACKARD INSTRUCTION BOOK for the users of the 1909 "30" and the Packard "18". The 1907 Packard is known as the "30"; the 1908 as the "30-A" and the 1909 as the "30-B", while the new (1909) Town Car is called the Packard "18". It is reprinted for owners, former owners and collectors.

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Supplies

Gasoline Tank

THE gasoline is carried in a copper tank beneath the front seats. The carburetor is adjusted for efficient operation when ordinary commercial grades of gasoline are used. The gasoline should invariably be strained through a chamois skin covered funnel, to keep dirt and water, from entering the tank. Located at the bottom of the gasoline tank near the right end is the outlet pocket. This pocket is designed to catch water or sediment that may accumulate in the gasoline, and is provided with a little petcock for draining. This petcock should be opened occasionally for a moment to drain off water or sediment that may have accumulated in the pocket. The gasoline supply pipe runs from the outlet pocket to the rear of the carburetor. By means of a stand pipe in the bottom of the tank, a reserve supply of about 5 gallons is provided.

Outlet Pocket

Shut Off Valve

On the right side of the car just under the front seats is a round shut off valve. By turning this valve as far as possible to the right to the mark "Shut", the flow of gasoline is entirely shut off at the tank. It may be locked in this position if desired. Giving the valve one-fourth turn to the left to mark "Reserve" takes the gasoline supply from the bottom of the tank. Giving the valve one-half turn to the left to mark "Open" the gasoline is taken from the top of the stand pipe; thus the operator has a reserve supply of about 5 gallons, after the supply with the valve in this position is exhausted

Reserve Supply

This reserve supply may be used by turning the shut off valve to "Reserve" position.

It is intended that the shut off valve be ordinarily left in "Open" position; by doing this warning is given before the tank is entirely empty.

Filter Well

Inside the filter well, at the bottom of the carburetor, to which the supply pipe connects, there is a gauze screen through which the gasoline passes on its way to the float chamber. In time this screen will become clogged somewhat, when it may be cleaned by unscrewing the plug at the bottom of the filter well and removing the screen. In replacing it care should be taken that the plug is screwed tight, to prevent leakage. The frequency with which this screen requires cleaning depends upon the cleanliness of the gasoline used and the care taken in filling the tank. The screen should be inspected at least once a month.

From the filter well the gasoline passes upward into the float chamber, where a proper level is maintained by means of the float and needle valve. From the float chamber it is passed to the spray nozzle in the base of the mixing chamber.

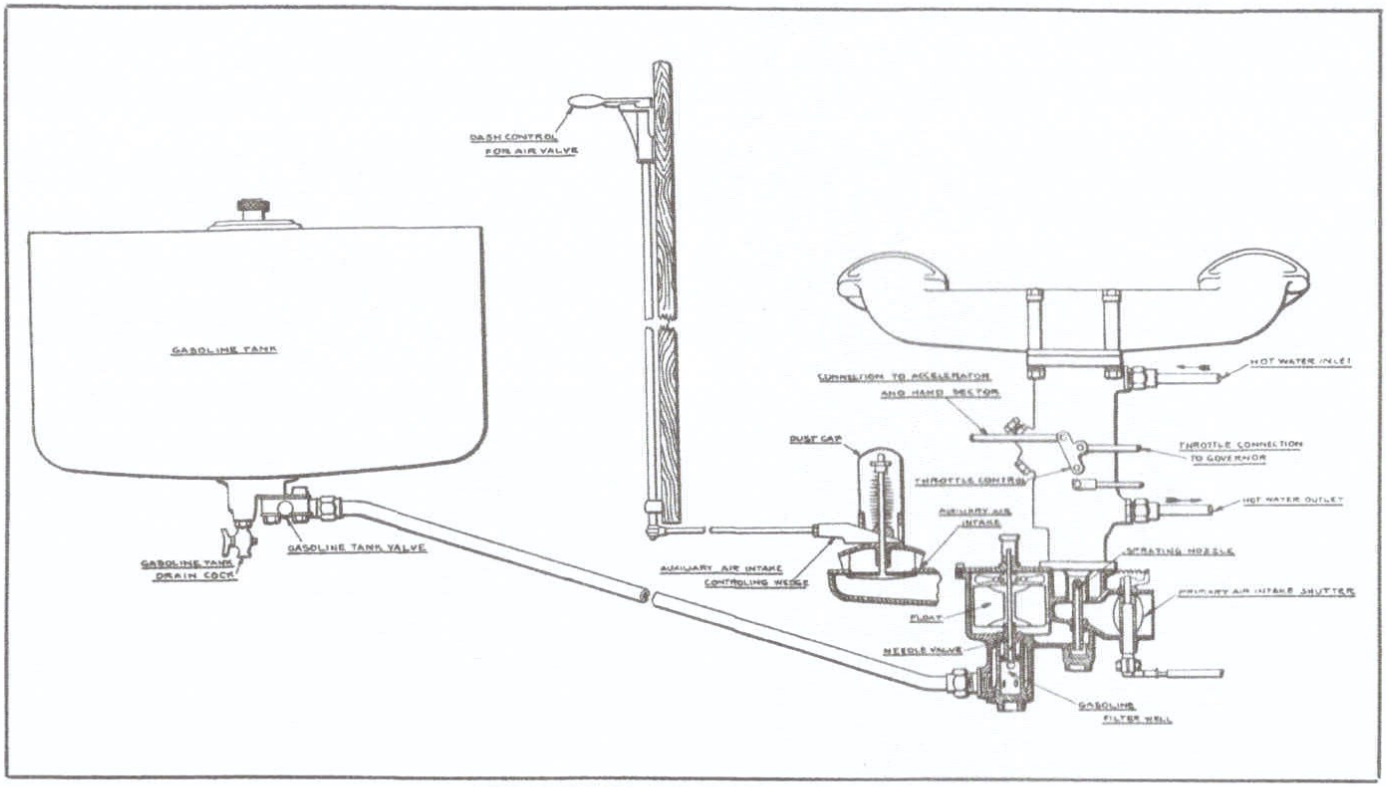
Primary Air Intake

On the forward side of the carburetor at the base of the mixing chamber is the primary air intake. Just inside of this opening is the primary air intake shutter, for use in starting in very cold weather. (See Page 31.)

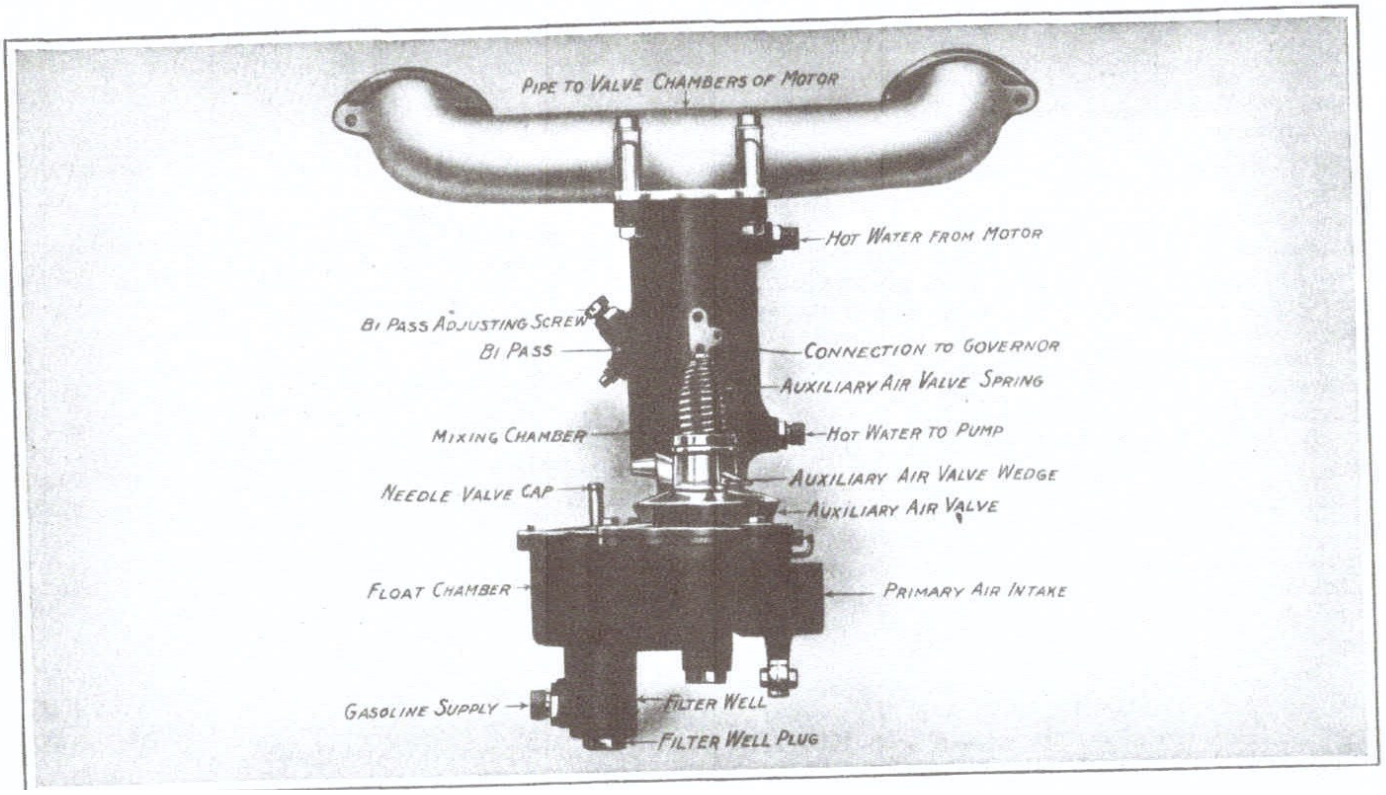
The air from this intake passes upward around the spray nozzle, through the funnel-shaped air passages. The vacuum created in the intake pipe and mixing chamber by the action of the motor pistons causes the gasoline to be lifted from the spray nozzle and dashed against the heated carburetor walls, where it is vaporized and carried to the cylinders.

Auxiliary Air Intake

At the outer side of the carburetor is placed the auxiliary air intake. This is automatic in its action, being provided with a spring controlled poppet valve which comes into operation whenever the motor speed is accelerated. The purpose of this auxiliary air intake is to automatically maintain a correct mixture under varying conditions.



THE PACKARD 30-B GASOLINE SYSTEM.



At the top of the auxiliary air valve chamber is a sliding wedge, which is operated from a small lever upon the dash of the car. The purpose of this wedge is to increase or decrease the tension upon the auxiliary air valve spring, thereby causing the valve to operate with more or less sensitiveness. The less the tension of the spring the greater the amount of air which will be drawn through the auxiliary valve, thereby decreasing the richness of the mixture; and, vice versa, the greater the tension of the spring the less the action of the valve and consequently an increase in the richness of the mixture. Swinging the lever to the right increases the spring tension, giving a richer mixture, and to the left decreases it, giving a thinner mixture.

Mixing Chamber

The mixing chamber is directly above the spray nozzle, and is surrounded by a hot water jacket in a manner similar to the cylinders of the motor.

The hot water which surrounds the mixing chamber serves to replace the heat absorbed by the evaporation of the gasoline, and to produce uniform vaporization under varying weather conditions.

Throttle Valve

In the mixing chamber is placed the throttle valve. This is simply a butterfly valve, and its operation controls the amount of mixture which is supplied to the motor. There is a bi-pass constructed around this throttle valve in the mixing chamber, for the purpose of supplying gas to the motor, when the throttle is closed. This bi-pass allows a small amount of gas to pass through it and around the butterfly valve to the cylinders. To regulate the speed of the motor relative to the throttle, simply loosen the check nut and screw down on the plug to decrease the speed of the motor and screw up on the plug to increase it.

The throttle valve is connected directly to the hydraulic governor, which is placed just forward of the carburetor and directly above the pump. The valve is consequently directly controlled by the governor. The valve is also connected to the hand throttle lever attached to the steering wheel and to the foot accelerator at the base of the

steering column, from which two points it is operated either by the hand or foot of the driver.

Carburetor Operation

In operation, the carburetor acts as follows: The suction of the pistons draws the air in through the primary air valve upward around the spray nozzle, where it picks up the gasoline, and both, owing to the shape of the various parts, are whirled violently against the hot walls of the mixing chamber, thoroughly vaporizing the gasoline. The auxiliary air valve is only slightly in operation at very low motor speeds. Its function is to temporarily furnish an increased supply of air which is required to maintain a proper mixture when the motor is speeded up.

This feature is one of very great importance and the automatic nature of its operation one of its chief values.

Leave the carburetor alone; try everything else first and save yourself useless work and possible additional trouble.

We would much rather have you write to us, giving a description of your difficulty, if you have any, than for you to attempt any alterations to the fixed adjustments of the carburetor.

Governor

The governor is of the well-known "hydraulic type," with special modifications. It consists of a circular chamber divided in the middle by a flexible diaphragm, one side being filled with water and connected with the pump and with the cylinders. On the side of the diaphragm, opposite the water, is a large piston, the stem of which projects through the guide and bearing and is connected with the throttle. As the motor is speeded up, the velocity of the water from the pump is increased, and this acts against the diaphragm, moving the piston, tending to close the throttle. As the motor speed decreases, the water pressure is lessened with a tendency to open the throttle.

