INFORMATION

"TWIN SIX"

"2-35" and "2-25"

Packard

MOTOR CARS

The Packard Line

ENCLOSED CARS

"2-35"	LIMOUSINE seven passengers	$4950
	LIMOUSINE cab sides, seven passengers	$5000
	IMPERIAL LIMOUSINE seven passengers	$5150
	LANDAULET seven passengers	$5000
	LANDAULET cab sides, seven passengers	$5050
	LIMOUSINE six passengers	$4900
	LANDAULET six passengers	$4950
	BROUGHAM four passengers	$4950
"2-25"	LIMOUSINE six passengers	$4450
	LANDAULET six passengers	$4500
	BROUGHAM four passengers	$4500
	COUPE three passengers	$4150

ALL PRICES ARE F. O. B. DETROIT

(*See other side*)

The Packard Line

OPEN CARS

"2-35" STANDARD TOURING CAR
seven passengers $3500

SALON TOURING CAR
seven passengers $3500

PHAETON
five passengers $3500

SALON PHAETON
five passengers $3500

CHASSIS
. . . . . $3000

"2-25" STANDARD TOURING CAR
seven passengers $3050

PHAETON
five passengers $3050

SALON PHAETON
five passengers $3050

RUNABOUT
four passengers $3050

RUNABOUT
two passengers $3050

CHASSIS
. . . . . $2650

ALL PRICES ARE F. O. B. DETROIT

(*See other side*)

INFORMATION

"TWIN SIX"

"2-35" and "2-25"

Packard

MOTOR CARS

PACKARD MOTOR CAR COMPANY
DETROIT, MICHIGAN

PACKARD DEALERS' SERVICE POLICY

NEW MOTOR CARRIAGES

Packard service has been organized for the purpose of assisting Packard owners to keep their motor carriages in good repair and adjustment.

Packard service includes the following:

1. We will make all necessary adjustments for one month after delivery of the motor carriage provided it is brought to our Service Department for that purpose and has not been tampered with or injured through accident or neglect. After that time all work will be done in a careful and workmanlike manner at our regular charge for such work, except as noted in Clause 2.

2. We will install at our service station without charge any parts that may be replaced as defective by the Packard Motor Car Company or ourselves under the warranty printed below, for a period of ninety days after delivery of the motor carriage to the purchaser.

3. All gratis work under the Packard warranty is to be done at our service station and in the event an owner requests warranty work to be done at a distance from our service station the expenses of the workman for transportation, board and lodging, if any, will be charged to the customer.

4. If desired, and within a radius of one hundred miles of our service station, we will supply gratis an instructor for a period of three days after delivery of the motor carriage.

5. If, at the time warranty work is being done, we are called upon to do ordinary repair work which does not come under the warranty, the labor and material required for such repair work will be charged at our regular rates.

6. It is our intention to give each and every purchaser of Packard motor carriages fair and business-like treatment. Should any patron not receive it, we ask in good faith to be so advised.

PACKARD WARRANTY

We fully guarantee new Packard motor carriages and trucks to be free from defects in material and workmanship for ninety days from date of delivery to purchaser.

We will replace free of charge, any part claimed to be defective, within ninety days from delivery of vehicle to purchaser, which shall be returned to us for credit or replacement, and which upon examination, we shall find to be defective. The free replacement of a part or parts does not include transportation charge to and from the Packard factory, nor the cost of installing the new part.

Tires, rims, batteries, speed instruments and other accessories are not covered by this warranty, they being subject to warranties of their respective manufacturers.

PACKARD MOTOR CAR COMPANY, DETROIT

The Packard Motor Car Company reserves the right to make changes or improvements at any time, without thereby incurring any obligations either to install the same on motor cars previously sold or to install the old part, which has been changed, improved or omitted, in new cars subsequently sold.

INSTRUCTIONS FOR ORDERING PARTS

IT has been found impracticable to provide owners with parts price lists which will be complete and up-to-date at all times. Owners desiring parts information not contained in this book, are referred to Packard dealers, who will be provided with a comprehensive and up-to-date price list for all models.

Parts in most frequent demand are shown in this book. The numbers on the illustrations are for identification of parts only. Owners should order parts by name, and not by number.

PACKARD PARTS

Close interchangeability and continued efficiency are best assured by making replacements only with parts made by the Packard Motor Car Company.

Owners are advised to consult Packard dealers about all repairs, adjustments and replacements, especially with regard to accessories furnished with Packard cars, but not manufactured by us, such as lamps, springs, etc.

ORDERING PARTS

When ordering parts from Packard dealers or the factory, specify:

Shipping directions.
Name of part.
Model symbol such as "2-35," "2-25," "1-35," "1-25," "48," "38," "30," or "18" and year.
Style of car, chassis or body (Touring Car, Limousine, etc.).
Motor number of car. (Stamped on dash plate.)
Color, if part is painted.

TERMS

All prices are net, f. o. b. factory, Detroit, Michigan.

Our responsibility ceases when goods are delivered in good condition to the transportation companies.

All quotations on parts or supplies are subject to change without notice.

Accounts are opened only with Packard dealers.

Orders from individuals which are not accompanied by cash will be sent c. o. d.

TECHNICAL SERVICE DEPARTMENT

The Technical Service Department of the Packard Motor Car Company will furnish, at any time, especially desired information concerning parts or the operation and maintenance of Packard cars.

OPERATION AND CARE

"2-35" and "2-25"

Packard
MOTOR CARS

GENERAL OPERATION

TO PREPARE THE CAR FOR SERVICE

Wash the car.

Directions on page 12.

Fill the radiator with clean water.

Directions on page 39.

Fill the gasoline tank.

Directions on page 23.

Turn on the gasoline.

Directions on page 23.

Be sure that motor oil reservoir is filled to pet cock level with cylinder oil.

Directions on page 21.

Be sure that all parts requiring lubrication are supplied with the proper lubricant.

The car is shipped from the factory with a supply of oil in all parts. Complete oiling directions are given in the "Schedule of Lubrication," beginning on page 10. The motor oiling system is described in the chapter on "Lubrication System," beginning on page 19.

PRELIMINARY TO STARTING THE MOTOR

Put the change speed lever in neutral position.

Complete instructions for the operation of this lever on page 49.

Set the hand brake.

Open the throttle one-sixth.

Purpose and operation of the hand throttle lever on the steering wheel and its relationship to the accelerator pedal on page 28.

Turn the auxiliary air valve hand wheel, on the control board, toward "Gas."

In cold weather or with a cold motor turn the hand wheel all the way around to "Choke." In warm weather or with the motor warm this will not be necessary. Full starting directions for cold weather, etc., are on page 16.

An experienced driver can readily determine the proper setting of the hand wheel for varying atmospheric conditions by the suction sound of the air entering the carburetor while cranking.

Be sure that dash indicator shows pressure in the tank.

Initial pressure may be obtained by using hand pump on the steering column.

TO START THE MOTOR

Turn the ignition switch to "Ignition."

Set the spark lever at mid position.

Crank motor, using electric-starter.

Instructions for using starter on page 37.

This is the standard method for starting the motor.

AFTER THE MOTOR STARTS

Turn the air valve wheel, on the control board, toward "Air" and set it at the point at which the motor runs best.

An experienced operator may obtain a still finer adjustment by resetting with the throttle closed.

Close the throttle until the motor runs slowly.

TO START THE CAR

Release the hand brake.

Push forward the left pedal to release clutch.

The clutch always must be disengaged while shifting gears.

Move the change speed lever laterally inboard, then straight back into first speed position.

Gear shifting instructions are on page 49.

Increase the speed of the motor slightly.

This may be done by advancing the hand throttle lever several notches, or by pressing on the accelerator pedal. An experienced operator will perhaps obtain the best results in shifting gears by using the accelerator pedal for increasing speed and releasing it during all shifting operations.

Be sure the spark lever is advanced one-half way or more.

Engage the clutch.

The car will move forward. Allow it to gain speed.

Again disengage the clutch.

Move change speed lever forward into neutral position, then outboard and straight forward into second speed position.

Engage clutch and open throttle gradually to increase the motor speed.

Allow the car to gain speed.

Again disengage the clutch.

Move change speed lever straight back, through neutral into third speed position, taking care not to move it inboard when it reaches the neutral position.

Engage the clutch.

Attain the desired speed by pressing with the right foot on the accelerator pedal or by advancing the hand throttle lever.

TO CHANGE BACK INTO LOWER SPEEDS

If, on account of a very steep grade or heavy going, the speed is reduced until the motor labors, shift the gears at once into the next lower speed, as follows:

Disengage the clutch; instantly move the change speed lever back into the next lower speed and engage the clutch.

TO STOP THE CAR

Reduce the motor speed. Disengage the clutch, and apply the foot brake. When the car has stopped, with the clutch still disengaged, place change speed lever in neutral position, set the hand brake and engage the clutch.

TO REVERSE THE CAR

When the car is stopped, disengage the clutch and move the change speed lever from neutral position laterally inboard and then forward and engage the clutch.

Never attempt this operation with the car in motion.

TO STOP THE MOTOR

Turn ignition switch on control board to "Off" position.

CARE OF THE CAR

KEEP MECHANISM CLEAN

Keep all working joints, oilers, etc., free from dirt, and the motor and all other parts as clean as possible.

An oily motor very rapidly collects dust and dirt, which eventually works into the mechanism and causes premature wear.

BATTERY

Every 1000 miles bring liquid to ½ inch above plates by adding distilled water.

Full directions regarding care of battery on page 35.

DISCONNECT SWITCH

The disconnect switch at the forward end of the generator regulator should be thrown over to the opposite side every 1000 miles.

The plug should be pushed inwardly as far as it will go and until it springs forward and locks itself in place.

LUBRICANTS

Where cylinder oil is specified in the schedule of lubrication, oil produced by reputable refiners, and having the following properties, is recommended: gravity (Baume), 28.5 to 29.5; viscosity 100° F. (Saybolt), 285 to 300; fire 495° to 500°.

We use monogram, medium oil at the factory.

At the factory Whittemore's compound No. 7 is used in the transmission and No. 45 in the rear axle. These or any similar compositions made by reputable manufacturers will give satisfactory results.

The universal joints and steering gear cases are filled at the factory with Spicer grease. If not obtainable, use graphite grease for the universal joints and a mixture of half cylinder oil and half graphite grease in the steering gear case.

SCHEDULE OF LUBRICATION

OILING

Description of the motor oiling system and its operation, and instructions for its care and adjustment, begin on page 19.

EVERY 300 MILES

Cup or graphite grease.

Clutch shifter end bearing grease cup (1)	Two complete turns.
Steering connecting rod grease cup (1)	One complete turn.
Steering cross tube grease cups (2)	One complete turn.
Rear axle shaft bearing sleeve grease cups (2)	One complete turn.
Motor fan bearing grease cup (1)	Two complete turns.
Motor water pump shaft grease cup (1)	Two complete turns.

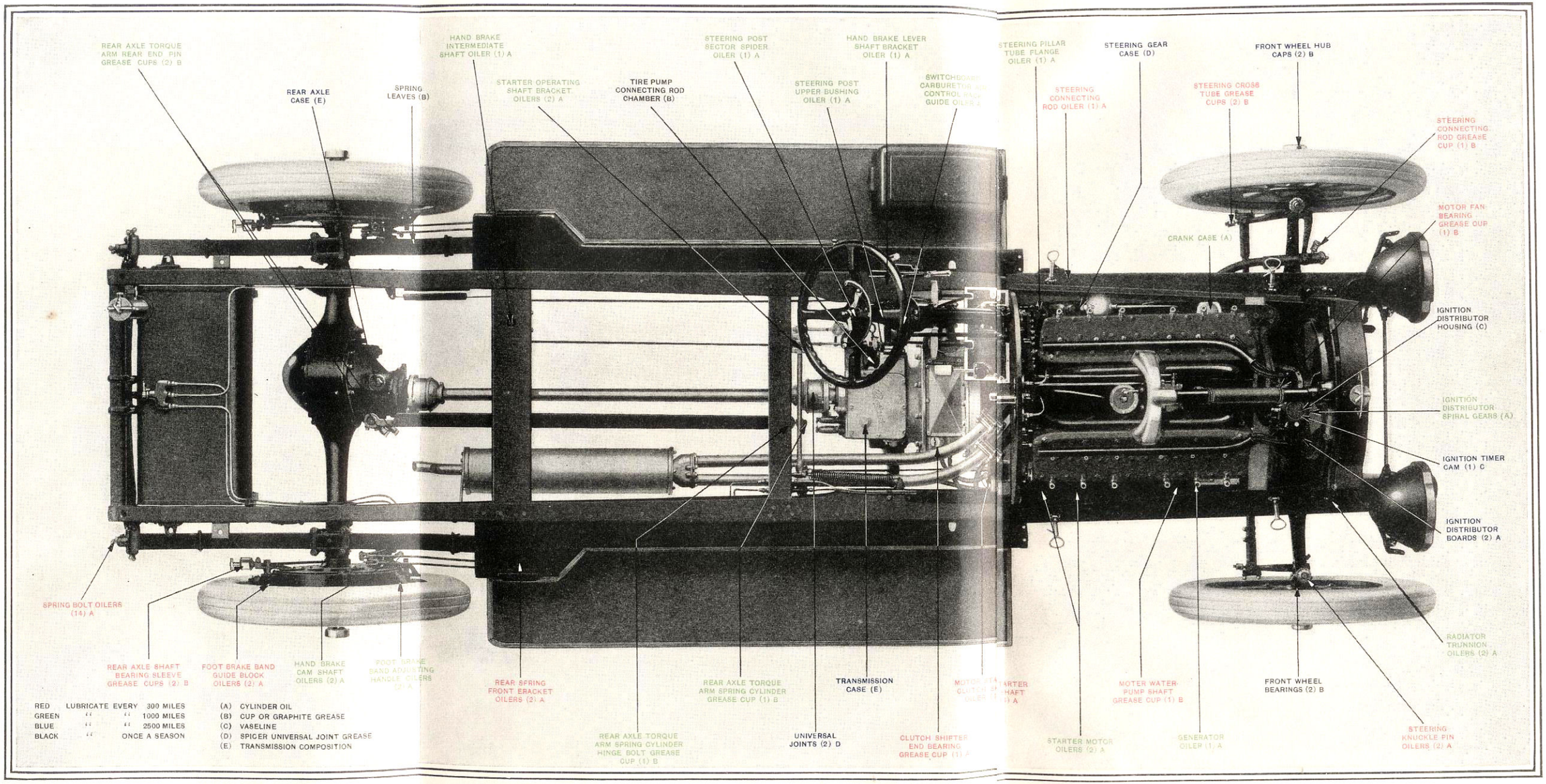
Cylinder oil.

Motor starter clutch shaft oiler (1)	Fill.
Foot brake band guide block oilers (2)	Fill.
Steering knuckle pin oilers (2)	Fill.
Spring bolt oilers (14)	Fill.
Rear spring front bracket oilers (2)	Fill.
Steering connecting rod oiler (1)	Fill.

EVERY 1000 MILES

Cup or graphite grease.

Rear axle torque arm spring cylinder hinge bolt grease cup (1)	Two complete turns.
Rear axle torque arm spring cylinder grease cup (1)	Two complete turns.
Rear axle torque arm rear end pin grease cups (2)	Two complete turns.



RED	LUBRICATE EVERY	300 MILES
GREEN	" "	1000 MILES
BLUE	" "	2500 MILES
BLACK	"	ONCE A SEASON

(A) CYLINDER OIL
(B) CUP OR GRAPHITE GREASE
(C) VASELINE
(D) SPICER UNIVERSAL JOINT GREASE
(E) TRANSMISSION COMPOSITION

Cylinder Oil.

Ignition distributor spiral gears	Liberally.
Hand brake cam shaft oilers (2)	Fill.
Hand and foot brake intermediate shaft oiler (1)	Fill.
Hand brake lever shaft bracket oiler (1)	Fill.
Foot brake band adjusting handle oilers (2)	Fill.
Radiator trunnion oilers (2)	Fill.
Steering post upper bushing oiler (1)	Few drops.
Steering post spark and throttle sector spider oiler	Few drops.
Switchboard carburetor air control rack guide oiler	Few drops.
Steering pillar tube flange oiler (1)	Fill.
Starter operating shaft bracket oilers (2)	Fill.
Starter motor oilers (2)	Few drops.
Generator oiler (1)	Few drops.
Crank case	Drain off dirty oil, flush with kerosene and fill to level. Directions on page 22.

EVERY 2500 MILES

Cylinder Oil.

Ignition distributor boards (2)	Wipe off carefully, apply oil and again wipe with a clean rag.

Vaseline.

Ignition timer cam	Wipe off and spread vaseline very sparingly on surface.

Cup or graphite grease.

Front wheel hub caps (2)	Repack.

Spicer universal joint grease.

Steering gear case	Fill to plug opening.
Universal joints (2)	Fill ⅔ full.

Transmission Composition.

Rear axle case	Fill to oil level plug.
Transmission case	Fill to oil level plug.

ONCE A SEASON

Cup or graphite grease.

Front wheel bearings (2)	Clean with kerosene and repack.
Tire pump connecting rod chamber	Repack.
Spring leaves	Jack up frame to separate leaves, clean and lubricate thoroughly. Repeat when springs squeak.

Vaseline.

Ignition apparatus housing	Repack.

WHEN OVERHAULING

Cup or graphite grease.

Clutch shaft forward bearing	Remove and clean and repack recesses in center of fly wheel.

CARE OF BODY AND FINISH

WASHING THE BODY

Extreme care should be used in washing the car, especially during the first few months that it is in use.

Varnish requires some time to season thoroughly, and while seasoning, is easily affected. Gasoline or soaps that are injurious to varnish never should be used.

Soap should never be used for washing a car, except for removing grease, and then only the purest is recommended. Use only with plenty of water and rinse the body thoroughly with luke-warm water. Never use extremely hot or cold water for washing the body.

Mud, water, grease or oil should not be allowed to remain on a car longer than it is possible to avoid. This is particularly true of a new car on which the finish may not be thoroughly seasoned.

Soak mud off with plenty of water instead of rubbing it off.

For drying the car after washing, use a clean chamois skin.

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.

Running boards can best be cleaned with soap and water.

CARE OF TOPS

Dust on the outside of Packard Standard tops should be removed with a dry or when necessary, a moist cloth. Grease or stains may be removed with a sponge and suds. Use plenty of clean water to remove all traces of soap.

The inside or cloth side should be dusted with a whisk broom or stiff brush. Remove stains with soap and water, but use a brush instead of a sponge.

The cloth side should be treated more carefully than the outside. Impure water or soap may change the color of the lining and make it necessary to go over the entire lining in order to obtain a uniform color.

Carriage dressings and gasoline are generally injurious for either the inside or outside, as they may kill the luster and cause the material to harden.

