OWNER'S INFORMATION

1936

PACKARD 120

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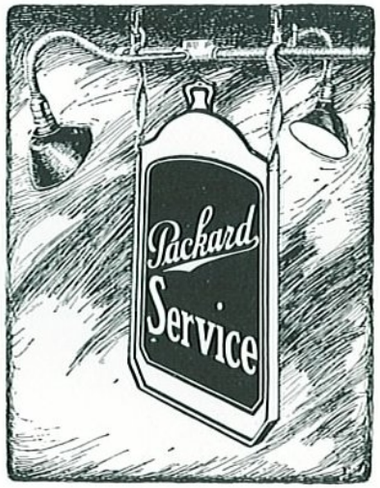
2ND EDITION 12-35 120-B



"A Friendly Service"

PACKARD WARRANTY

Packard Motor Car Company has warranted that for a period of ninety days from the date of original delivery to the purchaser of each new Packard car or before such car has been driven 4,000 miles, whichever event shall first occur, it will replace, free of charge, any part or parts thereof, including all equipment or trade accessories, except tires, supplied by it as standard equipment, claimed within that period to be defective and found by the Company upon examination to be so, provided such part or parts are returned to the Company within that period for credit or replacement. Such free replacement does not include transportation charges to or from the Packard factory.

NUMBER INFORMATION

Motor Number

Stamped on upper left hand corner of cylinder block.

Vehicle Number

Stamped on plate attached to front of dash.

Body Serial Number

Embossed in left front face of dash.

The motor number is the principal identifying number and should always be used when ordering parts.

The vehicle number is stamped on the plate before the car leaves the factory, but the delivery date, the name of the distributer or dealer making the delivery, and the city are stamped on the plate at the time of delivery to customer.

The delivery date is of particular importance because it establishes the age of the car for insurance purposes. **Be sure that the delivery date is stamped on your car.**

The body serial number is a thief-proof identification which is difficult, if not actually impossible, to alter or remove without leaving evidence of the change. This is used as final reference where the other numbers have been altered. This is an additional protective measure.

LOCK YOUR CAR

Locking is part of parking. Lock whenever you park. The greater the number of cars stolen the higher the insurance rate you pay.

Make a record of the key numbers.

SERVICE TO PACKARD OWNERS

by Distributers and Dealers

It is intended that every owner of a Packard motor car shall receive fair and satisfactory treatment. Should any owner not receive it, we will appreciate being advised.

The original purchaser of a new Packard car will be entitled to the following services:

1. Parts and Labor: For 90 days after the original delivery of such motor car to the owner, provided the car has not been driven to exceed 4,000 miles, any parts, including all standard equipment, except tires, that may be adjudged by Packard Motor Car Company to be defective under its warranty will be replaced or repaired by any Packard dealer or distributer in the United States and Canada without charge to the owner for material or labor.

2. Adjustment: The owner is entitled during this period to receive three inspections and necessary adjustments of his new car, at the Service Station of the Dealer selling the car, provided such adjustments are not made necessary by accident, neglect or misuse.

3. Inspections: Throughout the life of the car the owner is entitled to have it tested and inspected without charge every 30 days or 1,000 miles by an authorized Packard Service Station, provided such inspection requires no removal or dismantling of parts or units.

4. Owner's Service Card: At the time of delivery the owner is provided with an Owner's Service Card which will introduce him to any authorized Packard Service Station and entitle him to receive service in accordance with this policy. The owner should carry the card with him at all times so he can present it when necessary.

5. Tourist Privileges: When touring, the owner is entitled, upon presentation of the Owner's Service Card, to all of the benefits of this policy during the warranty period at any authorized Packard Service Station in the United States and Canada, provided the date of delivery and name of the dealer from whom the car was purchased are stamped on the plate provided for that purpose on the front face of the dash.

6. Change of Residence: In case the owner changes his residence from one location to another before the warranty period has expired, the Packard Service Station serving the locality into which the owner moves will, upon presentation of the Owner's Service Card, render any no-charge service to which the owner may be entitled.