Left to itself, the governor will hold the motor very closely and uniformly to any speed for which the throttle may be set by the sector lever on the steering wheel.

The action of the governor may be, however, neutralized by the accelerator, by which the driver can produce an immediate and complete opening of the throttle. The governor is adjusted when it leaves the factory and should be left alone.

Oiling Motor and Transmission

Packard Oil

There is nothing concerning the care of the car more important than lubrication. In order that Packard users may have a uniform grade of lubricants, which are best suited to their cars, we have carried on extensive tests, as the result of which we have concluded arrangements with the Havoline Oil Company, of New York, for a special lubricant suitable for every part of the Packard car. These lubricants may be obtained from Packard dealers or direct from the Company.

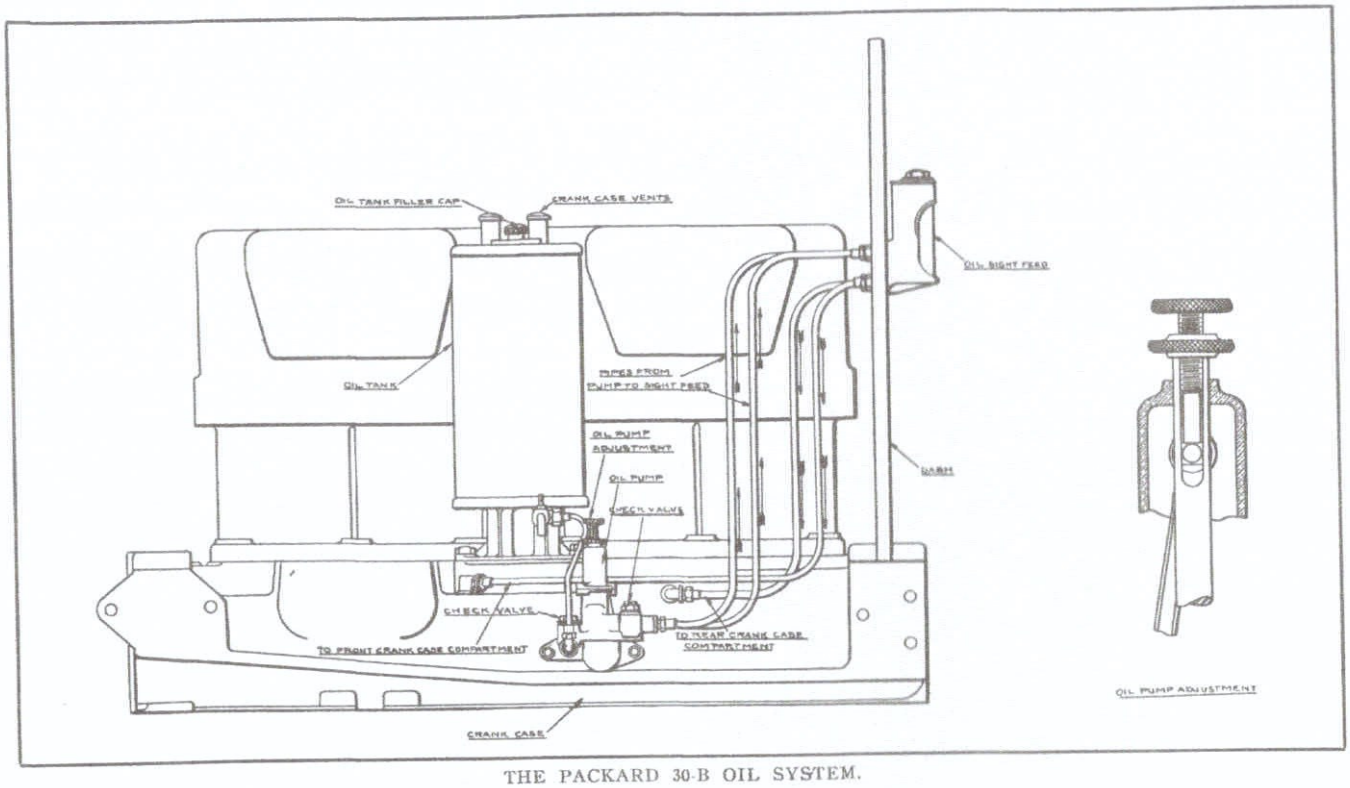
These lubricants are known by the following titles: Packard Cylinder Oil, for the motor; Packard Transmission Oil, for the transmission, rear axle and forward universal joint; Packard Cup Grease, for all grease cups; Packard Timing Gear Oil, for the front gear compartment of the motor; Packard Universal Joint Graphite Grease, for steering ball connections, rear universal joint, and pump and magneto shaft universal joints.

Oil Reservoir

The oil reservoir is located on the crank case between the front and rear pairs of cylinders on the left side. It holds about one gallon, and of course should never be allowed to get empty. A gauze screen is screwed into the filler opening and should always be used.

Vent Pipes

Passing vertically through this reservoir, but not connected with the interior, are two vent pipes connecting with the front and rear crank compartments. The oil supply in the crank compartments after draining and cleaning, may be replenished through these pipes. On the dash in plain sight of the driver is the double sight feed of the



THE PACKARD 30-B OIL SYSTEM.

motor lubricating system. The glass marked "F" feeds the forward crank compartment and the glass "R" feeds the rear crank compartment. These glasses afford the operator a constant knowledge as to the amount of oil the motor is receiving when in operation.

Sight Feeds

In the oil pipe leading from the oil tank to pump is a valve which has three positions:

Oil Shut Off Valve

Turned toward the front is a complete shut-off.
Turned sideways drains the oil tank.
Turned toward the rear feeds the pump.

Always keep this valve handle turned toward the rear when the motor is running.

The oil pump is located at the left side of the motor and nearly under the reservoir.

Oil Pump

The pump is driven by a worm upon the cam shaft, which engages with a spiral gear in the pump casing, which, in turn, operates an eccentric which drives the two plungers of the pump. These plungers work together.

Oil Pump Adjustment

The stroke of each plunger is independently adjustable by means of an adjusting screw and lock nut at the top. Thus the amount of oil fed to each crank compartment may be independently controlled.

To increase the flow of oil for either compartment, the adjusting screw for that plunger should be turned down until the desired amount of oil is fed.

To decrease the amount of oil the set screw should be turned upward. After adjusting, be sure to turn the lock nuts down firmly.

The plunger nearer the motor supplies oil to the rear crank compartment, and the outside plunger supplies to the forward crank compartment. There is a stuffing box at the top of each plunger, which can be tightened in case of leak. A small wrench is provided for that purpose.

Adjustments may be checked by noting the sight feeds.

At the bottom of the pump are four ball valves, one under each plunger to control the intake of oil and one under each discharge pipe to control the discharge of oil.

Oil Pump Operation

In operation, the pump draws oil from the reservoir. On the downward stroke of the plungers the oil is forced to the top of the sight feeds, through which it drops and from where it is carried to the two compartments of the crank case.

The oil in the two compartments of the crank case should be 1¼ inches deep at the center when the motor is not running. Two petcocks are screwed into the left side of the crank case, one near the center of each compartment, and at such a height that the level of oil will be approximately 1 15/16 inches deep in the center of the crank case when it reaches these petcocks. This is more oil than is necessary for normal running.

Oil Level in Crank Case

As the '09 Packard is shipped from the factory, the plungers of the oil pump are adjusted to feed an amount of "Packard" oil that is slightly in excess of normal requirements, and with use it may become desirable to reduce the oil feed slightly after a few weeks.

The correctness of the oil level can readily be tested by noting the blue smoke which will be very apparent in the exhaust if the level is too high.

It is not necessary to be continually testing the oil level by means of the petcocks. It is important, however, to see that, so long as the engine is in operation, oil is passing through both sight feeds in proper quantities. The amount fed must be left to the judgment of the operator, and should vary according to the kind of service required of the car. This will usually be about two to three drops to each plunger stroke for normal service.

The best method of determining if the motor is properly lubricated is by watching the flywheel oscillate after the switch has been thrown to neutral. Just before the motor comes to complete rest the flywheel will rock back and forth more or less, the amount of oscillation depending upon the proper lubrication of the working parts.

The oil pump should be set so that during all ordinary driving no smoke will be apparent in the exhaust, and so that smoke will show if the motor is made to race.

Special Oiling for Unusual Service

The instructions as to oil level in the crank case are intended to apply for all normal and usual service of the car.

Whenever abnormal or extraordinary driving is to be done, such for instance as a specially fast or hard run, oil should be poured through the two crank case vent pipes, until the oil level in each crank case is fully up to, or even somewhat above, the petcocks.

Cleaning Crank Case

Periodically, say once a month, or more frequently, if the car is doing continuous and heavy duty, and particularly before a long, hard journey, the oil in each crank case should be drained off by removing the large brass plugs provided for that purpose in the bottom of the crank case, and a fresh supply of oil poured in through the vent pipes. If the old oil that is drained off is very dirty, or is heavy, it is good practice to replace the brass plugs, pour about two quarts of kerosene into the crank compartments and run the motor for about thirty seconds rapidly. Then remove the plugs and drain off the kerosene thoroughly, after which the plugs should be replaced, and the crank compartments filled with the proper amount of "Packard" cylinder oil.

Oil in Transmission Gear Case

The transmission case should be filled with "Transmission Oil" up to the button head screw in the front cover. This will just allow the second speed countershaft gear to touch the oil. On the ledge in the bottom of the transmission case directly under the filler plug the oil will be about 5/8 inch deep. About two quarts is the necessary amount.

In winter it is advantageous to use Cylinder Oil or other light oil in the transmission case.

The oil in the transmission case should be drawn off by means of the plug in the bottom of the case, and replaced with fresh oil about once a month.

Oil in Bevel Gear Case

The rear axle bearings and bevel driving gears are in a separate compartment from the transmission gears. This compartment should be kept filled with sufficient Transmission Oil to cover the teeth at the bottom of the large bevel gear. A button head screw is provided in the back of the case for testing this level. About two quarts is the necessary amount. This oil can be inserted through the large brass plug at the top of the rear axle housing, and drawn off through the similar plug at the bottom of this housing. This should be done with the same frequency as the oil in the transmission gear case is renewed.

The differential gearing is contained in a skeleton case, forming the center of the rear axle itself, and these gears receive their lubrication from the oil in the bevel gear housing. Always make sure that the filling and draining plugs in the bevel gear housing are properly replaced after giving these parts attention.

Oiling Clutch and Other Parts

Oiling Clutch Leather

The clutch is of the expanding type. A leather band expanding against a metal shoe. Especially while new, the leather should be frequently treated with a small amount of Castor or Neats Foot Oil. In case too much oil is applied, the slipping may be overcome by injecting gasoline between the clutch leather and the fly wheel shoe. This can be best accomplished if the space between the two ends of the clutch band is turned to the top.

Grease Cups

The two grease cups for the steering gear are conveniently placed on the upper side of the base of the steering column. The caps on these cups should be given a turn every day, and the cups should be refilled when necessary.

Grease cups are placed at each end of the rear axle almost directly beneath the

rear springs for lubricating the bearings. The cups should be kept filled and a turn given each day.

It is especially important that the universal joints be kept well lubricated.

Oiling and Greasing Universal Joints

The forward universal joint is constructed to run in a bath of oil. The copper cover contains a small plug for filling. One pint of Transmission Oil is the proper amount. The oil should be drawn off and the joint flushed with kerosene and new oil installed about every 1,000 miles. The rear joint should be supplied with graphite grease by screwing the compression grease cup in place of the plug in the cover. This joint should also be cleaned about every 1,000 miles.

Open the leather cases covering the steering connection ball sockets and pack with graphite grease every week in constant service.

Other Greasing Directions

The universal joints of the pump and magneto shafts should be treated in the same manner.

The roller bearings in the front wheels should be removed, cleaned and repacked about every 1,000 miles.

The oil cups on the steering knuckles should be filled every 300 miles. The grease cups on the steering cross tube connections should be given a turn each day.

Oiling Front Wheels

The front hub dust caps are designed so as to form oil reservoirs. The caps may be removed, and these reservoirs filled with oil about once a week. This oil is supplemental to the grease above mentioned. The bearings should be thoroughly cleaned at least every two weeks.

General Oiling Directions

Commencing at the front end of the car, your oil can in one hand and a piece of waste or cloth in the other, give regular attention to the following places:

Front spring front bolts.
Starting crank bearing.
Front spring rear bolts and links.
Fan hub.

Finger on magneto make and break that runs on the internal cam at the end of the armature shaft, through the small oil cup on top of the aluminum cover.

Magneto bearings (use only the very best machine oil or "Packard" cylinder oil).
Commutator (through oil cup on top).
Clutch (sparingly, and only if action is harsh).
Clutch pedal joints.
Clutch rack and pinion and adjacent joints.
Clutch collar (where it slides on clutch shaft).
Clutch collar brass shoe.
Foot pedal shaft bearings.