Packard Standard seat covers may be cleaned in the same way as the lining of Packard Standard tops.

Seat covers may not be dry-cleaned because the interlining gum prevents the passage of the cleaning vapors.

Tops should never be folded or inserted in envelopes while they are still damp.

SIDE CURTAINS

Side curtains should be wiped off with a moist cloth before being stowed away.

Removing the dust and grit from the side curtains will help to keep the celluloid lights from becoming scratched.

Curtains should be folded with the numerals, which are sewed to them, on the upper side, and put away in order. They should also be folded as far as possible, so as to have the celluloid lights contact with curtain material instead of with other lights.

CARE OF STORED BODY

The body should be stored in a dry place with a subdued even light from all sides.

Varnish on a black ground always has a slightly greenish tint. Continued absence of light, as when a body is stored in a dark place or left crated, increases the greenish cast.

Washing the stored body at least twice a month will reduce the change in the color of the varnish.

Varnish that has turned green from storage in a dark place will resume its natural shade after lengthy exposure to the light.

ENAMEL CLEANSER

A good cleanser for enameled parts of the car, when parts are greasy and very dull, may be made of the following:

One pound of washing soda crystals to one pail, or 2½ gallons of water. This should be very briskly applied with a soft rag. Then polish with canton flannel.

The solution, before applying, should be carefully inspected to see that all crystals have been dissolved as any crystals remaining will scratch the surface.

CAUTION: This solution should be used only on enameled parts of the car, as it will ruin varnish or paint. The enameled parts of the car are the radiator, radiator splashers, bonnet, front and rear fenders, gasoline tank, tire carriers, steering column, shifter lever, black motor parts and enameled part of lamps.

ENAMEL POLISH

Enameled parts can ordinarily be kept bright when clean, by rubbing them with a soft cloth and any good body polish. If they should lose their luster and become very dull they can be brightened by applying the following special solution, although this solution should only be used in extreme cases.

It consists of the following:

3 ounces oil of citronella.
1½ ounces oil of cedar.
1 pint paraffine oil.
1 gallon turpentine.

Apply with soft cloth and rub dry with clean flannel.

SEAT CUSHION AIR VENTS

There is an air vent in the bottom of each seat cushion.

If a rubber apron or anything of a similar nature is carried under the cushion and directly in contact with it, the air vent may be closed, with the result that the cushion will not afford the proper degree of comfort.

NICKEL POLISH

A good rouge, such as a good silver polish, is the best for removing the tarnish from nickel.

Nickel trimmings may be prevented from tarnishing by frequently rubbing the surface with an oily rag. This will keep them bright without polishing.

Do not use brass polish on nickel as the abrasive ingredients scratch the surface.

CAUTION: Enclosed body interior fittings, such as regulator handles, arm sling swivels, etc., are lacquered over the silver plate, and should consequently never be polished with a metal polish.

LUBRICATION OF BODY PARTS

It is a good plan to occasionally put a drop or two of oil on the working parts of the windshield, also the door locks and hinges, foot rest, robe rail, tire carrier, etc.

Lubrication of these parts will keep them in a free working condition and will assist in eliminating squeaks.

STANDARD ADJUSTMENTS

CIRCUIT BREAKERS

The circuit breaker points of the ignition apparatus unit should be kept smooth and parallel, with a clearance of from .015 to .020 inch between them when fully separated. A feeler of the proper thickness is attached to the timer and distributor wrench.

Before making adjustments to the points, it is a good plan to put a drop of oil on each set while the motor is running and wait until the excessive sparking, which this will cause, has ceased, before stopping the motor.

Then wash the breaker mechanism with gasoline and wipe off carefully. Be sure all gasoline is evaporated before again starting the motor.

SPARK SETTING

The spark setting in the full retard position should be $\frac{7}{8}$ inch on the fly wheel travel, past upper dead center. Should it become necessary to check this, proceed as follows:

Set the spark lever on the steering wheel in the fully retarded position. Open all priming cups with the exception of the one in number one cylinder in the right block. Crank the motor by hand until compression begins in this cylinder, then open this priming cup and continue to crank the motor slowly to the point where the right circuit breaker just begins to separate. In this position the fly wheel marking for "Top Dead Center Cylinder Number One and Six Right" should be found to have traveled $\frac{7}{8}$ inch past the motor center line as indicated on the crank case. If it should become necessary to reset the spark consult a Packard dealer.

SPARK PLUGS

Spark plugs should have .032 inch clearance between the two wires across which the spark jumps.

A feeler of the proper thickness is attached to the distributor wrench.

CARBURETOR AUXILIARY AIR VALVE

The auxiliary air valve has $\frac{3}{32}$ inch drop when the hand wheel is set for the best idling position.

To check proceed as follows:

Set the auxiliary air valve hand wheel for the best idling position.

Measure the height of top of air valve stem from some fixed point on the motor.

Depress air valve until it strikes inside spring.

Measure height of top of stem as before.

The difference in these two measurements is the air valve drop.

Make sure that the air adjusting connecting rod clevis is so adjusted that the air shutter completely closes when the hand wheel on the control board is turned all the way over to choke.

If it becomes necessary to make carburetor adjustments, consult a Packard dealer.

OIL PRESSURE

The motor oil pressure should be 20 to 30 pounds at 1000 revolutions with the motor hot. A lower pressure when the supply is up to level, indicates that the oil being used has low viscosity or that the relief valve opens too far.

To adjust the relief valve opening, change tension of relief valve spring located in the pump housing.

COMPRESSION

Compression in the cylinders should show between 75 and 80 pounds pressure at cranking speed, with all cylinder pet cocks closed and the throttle wide open.

AIR PRESSURE

Two to three pounds on gauge.

The relief valve is located on the frame cross channel just forward of the front seat. If inoperative it should be cleaned with gasoline and oiled very sparingly. If necessary it can be adjusted by changing the tension of the spring.

VALVES

Both inlet and exhaust valves should be set with a full .004 inch clearance when the motor is cold.

VIBRATION DAMPER

The vibration damper, on the front end of the crank shaft, should be adjusted to slip, under a pull of approximately 95 pounds.

To check the frictional resistance, remove the fan belt and wind a rope in the pulley groove, until the end pulls directly at the pitch or mean diameter of the pulley. Hook a hand scale in the end of the rope, and adjust the stud springs so that it requires a pull of approximately 95 pounds to slip the pulley.

CLUTCH PEDAL

The clutch pedal in the engaged position should have one-half inch free motion without touching the floor board when the pedal is lifted by hand. If the pedal while in the engaged position is allowed to touch the floor board, the full action of the clutch spring is not obtained.

The adjusting link for obtaining the correct adjustment of the clutch pedal is to the left of the clutch housing. By lengthening this link the pedal is brought closer to the floor board and by shortening it, the distance between the pedal and the floor board is increased.

No other change from the original adjustment will be required as clutch surfaces are automatic in their compensation for wear.

CLUTCH BRAKE

Adjustments for wear can be made by releasing the clevis bolt lock nut and sliding the whole assembly to the rear along the slot in the clutch cover. Set so that the spring is compressed $\frac{3}{32}$-inch when the clutch pedal is pushed down against the floor boards.

Adjust tension of spring to give speed of shift desired.

FOOT BRAKES

Foot brake connecting rod from rocker lever on front channel to cross shaft on rear channel should ordinarily be in the middle hole on the front rocker lever. To adjust the foot brakes properly, make the clearance between the band and the drum equal all around and $\frac{1}{32}$ inch.

Details of adjustment on page 55.

HAND BRAKES

The hand brakes should be evenly adjusted, so that when applied there is the same resistance on each rear wheel.

Keep these brakes as tight as it is possible for them to be without dragging.

Details of adjustment on page 55.

COLD WEATHER PROCEDURE

STARTING THE MOTOR

Starting the motor during cold weather is accomplished the same as at any other time except that it is necessary to pay more particular attention to the setting of the air and gas wheel on the control board while cranking.

In extremely cold weather it is best to turn the hand wheel all the way over to "choke" and crank the motor in the usual way, immediately turning the wheel back a few notches toward air the moment the motor starts firing.

Turning the hand wheel to "choke," closes both primary and auxiliary air intake and permits the raw gasoline to be sucked into the cylinders. Caution: In warm weather or if the motor is warm, a mixture may be so rich that the charge will not ignite if the hand wheel is turned all the way over to "choke."

AUXILIARY AIR VALVE ADJUSTMENT

As the motor warms up, the hand wheel should be gradually turned toward air until the proper setting for the most efficient running is obtained.

There is no hard and fast rule which can be followed for the setting of the hand wheel. It will be necessary to vary the setting to compensate for different atmospheric conditions and the temperature of the motor. Make a careful study of the manipulation of this wheel as experience will dictate better than anything else the proper running position. Bear in mind, however, that even though a richer mixture is required while the motor is cold, than after it has become warm by running, the mixture should be given as much air as it will take without causing a pop back in the carburetor. If too rich a mixture is supplied to a cold motor, raw gasoline will be drawn into the cylinders which will not vaporize and may interfere with the proper lubrication of the cylinder walls.

USING THE SELF STARTER

Never attempt to start the motor by continued cranking. If it does not start after a few seconds of cranking release the heel button and determine the cause. See that the air and gas wheel is properly set, the ignition switch turned on, that there is gas in the tank, air pressure, etc.

During the winter months a very heavy drain is thrown on the battery due to the fact that more energy is required to start a cold motor, and to the greater length of time during which the lights are used. It is therefore essential, in order to conserve the energy of the battery as much as possible, that all adjustments be properly made before depressing the heel button.

DRAINING WATER SYSTEM

If the car is not to be used during freezing weather, the water circulation system should be thoroughly drained.

The method of draining the water system is given on page 40.

WATER IN GASOLINE LINE

In cold weather, water introduced with the gasoline is liable to give trouble by freezing in gasoline pipes.

If this trouble develops, the gasoline system should be drained.

Directions for draining and filling the gasoline system will be found on pages 23 to 25.

WATER IN OIL

At frequent intervals the crank case should be drained to be sure that it contains no water. If this is not done the oil pump may become frozen and inoperative, thus preventing oil circulation.

ANTI-FREEZING MIXTURE

During freezing weather, fill the water circulation system with one of the following anti-freezing solutions:

For a temperature not lower than five degrees below zero:

Alcohol	15 per cent
Glycerine	15 per cent
Water	70 per cent

For a temperature not lower than fifteen degrees below zero:

Alcohol	17 per cent
Glycerine	17 per cent
Water	66 per cent

About eight and one-half gallons of solution are required for the "2-35" and "2-25" cars. Alcohol should be added occasionally to make up for evaporation. The glycerine does not evaporate with the water. The above solution has been found to be entirely practical and is the best for several reasons. A simple solution of alcohol, while it is not injurious in any way, lowers the boiling point of the water. Consequently on warm days, with the car standing and the motor running, the solution will tend to boil easily and evaporate. The boiling point of denatured alcohol is about 10 degrees higher than that of wood alcohol.

The use of glycerine raises the boiling point of the solution. It is more expensive than alcohol and is slightly injurious to rubber. All things considered, a combination solution of alcohol and glycerine in water is the most satisfactory.

Do not use a solution of calcium chloride or any alkaline solution, these being injurious to the metal parts.

CAUTION: If the radiator should become frozen on account of not containing the proper solution, do not run the motor until full circulation has been started. It is not possible to thaw a frozen radiator by running the motor, whereas, by doing so the current of air caused by the fan may cause it to freeze up more solidly.

OIL PRESSURE

In starting the motor when extremely cold the pressure as shown by the dash gauge may be excessive. This is on account of the congealing of the oil in the pipes preventing free circulation.

Run the motor slowly for a few moments until the oil has had a chance to thin down.

THE BATTERY

If the car is used in ordinary service during the winter months the battery will require no special attention other than to keep distilled water above the tops of the plates as described on page 35. If the battery should become discharged from allowing the car to stand with the lights burning, ignition switch left on, or from any other cause, it should be given a recharge immediately. A fully discharged battery will freeze at about 20 degrees above zero, whereas a battery that is three-quarters discharged will freeze at about zero.

If the car is out of service for any length of time the battery must be recharged at regular intervals either from an outside source or by allowing the motor to run.

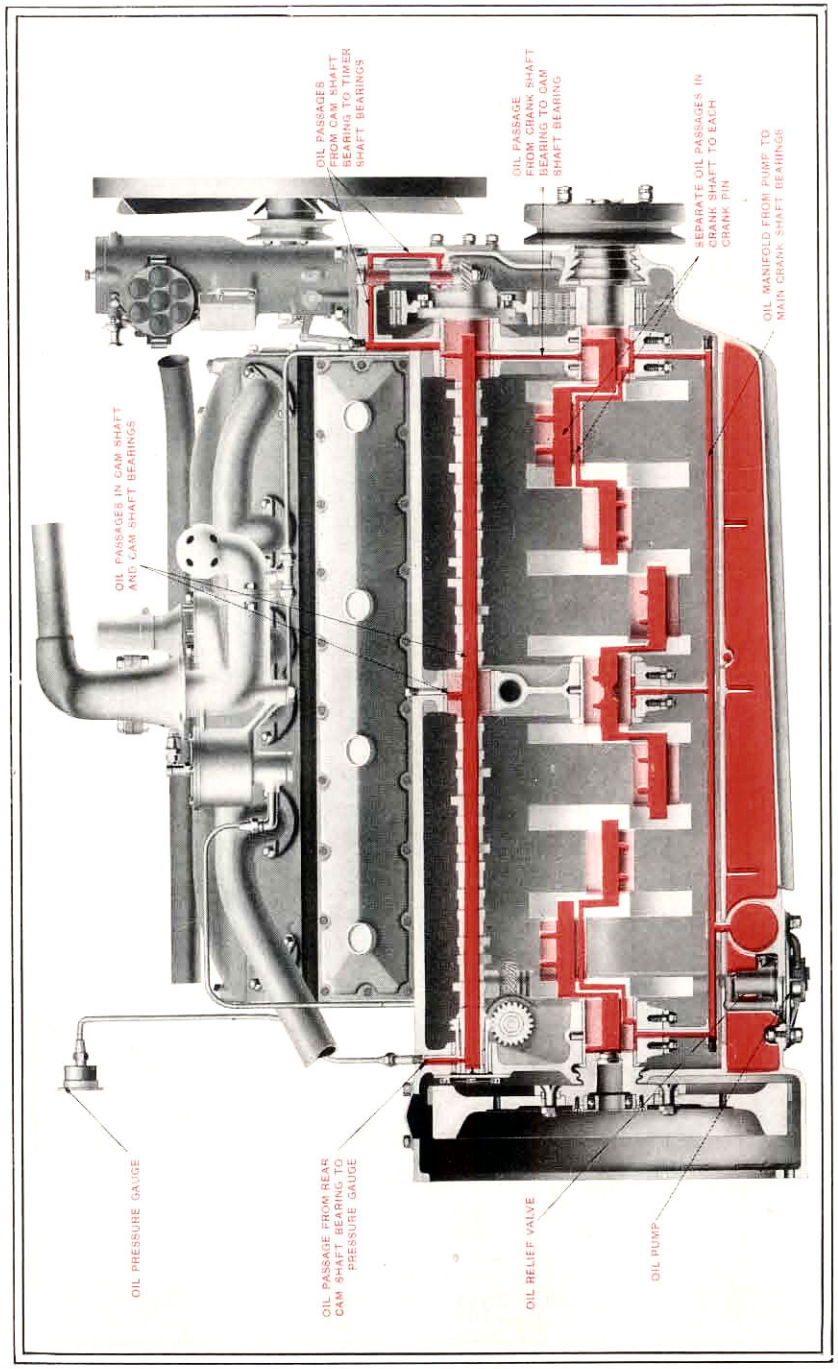


Plate No. 1 — Diagram of Motor Lubrication System

LUBRICATION SYSTEM

IMPORTANCE OF LUBRICATION

Lubrication of a car is more important than any other one thing in its care.

Detailed instructions regarding the frequency of oiling the different parts and the proper kind of lubricants to use for both motor and chassis parts are given in the "Schedule of Lubrication," beginning on page 10.

MOTOR OILING SYSTEM

Crank shaft, connecting rod and cam shaft bearings, and all parts within the crank case and cylinders are lubricated directly or indirectly by a forced feed oiling system.

MOTOR OILING CIRCULATION

The oil is pumped from the crank case oil reservoir through the oil strainer on the inside of the crank case to the main oil distributing manifold which is supported from the lower half of the crank shaft bearing caps. The oil is delivered from this manifold to all main crank shaft bearings through holes drilled in the bearing caps. Independent oil passages in the crank shaft carry the oil to each of the lower end connecting rod bearings, from the main bearings.

All bearings referred to are supplied with oil under pressure and leakage from these drains back into the crank case.

The cylinder walls and wrist pin bearings are lubricated by oil spray thrown from the lower end connecting rod bearings.

An oil lead running from the front crank shaft bearing to the front cam shaft bearing allows oil under pressure to reach the hollow cam shaft from which all cam shaft bearings are supplied.

The generator shaft and the timer drive shaft bearings are lubricated through oil leads from the cam shaft front bearings.

The front end chain receives oil from a sprayer connected to the oil duct in the crank case web.

The air pump drive shaft bearings are lubricated through an oil lead from the crank shaft rear bearing.

Holes drilled in the crank case allow the oil mist to rise into the valve compartments and lubricate the valve mechanism.

The oil is twice strained before it enters the crank case reservoir and again before entering the oil manifold. Baffle partitions located in the bottom of the crank case in addition to the crank case oil screen, prevent the oil from surging.

MOTOR OIL PUMP

A gear pump, located at the lowest point of the crank case, draws oil from the reservoir and forces it through a feed pipe, inside the crank case, to the main oil distributing manifold, which is attached to the crank shaft bearing caps.

The pump is operated by a shaft, driven by a spiral gear on the cam shaft.

The pump may be removed for cleaning or inspection by removing the nuts which hold it to the bottom of the crank case.

No adjustment of pump gears is possible or necessary. The oil pressure is regulated by means of a relief valve.