7. Service Charges: Every authorized Packard Service Station is provided with a Manual containing the correct charges for service work. In order that maintenance costs may be kept as low as possible, these rates are based on careful studies of the shortest times for doing the service operations consistent with proper workmanship. Guaranteed Packard Parts are sold through authorized Packard Service Stations in the United States at the published list.

LICENSE DATA

Number of cylinders 8
Cylinder bore . . . . . 3¼ Stroke 4¼
Horsepower A. M. A. Rating 33.8
Piston displacement . . . . . 282.04 cu. in.

SHIPPING WEIGHTS

Coupe—5 passenger . . . . . 3450 lbs.
Sedan—5 passenger . . . . . 3535 lbs.
Coupe—2-4 passenger . . . . . 3435 lbs.
Coupe—2 passenger . . . . . 3360 lbs.
Touring Sedan—5 passenger . . . . . 3600 lbs.
Convertible Coupe . . . . . 3400 lbs.
Club Sedan—5 passenger . . . . . 3455 lbs.

If weight of car ready for the road is desired, add 185 lbs. to cover gas, water and spare tire.

Wheelbase . . . . . 120″ Road clearance 8¼
Tire size . . . . . 16 x 700

ORDERING PARTS

It is advisable to make all parts replacements with Precision Built Packard Parts which may be procured from authorized Packard distributers and dealers.

When ordering specify: Shipping directions.

Motor number. Vehicle number.

Complete description. Color, if part is painted.

All quotations are subject to change without notice.

All parts should be ordered from the nearest Packard distributer or dealer. Orders sent direct to the factory will be shipped C. O. D., F. O. B. shipping point unless accompanied by cash. Our responsibility ceases when goods are delivered in good condition to the transportation companies.

STARTING THE ENGINE

The carburetor is equipped with an automatic choke control which provides easy starting even in the coldest weather provided the engine oil recommendations contained in Owner's Information Book are adhered to.

1. **Turn on ignition switch.**
2. **Depress clutch pedal fully. This relieves the starter motor of the effort necessary to turn the gears in the transmission.**
3. **Press starter button located at top center of instrument panel.**

NOTE: In cold starting, should **excessive choking** result from failure to turn on the ignition—or from any other cause—hold the accelerator pedal in the fully depressed or wide open position until the engine starts. Do not allow engine to race.

When hot, engines with down-draft carburetion start more readily with throttle fully opened. **Hold** accelerator in wide open position until engine starts. **Do not** pump accelerator.

The automatic choke control eliminates the need of a hand operated choke. It is positive in its action and automatically controls the amount of choking that is necessary to keep the motor running smoothly until an efficient operating temperature has been reached.

BREAKING IN THE CAR

The manner in which any new car is driven for
THE FIRST 250 MILES
actually has a pronounced effect upon its subsequent operation. This applies to brakes and gears as well as to engines.

All friction surfaces will burnish themselves to that high polish so essential to durability, quietness and smoothness if not too highly stressed or loaded during the break-in period.

The best procedure is to refrain from even momentary full power operation. Unless emergency demands it, do not fully depress accelerator pedal for acceleration or hill climbing and limit speed to 50 miles per hour until at least 250 miles have been covered. Observance of this suggestion will pay big dividends in ultimate satisfaction.

Instruments and Controls

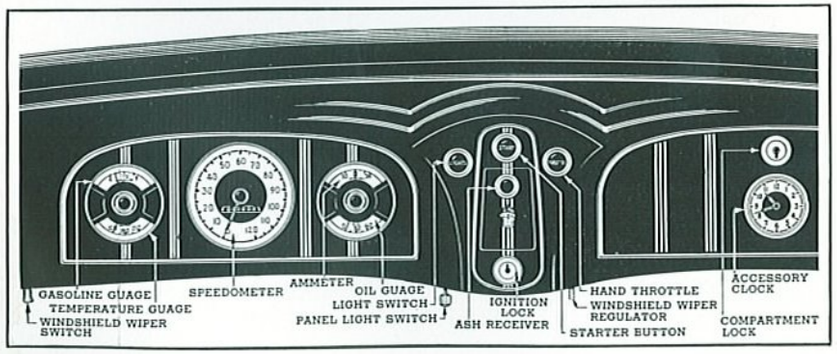
Ventilation is provided by means of a cowl ventilator and ventilating front door windows. The forward glass panel of the front door is pivoted at the top and bottom and by means of a convenient crank it can be swung outwardly to any desired position.