General Oiling Directions

Change speed and brake lever shafts and bearings.
Intermediate brake shaft and connections at each side of car.
Rear spring, front bolts and links.
Radius rod front connection.
Brake rod clevices.
External and internal brake fittings and connections.
Rear spring rear bolts and links.

Also oil occasionally:

Spark and throttle levers on the steering wheel and all joints in connection with these systems.

Accelerator.
Jack up frame of car once a week and freely oil between spring leaves.
Ratchet of hand brake lever.
Gear shifter shaft (where it enters transmission case).
Reverse connections (on front of transmission case).
Springs and clevice at forward end of transmission truss rod.

Give auxiliary air valve stem a squirt of gasoline occasionally, to clean out dust and prevent sticking.

Do not oil carbon brushes nor distributor on magneto.

Spring Clips

When a car is new the spring clips should be examined and tightened every day until the stretch of the metal and the surplus elasticity of the spring block has been taken up, after which they should be examined weekly.

The object of spring clips is not only to hold the spring firmly to the axle, but also to prevent movement of the spring between the spring clips, and it is safe to say that every spring which breaks at the middle, between the spring clips, is due to loose spring clips, and if you allow your spring clips to get loose you must expect broken springs. **Keep the spring clips tight.**

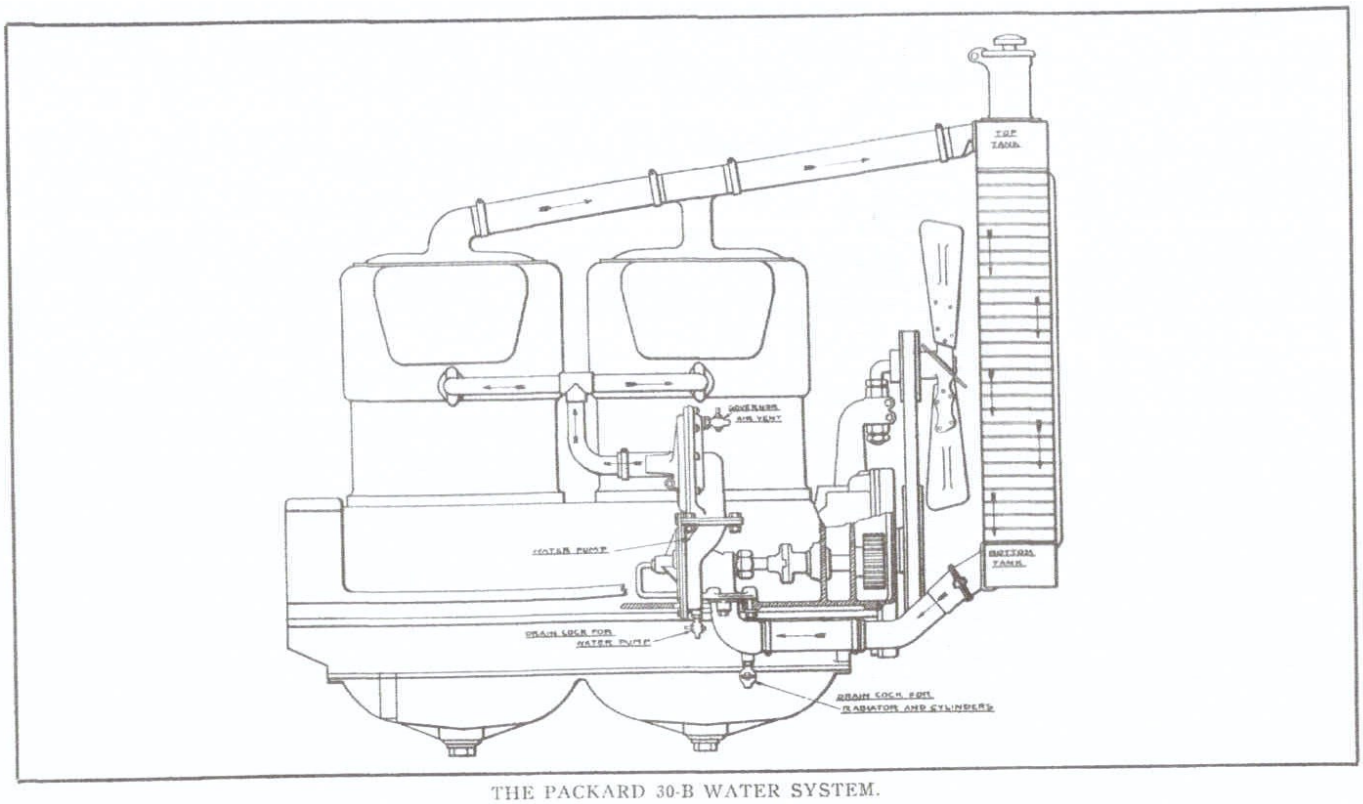
Water

Radiator

Use only clean water, as free from lime or other impurities as possible. Always pour through the screen which is in the top of the radiator beneath the filling cap until the radiator is full. The motor should always be running slowly whenever the radiator is being filled. As the discharge from the motor is into the top of the radiator, any steam or surplus water escapes through a vent pipe which extends from just beneath the filling cap down to the lower left-hand corner as you face with the car.

Circulating Pump

The pump, which is of the centrifugal type, is attached to the right side of the motor base, underneath the governor, and is direct driven from the front gear case. It



THE PACKARD 30-B WATER SYSTEM.

draws water from the bottom tank of the radiator, forcing it through the governor, upon which it acts according to its pressure, and into the cylinders. After circulating around the cylinder walls it is forced out through the tops of the cylinders into the top of the radiator. A belt-driven fan is used to induce a current of air through the radiator when the car is not in motion or is running at slow speed.

Causes of Hot Water

The circulating system is a very good indicator of the motor's condition. Excessive evaporation or an unusually high temperature of the water may be traced to a hot motor, due perhaps to operating with the throttle wide open and the spark retarded, or to insufficient lubrication, to frozen or clogged pipes, insufficient water, loose fan belt, or dirty strainer in pipe between bottom of radiator and pump.

To Drain Water

To thoroughly drain the water from the car, it is necessary to open the petcock in the under side of the pipe that connects the radiator with the water pump; also open the petcock on the under side of the water pump itself, and the petcock on the governor. Leave these open; then open the cap at the top of the radiator so as to permit a circulation of air. After the water has ceased to flow from the three petcocks, open the relief cocks on the tops of the cylinders and turn motor over a few times by hand to clear the pump of water. Then blow through all the water connections to make sure that they are drained clear and the passages left perfectly dry.

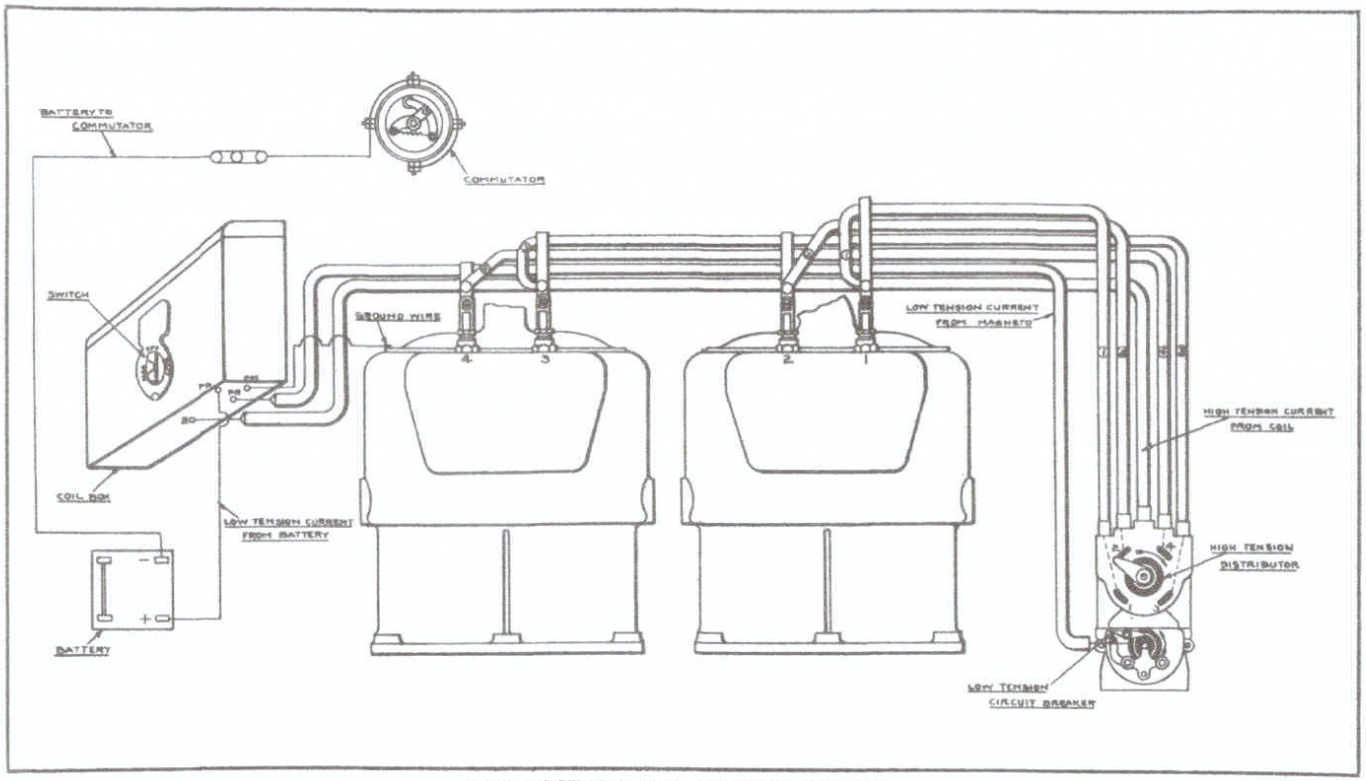
Electricity

Batteries

The battery is of the accumulator or storage type, and is contained in the box on the right hand running board. It is a good practice to have it recharged when the voltage has fallen from its normal of 6 to 5.7 volts.

Acid Solution

The electrolyte or acid solution should always cover the tops of the plates to the depth of one-quarter of an inch. Replace any loss from spilling with fresh solution.



THE PACKARD 30-B IGNITION SYSTEM.

Use distilled water where the loss is by evaporation. Use only chemically pure sulphuric acid. The proportions of acid to water are about 1 to 4, by liquid measure, at 66 degrees Fahr. Use a glazed stone vessel for mixing, and add the acid to the water very slowly while stirring with a glass or rubber rod. Test liquid with hydrometer when cool. It should read between 20 and 25 degrees Baume or 1,162 to 1,200 degrees specific gravity. When the battery is fully charged the electrolyte should be about 30 degrees Baume or 1,260 degrees specific gravity. If the specific gravity is low, remove some of the liquid (with rubber bulb) and add a stronger solution (not exceeding 1,400 sp. gr. or 41 degrees Baume). If too high, add distilled water till the proper point is reached. Never add warm acid solution to a battery. Always recharge immediately after adding solution.

Remove the vent plugs for each cell in charging to allow the escape of gas. Bring no naked flame near these openings while charging.

Charging Battery

The finish of charge is indicated, first by the fine boiling, and by the voltage, which will be about 7.5 or 2.5 per cell, while charging. For charging the current must be direct and not alternating. If a voltmeter is not available the charge should be continued until each cell has been gassing or bubbling about twenty to forty minutes. Do not prolong the charge beyond this limit.

Charge the battery at one-tenth its rated capacity in amperes. Thus, a 65 ampere hour battery at 6.5 amperes, or an 80 ampere hour battery at 8 amperes.

It is usually very much more convenient to have your batteries charged in a dealer's establishment. If an owner wishes to equip for doing his own charging, upon special request we will furnish instructions.

Coil Box

The box in the center of the dash contains two coils, a switch and a lock. Each coil as made is a complete unit in itself, and each may be lifted out for inspection, test, or repairs without disturbing any other part. Do not remove or insert either coil

without first placing switch in neutral position. This is important, as otherwise you may do damage to the switch mechanism.

The right hand coil is for battery current, and is fitted with a single vibrator. The left hand coil is for magneto current, and has no vibrator.

Switch

The switch has three positions. Turn to the right for battery current, turn to the left for magneto current, and turn to a vertical position for neutral (no current).

Above the handle of the switch will be found a lock, which enables the owner to leave his car with safety. Place the switch at neutral and lock.

Binding Posts

On the under side of the coil are four binding posts:

P. P. brings low tension current from the battery.

P. R. brings low tension current from the magneto.

B. transmits high tension current from both systems.

P. M. is a common ground wire for both kinds of current from both systems.

The low tension currents from both the battery and magneto, though of good amperage (volume), are low in voltage (velocity or force). The two coils receive from the battery or magneto their respective low tension currents and deliver currents of high tension, suitable for gas engine ignition.

Battery Wiring

Commencing at the positive pole of the battery (red and marked +), the current follows the connecting wire to the post on the under side of the coil marked P. P. At this point it enters and passes through the primary winding of the right hand or vibrator coil, coming out again at post marked P. M. and along the connecting wire to the screw on the motor, where it is grounded.

The only path by which it can return to the battery is through the contact shaft, and roller to one of the binding posts, and by means of the metal connecting strap to the wire running to the negative terminal, the circuit being completed each time the roller in the contact box passes over one of the metal contact pieces.