OIL RELIEF VALVE

The oil relief valve is contained in the pump body. It is controlled by the tension of a coil spring which should be set to maintain a pressure of from 20 to 30 pounds with the motor warm and running at a speed of about 1000 R. P. M., which is

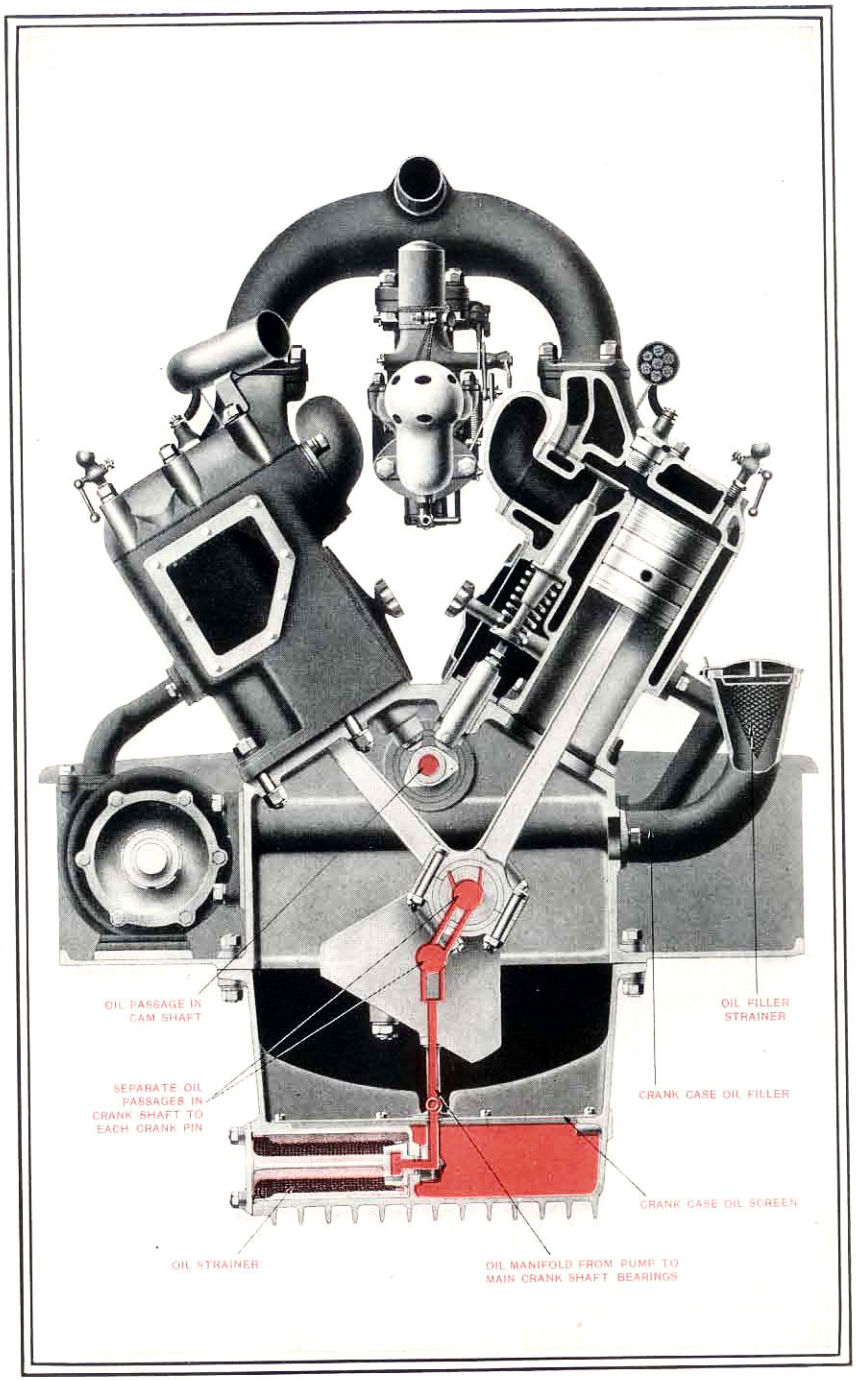


Plate No. 2 — Sectional View of Lubrication System

equivalent to a car speed of approximately 25 miles per hour. The relief valve inlet is connected with the pump discharge passage and any excess pressure causes the valve to open and allows the oil to return to the inlet side of the pump body. (See illustration below.)

To raise the oil pressure, remove the plug from the bottom of the pump housing, loosen the jam nut on the adjusting stud and increase the spring tension until the proper pressure is obtained.

To lower the oil pressure, the spring tension should be decreased.

Make sure that the jam nut is screwed up tight before the plug is replaced.

OIL SUPPLY

The supply of oil is obtained by pouring oil directly into the crank case through the crank case filler on the left side of the motor. Fill to pet cock level.

The pet cock is operated by a rod coming through the crank case web on the left side of the motor.

Do not put oil into the front end compartment through the plug opening at the left of the timer unit. This opening is intended for inspection of the chain only.

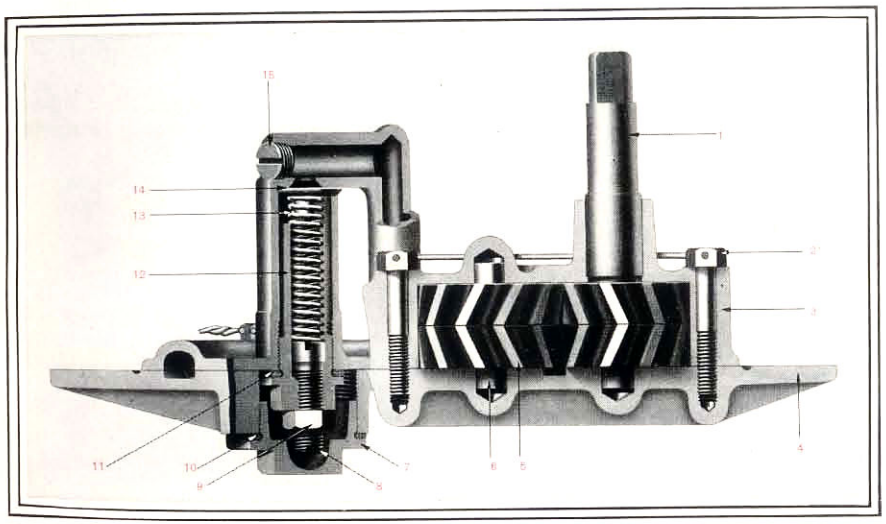


Plate No. 3 — Oil Pump and Relief Valve

Reference Number	Name of Part
1	Motor oil pump driving impeller assembly.
2	Motor oil pump body to base screw, long.
3	Motor oil pump body.
4	Motor oil pump base.
5	Motor oil pump driven impeller assembly.
6	Motor oil pump driven impeller shaft.
7	Motor oil pump base plug.
8	Motor oil pump relief valve spring adjusting screw.
9	Motor oil pump relief valve adjusting screw lock nut.
10	Motor oil pump base plug gasket.
11	Motor oil pump relief valve spring cap gasket.
12	Motor oil pump relief valve spring cap.
13	Motor oil pump relief valve spring.
14	Motor oil pump relief valve.
15	Motor oil pump body plug.

Parts should be ordered by name only, not by number.

MOTOR OIL STRAINERS

A primary oil strainer, located in the oil filler, prevents any foreign matter from reaching the crank case.

The oil reservoir is entirely covered and separated from the crank shaft compartment by an oil screen, which in addition to its strainer function, prevents the oil from splashing. The oil is again strained, after leaving the pump and before entering the manifold, through a cylindrical strainer carried in the housing integral with the crank case lower half.

If the oil pressure drops below normal when the crank case oil supply is up to the proper level, the cylindrical strainer should be removed from the crank case and cleaned. It should also be cleaned whenever a fresh supply of oil is put into the crank case. This can be done by removing the small plate, from the right hand side of the crank case lower half, bearing the inscription "Remove and disconnect oil manifold before taking off lower half of crank case." If the crank case lower cover is to be removed, it will be necessary to disconnect the oil manifold by using the special socket wrench provided with the tool equipment for this purpose.

Owing to the large surface of the crank case oil reservoir screen, cleaning is necessary only at times of overhauling of the motor.

OIL PRESSURE GAUGE

There is a gauge on the dashboard which shows the oil pressure in the manifold.

The normal running pressure is 20 to 30 pounds at 1000 R. P. M. with the motor warm.

Failure of the gauge to show pressure after the motor has been running for a few minutes is an indication of lack of oil or of the clogging of the cylindrical strainer or of the oil pipes.

The motor should be immediately stopped and the cause determined.

Also, excessive pressure on the gauge may indicate the clogging of the system.

When the motor is cold the pressure will be higher until the oil thins down.

DRAINING OIL FROM CRANK CASE

The oil in the crank case should be drained and a fresh supply put in every 1000 miles.

The oil may be drained by removing the drain plugs from the bottom of the crank case and from the oil pump housing.

After draining, flush the crank case with kerosene through the oil filler and thoroughly clean pump and strainer but do not run motor with kerosene in the system.

The motor should not be run until the crank case has been refilled with fresh oil to pet cock level.

INSUFFICIENT LUBRICATION

If, through oversight, the motor does not receive sufficient lubrication and begins to heat or to pound, it should be stopped immediately.

Allow the motor to cool. Bring the oil in the crank case oil reservoir up to the pet cock level. Fill the radiator with water after the motor is thoroughly cool. Run the motor slowly, making sure that the proper oil pressure is indicated by the gauge. Should there be apparent damage, the motor should be thoroughly inspected without further driving.

If no obvious damage has been done, the motor should be given a thorough shop examination at the earliest opportunity to see that the running without oil has not burned the bearings or caused other damage.

GASOLINE SYSTEM

GASOLINE TANK

The gasoline tank is located on the rear of the frame.

The capacity of the tank on all models is 21 gallons, including about a three-gallon reserve.

In filling the tank, pour the gasoline through a chamois skin to free it from water and impurities, but in doing so make sure that the side of the funnel makes a firm contact with the gasoline tank. Gasoline and chamois when brought into contact form static electricity which may cause a jump spark unless the funnel is grounded to the tank.

GASOLINE RESERVE

The gasoline tank is partitioned crosswise through the center for a short distance up from the bottom.

This arrangement divides the bottom of the tank into two compartments, thus automatically providing a reserve supply of three gallons on the side of the tank not connected with the outlet valve.

GASOLINE TANK VALVE

A three-way valve located on the top of the gasoline tank connects with outlet pipes leading to both sides of the tank.

Turning the valve handle to the right permits the gasoline to be completely drained from the right hand side of the tank and vice versa. When gasoline has ceased to flow, in order to obtain the reserve supply, turn the valve handle to its opposite extreme regardless of the previous running position. Turning the handle straight up shuts off supply.

CAUTION: If gasoline tank has been completely drained and is replenished with less than a five-gallon supply, be sure that the valve handle is turned to the left which is the side of the tank which traps the first three to five gallons; otherwise the gasoline will not flow.

PRESSURE GASOLINE FEED

The flow of gasoline from tank to carburetor is maintained by air pressure.

POWER PRESSURE PUMP

The air pressure is furnished by a two-cycle motor-driven air pump, located on the left side of the motor crank case at the rear.

This pump is driven from the cam shaft. It draws air from the outside and forces it under pressure past the relief valve to the gasoline tank. There is no adjustment to the air pump.

HAND PRESSURE PUMP

The hand or emergency pump on the steering column provides means of obtaining initial air pressure before the motor is started, providing the gauge on the dash shows that there is no air pressure in the gasoline tank.

The plunger leather of this pump should be oiled occasionally with neat's-foot oil. Mineral oils improve the operation of the pump only temporarily and tend to dry up the leather.

The hand pump stop cock handle should be turned to the front when the pump is not in use.

To obtain pressure by the hand pump, turn the hand pump stop cock handle toward the rear and operate pump till pressure shows on gauge.

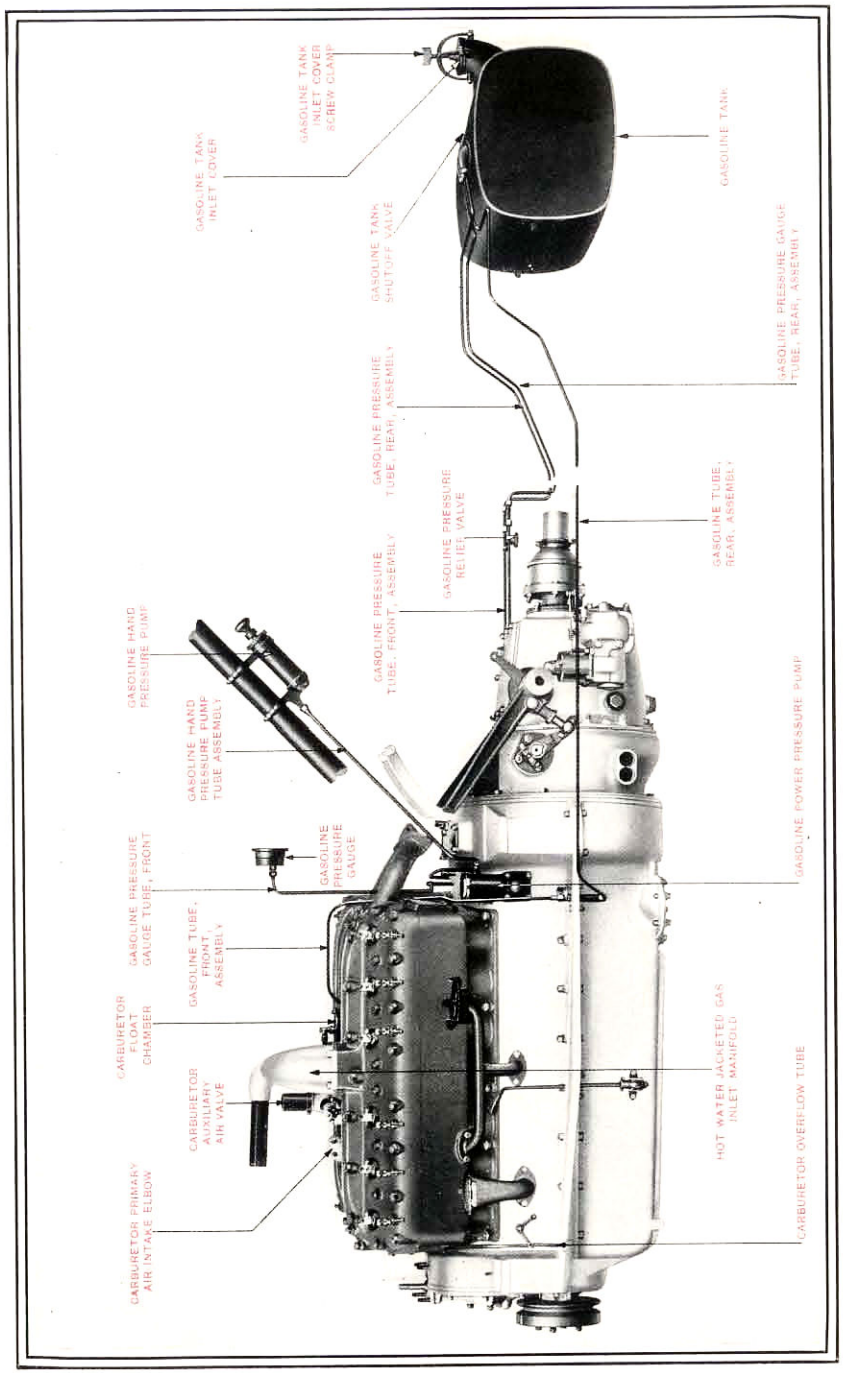


Plate No. 4 — Diagram of Gasoline and Pressure System

GASOLINE AIR PRESSURE GAUGE

On the dash there is a gauge connected directly with the gasoline tank, independently of the pumping system, which shows the exact air pressure in the tank.

PRESSURE RELIEF VALVE

There is a relief valve on the pressure system on right side at front cross channel to prevent the pressure in the gasoline tank from rising above the normal limit of two or three pounds.

There is very little chance of the relief valve getting out of adjustment. If it becomes inoperative it should be removed and cleaned with gasoline and oiled very sparingly with light oil. If too much, or too heavy an oil is used it may congeal, especially in cold weather, and will cause the valve to stick.

LACK OF PRESSURE

If the pressure gauge shows that the pump is not maintaining the proper pressure in the tank, proceed as follows:

Inspect gasoline tank filler cap to make sure it is tightly seated. See that gasket and seat are in good clean condition and free from nicks. See that relief valve is working properly.

If the trouble is not found by any of the above methods, examine all connections on the air pressure and gasoline supply lines to make sure there are no leaks.

A good method of locating leaks in the air line is to put pressure in the tank and go over the line carefully with soap suds.

GASOLINE SUPPLY LINE

The gasoline pipe from the tank connects with a filter well at the entrance to the carburetor float chamber.

This filter well is provided with a screen which can be easily removed when necessary. A plug at the bottom of the well provides for the convenient removal of the screen. This screen should be removed occasionally and cleaned.

CLEANING GASOLINE LINE

The gasoline tank may be easily flushed after removing both drain plugs from the bottom of the tank.

If it is desired to clean the gasoline and pressure pipes at the same time, it can be done by disconnecting the pipes at the unions.

Flushing the gasoline system should not be necessary except at long intervals, if the proper precautions are taken when filling the tank.

CARBURETOR FLOAT CHAMBER

The float chamber maintains a constant level, or supply, of gasoline for the carburetor.

The gasoline flows into the float chamber through a needle valve. The height of a copper float automatically adjusts the position of the balance levers, which in turn, raise or lower the needle valve to regulate the incoming flow of gasoline.

CARBURETOR MIXING CHAMBER AND INTAKE MANIFOLD

After leaving the float chamber, the gasoline passes through the spray nozzle into the mixing chamber and thence into the intake manifold.