The throttle button is located at the right of the center panel. Pulling it out opens the throttle so as to maintain any desired motor speed on the road without holding down accelerator pedal.

The starter button is located at the upper center of the center panel. Pressing the button closes the main starter switch fastened on the top of the starter motor. This main switch will open when the button is released.

The foot accelerator is a rectangular rubber covered steel stamping pivoted on the toeboard with the proper spring tension to give an easy and restful driving position. Depressing this pedal opens the throttle valve in the carburetor. This pedal also operates the accelerator pump which is incorporated in the carburetor assembly. If necessary, two or three downward strokes of the pedal will supply an extra amount of fuel for cold weather starting. Do not use accelerator pump if motor is hot as this will tend to flood the engine and make starting difficult.

The light switch is located on the left side of the center panel and is of the push and pull type. With the button pulled out to the first notch, parking and tail lights are turned on. Pulling the switch out another notch turns on the city beam for driving on lighted highways. Pulling switch all the way out turns on either the country driving beam or the passing beam, depending upon the position of the foot dimmer switch. Separate bulbs controlled by a rheostat switch illuminate the instrument dials. The ignition lock, front compartment and glove compartment are illuminated by a bulb connected to the parking light terminal on the lighting switch.



Front Compartment

The fuel gauge is an electrical indicator and is combined with a temperature gauge in one unit at the left end of the left hand instrument panel.

The ammeter is combined with the oil pressure gauge in one unit at the right of the left hand instrument board panel.

The speedometer, a 120 mile unit is located between the two combination units mentioned.

The ash tray is located in the center panel and swings out from the top.

The package compartment is at the right of the instrument board and the door is equipped with a lock and key.

The gear shift lever permits the selection of the gear reduction desired. The conventional "H" type of shift is used with speed synchronizers between second and high speed.

The clutch pedal provides a convenient means for the control of the clutch engagement. Do not ride this pedal.

The brake pedal is attached to the hydraulic brake master cylinder and controls all four wheel brakes.

The hand brake or parking brake is attached by a mechanical hookup to the two rear sets of brake shoes and is primarily designed to hold the car after it has been stopped and not as a decelerating means.

The windshield wiper control is located at the left end of the lower flange of the instrument board. The speed regulator valve is located just below the ignition switch.

The rear view mirror is conveniently located and adjustable through a friction type ball and socket joint to any desired angle.

An ignition lock is provided in the switch in the center panel. Always lock your car when not in use.

Keys

The keys which unlock the instrument board compartment also unlock all other baggage compartments, such as the luggage and wheel compartment on the Standard Sedan, and the trunk and tire compartment on the Club and Touring Sedan.

The other set of keys unlocks the ignition and the car door. It also unlocks the side wheel carrier locks on the DeLuxe equipped cars.

The lock number is stamped on each key and is omitted from the lock in order to protect the car against theft. **A record of the key number should be made by the owner** so that in case both keys are lost a duplicate may be obtained from a Packard service station.

Front Seat Adjustment

The front seat is on slide rails and may be adjusted forward or backward to any desired position.

The seat is operated by pulling up a button located at the left side which unlatches the locking device in each rail and permits the seat to be moved to the desired position. The seat is locked in place by releasing the button.

General Lubrication

The subject of lubrication of the complete automobile should be given careful attention. It is important that the lubrication schedule be followed out and that the proper lubricant be used if the car is to give quiet and efficient performance. The use of high grade lubricants will prolong the life of the wearing parts and prove most economical in the long run.

It is now common practice of oil companies to grade their oil by the S. A. E. specifications, instead of the old method of designation as light, medium or heavy. The application of the S. A. E. viscosity number to a lubricant is intended only to indicate the body or fluidity of the oil and has no bearing on the quality of the product. Only high quality oils furnished by reputable companies should be used in the crankcase and for accuracy they should be ordered by S. A. E. numbers.

A low viscosity oil is recommended for use during the Fall, Winter, and Spring months as the light oil insures easy starting and also insures a flow of oil to the bearings in a minimum of time when starting in cold weather. Too heavy an oil will prevent starting; whereas, too thin an oil will only cause slightly higher oil consumption. A thin oil will not cause more rapid wear than will a heavy oil.