High Tension Current

Whenever this low tension circuit from the battery is completed, as above described, a high tension circuit is induced in the secondary winding of the battery coil. This current leaves the coil at post "B" to the central post at the top of the square distributing plate on the magneto.

From here it passes along a wire embedded in the plate to a continuous copper ring in the outer face of the plate. From here it is taken up by a carbon contact piece midway the length of the rotating arm. This contact piece is held by a light coil spring in contact with the ring mentioned.

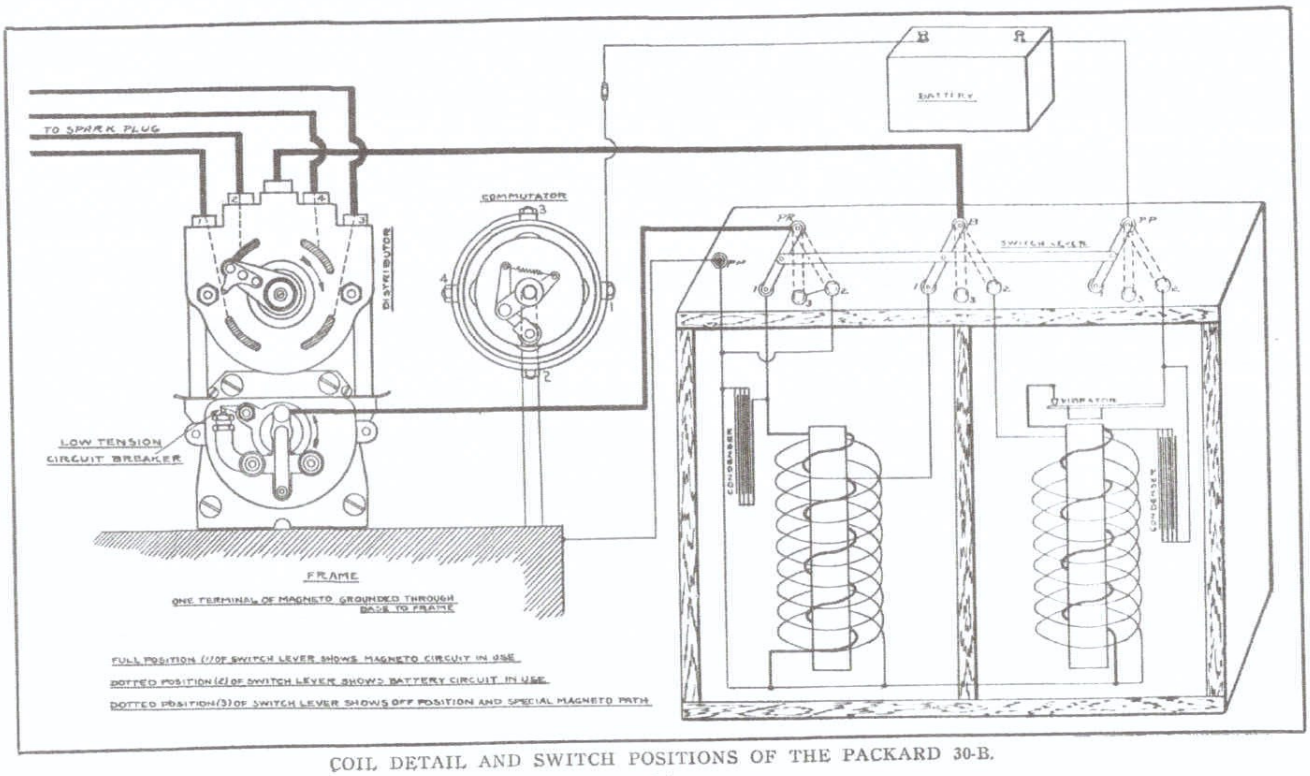
The current now passes to a metallic contact piece at the outer end of the rotating arm, which is held by a coil spring into contact with the face of the plate. Embedded in the face of the plate are four brass segmental pieces which are connected by means of wires running through the plate to four binding posts at the top of the plate. The current passes in turn from the metallic contact plunger to each of these four segmental contact pieces as the distributor arm rotates, and from these segmental plates to the four binding posts, and then through the connecting wires and spark plugs to the "ground" and back again to the battery coil, through the binding post P. M. on the coil box.

Battery Current

The battery current is generated by chemical action, and is ready to flow the instant its circuit is completed. It is therefore particularly useful for starting "on the switch." It is only necessary to break the circuit to stop the flow of current. Batteries require frequent recharging and occasional renewals.

If the battery terminals become dirty or corroded by acid, clean them with ammonia and a tooth brush; also paint the terminals with a small quantity of graphite grease.

Keep the commutator free from dirt and with a film of clean oil over all its working parts.



COIL DETAIL AND SWITCH POSITIONS OF THE PACKARD 30-B.

Vibrator Adjustment

The vibrator operates only when the low tension current is passing through the primary winding of the battery coil. It is adjusted by means of a screw and lock nut. If too tight or too loose, the results may not be satisfactory. Too tight an adjustment is not economical. A medium adjustment is best. A good plan for adjustment is to turn up on the thumb screw at the loose end of the vibrator, then adjust the spring so the distance between it and the top of the coil will be about 1/16 of an inch, and screw down on the adjusting screw until a medium toned buzz is obtained.

The vibrator points should be kept flat and parallel. If pitted, may be carefully smoothed with a thin, fine file. A nail file is quite satisfactory for the purpose.

Magneto Current

The magneto current is the result of magnetic induction and is practically inexhaustible. The magneto only generates current when its armature is being revolved, either by turning the starting crank or by running the motor.

The low tension current from the magneto enters the primary winding of the magneto coil at the post P. R. and leaves it at post P. M., returning to the magneto through the "ground."

You will readily see what an important part the wire connecting post P. M. with the screw on the rear cylinder has to perform: It is the common path for all of the current of both systems. Its connections must be well made and clean.

The high tension current thus induced in the secondary winding of the magneto coil follows exactly the same path as described in connection with the high tension battery current from post "B" through the distributor arm and plate of the magneto to the respective spark plugs, and back again to the magneto coil through the "ground" and post P. M.

Whenever the motor is running, the magneto is developing current. It only passes through the magneto coil, however, when the switch is thrown to "Mag." With

the switch in any other position, the current is grounded without passing through the primary winding.

Magneto Make and Break

The make and break mechanism of the magneto is located at the rear end of the armature shaft, and is protected by an aluminum cover. This mechanism should be kept clean and the contact points flat and parallel with each other, and adjusted so as to open 1/64 in. when breaking the circuit. Ordinarily they can be cleaned by inserting a piece of paper between them and drawing it about. If these points become pitted they should be dressed down by drawing an exceedingly fine thin file between them.

To adjust these points retard the spark to its limit, and in order to make certain that this is done, with the hand press the plate which supports this mechanism down to its lowest possible point, so as to take up all slack in various spark levers and connections. Then rotate the armature shaft until the little groove marking on the edge of the cam which operates the make and break lever comes precisely opposite the little pointed stud in the face of the plate; then adjust the anvil (or fixed point), of the make and break device, so that the points will begin to separate as the marking groove passes the pointed stud.

Carbon Brush

A carbon brush is held in contact with the rear end of the armature shaft by a flat spring. This contact should be kept clean and free from oil. A simple and effective method is by passing a slip of paper between the two and moving the paper about.

Low tension current, having little velocity, is unable to jump across a gap or overcome much resistance. Particular attention should be given all connections, to keep them clean and to maintain a firm contact.

See that there are no loose ends of wire straying away from the binding posts. All wiring should be kept free from water and oil.

High tension current will pass through an imperfect connection and will overcome considerable resistance. Extra heavy insulation is therefore necessary to prevent electrical leaks.

Knife Switches and Spark Plugs

The knife switches should have a firm contact with the top of each spark plug. A spark plug with a cracked porcelain is a very frequent source of "missing," though too great a gap between the points will produce the same result. The gap should be 1/64 inch.

Ignition Timing

The proper timing of the electrical apparatus is illustrated in the Timing Diagram. We will imagine, for the sake of this description, that everything has been disturbed.

Wires

First, trace the wires—

Battery (+) to coil P. P.
Battery (—) to commutator.

Magneto, low tension from end of armature shaft to P. R.
Coil high tension B to central post on top of magneto front plate.
High tension wires 1-2-4-3 to spark plugs.
Common ground P. M. to motor.

Second, open the relief cocks on top of three cylinders as, for example, No. 1, No. 3, No. 4, leaving No. 2 closed.

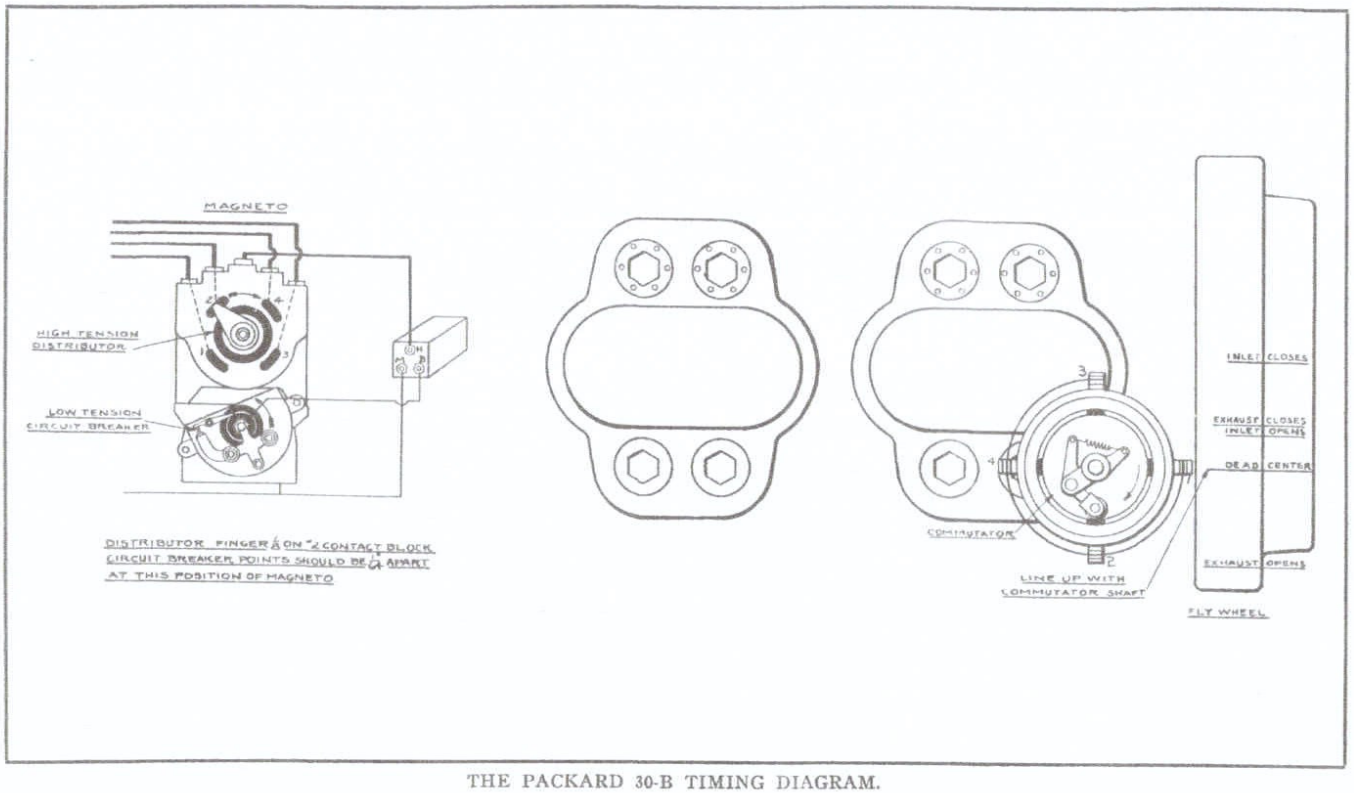
Third, turn the starting crank to the right until the resistance due to compression in No. 2 cylinder is distinctly felt.

Now remove front foot board and, after opening No. 2 relief cock, by standing on the left hand side of the car, pull the top of the fly wheel toward you.

Setting by Fly Wheel

On the rear edge of the fly wheel rim and diametrically opposite each other are two sets of four marks reading:

Exhaust open	Exhaust close
Inlet open	Inlet close



THE PACKARD 30-B TIMING DIAGRAM.

When you encounter compression in No. 2 cylinder one set will be coming to the top. Bring the mark "Centre Line" directly in line with commutator shaft. It may be desirable not to bring this line quite up to the commutator shaft.

Setting Commutator

Fourth, place spark lever on steering wheel in position for retard spark.

Fifth, place commutator roller in position shown in illustration, that is, just making contact with pole marked No. 2. To do this loosen the screw fastening roller holder, and with finger and thumb turn roller holder about its shaft into desired position; tighten screw.