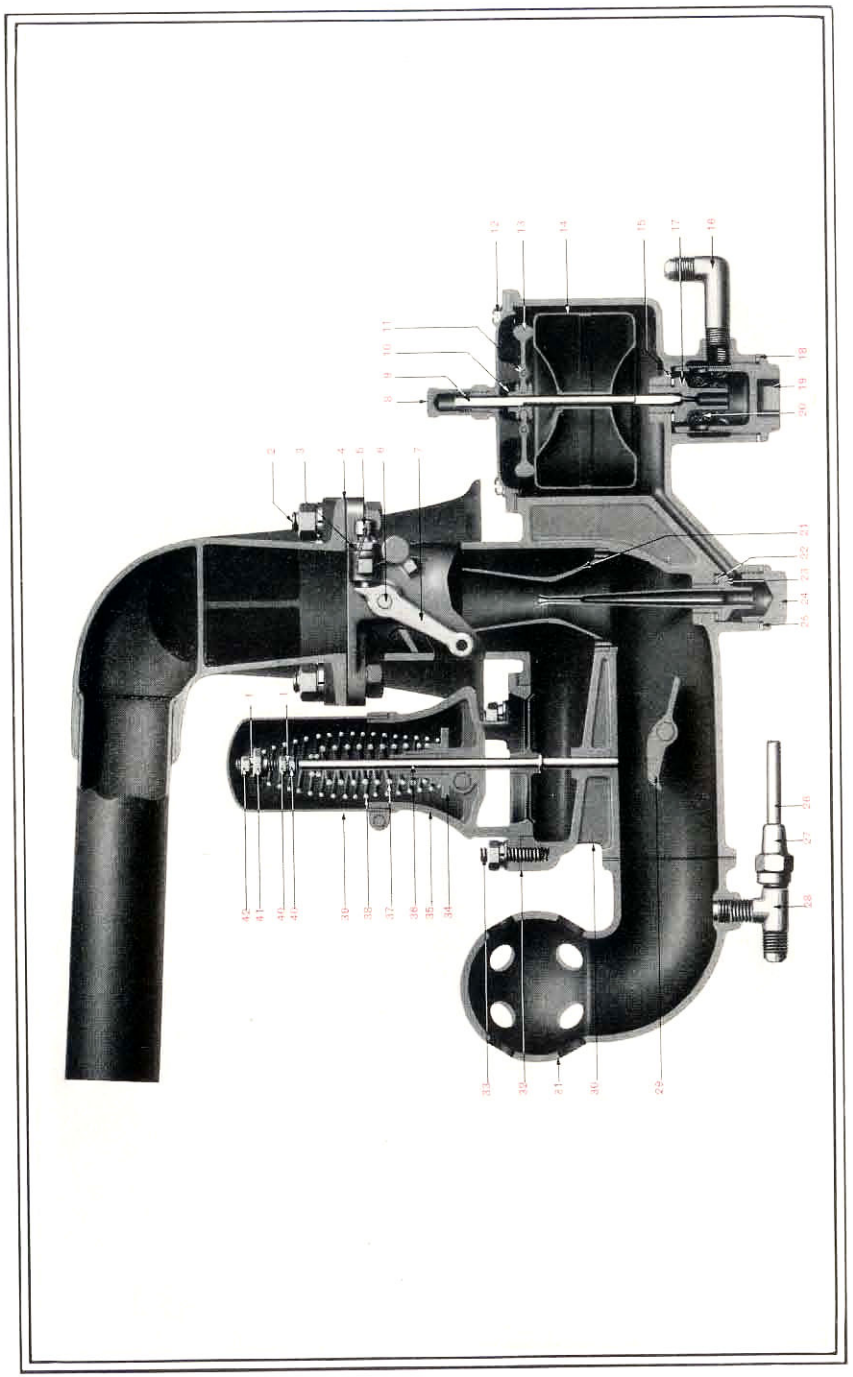


Plate No. 5 — Carburetor

The carburetor is placed above and between the cylinder blocks. Thus the heat derived from the exhaust pipes, in addition to the completely hot water jacketed cross and cylinder block manifolds, permits a uniform temperature and insures efficiency in mixing the sprayed gasoline with air. The mixing chamber is a cylindrical chamber around and above the spray nozzle. The vacuum created by the pistons, causes air to enter the mixing chamber through both the primary and the auxiliary air inlets. This air passes through the mixing chamber around the nozzle, atomizes and mixes with the gasoline sprayed through the latter.

It is important that the proportion of air and gasoline in the mixture be correct for all motor speeds. Consequently, although the primary air inlet remains wide open under all running conditions, the auxiliary air inlet valve is controlled by springs, so that while the valve opens slightly at low speed, the increased vacuum of high speed opens it still more, letting in the greater amount of air required to maintain the correct proportion of the mixture.

The carburetor thus automatically produces a correct mixture for all motor speeds, the auxiliary air valve hand wheel on the control board being used only for the regulation of the mixture for starting and to suit different atmospheric conditions.

Do not adjust the carburetor.

There is very little chance of it being out of adjustment. Consult a Packard dealer if there is any question regarding its action.

AUXILIARY AIR VALVE

The auxiliary air valve is in a housing forward of the mixing chamber.

It is controlled by the tension of two springs, one within the other.

Regulating the tension of the springs adjusts the action of the valve.

Two cams underneath the springs control their tension.

Plate No. 5 — Carburetor

Reference Number	Name of Part
1	Motor carburetor air valve spring (small) adjusting nut lock washer.
2	Motor carburetor to inlet manifold screw.
3	Motor carburetor throttle valve adjusting screw lock nut.
4	Motor carburetor to inlet manifold gasket.
5	Motor carburetor throttle valve adjusting screw.
6	Motor carburetor throttle valve shaft assembly.
7	Motor carburetor throttle valve lever.
8	Motor carburetor float chamber needle valve cap.
9	Motor carburetor float chamber needle valve.
10	Motor carburetor float chamber needle valve collar.
11	Motor carburetor float balance weight pivot.
12	Motor carburetor float chamber cover screw.
13	Motor carburetor float balance weight.
14	Motor carburetor float assembly.
15	Motor carburetor float chamber needle valve seat gasket.
16	Motor carburetor float chamber inlet tube elbow.
17	Motor carburetor float chamber needle valve seat.
18	Motor carburetor float chamber filter well gasket.
19	Motor carburetor float chamber filter well.
20	Motor carburetor float chamber filter well screen.
21	Motor carburetor spray mixing tube.
22	Motor carburetor spray tube gasket.
23	Motor carburetor spray tube assembly.
24	Motor carburetor body plug.
25	Motor carburetor body plug gasket.
26	Motor carburetor float chamber vent tube assembly.
27	Motor carburetor float chamber vent tube union nut.
28	Motor carburetor vent tube union tee.
29	Motor carburetor air shutter.
30	Motor carburetor body.
31	Motor carburetor air intake elbow.
32	Motor carburetor air valve seat gasket.
33	Motor carburetor air valve seat stud, short.
34	Motor carburetor air valve cam collar.
35	Motor carburetor air valve seat.
36	Motor carburetor air valve assembly.
37	Motor carburetor air valve spring, small.
38	Motor carburetor air valve spring, large.
39	Motor carburetor air valve spring cap assembly.
40	Motor carburetor air valve adjusting nut lock nut.
41	Motor carburetor air valve adjusting nut.
42	Motor carburetor air valve spring (small) adjusting nut.

Parts should be ordered by name only, not by number.

The cams are connected with and regulated by the auxiliary air valve hand wheel on control board.

Turning the air valve hand wheel toward "Gas" provides a rich mixture; turning it toward "Air" provides a rare mixture.

Directions for using auxiliary hand wheel in starting are given under "General Operation," beginning on page 8.

If the hand wheel is turned too far toward "Air," the consequent rare mixture may cause back firing into the carburetor. If it is turned too far toward "Gas," the consequent rich mixture may cause irregular running and overheating. Experience will dictate the best position for the most efficient running under different conditions.

PRIMARY AIR INTAKE

The primary air intake is at the front end of the carburetor.

It contains a shutter which is normally open and not in use when running. The shutter is operated by the hand wheel on the control board, which also operates the auxiliary air valve. By turning the hand wheel all the way over to "Choke," the air intake is closed and a rich mixture is drawn into the motor cylinders. The hand wheel should be set back toward "Air" and consequently the air intake opened, as soon as the motor is started.

THROTTLE VALVE

The throttle valve is of the butterfly type and is located in the mixing chamber, above the spray nozzle. It is controlled by the hand throttle lever on the steering wheel and by the accelerator pedal.

The throttle valve does not regulate the quality or richness of the mixture but simply the amount supplied to the motor cylinders through the inlet header.

USE OF HAND THROTTLE LEVER AND ACCELERATOR

The accelerator pedal is the usual means of controlling the speed of the car.

When pressed downward for increase or released for decrease of speed, its action is instantaneous. When the accelerator is released the motor immediately resumes the speed determined by the position of the hand lever on the steering wheel. Although either the hand throttle lever or the accelerator may be used to control the speed of the car, the use of the hand lever is advised for beginners. After confidence in driving has been gained, the more delicate action of the accelerator will be preferred. Movement of the accelerator pedal when the hand throttle lever is moved is proof of the proper action of the latter.

There should be $\frac{3}{16}$ inch clearance between the accelerator pedal and the toe board, when the pedal is fully depressed.

THROTTLE VALVE STOP

An adjustable stop holds the throttle valve slightly open and thus allows a small amount of mixture to reach the motor cylinders, even when the hand throttle on the wheel is entirely closed.

The minimum amount of mixture for the slowest running of the motor is thus supplied.

To increase this minimum speed, loosen the check nut and screw the stop forward. To decrease the speed, screw the stop backward.

This screw is adjusted and sealed at the factory and there is ordinarily no occasion to change the adjustment.

IGNITION SYSTEM

GENERAL PRINCIPLE

The source of current for ignition is the generator, with a storage battery floating on the line. The low tension current passes through separate low tension circuits for each block of cylinders. The sudden breaking of these circuits, in the timer unit, induces a high tension current, in the transformer coils. This current is carried through the distributors and spark plugs in proper succession to cause ignition.

LOW TENSION CURRENT

The low tension current, starting at the positive ignition terminal in the dash wiring moulding, is conducted to the ignition coils on the front left crank case arm, through a wire carried in a flexible conduit in the left frame side member; through the low tension windings of the coils and thence to the timer unit by means of wires leading from the number 2 terminals on the tops of the coils. The low tension circuit is completed, when the breaker points are in contact, through the central terminal on the timer which is common to both sets of breaker points, and through the low tension wire returning through the conduit on the left side of the frame to the ignition switch in the control box.

IGNITION TIMER

The low tension circuit is completed and broken in the twin timer at the top of the ignition apparatus.

When the circuit breaker points are in contact the low tension circuit is completed. When the points separate, the instantaneous clearing of the low tension current from the primary winding of the transformer coil induces a high tension current in the secondary winding which is used for ignition in the cylinders.

The breaker mechanism consists of a separate set of circuit breaker points for each low tension circuit. These are operated by a single three-lobed cam mounted on the top of a vertical shaft which is driven at crank shaft speed. This causes each low tension circuit to be broken three times to each revolution of the crank shaft.

The circuit breaker points should be kept smooth and parallel with a clearance of from .015 to .020 inch between them when fully separated.

Arcing across the contact points when they are separating is minimized by the use of separate condensers, for each set of breaker points, located in the rear side of the ignition timer and distributor housing. Indirectly these condensers also serve to intensify the high tension current wave. Resistance units in both low tension circuits, and located on either side of the common return terminal on the timer housing, serve to keep the low tension current down to the proper rate of flow.

HIGH TENSION CIRCUITS

The high tension current which originates in the secondary windings of the transformer coils passes through the H terminal at the front of the coils to the high tension distributor, thence to the appropriate spark plug. The high tension current after jumping the spark plug gap, completes the circuit through the spark plug body, cylinder castings and crank case to the coil bracket.

HIGH TENSION DISTRIBUTOR

Separate high tension distributors are provided for each cylinder block. These are mounted on either side of the ignition apparatus housing and are operated by a cross shaft driven from the vertical timer shaft. The high tension distributor is in no sense a timer. It simply serves to complete the high tension circuit to the proper plug at the time of separation of the breaker points.

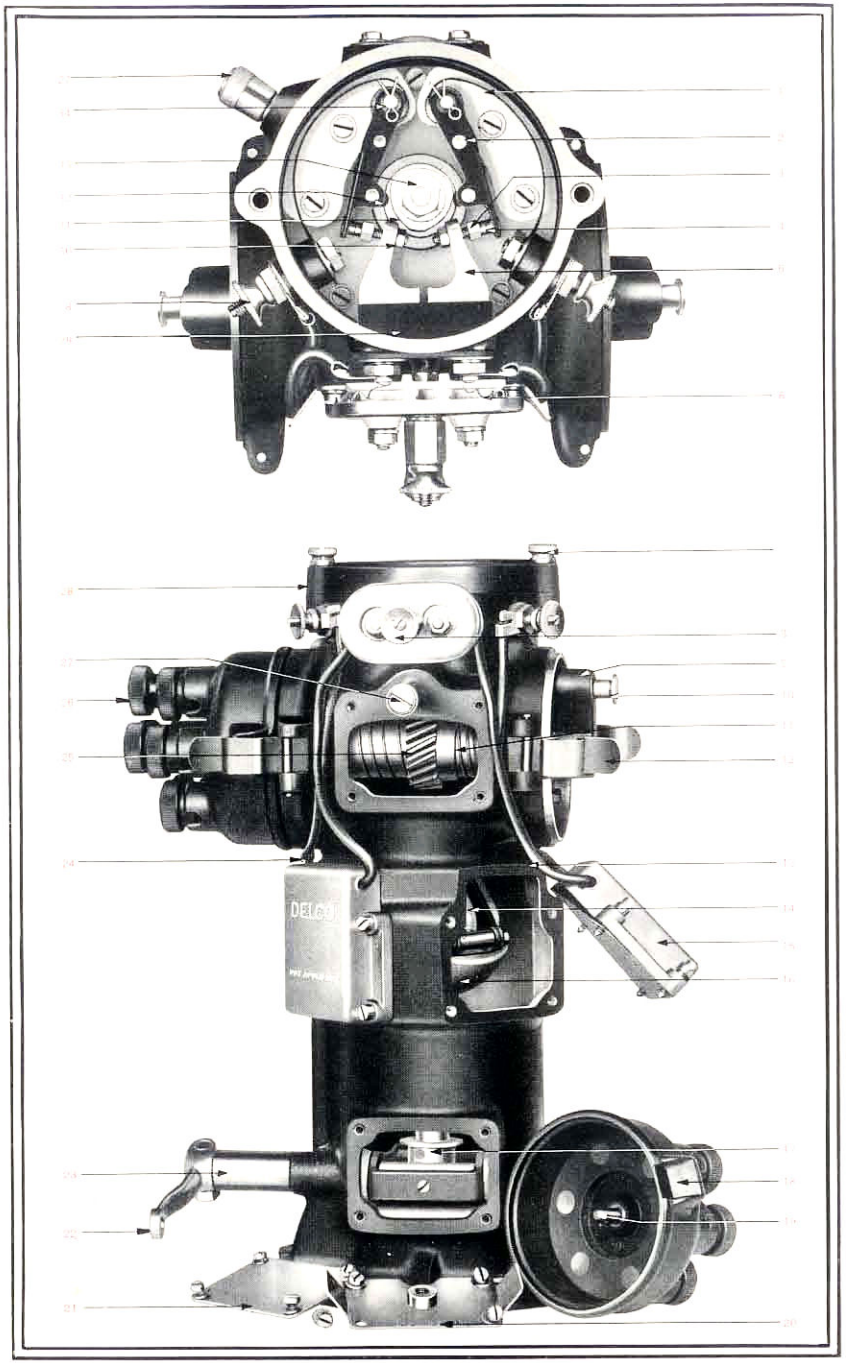


Plate No. 6 — Distributor Unit

FIRING ORDER

The firing order in each block is 1; 4; 2; 6; 3; 5; the impulses alternating between the two cylinder blocks. Numbering the cylinders in succession, beginning with number one at the front of each block, the firing order would be 1R; 6L; 4R; 3L; 2R; 5L; 6R; 1L; 3R; 4L; 5R; 2L; the R and L designating the right and left cylinder blocks.

MOTOR WIRING

Detailed and simplified wiring diagrams including ignition, starting and lighting circuits, are shown on pages 32 and 34.

On the motor the high and low tension wiring is readily distinguishable by the difference in size, the low tension wires having the thinner insulation. The low tension current is carried in a complete two-wire circuit not grounded at any point. The high tension current is grounded from the spark plug body, through the motor to the coil bracket.

High tension wires from distributors to spark plugs are carried in tubes supported on the cylinder blocks.

The wires between the coils and distributors are carried in a metal tube supported on the crank case arm and distributor.

SWITCH

The switch on the control board has two positions.

A low tension circuit is completed through either one set of breaker points or the other, whenever the switch handle is turned to Ignition, and the battery current flows continuously. The car should, therefore, never be left unattended with the switch in this position. Even if the motor is running and should stop accidentally, the battery would be rapidly exhausted.

A key lock permits the switch to be locked in the "off" position.

SPARK ADVANCE

The point at which ignition occurs in the cylinders relative to piston travel is automatically controlled by a centrifugal governor in the ignition apparatus. This is accomplished by varying the angular relation between the timer shaft and crank shaft. This angular relation may also be affected by operating the spark advance lever located above the steering wheel at the left side, which has the effect of bodily shifting the entire range of action of the automatic spark advance.

Plate No. 6 — Distributor Unit

Reference Number	Name of Part
1	Distributor interruptor spring.
2	Distributor interruptor lever assembly.
3	Distributor interruptor contact screw.
4	Distributor interruptor lever contact.
5	Distributor interruptor contact screw bracket.
6	Distributor resistance wire.
7	Distributor top cover screw.
8	Distributor low tension terminal stud nut.
9	Distributor brush holder assembly.
10	Distributor brush.
11	Distributor brush shaft spring, right.
12	Distributor head spring clip.
13	Distributor condenser cable, short, assembly.
14	Distributor governor link.
15	Distributor condenser, right, assembly.
16	Distributor governor weight assembly.
17	Distributor yoke collar.
18	Distributor head, right.
19	Distributor head, brush.
20	Distributor brush shaft gear cover plate.
21	Distributor advance yoke cover plate.
22	Distributor advance lever.
23	Distributor advance lever spacer.
24	Distributor condenser cable, long, assembly.
25	Distributor brush shaft gear.
26	Distributor high tension terminal nut.
27	Distributor oiler.
28	Distributor top cover plate assembly.
29	Distributor interruptor contact screw bracket insulator.
30	Distributor interruptor contact screw lock nut.
31	Distributor interruptor cam.
32	Distributor interruptor lever block.
33	Distributor interruptor cam nut.
34	Distributor interruptor lever stud.

Parts should be ordered by name only, not by number.

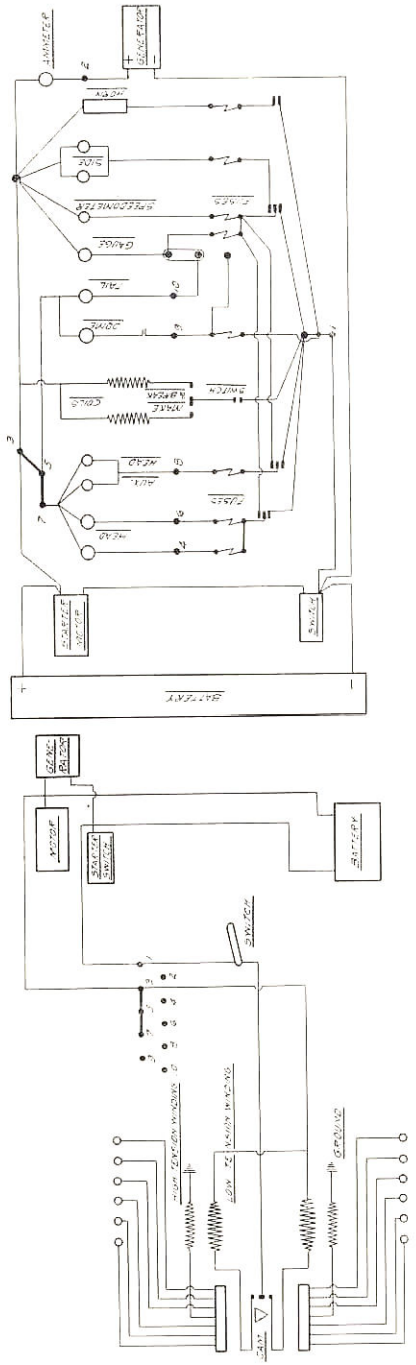


Plate No. 7 — Ignition and Simplified Ignition, Lighting and Starting Diagrams

For starting and ordinary running, the hand advance lever may be set and carried in the midway position. For extremely low speed it is advisable to carry this lever in the fully retarded position and for extremely high speed in the fully advanced position. For maximum economy above fifteen miles per hour the lever may also be fully advanced.