Choose your oil from the following table at all times so that it will be in accordance with the lowest temperature expected to be encountered:

Below minus 10°F.	10-W plus 10% kerosene
Minus 10°F. to plus 45°F.	SAE-10-W
Plus 10°F. to plus 85°F.	SAE-20-W
25°F. to plus 85°F.	SAE-20-W or 20
40°F. and over	SAE-30
90°F. and over	SAE-40

Motor Oil Circulation System

A supply of oil is carried in the crankcase reservoir and forced under pressure to all main, connecting rod and camshaft bearings, and through rifle-drilled holes in the connecting rods to the piston pin bushings. A metered hole in the top side of the crankpin end of the connecting rod also provides a passage for the lubricant to spray the cylinder walls, pistons, distributor driving gear and valve tappets. A generous size basket type screen at the pump intake serves to filter out dirt and foreign substances that would tend to injure the bearings. The amount of oil circulated is proportional to engine speeds and increases as the demand arises and insures proper lubrication at all operating speeds.

The oil pump incorporating the relief valve is located outside the motor and is easily accessible for repairs. The normal oil pressure is 35 pounds at 30 miles per hour car speed. If for any reason the gauge does not register at least 20 pounds at this speed, check should be made of the gauge, line, screen and oil pressure relief valve spring. The relief valve spring should support a load of six pounds when compressed to 2″ if in normal condition. Failure of the gauge to show pressure after the motor has been running a few minutes is an indication of a lack of oil, a clogged oil line, defective regulator valve, or a defective pump.

NOTE—The oil pump strainer screen should be cleaned at least once a year.

Water Pump Shaft

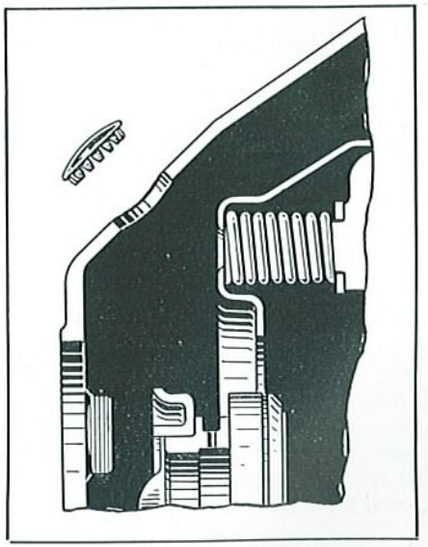
The water pump shaft bearings are lubricated with 30 S. A. E. or 20-W S. A. E. engine oil, depending upon air temperatures. The front oiler which is connected to a ring type reservoir is reached through a hole in the belt pulley. When reservoir is full the excess oil will run out through a vent near the top of the boss. The oiler at the rear bearing is at the top of a small standpipe and should be filled full.

Clutch Shifter Thrust Bearing

The clutch shifter thrust bearing is packed with lubricant and sealed and should not require additional attention. In an emergency, however, the bearing can be lubricated by removing the snap button in the metal toeboard and another just below it in the flywheel housing. A long nozzle oil can inserted through these bodies will reach the well in the bearing housing. A teaspoonful of oil is sufficient for one oiling. Do not overoil this bearing. Use S. A. E. 30 for Summer and S. A. E. 20-W for Winter.

Clutch and Brake Pedals

The clutch and brake pedal bearings have wick oilers. These can be reached with a long nozzle can through holes in the floorboard.



Clutch Throwout Bearing Lubrication

Universal Joint Spline

The universal joint journals are packed with lubricant and do not require periodic lubrication. Lubricate spline with pressure gun.

Steering Gear

Use mineral oil in the steering gear—S. A. E.-160 for summer and S. A. E.-90 for winter.

Rear Axle

The oil level in the rear axle should be checked at every 2000-mile greasing operation to make certain oil level is up to filler opening. A special rear axle gear oil is necessary for hypoid gears and the use of alternate lubricants may ruin the gear set. Always change oil at the approach of cold weather. See Packard Dealer for approved lubricant.