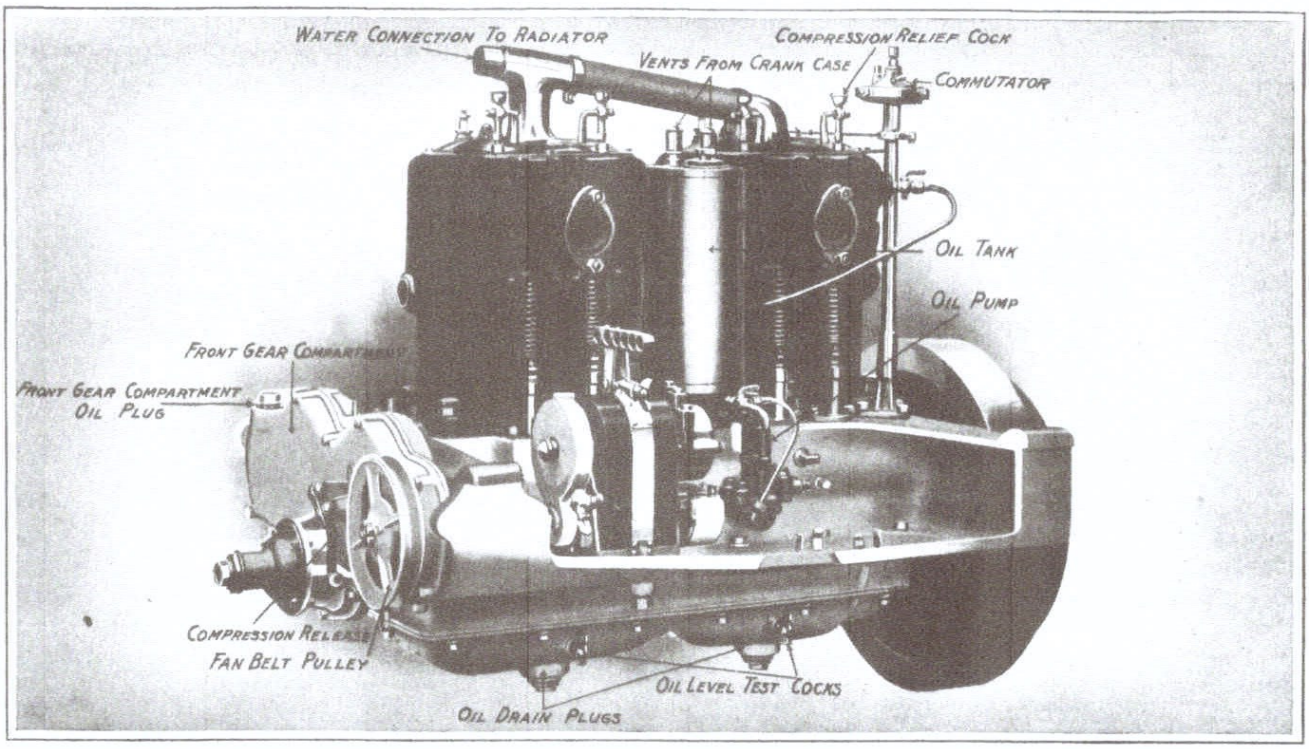
Sixth, the setting of the magneto is done at the factory, and is permanently fixed. Therefore, no further adjustment need ever be made, and none should be attempted.

Setting Magneto

However, after the magneto is removed for any purpose, it is important to replace it carefully, so that the timing may be correct. This should be done as follows: Turn the motor in the same manner as is described for setting the commutator until you encounter compression on No. 2 cylinder, and bring the mark, "Centre Line," directly in line with the commutator shaft. Now turn the magneto shaft until the distributor arm is over the contact segment for No. 2 cylinder. With the magneto shaft in this position the lugs of the universal joint on the end of the shaft will be nearly in a horizontal position. Next place the intermediate piece of the universal joint on the magneto shaft into engagement with the magneto end of the joint, then put the magneto in place by sliding it horizontally from the rear toward the front of the motor, at the same time engaging the jaws of the intermediate universal piece with the lugs of the universal on the end of the magneto driving shaft. With the magneto in place, bring the steel securing band into position, turn up the butterfly nut tightly, and then insert a small cotter pin in the hole provided in the end of the screw.

Seventh, with the high tension distributor in the position described, the contact screws of the low tension circuit breaker should be not over 1/64 in. apart. The open-

Magneto Circuit Breaker



LEFT, OR EXHAUST SIDE OF THE PACKARD 30-B MOTOR.

ing between the screws must be sufficient to break the flow of low tension current, but not sufficient to prevent the two screws from making perfect contact again when the motor is running at high speed.

Details of General Construction

Throttle Control

The butterfly valve in the mixing chamber of the carburetor may be operated by the action of the hand sector lever on the steering wheel against the coil springs on the rod running from the foot throttle to the carburetor. As the tension of these springs is greater or less, the automatic control by the governor is greater or less for any given position of the sector lever. In other words, if the tension on these springs is weak, the governor has considerable range of throttle action in maintaining a constant motor speed. If the springs are stiff, the automatic governor action will be correspondingly less. (For description of governor action see Page 8).

Foot Accelerator

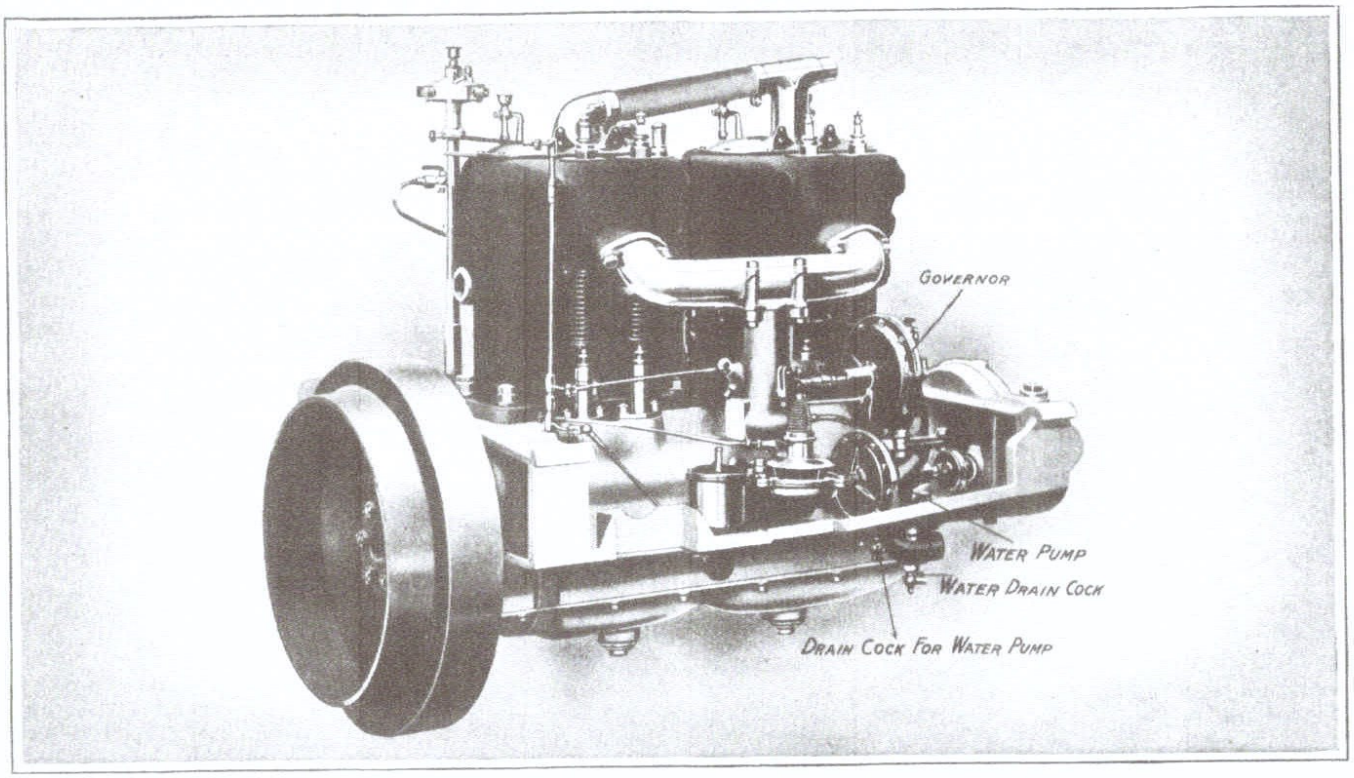
The foot accelerator is directly connected with the butterfly valve. Therefore, any movement of the accelerator has a positive and direct effect upon the throttle, irrespective of any tendency of the governor; thus with the accelerator the operator may produce a quick opening of the throttle whenever such may be required.

Compression Relief

Under the lower left hand corner of the radiator is a T handle. When pulled out this shifts the exhaust cam shaft, bringing into play a set of minor cams that release part of the compression and make cranking easier. **Be sure** this T handle is pushed back into its normal position after using.

Air Shutter for Cold Weather Starting

Under the lower right hand side of the radiator you will find a small button on the end of a rod. This is connected with the shutter at the opening of the primary air intake. When this button is pulled forward the primary air intake is entirely closed, producing a very rich mixture, which greatly assists starting in cold weather. This



RIGHT, OR INTAKE SIDE OF THE PACKARD 30-B CHASSIS.

should not be used, however, in warm weather, and care should be taken to always push it back after the motor is started.

Throttle Lever

As you sit in the driver's seat you will notice upon the steering wheel the words "Open" and "Closed," indicating the two extreme positions of the hand sector lever. The closed position is next to you, and the open position is at the farther side of the steering wheel.

Spark Control

On top of the steering wheel, near the left hand side, is a small vertically rocking lever which, through the medium of several connections, rotates the commutator case, so that the little roller makes contact with the various poles earlier or later, depending upon the position of this lever, and at the same time the operation of the primary current make and break of the magneto is advanced or retarded. Thus all these parts work in harmony to advance or retard the time of the spark, whether the motor be running on the magneto or on the battery. Upon the arm of the steering wheel, to which the little lever is attached, are stamped the words "Advance" and "Retard," to indicate that the spark is advanced or retarded as the lever is moved toward either word. The lever should always point to the rear toward the word "Retard" when cranking the motor.

Never try to start the motor with this lever pointing upwards or toward the word "Advance," or in any other position than as far back as possible toward the word "Retard."

As in the case of the hand sector lever, the spark lever is moved away from the operator in a forward direction to increase the speed and power of the motor, and is drawn toward the operator in a backward direction to retard or slow down the motor. Both levers move forward to accelerate, and backward to retard.

As much driving as possible should be done with an advanced spark and more

Driving With Advanced Spark

or less closed throttle. If the motor is driven with an open throttle and retarded spark, it is liable to overheat. Do not, however, advance the spark so far that the motor will pound. Do not leave the battery switch on contact with the spark retarded, either with the motor running or idle, as it has a tendency to burn holes in the distributor plate of the magneto. The spark should be advanced as soon as possible after starting.

Connecting Rod Adjustment

The crank case of the motor is divided horizontally into three sections. The upper or main section comprises the entire base and support of the motor, and contains all of the gears for operating the cam shafts, the water pump and the magneto. The central section comprises a frame, which is attached to the upper section by means of suitable studs and nuts which, in combination with the upper section, affords complete support for all of the crank shaft bearings. This central section is entirely open at the bottom. The lower section comprises simply a pan or lid to close the bottom of the crank case, and is attached to the central section by means of studs and nuts. It is therefore readily removable, and thus easy access is had to the mechanism at the bottom of the motor for the purpose of inspection, cleaning, or adjustment. This lower section can be removed without disturbing any other part or altering any adjustment.

Testing Compression

Test the compression of the various cylinders of your motor occasionally by turning the starting crank at the front of the car until resistance is felt and overcome, and do this in turn with each of the four cylinders and compare the resistance due to compression. If one is less than the others, or all are weak, it may be due to the piston rings being gummed or to leakage past the valves. If the piston rings or valves are stuck, the application of a little kerosene through the compression cocks, when the motor is warm, will cut the oil deposit and usually restore compression. After a tablespoonful of kerosene has been poured into each cylinder through the cocks, the

motor should be briskly turned over by hand several times, and then allowed to stand for several hours—over night if possible. There may be a little difficulty in starting the motor afterwards because of the kerosene interfering with combustion.