REPLACING THE COMPLETE IGNITION APPARATUS

If the ignition apparatus has been removed for any reason, it may be replaced as follows, providing the driving spiral gear on the front end of the cam shaft has not been moved relatively to the cam shaft:

Remove the inclined front floor board and the cover over the fly wheel, and open all cylinder priming cocks. Turn the motor slowly until the emission of air from the priming cock on the right front cylinder denotes compression in that cylinder. Continue to turn carefully until the inscription "Top dead center cyl. No. 1" on the fly wheel is $\frac{7}{8}$ inch past the highest point in its travel.

Remove the right distributor head from the ignition apparatus and rotate the distributor arm until its position corresponds with the position of the No. 1 terminal on the distributor head. Keep the spark advance lever in its upper or "retard" position. This lever is on the left side of the ignition apparatus near the bottom. The ignition apparatus may now be set in place and all connections made.

RETIMING THE SPARK

Retiming of the spark should not be necessary unless previous disassembling has caused disarrangement of related parts. It may be accomplished as follows:

Remove the small cover which is in front of the cam shaft. Remove the wire from the heads of the three cap screws in the spiral gear, loosen the cap screws, and tap them lightly toward the rear. Place the fly wheel in the position described under the heading "Replacing the complete ignition apparatus." See that the ignition apparatus is bolted in place and turned into the position described under that same heading, taking the further precaution of removing the cover from over the timer and turning the rotating parts to the exact position where clock-wise rotation of the vertical shaft causes the right-hand pair of contact points to begin to separate.

Tighten the three cap screws on the front end of the cam shaft and replace the locking wire.

SPARK PLUGS

The ignition spark jumps across a gap between the center wire, or electrode, and the wire connected to the body of the plug. These wires should be adjusted so that they are parallel to each other with a gap of $\frac{1}{32}$ of an inch between them. Improper adjustment of the spark plugs will impair the efficiency of the motor and may cause it to miss fire.

A $\frac{1}{32}$ of an inch gap gives a good spark for slow running and for hard pulling, and is the best all around adjustment obtainable.

The spark plug should be kept free of carbon which otherwise will cause short circuiting. The plug points may be cleaned with fine emery cloth. It is also a good plan to occasionally wash them thoroughly in gasoline.

It is not possible to disassemble the plug.

The center electrode is insulated from the body of the plug with porcelain. If this becomes cracked the plug should be replaced as the current otherwise, following the course of least resistance, may jump the gap at the crack in the porcelain rather than through the highly compressed charge in the cylinder, making the plug ineffective.

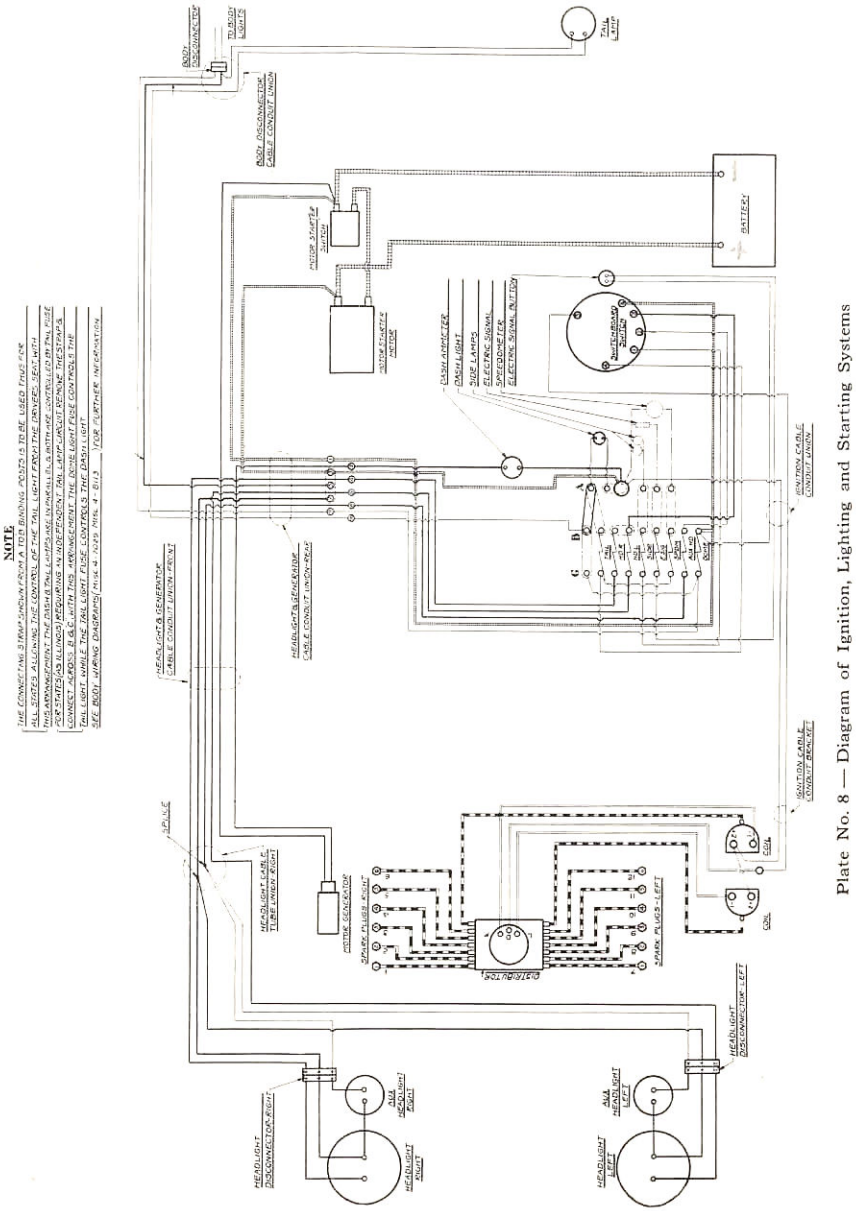


Plate No. 8 — Diagram of Ignition, Lighting and Starting Systems

STARTING AND LIGHTING SYSTEM

GENERAL PRINCIPLE

The current for starting and lighting is furnished by the generator, with a storage battery floating on the line. The current is taken from the ends of two heavy cables leading from the battery.

One of the cables is attached to a terminal on the cranking motor and the other to a terminal on the starting switch. The other terminals on the motor and switch are connected together.

THE BATTERY

The battery is common to ignition, starting and lighting systems. It is composed of three cells, and is 6-volt with a capacity of 120 ampere hours.

The battery rests in a base located on the left running board. It is held in place by holding-down bolts at each end, the nuts of which should be tightened down just enough to hold the battery firm.

To disconnect the battery, take off the battery box cover and remove the screws in the top of the connectors so that the terminal plugs may be pulled out of their sockets.

Care should be taken that the terminal plugs do not come in contact with each other or any metal part when the battery is disconnected. Care should be taken not to run the engine at a car speed over 20 miles an hour when the battery is disconnected.

In ordinary service the battery should require no further attention than to keep distilled water above the tops of the plates.

To add water to the battery remove the vent plug in each cell of the battery and fill with distilled water, using the syringe furnished for this purpose, until the liquid is one-half inch above the top of the plates.

Be sure to bring the liquid to this point. Do not fill above and then drain the excess. Be sure to screw the vent plugs securely into the vent holes.

Full information relative to charging the battery and caring for it when not in service will be furnished by the Technical Service Department of the Packard Motor Car Company upon request.

GENERATOR

The generator is carried at the front end of the motor on the right side. The generator is provided with three terminal tubes on the top, into which the three split pins of the regulator box fit.

Thus the generator is a self-contained unit provided with a detachable sealed regulator.

LIGHTING SYSTEM

THE LIGHTING SYSTEM

All electric light appliances derive their current from the ends of the two heavy cables leading from the battery. One of the cables is attached to the cranking motor and the other to the starting switch.

Wiring for tail and dome lights is carried in a flexible metal conduit attached to the frame.

Wiring for electric horn, side lights and speedometer is connected to terminals on the dash and carried in the bonnet dash shelf.

Headlight and auxiliary headlight wires are carried forward in flexible metal conduits located on the right frame member.

An inspection lamp with wire connections is included in the tool box.

Lamp sizes:

Headlights — 24 cp., 7-volt, $2\frac{1}{16}$-inch round bulb.
Auxiliary headlights — 6 cp., 7-volt, $1\frac{1}{4}$-inch round bulb.
Side lamps — 2 cp., 7-volt, $\frac{21}{32}$-inch round bulb.
Gauge lamp — 4 cp., 7-volt, $\frac{3}{4}$-inch round bulb.
Tonneau light for open bodies—12 cp.,6.5-volt, 1-in. round gas-filled bulb.
Tail lamp — 2 cp., 7-volt, $\frac{21}{32}$-inch round bulb.
Inspection light — 4 cp., 7-volt, $\frac{3}{4}$-in. round bulb.
Dome light in enclosed bodies—12 cp., 6.5-volt, 1-in. round gas-filled bulb.
Coupe — baggage compt., 12 cp., 6.5-volt, 1-in. round gas-filled bulb.
Speedometer light (Coupe only) 2 cp., 7-volt, $\frac{21}{32}$-in. round bulb.

FUSE BOARD

All lamp circuits and the horn circuit pass through a fuse board on the engine side of the dash. When lamps or horn fail the fuses should be inspected.

If it is in good condition the wiring should be inspected for loose connections.

All fuses are of the glass tube type making inspection easy. If a fuse has been blown it should be replaced. Should the fuse in any circuit continue to be blown out, it indicates a short circuit which should be cleared.

TAIL LAMP WIRING

The tail and license lamp is so wired that it can either be turned on by a switch on the control board or by a revolving switch at the lamp.

In cases where the tail lamp is wired to be turned on and off at the lamp, as required by law, in some states, the circuit is controlled by the dome light fuse and the dash light by the tail lamp fuse.

AMMETER

The ammeter is located on the dashboard. It is connected between the generator and battery; thus, with the engine idle, the ammeter does not indicate, regardless of whether the lights are on or off. Should it register to the left of zero with the motor idle, remove the disconnect plug from the regulator, to prevent discharging the battery.

When the engine is running the ammeter registers the amount of charging current passing from the generator to the storage battery. When the engine is running and lights are turned on, the ammeter shows the amount of current passing from the generator to both lights and storage battery. If ammeter fails to register when engine is running about 750 revolutions or over 20 miles per hour, look for loose connections or broken wires between generator and battery, also see that the generator commutator is clean and that the brushes are making good contact. Should ammeter indicate a high current continuously of 25 or 30 amperes it indicates a heavy ground or short circuit in the wiring or storage battery.

Disconnect the battery to prevent discharging and examine wiring for short circuits.

REGULATOR

The generator regulator is located on top of the generator. It is provided with three split pins which fit into the three terminal tubes on top of the generator body. It is clamped down in position by a single brass thumb nut which should be screwed down securely on leather washer.

The generator regulator box contains the regulator and an automatic switch which closes the circuit between generator and battery when the generator speed is sufficient to begin furnishing current.

The generator regulator keeps a constant electrical pressure or voltage, slightly higher than the voltage maintained by a fully charged battery, this pressure being maintained regardless of speed.

The voltage being constant, the current generated naturally varies, being small when the battery is fully charged and increasing as the lights are turned on or the battery is partially discharged.

ELECTRIC STARTER

THE SYSTEM

The electric starter system consists of a cranking motor, the storage battery also common to lighting and ignition system, a starting switch and a heel button with suitable connections between it and the switch.

THE MOTOR

The cranking motor is located on the right side of the engine at the rear. The motor shaft, at its rear end, carries a pinion adapted to mesh with an over running roller clutch gear concentric with a pinion which is adapted to mesh with teeth in the fly wheel.

THE STARTING SWITCH

The starting switch is attached to the upper side of the crank case arm at the rear of the cranking motor. The switch is always open when not in use. Pressure on the heel button starts to close the switch and a resistance in the switch allows only enough current to reach the motor to make it rotate slowly. This same operation meshes the pinion with the fly wheel.

When the pinion is fully meshed the resistance is short circuited, allowing full current to flow through the cranking motor.

HEEL BUTTON

The heel button is located in the level front floor board and is connected through a spring retracted rock shaft to the rod which actuates the switch and also throws the clutch gears into contact with the fly wheel and motor pinion.

The starting mechanism is operated by pressing down on this heel button slowly but firmly, the full length of its stroke.

If starting gears do not mesh properly at first, do not try to force them into mesh but release pressure on starting button and wait until starting motor stops spinning before again pressing on the heel button.

OPERATION OF STARTER

Turn the auxiliary air valve hand wheel, on the control board, toward "Gas." Full directions for proper position of hand wheel on page 8.

Set the spark lever somewhat beyond mid position. Turn the ignition switch to "Ignition" position. Press down slowly but firmly on the heel button as far as it will go. Hold the button down until the engine starts firing, when it should be instantly released. Never press heel button down while engine is running.

A very heavy drain is thrown upon the battery whenever it is used for starting purposes. If the motor does not start readily, do not attempt to start it by continued cranking. Release the heel button and locate the trouble. It may be due to an improper setting of the air and gas wheel, no gasoline or air pressure, switch turned off, loose or broken wire connection, or other causes. Continued cranking may cause battery trouble.

In event of any electrical trouble consult the nearest Packard dealer. Do not attempt any repairs or allow local electricians to tamper with the electrical equipment as the maker's responsibility ceases where any repairs have been attempted.

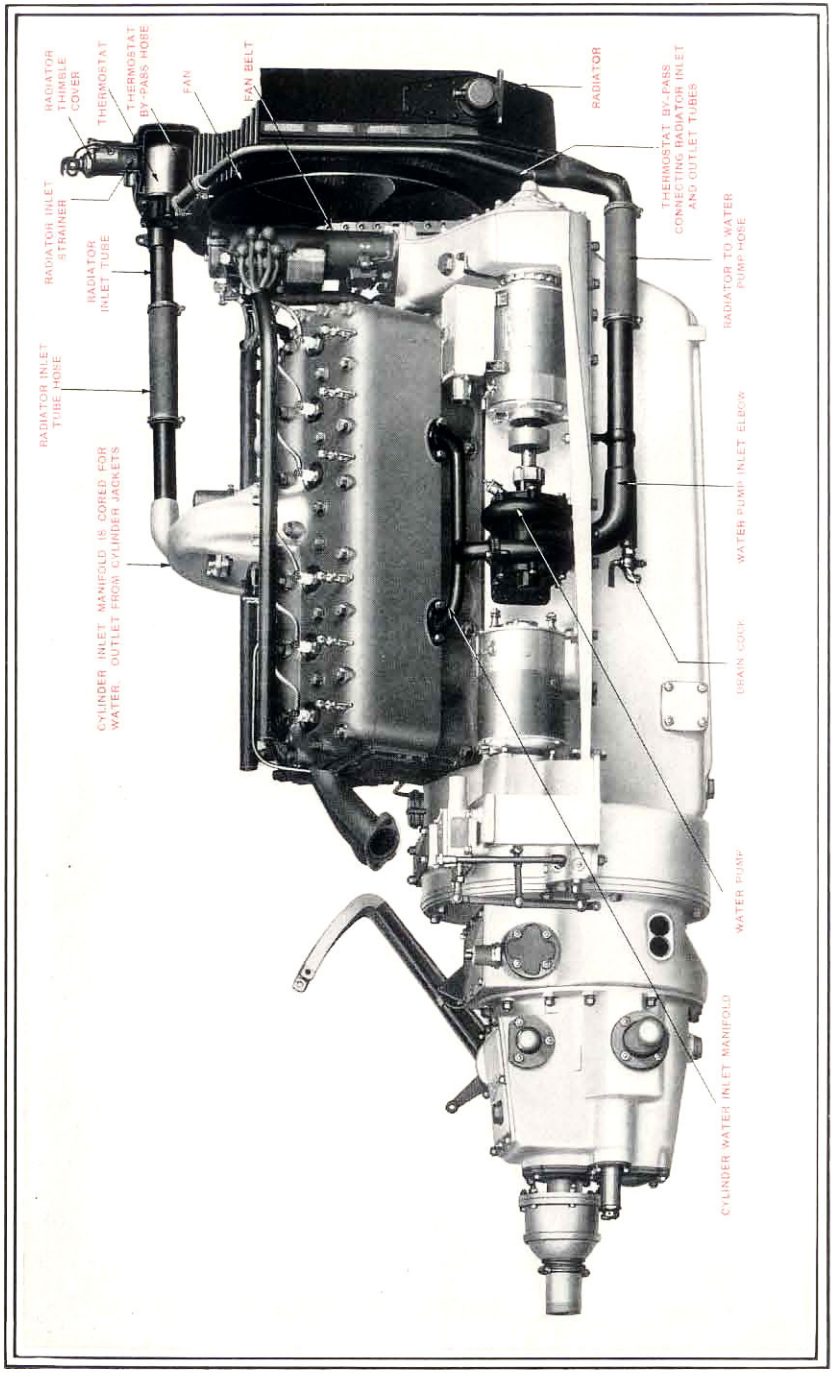


Plate No. 9 — Diagram of Water Circulation System

COOLING SYSTEM

FILLING THE RADIATOR

Keep the radiator filled with water which is as free from lime and other impurities, as possible.

For cold weather solution see instructions on page 17.

Any steam or surplus water will escape through a vent pipe, extending from beneath the filler cap to the lower left corner of the radiator.

The emission of steam is generally an indication of a low water supply or an overheated motor. It may also be caused by a frozen radiator or a clogging of the water system.

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

WATER PUMP

A centrifugal water pump is attached to the right side of the motor and is driven by the generator shaft.

There are two impellers, opposed to balance the thrust, each impeller supplying a single cylinder block.

An adjustable gland nut at the front end of the pump shaft permits the packing to be kept tight to prevent leaking at the gland.

WATER CIRCULATION

The water is drawn from the bottom of the radiator by the double impeller pump and is distributed through manifolds to each of cylinder block water jackets. The outlet is through the water jacket surrounding the gas intake header, which connects the two cylinder blocks, and thence through the tube leading to the top of the radiator.

The purpose of the water jacket surrounding the gas intake header is to furnish heat to assist in vaporizing the gasoline.

THERMOSTAT

A thermostat located in the upper tank of the radiator prevents the water from circulating through the radiator until it has reached the proper temperature for efficient running of the motor.