Transmission

The oil level in the transmission should be checked at every 2000 mile greasing operation to make certain oil level is up to filler opening. At the approach of cold weather dilute with ¼ pint of kerosene or change to SAE-90. Change oil in spring. Use one quart of SAE-160.

Generator and Starter

A few drops of engine oil for every 2000 miles in the oilers of the generator and starting motor is sufficient. Do not over oil. Use SAE-30 for Summer and SAE-20-W for Winter temperatures.

Distributor

Give grease cup mounted on the distributor shaft one turn every 2000 miles and refill if necessary. Apply a small amount of vaseline to the breaker cam and a few drops of engine oil to the wick under the distributor arm.

LUBRICATION SCHEDULE

2000 Miles

Knuckle pins	Pressure gun grease	2 lubrication connections
Steering connecting rod	Pressure gun grease	2 lubrication connections
Steering tie rods	Pressure gun grease	4 lubrication connections
Rear spring shackles	Pressure gun grease	4 lubrication connections
Water pump shaft	SAE-30 or 20-W	2 oilers
Generator	SAE-30 or 20-W	2 oilers
Starter motor	SAE-30 or 20-W	2 oilers
Distributor	No. 3 cup grease	1 turn of cup
Clutch and brake pedal	SAE-30 or 20-W	Saturate wicks

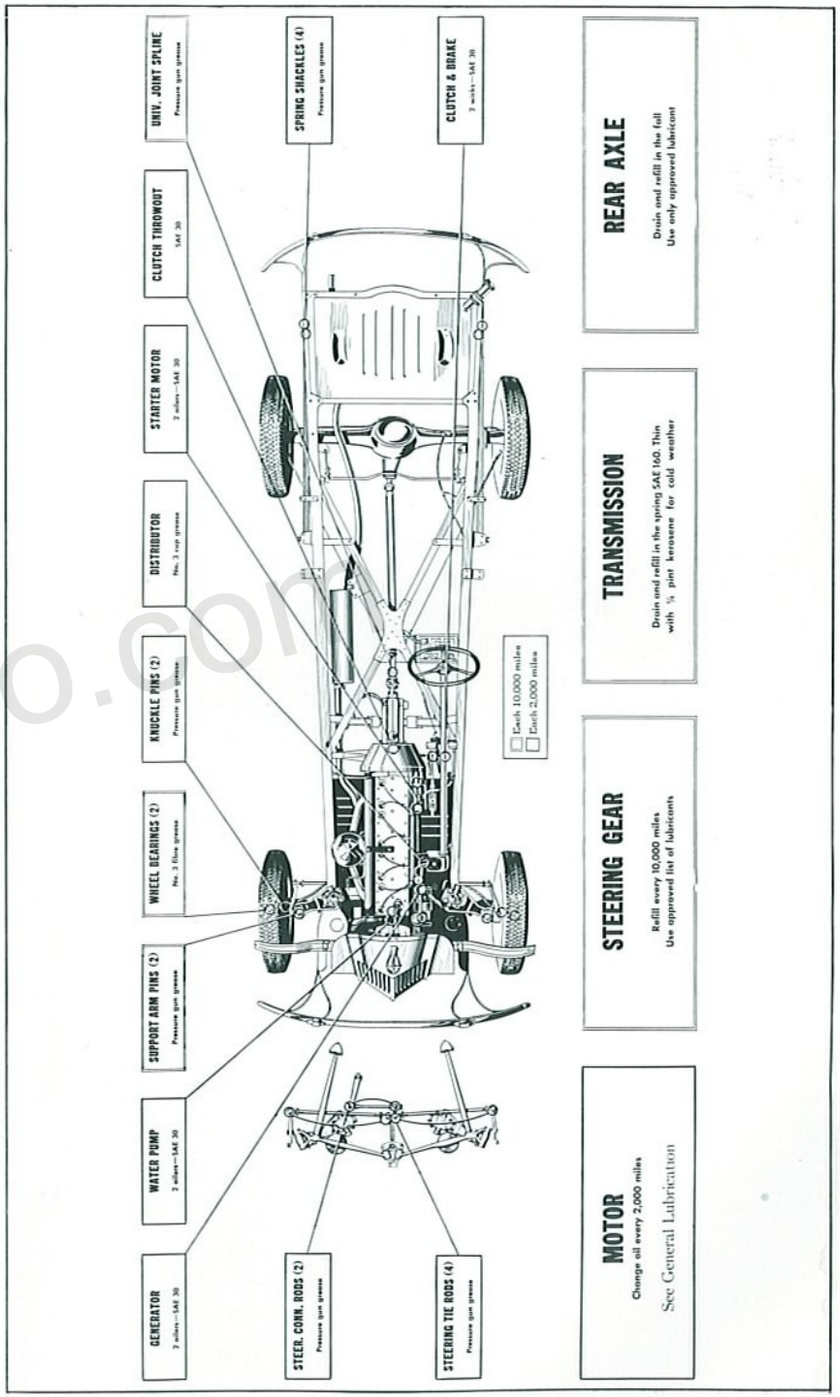
Add a few drops of light oil to the clevis pins, door hinges, dovetails and locks. Grease hood lacing and hinges as needed.