Valves

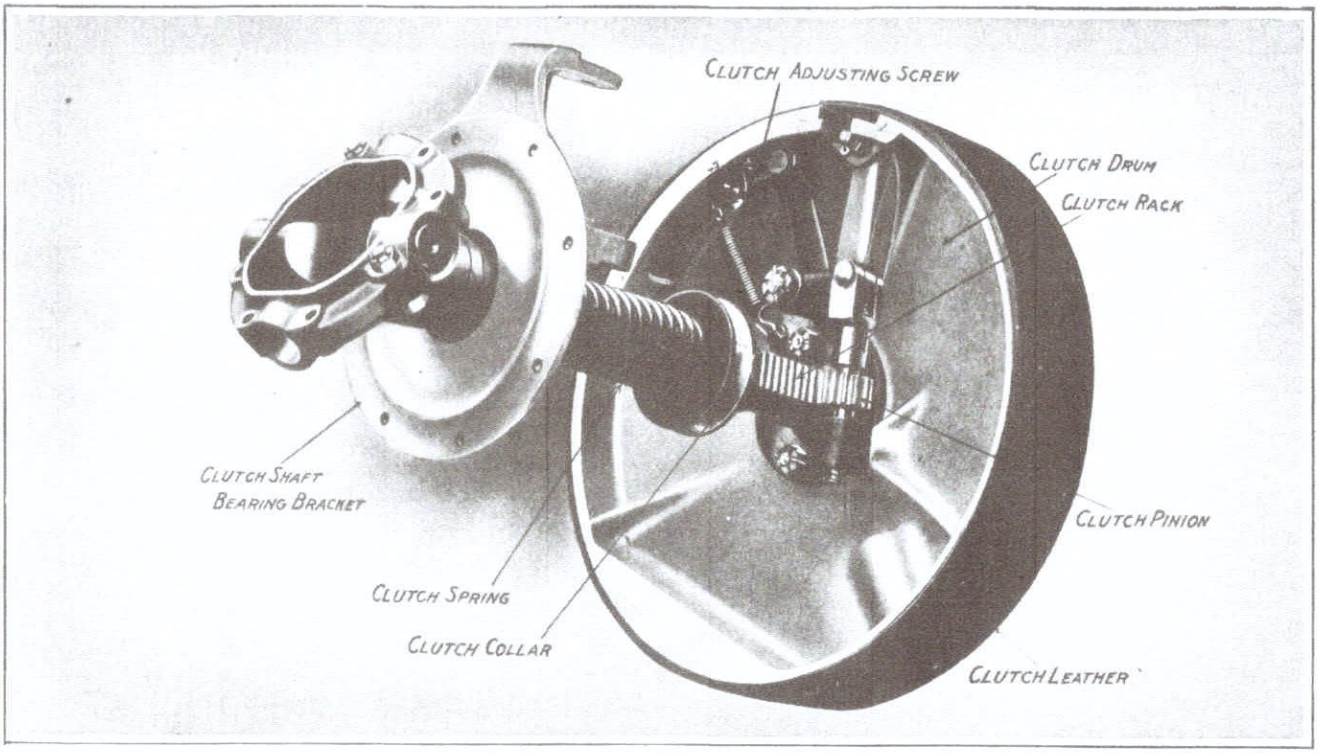
If the valves leak they should be ground to fit the seats by using oil and powdered glass, exercising care not to get this mixture into the cylinders. Access to the valves is secured by removing the plugs which are screwed into the valve chambers directly above each valve. By removing these plugs and the key which runs through the valve stem under the plate at the bottom of the valve spring, the valves can be readily removed, examined, ground, and replaced. The valve stems should not rest upon the push rods which lift them except when they are being held open by the operation of the cams. When the valve, and the push rod, are at their lowest point there should be a clearance of about .012 of an inch between the lower end of the valve stem and the upper end of the push rod. In grinding valves, time can be saved if a coil spring is used under the head of the valve, just strong enough to hold weight of the valve about ¾ inch above the seat.

Clutch

The clutch is a very important part of a motor car, and should be inspected regularly, and, when necessary, oiled, cleaned or adjusted. Its friction contact is leather against cast iron, and the action of each surface is to smooth the other. The diameter of the clutch is so great and its operation such that it will not slip when in proper condition and adjustment. It may, however, grip too quickly. If this is the case, a slight application of oil (Castor or Neats Foot oil is good) to the leather band will soften the leather and cause the clutch to take hold gradually.

Clutch Leather

When the clutch is new and its action harsh—in other words, when it jerks the car, even though it be engaged properly—very severe strains are of course placed upon all of the mechanism used in transmitting power to the rear wheels. This can, and always should be, avoided by the use of oil on the friction surfaces of the clutch,



THE PACKARD 30-B CLUTCH.

particularly during the period when you are becoming familiar with the operation of your car. This will also help to obviate stalling the motor. In the meantime, the surface of the leather will be attaining the best possible condition. The proper condition of the clutch leather is soft and pliable, but not over-saturated with oil. If it should be over-saturated, and thus cause the clutch to slip, the condition can be easily remedied by the injection of a little gasoline between the clutch leather and the fly wheel, with the clutch disengaged. (See Page 14.)

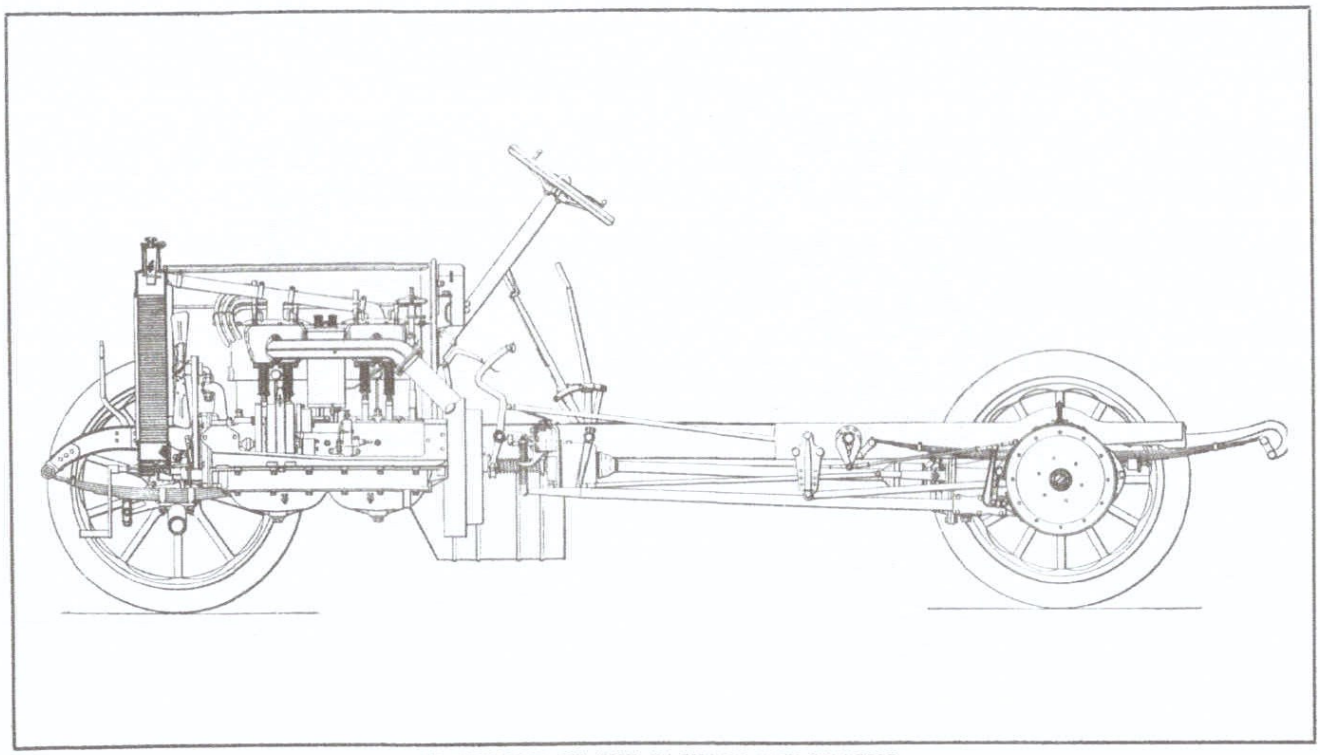
Clutch Engaging

The clutch should always be engaged slowly, so as to avoid any possibility of the jerk above mentioned. After the car is started, the foot pedal may be entirely released.

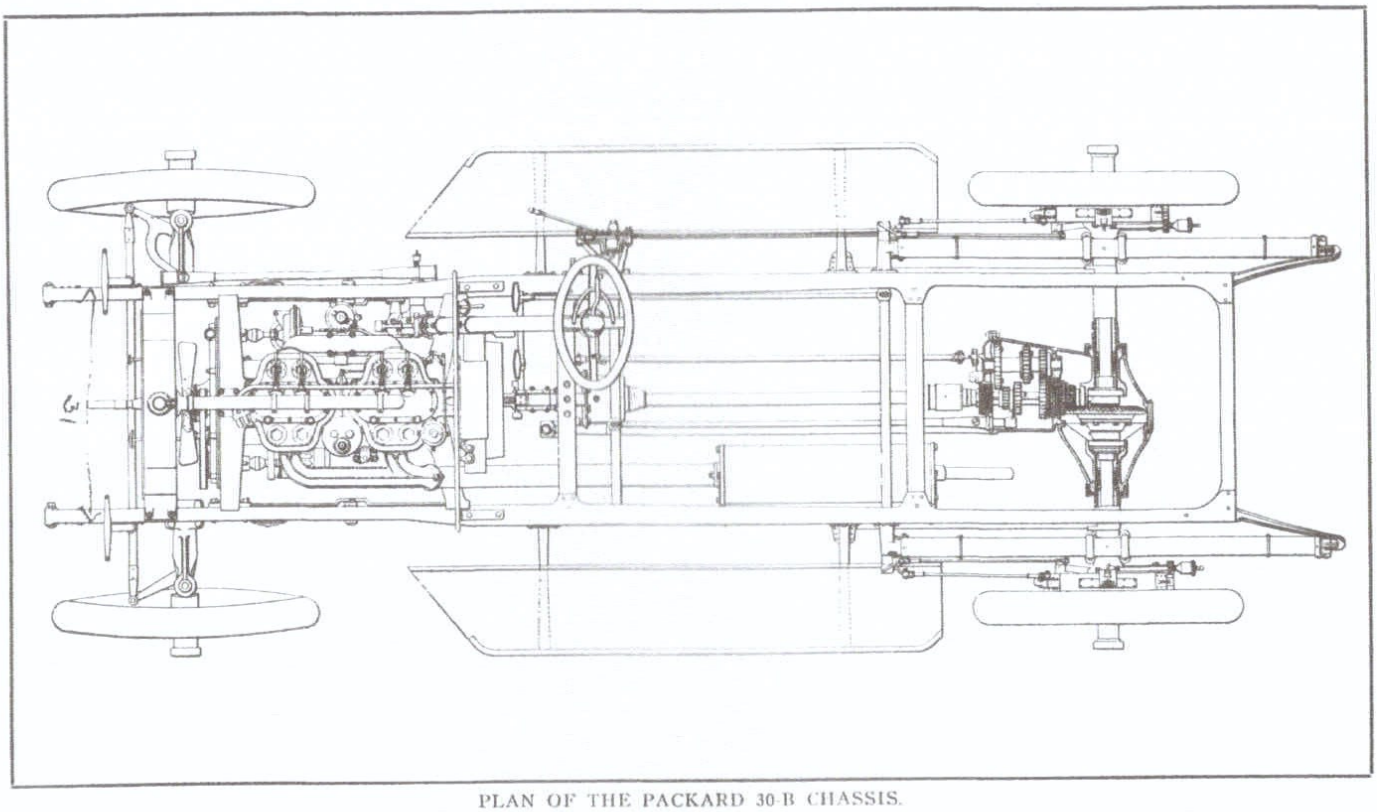
The construction of the clutch is such that the hub, which slides upon the clutch shaft and has a rack extension operating the pinion, is forced toward the fly wheel by the heavy coiled spring, thereby rotating the pinion, and operating its connections, until the band is completely expanded. In this way the wear of the leather is followed by the spring. You will readily see by examining the illustration that in time the face of this hub which carries the rack extension may come in contact with the hub of the clutch itself, and that the spring will no longer be able to expand the band to its full extent. The result will be a slipping clutch. The adjustment is very easy.

To Adjust Clutch

To tighten the adjustment of the clutch, turn it so that the rack and pinion are uppermost. The extensions of the pinion shaft have right and left-hand threads. These work in threaded sleeves, the one on the left of the pinion having a forked head, which, through the bell crank and connecting link, transmits motion to the end of the clutch band. Remove the pin which connects this forked sleeve with the end of the bell crank, raise the pinion until its teeth are free from the teeth in the rack, then rotate the top of the pinion toward the rear of the car one or more teeth, ac-



ELEVATION OF THE PACKARD 30-B CHASSIS.



PLAN OF THE PACKARD 30-B CHASSIS.

cording to the amount of adjustment necessary. Drop the pinion back into engagement with the rack and connect the parts as before. Make absolutely sure that the cotter pin is replaced in the hole in the end of the pin which connects the forked sleeve with the end of the bell crank. It may be necessary to partially release the clutch by means of the foot pedal before the pin can be replaced in the forked sleeve and the end of the bell crank. This adjustment is a very simple matter, however.

Proper Clutch Adjustment

When everything is connected again, notice the amount of clearance between the hub carrying the rack extension and the hub of the clutch drum. When the clutch is fully engaged, this distance should not be less than one-eighth of an inch nor more than three-eighths. If it is less than one-eighth the one will soon be bearing against the other, which will cause the clutch to slip. If it is more than three-eighths the foot pedal will not fully disengage the clutch, and it will be difficult to shift the transmission gears.

There is a very remote possibility that the coil spring surrounding the clutch shaft, and operating the clutch, will deteriorate slightly. If this occurs, the weakening can be compensated for by means of the adjusting collar which is screwed onto the clutch shaft back of the spring. Loosen the binding screw which holds this collar and turn the collar to the right until the desired tension of the spring is secured. Then carefully tighten the screw again.