A by-pass pipe connecting the radiator inlet and outlet tubes contains a shut-off valve which is controlled by the action of the thermostat. When the water in the cooling system is cold the valve at the radiator inlet, also controlled by the thermostat, is closed causing the water to flow directly from the radiator inlet, back to the pump inlet through the by-pass pipe without entering the radiator. As the water warms up, the expansion of the thermostat, caused by the heat, automatically closes the by-pass valve and opens the radiator inlet valve. This makes it necessary for the water to circulate through the radiator, thus keeping it at a predetermined temperature.

There is no adjustment to the thermostat.

FAN

A belt-driven fan placed directly behind the radiator draws a current of air through the radiator to increase the cooling efficiency.

Adjustment is provided for the tension of the fan belt by sliding ways in the timer housing into which the fan bracket is mounted.

The fan belt is driven by a pulley attached to the crank shaft by means of a frictional clutch.

DRAINING THE WATER SYSTEM

To thoroughly drain the water from the entire system, open the drain cock at the water pump inlet tube, also the radiator filler cap.

When the water has ceased to flow, it is a good plan to run the motor slowly for about a minute.

CLEANING THE WATER SYSTEM

The radiator and cylinder water jackets should be occasionally flushed with water to remove any sediment which may accumulate.

To clean radiator, remove the hose connections and flush out by forcing water under city pressure through it, from the bottom to the top. Avoid excessive pressure.

The cylinder water jackets should be thoroughly cleaned and flushed at times of overhauls. To facilitate the cleaning of the jackets, the plates may be removed from the ends of the cylinders.

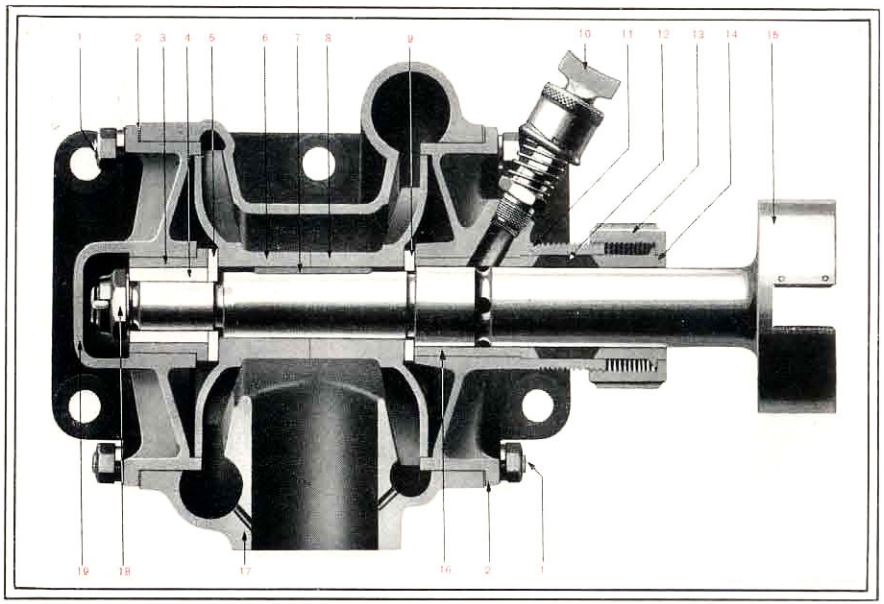


Plate No. 10 — Motor Water Pump

Reference Number	Name of Part
1	Motor water pump cover stud.
2	Motor water pump cover gasket.
3	Motor water pump shaft bushing, rear.
4	Motor water pump shaft sleeve.
5	Motor water pump shaft sleeve washer.
6	Motor water pump impeller, rear.
7	Motor water pump impeller key.
8	Motor water pump impeller, front.
9	Motor water pump impeller thrust washer.
10	Motor water pump shaft grease cup.
11	Motor water pump cover, front.
12	Motor water pump shaft gland packing.
13	Motor water pump shaft gland nut.
14	Motor water pump shaft gland.
15	Motor water pump shaft assembly.
16	Motor water pump shaft bushing, front.
17	Motor water pump body.
18	Motor water pump shaft nut.
19	Motor water pump cover, rear.

Parts should be ordered by name only, not by number.

IMPORTANT FEATURES OF MOTOR

GENERAL PRINCIPLE

The motor is a twelve-cylinder four-cycle V type with two blocks of L head cylinders bolted to the crank case at an angle of 60 degrees. The left block is set one and one-quarter inches ahead of the right block to permit the lower end connecting rod bearings from opposite cylinders being placed side by side on the same crank pin. This arrangement also permits the use of a single cam shaft with a separate cam, for each valve operating directly on the valve push rod roller.

RUNNING A NEW MOTOR

Do not, under any circumstances, run a new motor at sustained high speed. Do not unnecessarily race the motor, at any time.

This is extremely injurious and is never of any purpose.

MAINTAINING COMPRESSION

Compression in all cylinders should be equal and up to the standard. Weakness or loss of compression is most probably due to imperfectly seating valves, which may be caused by insufficient clearance between the valve stems and lift rods, carbon deposit on the valve seats or by the valve stems sticking in the guides. Compression should be tested for uniformity in all cylinders at regular intervals.

To test compression in a cylinder, remove the spark plug and replace it with a standard compression gauge. Then, with the ignition switch "off" and petcocks in all cylinders closed, crank the motor using the electric-starter. At cranking speed the gauge should register between 75 and 80 pounds with the throttle wide open.

VALVE ADJUSTMENT

The valve roller holders, or lift rods, should be so adjusted that the clearance between the lift rod and the valve stem, when the valve is closed, is .004 with the motor cold.

A full .004 clearance is required under all conditions on account of the expansion of the valve stem, caused by the heat.

GRINDING THE VALVES

The valve seats may, in time, collect a carbon deposit which will prevent the valve from seating properly. When this occurs the valves should be removed and the seats ground, using a mixture of oil and powdered glass or some prepared valve grinding paste.

To grind the valve seats, disconnect the carburetor intake manifold and spark plug connections, and remove the cylinder head. Remove the valve collar key, valve collar and spring, using the special valve lifter furnished with the tool equipment. Take out the valve and clean it thoroughly, also noting whether or not the stem is clean and otherwise in good condition. It is a good plan to put a light spring around the valve stem before putting the valve into place for grinding. This raises the valve stem from its seat and prevents grinding a groove in the seat. Grind by rotating the valve back and forth, with a screw driver or hand brace, with the grinding paste between the valve and its seat.

CAUTION: Before using the grinding compound care should be taken to stuff rags or waste into the cylinders to prevent the abrasive from reaching the cylinder walls.

All carbon should be cleaned from cylinder heads and pistons whenever heads are removed.

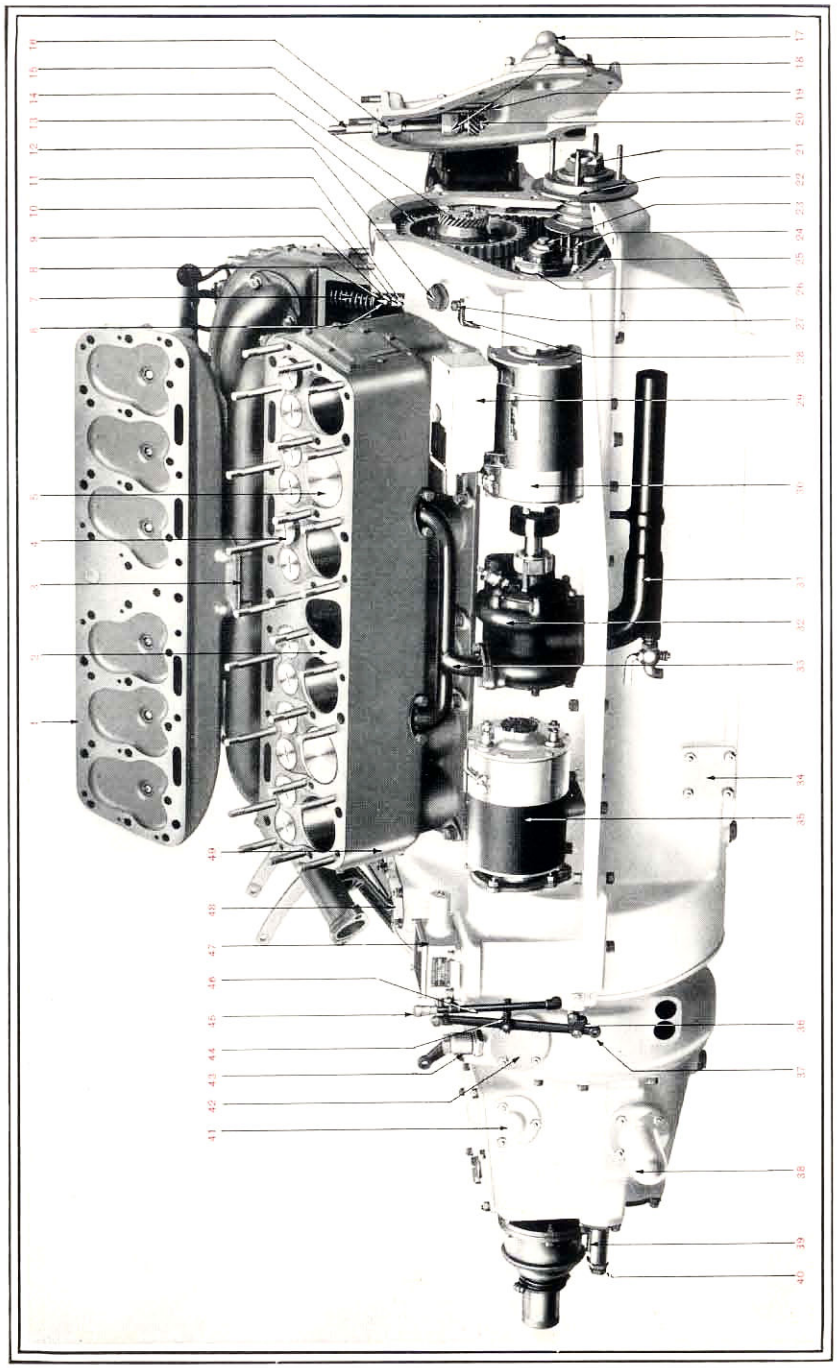


Plate No. 11 — Motor, Right Side

CARBONIZED CYLINDERS

If the motor knocks easily, and does not seem to develop the normal amount of power, it is generally an indication that the cylinders are carbonized.

To clean the carbon, remove the cylinder heads according to directions given above under the heading "Grinding the Valves," after which the carbon can easily be removed with a scraper.

CAUTION: Before replacing the cylinder heads be sure that the cylinders are clean and entirely free from loose carbon or any other foreign substance. Also see that the cylinder head gasket is not broken and is otherwise in good condition.

FRONT END DRIVE

The cam shaft and generator shaft are operated by a triangular drive of silent chain with provision for adjustment. The generator driving sprocket is mounted on an eccentric block through which the generator shaft projects. The generator shaft is driven by the sprocket through a sliding universal joint making adjustment of the sprocket possible without changing the position of the generator shaft.

Adjustment of the chain will ordinarily be necessary after about the first 2000 miles of running, after which adjustments should be required only at times of overhaul. To inspect the chain, remove the inspection hole plug which is above the chain at the right forward end of the crank case.

If the combined, upward and downward deflection of the chain, at a point midway between the cam shaft gear and the generator gear, equals or exceeds 1¼ inch, the chain should be readjusted.

Adjustments when necessary should be made by a Packard dealer's mechanical department, although if this is not convenient, full instructions regarding adjustment will be furnished by the Technical Service Department of the Packard Motor Car Company.

SETTING VALVE CAM SHAFT

Disarrangement of the valve cam shaft setting is possible only by removing the front end chain. Adjustments to the chain do not affect the valve timing.

Plate No. 11 — Motor, Right Side

Reference Number	Name of Part
1	Motor cylinder head, core plugs and studs assembly.
2	Motor cylinder head gasket.
3	Motor cylinder inlet manifold to cylinder head gasket.
4	Motor valve.
5	Motor piston.
6	Motor valve spring collar key.
7	Motor valve spring.
8	Motor valve spring collar.
9	Motor valve roller holder screw.
10	Motor valve roller holder screw check nut.
11	Motor valve roller holder and roller assembly.
12	Motor crank case cam shaft driving chain inspection hole plug.
13	Motor cam shaft sprocket.
14	Motor cam shaft spiral gear, front.
15	Distributor driving shaft.
16	Distributor driving shaft bushing, upper.
17	Motor gear cover plate, large.
18	Distributor driving shaft bushing, lower.
19	Motor gear cover oil trap.
20	Distributor driving shaft gear.
21	Motor crank shaft starting crank jaw.
22	Motor fan driving pulley hub assembly.
23	Motor generator shaft nut.
24	Motor crank shaft sprocket.
25	Motor cam shaft driving chain.
26	Motor generator sprocket coupling, female, nut lock.
27	Motor generator shaft eccentric lock.
28	Motor generator shaft eccentric clamp nut lock.
29	Motor generator regulator.
30	Motor generator.
31	Motor water pump inlet elbow assembly.
32	Motor water pump assembly.
33	Motor cylinder water inlet manifold, right.
34	Motor oil strainer cover.
35	Motor starter motor.
36	Motor starter switch operating lever link, yoke end, female.
37	Motor starter switch operating lever.
38	Transmission gear shifter lock cap.
39	Transmission gear shifter fork shaft bearing.
40	Transmission gear shifter fork shaft stop screw.
41	Transmission gear shifter shaft bearing, right, cap.
42	Clutch shifter end bearing, right.
43	Clutch shifter end bearing grease cup.
44	Motor starter switch operating lever pivot yoke.
45	Motor starter clutch shaft oil cup.
46	Motor starter clutch shaft oiler extension.
47	Motor starter switch.
48	Motor crank case inspection plate.
49	Motor cylinder and core plugs assembly.

Parts should be ordered by name only, not by number.

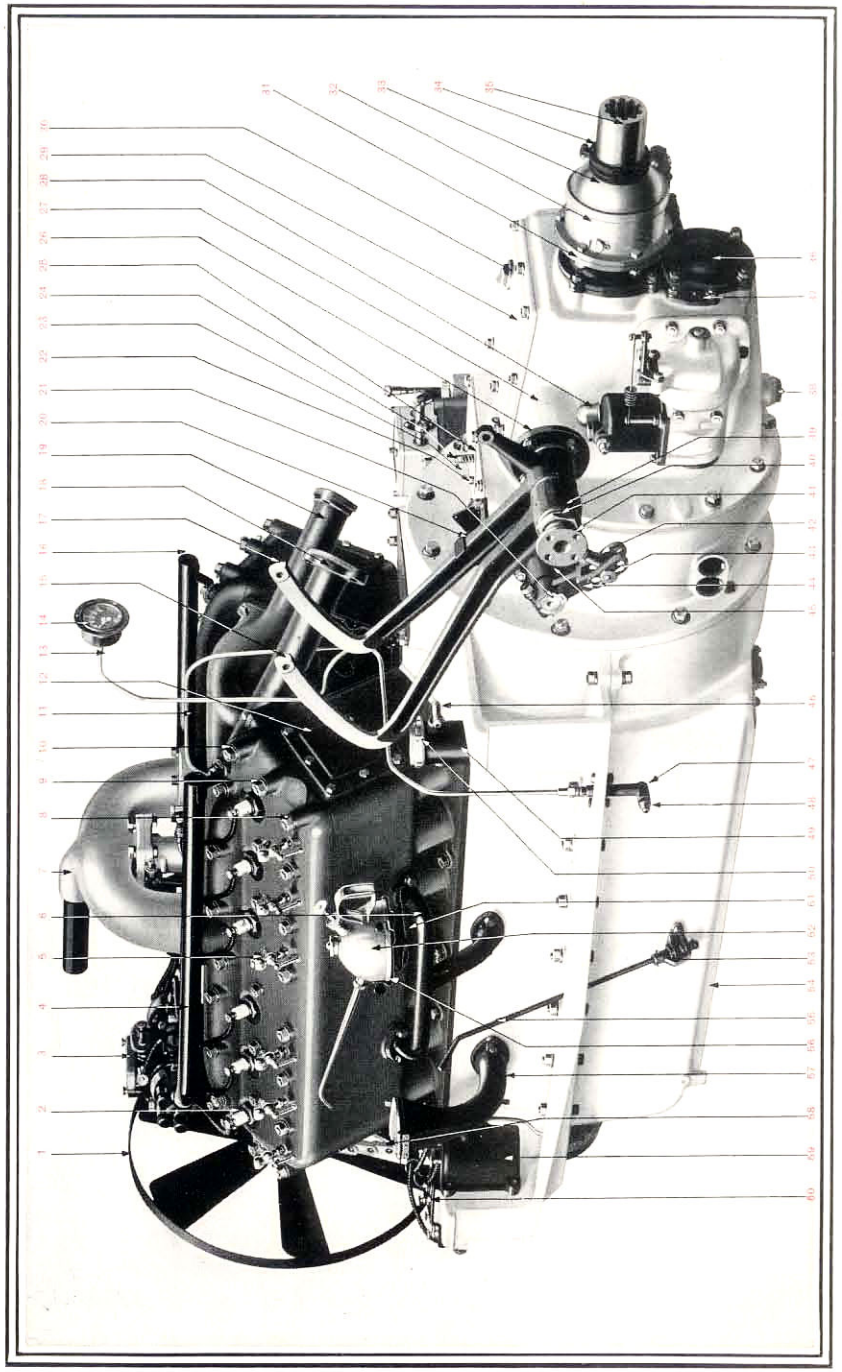


Plate No. 12 — Motor, Left Side

In resetting the cam shaft the arrows on both the crank shaft and cam shaft gears, should point directly upward and be in line with the arrow on the front end cover face of the motor. In this position the inscription on the fly wheel "Exhaust closes 1 and 6 R" will be on the top dead center line of the motor, which is the center between the two cylinder blocks, and number 1 right piston will be in the firing position.

THE MOTOR CRANK CASE

The crank case is divided horizontally into two sections, and carries the clutch and transmission housing at the rear.

The uppermost or main section forms the engine base and contains the cam shaft and the seats for the upper half of the crank shaft bearings. The lower half of the crank shaft bearings are held rigid by caps bolted to the upper crank case section. A forward extension contains the chain for operating the cam shaft, generator, water pump and timer. The lower section or bottom cover is easily removable for inspection and adjustment of connecting rods, cam shafts, etc., without disturbing crank shaft bearings or the front cover, although the oil manifold must be disconnected in accordance with inscription on the small plate on the right hand side of the crank case. This may be done by using the special square headed wrench provided with the tool equipment.

MOTOR BEARINGS

The main and connecting rod bearings are of the babbitt-faced bronze type.