Crankcase—while it is desirable to make the first change at low mileage —after the first change it is not necessary at less than 2000-mile intervals.

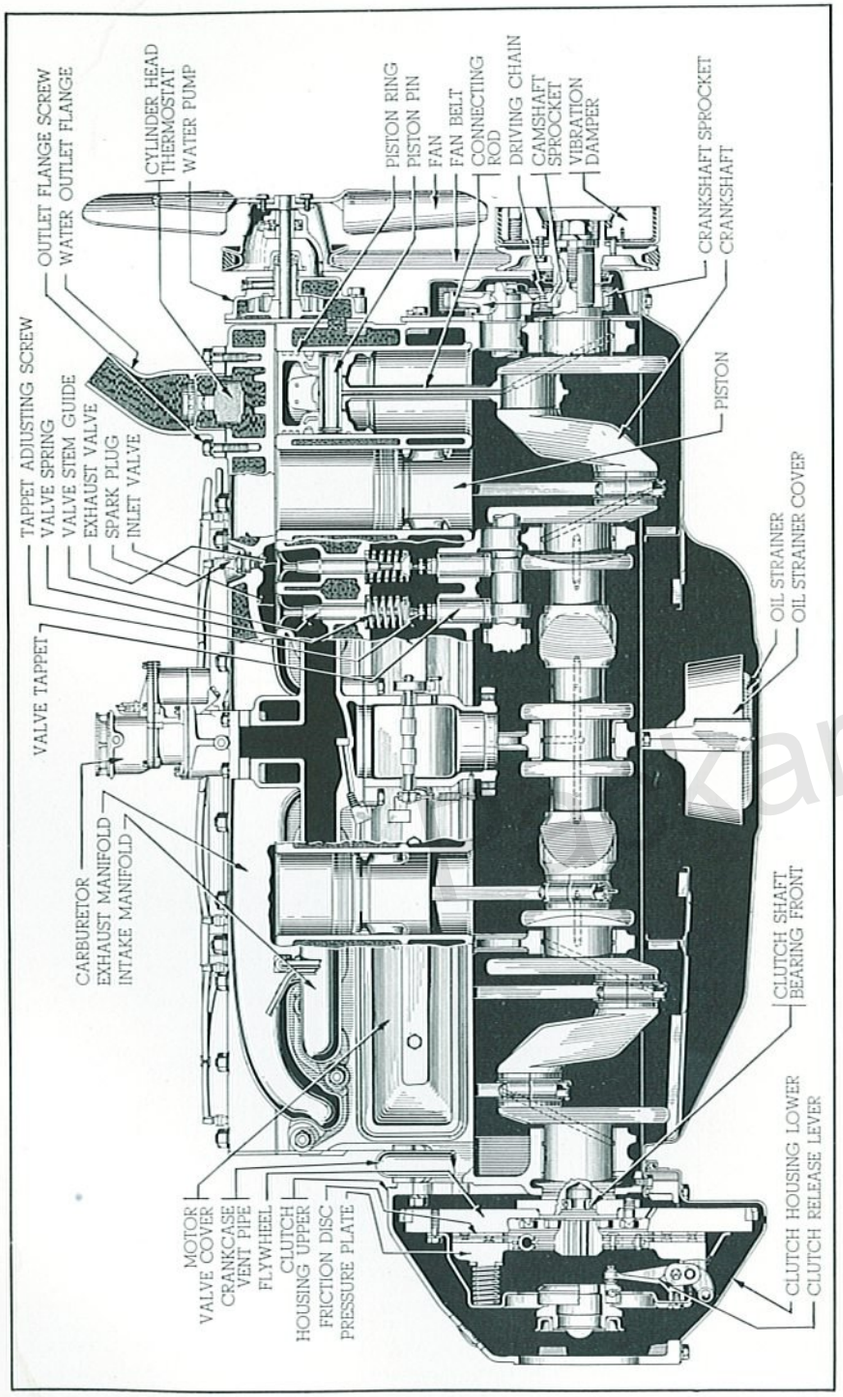
10,000 Miles

Support arm pin	Pressure gun grease	2 lubrication connections
Front wheel bearings	Fibre grease	Repack
Transmission	SAE-160—Summer Dilute with kerosene or use SAE-90 for Winter	Fill to level
Steering gear	SAE-160—Summer Dilute with 2 oz. of kerosene or refill with SAE-90 for Winter	Fill to level
Universal joint spline	Pressure gun grease	1 lubrication connection
Rear axle	See note	Drain and refill

Rear axle gears require a special lubricant, see Packard Dealer.



Lubrication Chart



Engine—Side Section

Engine

The Packard One Twenty engine is an unusually smooth operating Straight Eight unit. It was designed to include all of the desirable features of the L-head poppet valve construction. The cylinders and upper part of the crankcase are cast in a single unit from a high grade iron. An aluminum cylinder head is attached to the block by studs, and the oil pan of pressed steel is held to the lower flanges by cap screws.

The valves are actuated by barrel type adjustable, mushroom tappets that work directly in guides machined in the block. The camshaft driven by a silent chain from the crankshaft operates the fuel pump, the oil pump and the distributor.

The water pump, at the front of the engine, forces the water through a brass water manifold tube that delivers it directly to the exhaust valve seats. A thermostat at the water outlet controls the motor temperature and there is a by-pass that insures a uniform, fast warm up.