To condense the above in a very few words:

Oil clutch at once whenever it takes hold too quickly.

Never use a slipping clutch; adjust it at once, and also wash out the surplus oil, if any is present.

Keep hub carrying rack extension between one-eighth and three-eighths inches away from the hub of the clutch drum when clutch is expanded.

Brakes

There are two sets of brakes, one set internal and one set external, operating directly upon the rear wheel hub drums.

External Brakes

The external brakes are connected to the foot pedal, and are applied by a forward movement of this pedal. This brake is of the clamping variety and operates equally well either going forward or backward. It consists of a steel band lined with special friction material.

Adjusting External Brakes

Ample adjustment is provided in the connections, and the brakes should always be perfectly free, and not exert any drag upon the drum when not in use and at the same time exert their full braking power when the pedal is operated. It is important to have the brakes on each rear wheel adjusted alike. To accomplish this, jack up the rear axle so that both wheels are clear from the floor; then have someone apply the brake while you rotate each rear wheel by hand. If the brake resistance is alike on both wheels the adjustment is correct. If it is not alike, then the adjustments should be equalized. Use will tend to keep them equalized.

The internal or expanding brakes are connected to the outside hand lever. This lever is provided with a ratchet which engages a toothed sector on the lever quadrant, thus the expanding brakes may be locked or released at will. These brakes are applied by drawing the hand lever backward toward the operator.

Internal Brakes

The brake itself consists of a ring of manganese bronze, the surface of which is covered with cast iron, facilitating its easy renewal when worn. The ring is split transversely, one side being fastened by two bolts, the other working with a cam so arranged between the two ends that the whole ring can be expanded and made to bear against the inner surface of the brake drum. This brake is also equally effective when the car is going either forward or backward.

Adjusting Internal Brakes

In making an adjustment of this brake, care should be taken that the lever which operates the cam is not slanting so far to the rear as to partially apply the brake in the reverse direction. This adjustment may be tested by throwing the hand brake lever forward to its limit and noting the rearward slant of the cam lever while the brake lever is in this position. Then disconnect the draw rod which runs from the cam lever forward to the intermediate brake shaft lever by removing the pin which connects the forward end of the draw rod to the latter lever. After disconnecting as above, rock the cam lever forward and backward, observing by the resistance when the cam begins to expand the brake ring forward and backward. The position at which it begins to expand the brake ring when moved backward should be a little farther to the rear than the position the cam lever occupied before the parts were disconnected and while the hand brake lever was thrown forward to its limit. In making adjustments of the expanding brakes, each side should be tested separately in the same manner as described above for adjusting the external brakes.

The best equalizer for either set of brakes is use. Adjust both external and internal brakes as closely as you can in the manner described above. Using them a few times will bring them exactly alike. After they are once working together they will wear together and will require no further adjustment until both are taken up on account of wear.

Transmission

The three forward speeds are produced by a compound gear sliding upon the main driving shaft and engaging with other gears upon a countershaft, and with an internal gear on its own axis.

Speed Change Gears

Reference to the exterior illustration on page 44 and the detail illustration on page 48 will make this construction clear. In the illustration the compound sliding gear is shown in the neutral position, the gears not being engaged with either of the gears

on the countershaft. Sliding the compound gears from the neutral position toward the front of the car engages its smallest gear with the largest gear on the countershaft. This produces the lowest gear ratio. Sliding the compound gear from neutral position toward the rear of the car one space engages its largest gear with the intermediate gear of the countershaft. This produces the intermediate gear ratio. Sliding the compound gear still further to the back of the car causes it to engage with the internal teeth cut in the direct drive gear, thus giving the direct drive and highest gear ratio without transmitting power through the countershaft.

The four different positions of the forward speed lever are clearly shown in the illustration.

Reverse Gear

If the change speed lever is brought to the neutral point and after tripping the reverse lock with the foot, the lever is then carried towards the car into the slot in the inner side of the quadrant, through a series of connections, a broad-faced gear which normally rests on the bottom of the gear box will be brought into mesh with the smaller diameter of the compound gear and with the large gear on the countershaft. The gears are now in position for driving the car backward.

The cut upon page 48 is simply an outline to show the arrangement of the various gears. The details, including all of the bearings, are not shown in this cut.

Operation

Position of Operating Lever

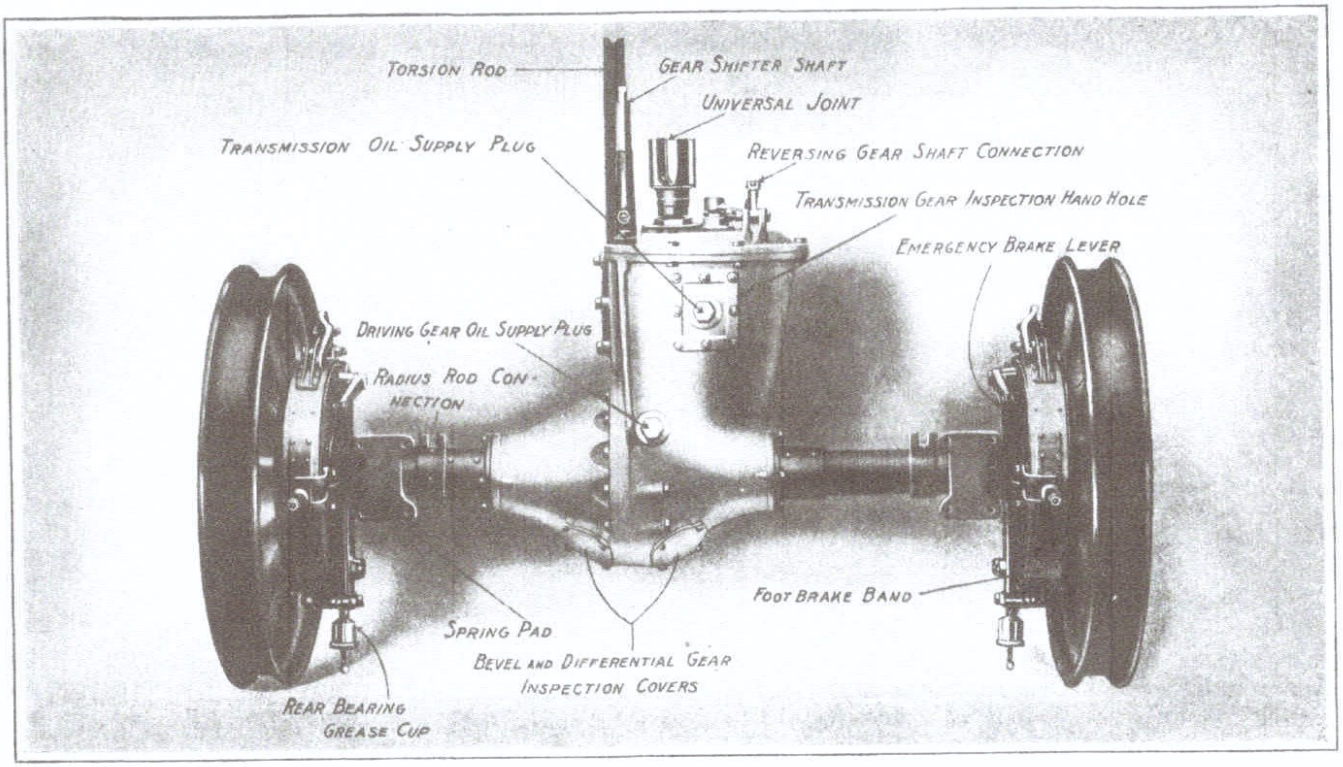
Know that your gasoline tank is full, your gasoline shut-off valve open, and your battery in good condition before attempting to start motor.

See that all parts are properly lubricated.

Put gear shifting lever into neutral position. (This is imperative.)

Apply hand brake lever. This will lock itself in position.

Place spark lever in a vertical position.



THE PACKARD 30-B REAR AXLE AND TRANSMISSION.

Place throttle lever on right hand side of steering wheel to position for one-third opening of the throttle.

Give starting crank two or three brisk turns.

Throw switch on the face of coil box to the right (marked "Battery"); retard the spark lever until the vibrator sounds. The motor should start.

After the motor has started, the spark lever should be immediately advanced to vertical position and the switch on the front of the coil box should be turned to the left (marked "Magneto"). This changes the source of current from the batteries with which the motor is started to the magneto with which it is normally run.

Starting Crank

Danger

We have suggested that the beginner crank the motor with the switch off because then there is absolutely no danger. To those who are familiar with motor cars this may be an unnecessary precaution. We would suggest that, in cranking with the switch on, the left hand be used engaging the crank near its lowest point, as described above, and lifting quickly over compression. Cranking the motor in this manner with the left hand, if by oversight the spark be advanced, the back kick of the motor would merely pull the handle out of your fingers; whereas, if you should push down on the handle, a serious sprain might result to your wrist or hand.

Starting on Switch

Within several hours after it has been in operation the motor will often start by merely turning the switch on the front coil box to the right (battery connection), provided the spark lever is in retard position. If switch is turned to "Bat," while spark lever is in "advance" position, motor will probably start backward.

The certainty of the motor starting "on the switch" in cold weather will be greatly increased if a little pains is taken in stopping the motor. A good plan is to bring the hand throttle lever on the wheel toward the closed position, reducing the motor speed to about 300 revolutions per minute. Then swing the mixture-adjusting lever on the dash clear over to "gas." This produces a mixture so rich as to choke

the motor and stop it. In starting the motor after stopping as above, do not change the setting of the mixture lever, nor of the hand throttle lever. Simply throw the switch to the battery side and retard the spark lever on the wheel until contact is made as indicated by the sound of the vibrator, and immediately advance the spark when the motor starts. Never start the motor with a wide open throttle, especially when it is cold.

In starting the car "on the switch" in warm weather, the motor should not be given so rich a mixture.

After starting the motor "on the switch," the switch should be turned over to the left (Magneto connection) just the same as when starting the motor with the crank.

There is never any occasion for continued cranking of the motor. If it does not start readily, look for the reason, and correct the trouble instead of attempting to coax the motor into running by means of continued cranking. Check over your gasoline line and carburetor first, then your electrical system, etc., until you have found a good cause for the trouble.

After the motor has been started either with the crank or by the switch, reduce the motor speed by means of the hand throttle to the lowest point at which it will run evenly.

Engage Gears

With your foot push the clutch pedal forward to its limit, then after releasing the outside or hand brake lever, push it as far forward as possible. Pull the change speed lever from neutral position to the rear into the position for first speed forward. If the lever will not come back readily, return it to the neutral point and engage the clutch slightly so as to spin the transmission gears, and after **again releasing the clutch** try again. If the gears "growl," don't try to force them, but hold clutch pedal forward and wait an instant for the clutch to stop spinning and then try. The growl is because one gear is rotating much faster than the other.

Engage Clutch

With your first speed in, slightly increase the speed of your motor and slowly allow the clutch to engage. An easy way to do this is to plant your heel firmly on the foot board and by gradually raising your toe allow the clutch pedal to slide down the sole of your shoe. In this way you will be able to obtain a most delicate control of the clutch.