The bearings are set with a .0015 to .002 clearance and are constantly flooded with a film of oil between the shaft and the bearing surface which should make adjustments for wear necessary only at long intervals. The adjustment when required should be made by a Packard dealer.

Plate No. 12 — Motor, Left Side

Reference Number	Name of Part
1	Motor fan.
2	Ignition spark plug assembly.
3	Distributor.
4	Ignition high tension cable tube, left, assembly.
5	Motor cylinder pet cock.
6	Motor cylinder water inlet manifold, left.
7	Motor cylinder inlet manifold.
8	Motor cylinder head stud, short.
9	Motor cylinder head stud, intermediate.
10	Motor cylinder head stud, long.
11	Gasoline tube, front, assembly.
12	Motor cylinder water jacket plate.
13	Motor oil pressure gauge tube assembly.
14	Motor oil pressure gauge.
15	Clutch pedal.
16	Ignition high tension cable tube, right, assembly.
17	Foot brake pedal.
18	Exhaust manifold, left.
19	Exhaust manifold, right.
20	Foot brake pedal stop.
21	Clutch shifter.
22	Clutch brake shoe hinge.
23	Clutch housing.
24	Clutch brake shoe stud.
25	Clutch brake shoe spring.
26	Transmission gear shifter shaft bearing, left.
27	Transmission case.
28	Tire pump.
29	Transmission case cover.
30	Transmission case cover oil filler plug.
31	Transmission driving shaft rear bearing housing cover.
32	Universal joint inside casing.
33	Universal joint outside casing.
34	Universal joint rear casing spring retainer assembly.
35	Universal joint sleeve yoke.
36	Transmission counter shaft rear bearing housing cover.
37	Transmission reversing pinion pin.
38	Transmission case oil drain plug.
39	Clutch pedal bushing.
40	Transmission gear shifter shaft bearing, left, lock nut.
41	Transmission gear shifter shaft assembly.
42	Clutch shifter link assembly.
43	Clutch shifter lever connecting yoke end pin.
44	Clutch shifter lever.
45	Clutch shifter end bearing, left.
46	Gasoline power pressure pump tube tee.
47	Gasoline tube connection, front.
48	Gasoline tube connection, front, union.
49	Gasoline power pressure pump assembly.
50	Gasoline power pressure pump cylinder cap.
51	Oil can holder support.
52	Oil can.
53	Motor crank case overflow valve assembly.
54	Motor crank case, lower half.
55	Motor crank case overflow valve handle.
56	Motor oil can holder.
57	Motor crank case oil filler assembly.
58	Motor fan belt.
59	Ignition coil.
60	Ignition coil bracket.

Parts should be ordered by name only, not by number.

THE TRANSMISSION

GENERAL PRINCIPLE

The motor unit includes the clutch and transmission assemblies. These are enclosed in housings attached to the rear end of the crank case casting. The transmission case, which is bolted to the rear of the clutch housing, contains a selective gear set giving three speeds forward and one reverse. The driving torque is transmitted to the worm bevel driving gears in the rear axle unit through a shaft with an encased universal joint at each end. The final drive is through the differential and live axle shafts to which the rear wheels are keyed.

THE CLUTCH

Attached to the fly wheel and enclosed in a housing bolted to the crank case casting is a multiple disc clutch. It consists of two series of dry plates which are alternately connected with a casing attached to the fly wheel and with a spider on the clutch shaft. The casing or driving plates are faced with special friction material which contacts with the hardened and ground steel spider or driven plates.

The clutch plates are held in contact by the tension of a strong coil spring. Pressure upon the left pedal compresses the spring and allows the plates to separate slightly by sliding endwise on their respective keys, which connect the driving plates to the drum and the driven plates to the spider.

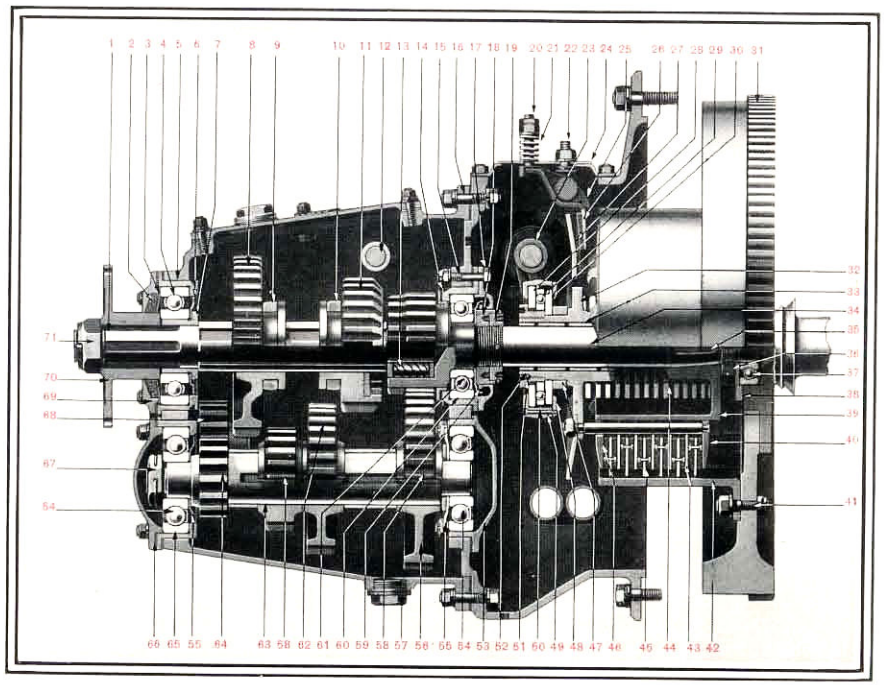


Plate No. 13 — Transmission and Clutch Assembly

CARE OF THE CLUTCH

Do not slip the clutch to reduce the speed of the car or to partially relieve the load from the motor. Use the throttle or shift to the next lower gear.

The clutch plates are run dry. They are unaffected by atmospheric conditions and in service require no lubrication or other attention.

Oil the clutch bearings as described in the "Schedule of Lubrication" beginning on page 10.

CLUTCH PEDAL

The clutch pedal in the engaged position, if properly adjusted, should have one-half inch free motion or play when the pedal is lifted by hand. If the pedal while in this position is allowed to touch the under side of the floor board the full action of the clutch spring is not obtained.

Details of adjustment on page 15.

CLUTCH BRAKE

There is a clutch brake attached to the clutch housing cover which contacts with the cone attached to the clutch spring sleeve when the pedal is depressed. This prevents the counter shaft gears from spinning and assists in shifting gears.

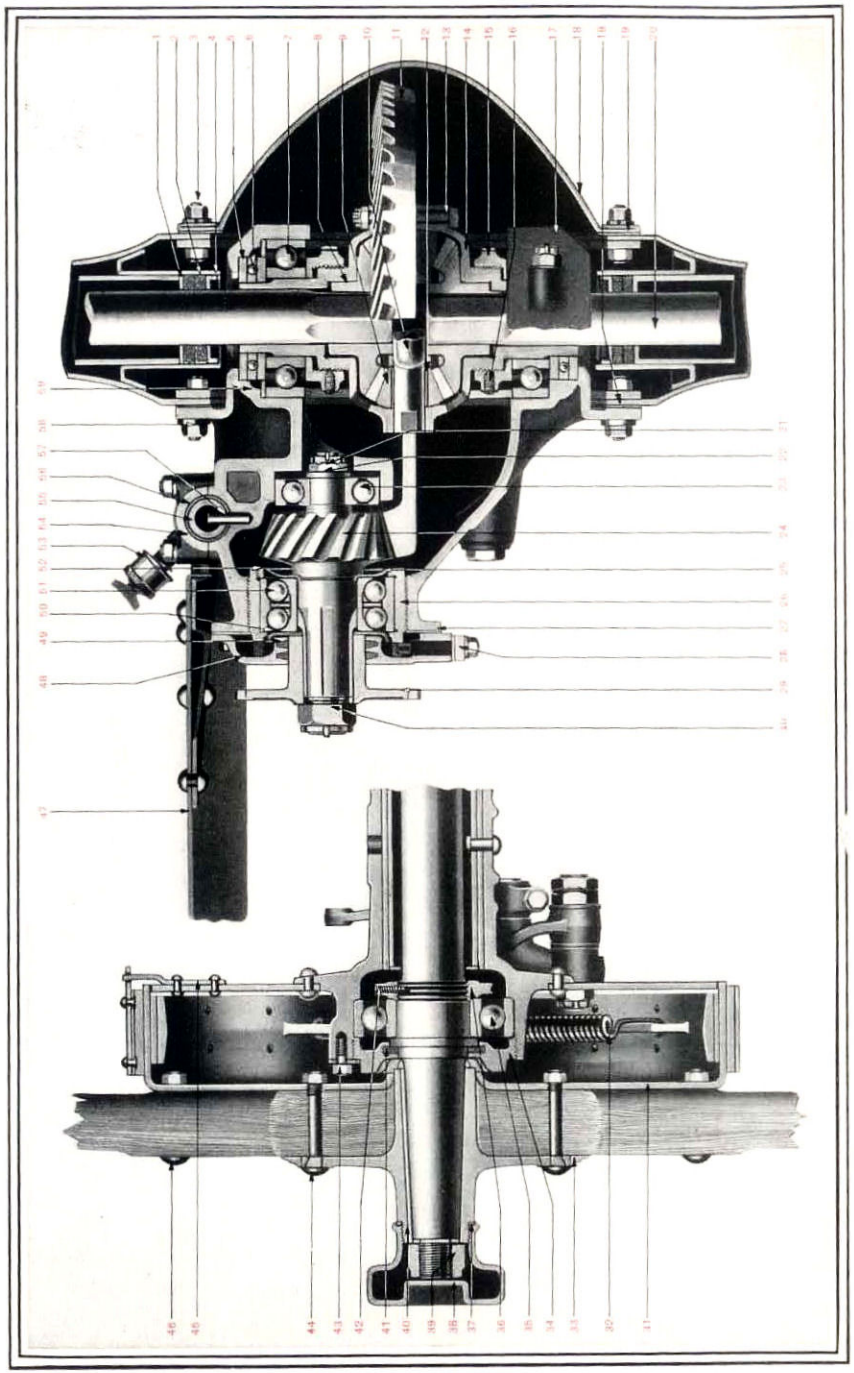
The clutch brake is fully adjustable and can be set to give the speed of shift agreeable to each individual owner.

Details of adjustment on page 15.

Section of Transmission Assembly

Reference Number	Name of Part
1	Transmission driving shaft.
2	Transmission driving shaft rear bearing dust washer.
3	Transmission driving shaft rear bearing oil retainer.
4	Transmission driving shaft ball bearing, rear.
5	Transmission driving shaft rear bearing housing.
6	Transmission driving shaft rear bearing oil thrower.
7	Transmission driving shaft bearing bushing.
8	Transmission first speed and reversing gear.
9	Transmission first speed and reversing gear shifter fork.
10	Transmission direct drive and second speed gear shifter fork.
11	Transmission direct drive and second speed gear.
12	Transmission gear shifter shaft.
13	Transmission driving shaft bearing, front.
14	Clutch shaft oil thrower.
15	Clutch shaft rear bearing housing bolt.
16	Transmission case to clutch housing stud.
17	Clutch shaft rear bearing dust washer retainer.
18	Clutch shaft rear bearing nut.
19	Clutch shaft rear bearing lock nut.
20	Clutch brake shoe stud.
21	Clutch brake shoe stud spring.
22	Clutch brake shoe hinge.
23	Clutch shifter.
24	Clutch brake shoe stud plate.
25	Clutch brake shoe assembly.
26	Clutch brake shoe facing.
27	Clutch brake cone.
28	Clutch shifter thrust bearing washer, rear.
29	Clutch shifter thrust bearing.
30	Clutch shifter thrust bearing washer, front.
31	Motor fly wheel.
32	Clutch spring sleeve.
33	Clutch spring sleeve bushing.
34	Clutch shaft.
35	Clutch spider key.
36	Clutch spider lock nut.
37	Clutch shaft ball bearing, front.
38	Clutch shaft front bearing retainer plate.
39	Clutch spider.
40	Clutch spider clamp plate and studs assembly.
41	Clutch casing stud.
42	Clutch casing.
43	Clutch spider plate.
44	Clutch spring.
45	Clutch casing plate assembly.
46	Clutch spider end plate.
47	Clutch shifter thrust bearing spacer.
48	Clutch shifter thrust bearing sleeve collar.
49	Clutch shifter thrust bearing sleeve.
50	Clutch shifter thrust bearing sleeve screw.
51	Clutch spring sleeve collar.
52	Clutch spring sleeve collar screw.
53	Transmission countershaft front bearing housing.
54	Transmission countershaft ball bearing.
55	Transmission countershaft bearing baffle plate.
56	Transmission countershaft gear.
57	Transmission case oil-drain plug.
58	Transmission countershaft gear key.
59	Clutch shaft rear bearing oil thrower.
60	Clutch shaft rear bearing housing.
61	Clutch shaft ball bearing, rear.
62	Transmission countershaft second speed gear.
63	Transmission countershaft first speed gear.
64	Transmission countershaft.
65	Transmission countershaft ball bearing housing.
66	Transmission countershaft rear bearing housing cover.
67	Transmission countershaft bearing lock nut.
68	Transmission reversing pinion.
69	Transmission drive shaft rear bearing housing cover.
70	Transmission drive shaft universal joint flange.
71	Transmission drive shaft nut.

Parts should be ordered by name only, not by number.



14 — Section of Rear Axle

MOVEMENT OF CHANGE SPEED LEVER

The gear shift is of the selective type with three speeds forward and one reverse which are obtained by different movements of a single change speed hand lever located at the left of the driver.

The actual operations in making gear shifts are described under "General Operation" on page 9.

In neutral position with no gears engaged the change speed lever is in the vertical position.

In first speed position the lever is inboard and at the rear of the slot.
In second speed position the lever is outboard and at the forward end of the slot.

In third speed, or direct drive position, the lever is outboard and at the rear end of the slot.

In reverse the lever is inboard and forward in the slot. In all positions the lever should be moved to the limit of its range where it is automatically held in position.

ACTION OF SPEED CHANGING GEARS

There are three forward speeds and one reverse.

A splined driving shaft contains two sliding gears, actuated by a single shifter lever. These gears engage with countershaft gears for first and second speeds, and a constant mesh idler gear for reverse. Third speed or direct drive is obtained by coupling the second speed gear to the end of the clutch shaft.

Plate No. 14 — Rear Axle Section

Reference Number	Name of Part
1	Rear axle dust washer retainer, outer.
2	Rear axle dust washer.
	Rear axle case cover stud.
	Rear axle dust washer retainer, inner.
5	Differential thrust bearing washer.
6	Differential thrust bearing.
7	Differential ball bearing.
8	Differential gear.
9	Differential pinion.
10	Differential pinion spider.
11	Differential driving gear.
12	Differential pinion bushing.
13	Differential casing bolt.
14	Differential casing.
15	Differential adjusting nut.
16	Differential adjusting nut set screw.
17	Differential carrier cap.
18	Rear axle case cover.
19	Rear axle case gasket.
20	Rear axle shaft, left.
21	Differential driving pinion bearing (small) lock nut.
22	Differential driving pinion bearing (small) washer.
23	Differential driving pinion bearing, small.
24	Differential driving pinion.
25	Differential driving pinion bearing (large) oil thrower, rear.
26	Differential driving pinion bearing sleeve.
27	Differential carrier cover gasket.
28	Differential driving pinion bearing sleeve lock.
29	Universal joint flange.
30	Differential driving pinion flange nut.
31	Foot brake drum.
32	Hand brake expanding ring retracting spring, front.
33	Wheel hub core, rear.
34	Rear axle shaft bearing retainer.
35	Rear axle shaft ball bearing.
36	Rear axle shaft bearing check nut, right.
37	Wheel hub cap, lock washer, rear.
38	Wheel hub cap, rear.
39	Rear axle shaft nut.
40	Rear axle hub key.
41	Rear axle shaft bearing dust washer.
42	Rear axle shaft bearing check nut lock screw.
43	Rear axle shaft bearing retainer lock plate screw.
44	Wheel hub core (rear) to spoke bolt.
45	Foot brake band steady bracket guide.
46	Wheel spoke to brake drum bolt.
47	Torque arm assembly.
48	Differential carrier cover.
49	Differential carrier cover dust washer.
50	Differential driving pinion bearing (large) oil thrower, front.
51	Differential driving pinion bearing, large.
52	Differential driving pinion bearing, large jam nut.
53	Rear axle torque arm rear end pin grease cup.
54	Differential carrier torque arm pin cap.
55	Rear axle torque arm rear end pin.
56	Rear axle torque arm rear end bushing.
57	Rear axle torque arm rear end pin dowel.
58	Rear axle case to differential carrier stud nut.
59	Differential carrier.

Parts should be ordered by name only, not by number.

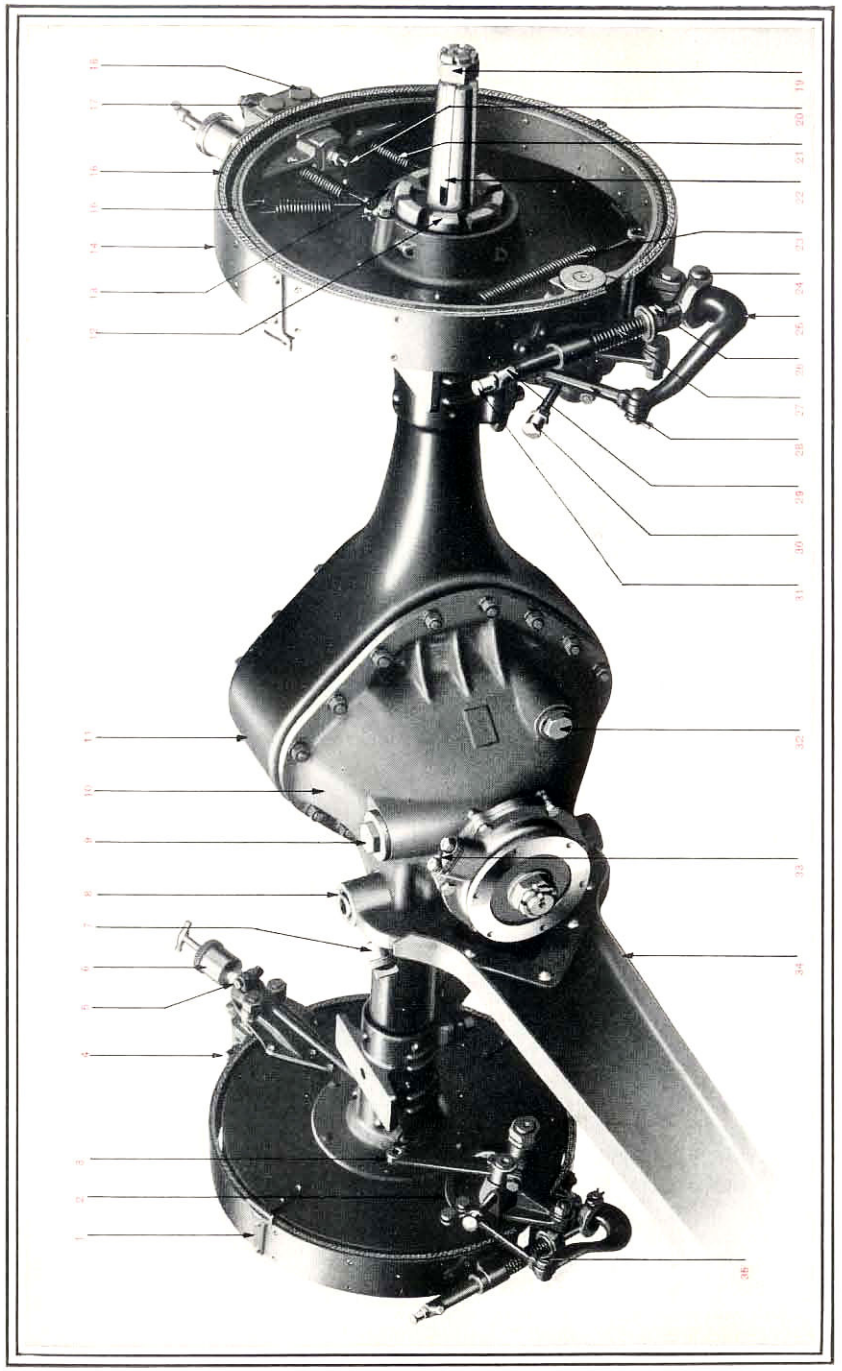


Plate No. 15 — Rear Axle and Brake Construction

The plan view of the transmission on page 46 shows the gears in the neutral position.