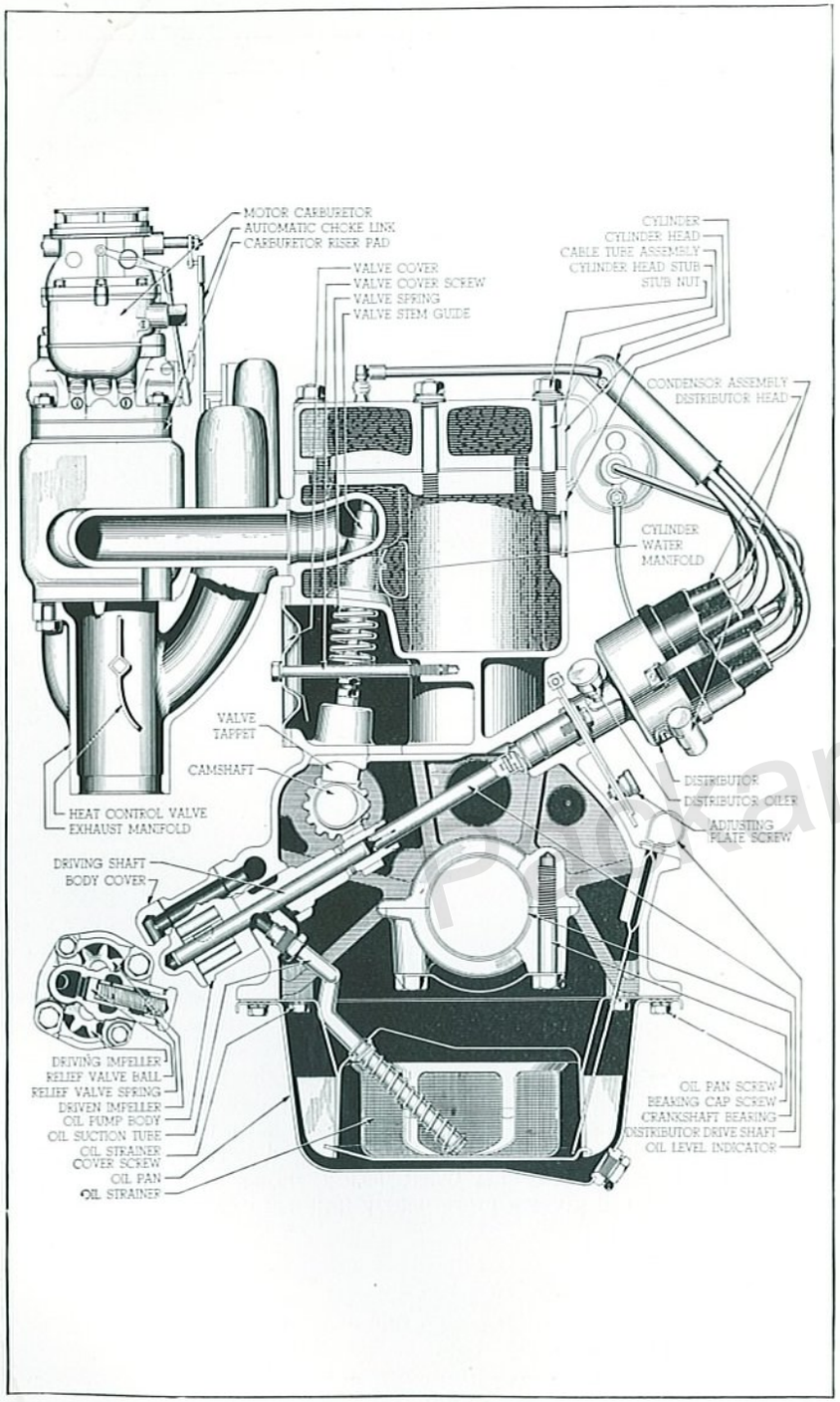
The oil pump forces oil under pressure to the crankshaft, connecting rod, wrist pin and camshaft bearings. An intermittent jet of oil is delivered to the chain drive. Metering holes in the rods supply oil to the cylinder walls and also produce a spray which lubricates the valve lifters.

Pistons and Rings

Light weight, long skirt, steel strut, aluminum alloy pistons are used in the engine. They are assembled so that the slot in the skirt is away from the camshaft and are fitted so they have a minimum clearance of .0015″ at the skirt. A .0015″ feeler ½″ wide and about 8″ long is used to fit each piston in its own bore. By inserting the feeler with the piston so that it is on the side opposite the slot a correctly fitted piston should require from 5-7 pounds pull to withdraw the feeler.

Piston pins are fitted to the pistons so they give a palm push fit when the piston has been heated to 160 degrees F. The connecting rod bushings are fitted so that the pin requires a thumb push to insert them at room temperature of 70 degrees F. These fits give the correct clearance necessary for a lubrication film at engine operating temperatures.