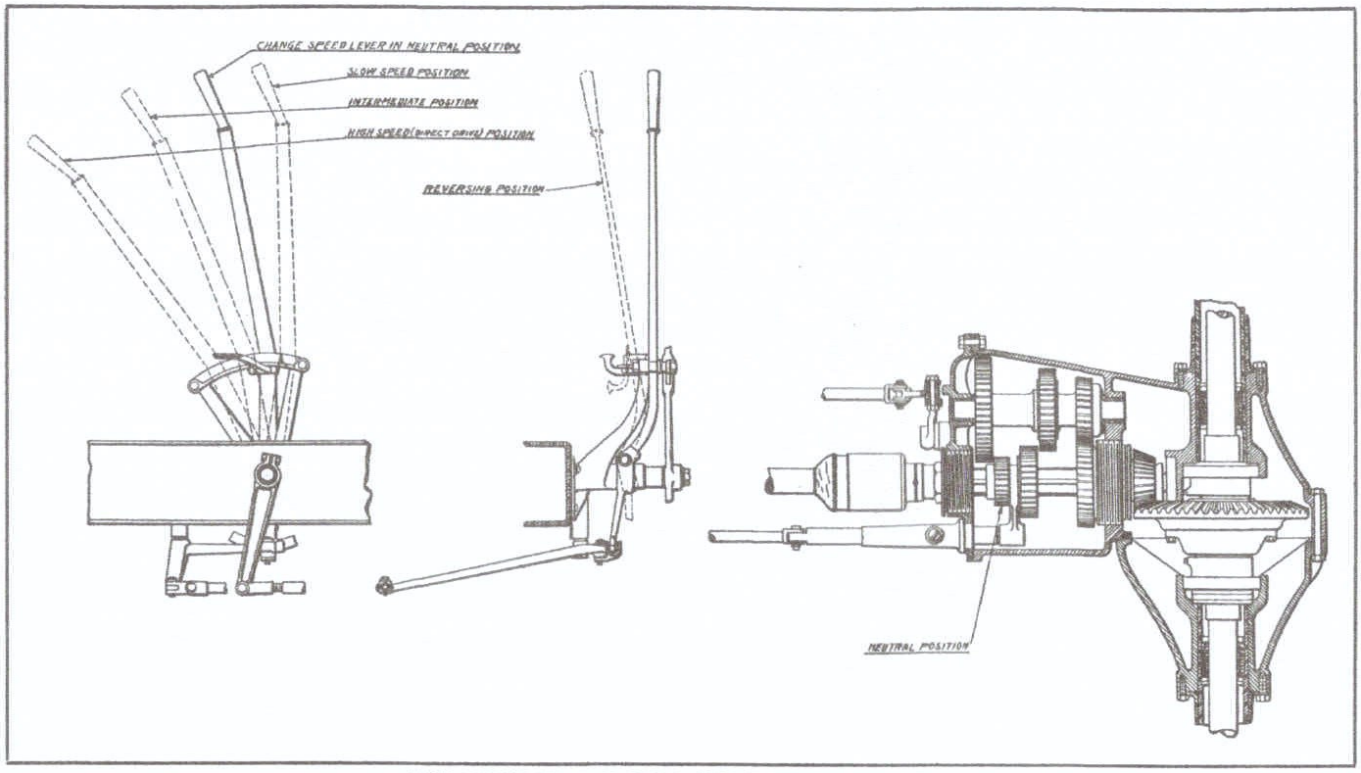
Speed Change

With your car under motion, and wishing to change to the second speed, release the clutch completely with the left foot and push your change speed lever forward through neutral into the position for second speed ahead. This should be done slowly. Allow sufficient time for the spinning gear to come nearly to a stop, when it will enter the second speed position readily and without noise. As soon as the gear is engaged allow the clutch pedal to come back gently in the manner above described. You can easily distinguish when the change speed lever is in position for any of the various gears by feeling the check which will occur as the gear locks drop into their respective grooves. Always stop the lever in one of the positions indicated by this feeling; do not leave it where it is perfectly free, for in that case the gears are not wholly engaged.

The change from second speed to third speed is made in precisely the same manner as the change from first to second speed, excepting that the lever is moved from second speed position to third speed position.

Changing to Lower Speed

If, upon the high speed occasion arises to change to a lower speed, the operations are substantially as above described, except that the speed lever is of course to be moved from its position backward to engage the next lower gear. It is important not to make such change too soon; that is, a lower gear should not be engaged until the speed of the car has slackened materially. After having disengaged the clutch, the shift to the lower gear should be made very quickly.



THE PACKARD 30-B GEAR SHIFTING MECHANISM.

If the throttle and spark are so handled that the motor will not race when the clutch is released, the operation for forward shifting would be:

Release clutch.
Shift position of speed lever.
Engage clutch.
When you are upon the high speed, open throttle and advance spark slowly.

Control of Spark

Actual experience alone will teach you the best position of the spark lever for different speeds. The general rule is to follow the throttle opening with the advancement of the spark and advance the spark further and further as the speed of the motor increases. At very high motor speeds the spark may be fully advanced, but the spark lever should not be carried forward any faster than the motor gains in speed or your motor will pound.

If, under a heavy load, the motor speed decreases, then the spark should be retarded in equal proportion, and when the motor speed has been retarded to a great extent, then the speed lever should be shifted to the position for a lower gear, and the motor speed accelerated by means of the throttle and spark.

Watch the oil feed glasses in the oiling system so as to be sure that the oil is feeding and that the proper quantity is being fed equally to each of the crank case compartments.

Handling Car

Always start and stop gradually and without jerk. Control the car speed by the throttle and spark. Let the car coast to a stop; slow down for corners with the throttle closed rather than through the sudden application of all brakes at the last moment.

Position for Leaving Levers

When coming to a stop, release the clutch and draw the change speed lever into neutral position, **in the last few feet that the car is moving.**

Reversing

To reverse, release clutch, bring change speed lever opposite neutral position,

trip the reverse lock and carry the hand lever towards the car into the slot in the quadrant and handle motor and clutch as before.

The reader may have noted that in all of the above no instructions have been given for the operation of the accelerator. This has been purposely deferred until more important matters have been mastered.

Accelerator

The accelerator pedal is practically an auxiliary throttle connection; it is located just back of the steering column. Unlike the hand throttle lever, the accelerator pedal is rigidly connected to the throttle valve, and therefore its action is positive. It is to secure a quick increase in motive power whenever occasion requires, and the degree of its effect depends upon the extent to which this pedal is depressed by the foot. Upon this pedal being released, the accelerator promptly ceases to act and the car returns to the speed at which it was running before the accelerator was brought into use.

To illustrate, suppose the throttle is set to give the car a speed of twenty miles an hour and the car strikes a stretch of deep sand or the operator desires to quickly pass a trolley car or climb a steep grade, the throttle need not be touched, but pressure upon the accelerator pedal will cause instant increase of power to any extent desired within the capacity of the motor. As soon as the desired purpose is accomplished the pedal is released by the operator and the car at once returns to its twenty-mile speed under control of the governor.

Carburetor Adjustment

To find the best carburetor adjustment drive car on second speed with motor speeded up on about two-thirds throttle and spark, and move lever at right of spark coil to left (air) and right (gasoline) until the position is found at which the best results are obtained. This gives the user a wide range from a mixture almost too rich to ignite, shooting volumes of black smoke from the muffler, to a mixture that is much too weak on account of the large proportion of air.

Valve Setting

We briefly describe the process of setting the valves for the benefit of those owners who desire to take entire charge of their own cars. First, open the relief cocks on top of the four cylinders, and wipe the rim of the fly wheel clean. It is also more convenient if the front mud guards are removed. By examining the rim of the fly wheel you will notice a number of lines across its face at varying intervals; each line is marked to indicate its significance, "inlet open," "inlet closed," "exhaust open," "exhaust closed." You will also find on the back face of the rear cylinder a center line, and in making the various adjustments below described, the lines upon the fly wheel should be brought to coincide exactly with the line upon the back of the cylinder. Begin the adjustment with the inlet valve of the front cylinder, this being the foremost valve on the right side facing forward. Turn the top of the fly wheel by hand toward left of car until the inlet valve plunger of the first cylinder comes into contact with the lower end of the valve stem. At this point the third of the three lines on the fly wheel, which are about two and one-half inches apart, and which line is marked "inlet opens," should be in line with the center line of the cylinder. If the contact between the plunger and valve stem is made before the fly wheel comes into the position described, the valve is opening too early and the adjustment should be corrected by means of the set screw and lock nut in the upper end of the valve lifter. The correct adjustment is to have the upper end of the plunger set screw just come into contact with the lower end of the valve stem, when this fly wheel line coincides with the center line of the cylinder. Having gotten this adjustment correct, revolve the fly wheel to the left nearly half a revolution until the center one of the group of three lines on the opposite side of the fly wheel from where you have been working comes into line with the center of the cylinder. This line on the fly wheel is marked "inlet closed," and at this point the inlet valve of the first cylinder should just seat itself.

Setting the Inlet Valves

Now proceed to the inlet valve of number two cylinder, by turning the fly wheel to the left to a line which is only about two and a half inches from the center line at

which you have been working. This next line is marked "inlet opens," and you should adjust the opening of the inlet valve of the second cylinder as above described for the first cylinder, turning the wheel to the left nearly half a turn to reach the line for the closing of the inlet valve.

Setting the Exhaust Valves

Next proceed to the inlet valve of the fourth cylinder. This is the rearmost of all the valves on the right side. Adjust this in the same way, and then proceed to the inlet valve of the third cylinder, which is the forward valve of the rear group of two valves on the right side. Having mastered the adjustment of the first valve, the others will be easy, as they are simply a repetition of the original process.

Now proceed to the adjustment of the exhaust valves. Turn the fly wheel to the left until the plunger of the exhaust valve of number one cylinder (which is the foremost valve on the left of the motor) makes contact with the valve stem. This should bring you to the line on the fly wheel marked "exhaust opens." The contact between the valve lifter and the valve should be made just as this line coincides with the center line of the cylinder. Next turn the wheel to the left about two-thirds of a revolution until reaching the first of the second group of three lines marked "exhaust closed." The exhaust valve of number one cylinder should just seat itself at this point. If the contact between the plunger and the valve stem is not correct, it should be made so by means of the set screw and lock nut just the same as in the case of the inlet valve plunger. There should be the same amount of clearance between the bottom of the valve stem and the top of the set screw on the lifter. Now turn the fly wheel to the right until reaching the next single line marked "exhaust opens." This will bring you to the exhaust valve of number two cylinder, and you should proceed with it the same as has been done with number one cylinder. Then again turn the fly wheel to the left until reaching the first of the second group of three lines marked "exhaust closes," and proceed as before through number four and number three exhaust valves.

Careful reading will make apparent the fact that in passing from one to another

of the exhaust valves the fly wheel has to be turned to the right instead of continuously to the left, as in the case of the intake valve. This is because the exhaust valves remain open longer than the intake valves and therefore the action of one overlaps the action of the next one somewhat. That is, number two exhaust will start to open before number one exhaust valve is fully closed. The main point in maintaining proper valve settings and adjustments is to never permit contact between the lower end of the valve stem and the upper end of the plungers when the valves are closed, and at the same time keep the adjustments so close that there is no great lost motion between the two parts.

Testing Contact With Tissue

The best method of testing when the valve push rod makes contact with the valve stem, and also when it releases contact, is by using a piece of tissue paper between them. So long as the paper is held you will know there is good contact, but the moment the paper is released and you can move it between the end of the valve stem and the push rod you will know that contact is broken.

One of the most common errors of operation is for a driver to keep his car on the high gear until the very limit is reached when pulling through heavy roads or climbing hills. When the work gets so heavy that the engine labors severely, it is much better to go down to a lower gear. You will thereby make really better speed, and at the same time save your car a lot of unnecessary and injurious strain and wear.

Special Gasoline System of Packard Runabout

Runabout Gasoline Tank

The gasoline system in the '09 Packard runabout differs from the '09 Packard touring car only in one essential detail, namely, that owing to the general design of the runabout, the gasoline tank is carried farther back and is provided with an auxiliary pressure feed to assist the action of gravity when necessary. The gasoline tank is

located on top of the frame at the rear. It is provided with an opening for filling near the left hand end. The cap to this opening should at all times be kept screwed down so as to produce a tight joint, and without vent, as is the case with the touring car. The gasoline is supplied from the tank to the carburetor, same as in the touring car.

Pressure Valve

On the front of the dash at the left near the commutator is an automatic pressure valve. From this valve three pipes lead. The one from the front leads to the exhaust pipe near the outlet from the rear pair of cylinders. The one from the left leads under the body of the car and back to the gasoline tank. The one from the right leads to a small pressure gauge on the back of the dash in plain view of the driver. The connections for all these pipes must be kept tight.

The valve mechanism consists mainly of two spring controlled poppet valves placed vertically, one above the other, the upper one being the larger. The springs actuating both valves are adjustable by means of screws and nuts provided for the purpose.

Operation of Pressure System

The operation by which the pressure is produced in the gasoline tank is very simple. A portion of the exhaust gas is caught by the pipe which enters the exhaust header. This leads to a chamber underneath the lower poppet valve, and the pressure from the exhaust causes this poppet valve to lift slightly. Then the pressure is transmitted to the next chamber above, from whence it passes to the left and to the right to the gasoline tank and the pressure gauge respectively. Each exhaust from the motor serves to supply fresh pressure to the valve, which valve closes between impulses from the exhaust gases, and in this manner maintains a constant pressure in the gasoline tank. In the top of the pressure chamber is placed a second and larger poppet valve. The function of this valve is to relieve any undue pressure that may be generated in the system. It is held downwardly on its seat by a coil spring, the tension of which is controlled by means of a set screw extending through the top of the valve chamber. By means of this screw the pressure can be maintained at any desired point.

Turning the screw to the right increases the spring pressure upon the upper poppet valve, and in this manner increases the gas pressure in the gasoline tank. Turning the screw to the left acts to the contrary, and it is therefore an easy matter to cause the valve mechanism to maintain any pressure which may be desired within its limit. A pressure of ½ to 1 pound, indicated by the gauge on the dash board, is generally ample.

Only one thing is necessary to keep the valves working perfectly, and that is to maintain them and their seats clean and free from grit of any kind so that the valves may seat properly and prevent leakage. It is good practice to turn the valves about on their seats whenever cleaning or looking over the motor. This can be done in the case of the lower valve by grasping the lower end of the stem and turning it around, and in the case of the upper valve by turning the valve itself with the finger pressed against the knurled edge which projects from the sides of the valve chamber.

Starting by Gravity or Pressure

The gravity flow of the gasoline to the carburetor is sufficient for nearly all conditions, and the pressure system is introduced merely as an auxiliary.

In starting the motor after car has been standing over night and become cool, merely unscrew the filling cap on the gasoline tank to permit the gasoline to flow by gravity to the carburetor, screwing the cap down again after the motor has started; or if it is preferred to start with the gasoline under pressure, this can easily be done by opening the valve at the bottom of the hand pump which is placed at the center of the front seats and taking a few strokes with this pump to produce a slight pressure.