In this position, with the motor running and the clutch engaged, all gears are in motion with the exception of the direct drive first and second speed gears which are fitted by means of sliding ways to the main transmission driving shaft. The forward end of this shaft is mounted in a roller bearing located on the inside of the clutch shaft gear, hence, no torque is transmitted to the driving shaft unless one of the driving shaft gears is in mesh.

First speed is obtained by sliding the larger or first speed and reverse gear forward into mesh with the first speed countershaft gear. This permits the car to be driven forward at the lowest transmission gear ratio, through the constant mesh gears, at the front end of the case, countershaft and first speed gears.

Second speed is obtained by sliding the smaller or second speed and direct drive gear back into mesh with the second speed countershaft gear. Third speed or direct drive is obtained by sliding the smaller driving shaft gear forward until the internal teeth in this gear engage with the outer ends of the teeth on the clutch shaft gear, thereby locking both shafts together for direct drive.

For reversing the drive the larger transmission driving shaft gear is brought back into mesh with the reverse idler pinion, which is in constant mesh with the small gear at the rear end of the countershaft. The drive is then through the constant mesh gears at the forward end of the transmission case, countershaft and the reverse idler pinion which is in mesh with both the countershaft and driving shaft gears. This arrangement causes the main driving shaft to be revolved in the reverse direction.

While it is possible to shift from any one gear to another without going through an intermediate gear, it is necessary in each case to bring the shifter lever through the neutral position. This brings the sliding gears out of engagement and in making the next shift the gear that is not to be used is automatically locked in the neutral position.

Plate No. 15 — Rear Axle and Brake Construction

Reference Number	Name of Part
1	Foot brake band steady bracket guide.
2	Foot brake operating lever, left.
3	Hand brake cam lever.
4	Foot brake band guide block oiler.
5	Rear axle shaft bearing sleeve grease cup clamp bolt.
6	Rear axle shaft bearing sleeve grease cup.
7	Rear axle torque arm rear end pin grease cup.
8	Rear axle torque arm rear end pin.
9	Differential carrier oil hole plug, large.
10	Differential carrier.
11	Rear axle case assembly.
12	Rear axle shaft bearing retainer.
13	Rear axle shaft bearing retainer lock plate.
14	Foot brake band, right, and guide assembly.
15	Hand brake expanding ring facing.
16	Foot brake band lining.
17	Foot brake band guide block.
18	Foot brake band guide block stud.
19	Rear axle shaft nut.
20	Hand brake expanding ring adjusting screw.
21	Hand brake expanding ring retracting spring, rear.
22	Rear axle hub key.
23	Hand brake expanding ring retracting spring, front.
24	Foot brake band adjusting clevis pin and foot brake band lever clevis pin.
25	Foot brake band lever, right.
26	Foot brake band adjusting clevis guide.
27	Foot brake band adjusting spring.
28	Foot brake link.
29	Foot brake band adjusting handle.
30	Hand brake cam bracket oiler.
31	Foot brake band adjusting handle oiler.
32	Differential carrier oil hole plug, small.
33	Differential driving pinion sleeve lock.
34	Torque arm assembly.
35	Foot brake link pin.

Parts should be ordered by name only, not by number

REAR AXLE

The differential is mounted in ball bearings supported in the differential carrier which is bolted to the front end of the rear axle case. The axle shafts are mounted in ball bearings at the outer ends of the case, and are fitted to the differential gears at the inner ends by means of hexagonal prisms. The rear wheels are keyed directly to the axle shafts.

The differential bevel gears are properly adjusted at the factory and should require no further attention other than to receive proper lubrication as outlined on page 11. If for any reason the differential has been disassembled, readjustment of the gears should be made by a Packard dealer's mechanical department.

CLEANING TRANSMISSION AND REAR AXLE

It is a good plan to drain the oil from the transmission and differential after about every 5,000 miles of running and to flush out the cases with kerosene. The cases should then be refilled to the proper level with fresh oil.

The transmission case oil level plug is on the left-hand side just forward of the air pump.

The rear axle case oil level plug is located in the front end cover to the left of the drive shaft.

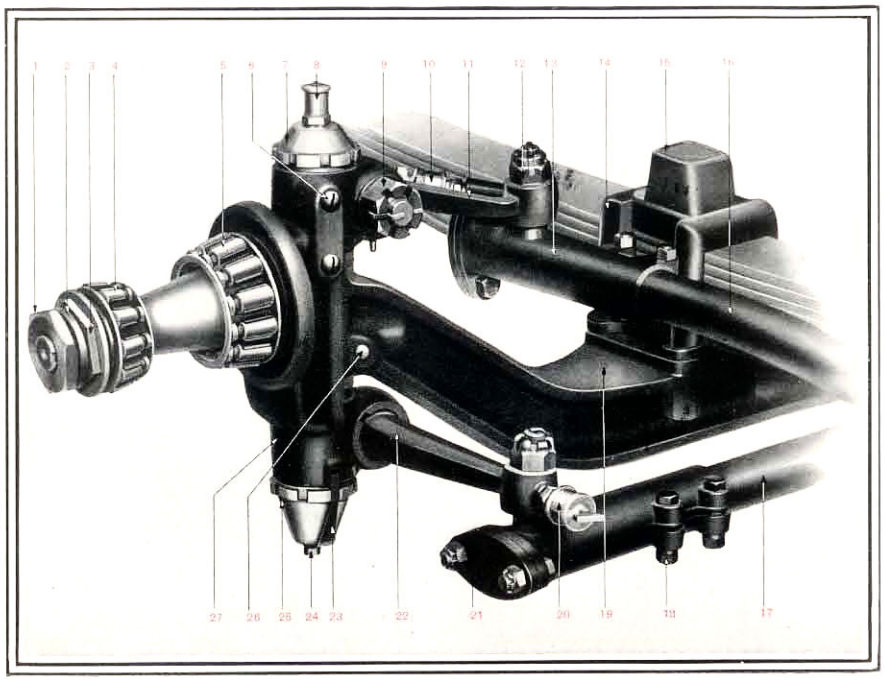


Plate No. 16 — Front Axle Parts

RUNNING GEAR FEATURES

STEERING

Do not turn the front wheels through the steering connections while the car is not in motion.

THE STEERING GEAR

The steering gear is of worm and nut type.

Keep the steering mechanism properly lubricated and further attention will be required only at extremely long intervals.

Adjustments for wear should be made in a Packard dealer's mechanical department.

STEERING CONNECTIONS

All exterior steering connections should be frequently inspected and properly lubricated. All bolts should be kept tight.

See "Schedule of Lubrication" on page 10.

FRONT WHEEL ALIGNMENT

The front wheels should have a toe-in of ⅛ inch; the measurements to be taken between the felloe bands at the front and rear of the wheels on a horizontal plane with the steering knuckle spindle.

Adjustments can be made by disconnecting the steering cross tube at the left steering knuckle lever, loosening the ball casing clamp bolts and setting the clamp to give the proper adjustment. Lengthening the cross rod increases the amount of toe-in.

FRONT WHEEL BEARINGS

The front wheels are mounted on tapered roller bearings which fit into tapered seats in the wheel hub core.

In replacing a front wheel, the steering knuckle adjusting nut should be tightened until it is difficult to turn the wheel by hand. The nut should then be backed off, not less than the full spacing between adjacent holes, nor more than twice this distance. Great care must be taken not to get the wheel too loose.

Plate No. 16 — Front Axle Parts

Reference Number	Name of Part
1	Steering knuckle adjusting lock nut, left.
2	Steering knuckle adjusting lock washer.
3	Steering knuckle adjusting nut, left.
4	Steering knuckle bearing, outboard.
5	Steering knuckle bearing, inboard.
6	Steering knuckle speedometer brass filler screw.
7	Steering knuckle cap, upper.
8	Steering knuckle cap, oiler.
9	Steering knuckle lever nut.
10	Steering knuckle lever grease cup.
11	Steering knuckle lever, upper, left.
12	Steering knuckle ball joint nut.
13	Steering connecting rod ball socket casing.
14	Front axle spring clip.
15	Front axle spring rubber bumper.
16	Steering connecting rod assembly.
17	Steering cross tube assembly.
18	Steering cross tube ball casing clamp bolt
19	Front axle.
20	Steering knuckle lever grease cup.
21	Steering cross tube ball casing end plate.
22	Steering knuckle lever, lower, left.
23	Steering knuckle cap, lower, lock.
24	Steering knuckle cap, lower, stud nut.
25	Steering knuckle cap, lower.
26	Steering knuckle stop screw.
27	Steering knuckle, left.

Parts should be ordered by name only, not by number.

UNIVERSAL JOINTS

There are two universal joints on the driving shaft, between the transmission and rear axle.

These are surrounded by metal casings and packed in grease.

When necessary, additional grease may be added by removing the oil-hole plug in the inner casing and injecting new grease with a squirt gun. This casing should be kept about two-thirds full of grease.

FOOT AND HAND BRAKES

There is an external contracting brake and an internal expanding brake on each wheel. The external or service brakes are operated by the right pedal. The internal or emergency brakes are operated by the hand lever.

Both external and internal brake bands are faced with a wire woven asbestos fabric which contacts with the rear wheel brake drums.

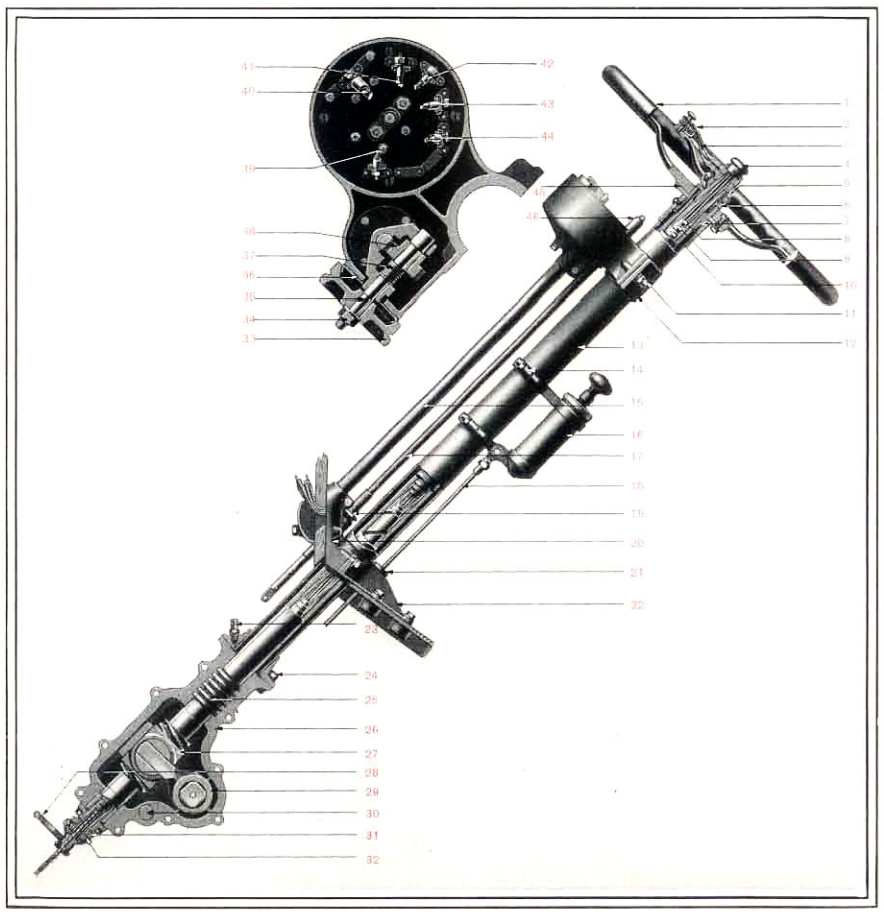


Plate No. 17 — Steering Gear Parts

FOOT BRAKE ADJUSTMENT

Foot brake connecting rod from rocker lever on front channel to cross shaft on rear channel should ordinarily be in the middle hole on the front rocker lever. To adjust the foot brakes properly, make the clearance between the band and the drum equal all around and $\frac{1}{32}$ inch. In making this adjustment, proceed as follows:

1. Adjust the nut at the rear support until the clearance between the drum and the brake band is $\frac{1}{32}$ inch at this point.

2. Adjust the two nuts on the shank of the clevis just below the eye bolt at the front of the brakes until the distance between the lower half of the brake band and the drum is $\frac{1}{32}$ inch.

3. Adjust the T handle which operates the adjusting screw until there is a clearance of $\frac{1}{32}$ inch between the upper half of the brake band and the drum.

These adjustments give the greatest braking efficiency as they result in the use of the full braking surface.

HAND BRAKE ADJUSTMENT

The hand brakes should be evenly adjusted, so that when applied there is the same resistance on each rear wheel.

Adjustment for wear should be made at the forward ends of the rods connecting with the cam levers.

By removing the rear wheel the hand brake band can be set concentric with the brake drum by means of the adjusting set screw at the rear.

Keep these brakes as tight as it is possible for them to be without dragging.

Plate No. 17 — Steering Gear Parts

Reference Number	Name of Part
1	Steering wheel assembly.
2	Steering post spark control sector lever and shaft assembly.
3	Steering post throttling sector lever and shaft assembly.
4	Steering post electric signal button.
5	Steering post spark and throttling sector spider.
6	Steering post upper end nut.
7	Steering wheel spider hub bushing.
8	Steering post spark control shaft.
9	Steering post throttling shaft.
10	Steering post spark and throttling sector anchor tube.
11	Switchboard cap stud nut.
12	Switchboard cap.
13	Steering pillar tube.
14	Gasoline hand pressure pump bracket cap.
15	Switchboard cable conduit.
16	Gasoline hand pressure pump assembly.
17	Switchboard carburetor air control rod assembly.
18	Gasoline hand pressure pump tube assembly.
19	Steering post carburetor air control rod gland.
20	Steering post bracket, dash half.
21	Gasoline hand pressure pump tube bushing.
22	Steering post bracket, toe board half.
23	Steering pillar tube flange oiler.
24	Steering pillar tube flange to gear case stud.
25	Steering worm.
26	Steering gear case, right.
27	Steering worm nut.
28	Steering post spark control lever and shaft assembly.
29	Steering yoke.
30	Steering gear case to frame bracket bolt.
31	Steering post throttling gear, small.
32	Steering post spark control gear, small.
33	Switchboard carburetor air control hand wheel.
34	Switchboard carburetor air control hand wheel shaft nut.
35	Switchboard carburetor air control hand wheel shaft.
36	Switchboard carburetor air control hand wheel friction washer.
37	Switchboard carburetor air control hand wheel spring.
38	Switchboard carburetor air control rack gear.
39	Switchboard side lamp switch to fuse cable.
40	Switchboard headlight, auxiliary, switch to fuse cable.
41	Switchboard headlight switch to fuse cable.
42	Switchboard tail lamp switch to fuse cable.
43	Switchboard ignition switch to ignition terminal cable.
44	Switchboard common terminal to dash wiring moulding binding post No. 1 cable.
45	Steering wheel spider hub.
46	Switchboard carburetor air control rack guide.

Parts should be ordered by name only, not by number.

USING THE BRAKES

Apply the brakes gradually.

When stopping the car, or slowing it for rounding corners, reduce the speed as much as possible by closing the throttle; disengage the clutch and then apply the brakes. Do not unnecessarily apply the brakes harshly upon a swiftly moving car.

If the brakes are in good condition, and properly adjusted, either the foot or the hand brakes are sufficient to slide the wheels.

When descending very steep hills, assist the brakes by shifting the gears into second speed, engaging the clutch, closing the throttle and allowing the motor to run with the spark advanced.

If it becomes necessary to use the brakes in descending a hill, the foot and hand brakes should be applied alternately.

INFLATING TIRES

A motor driven tire pump is attached to the left side of the transmission housing and is driven from the transmission reverse idler pinion. When the pump is in operation the motor should be run at a speed of about 300 R. P. M., which is equivalent to a car speed of approximately 7 miles per hour.

To inflate tires, attach hose connection at left running board splasher and with the motor running slowly, pull out lever button to mesh the tire pump gear. Inflate the tires to the following pressures.

Front Tires (All models) 65 pounds.
Rear Tires (All models except Coupe and Runabout) 80 pounds.
Rear Tires (Coupe and Runabout) 70 pounds.

EQUALIZING TRACTION

Tires of the same diameter should always be used on the rear wheels; also tire chains and special treads should always be used in pairs.

Any variation in the diameter of the rear tires or in the traction of the wheels causes the differential to work whenever the car is in motion. The result is considerable loss of power and unnecessary wear of the differential parts.

SPRING CLIPS

Keep the spring clips tight.

Spring breakage is frequently due to the spring clips being loose and not holding the spring firmly to its seat. The spring clips will require taking up more frequently when new than after the vehicle has been in service for a few hundred miles.

CONTENTS OF INDEX

PARTS ILLUSTRATED

OPERATION AND CARE

THE CORDAY & GROSS COMPANY, CLEVELAND