The pistons are fitted with three of the latest type rings. Two ⅛″ grooved compression rings are fitted above the $\frac{3}{16}$″ slotted oil ring. The compression rings should have a gap of .007 to .012″ while the oil ring may have a gap of .007 to .015″. In fitting rings the top compression rings should be fitted with a minimum side clearance of .002″ (by feelers) and the other two rings a minimum clearance of .0015″.



Engine, Front Section

Piston and connecting rod assemblies can only be removed from the top of the block. Never attempt to withdraw them from the crankcase as it can not be done. When replacing assemblies in the block make certain the connecting rod bleed holes are on the camshaft side and that the slots in the pistons are away from the camshaft side. Always clean and lubricate parts when reassembling so that they have lubrication until the oiling system starts to function when the engine is first started. Use only Genuine Packard Parts as they will match the parts already in the car and are tested products.

Bearings

The camshaft, crankshaft and connecting rod bearings are all of the precision, steel-backed, babbitt-lined type. They are non-adjustable and in event that they fail, for any cause, it is necessary to replace them with new ones.

The crankshaft is an exceptionally rigid, counterweighted forging, balanced both statically and dynamically. It is supported in the crank case by five precision bearings. They are assembled without selection and have from .001″ to .003″ clearance.

The connecting rods are fitted with this same type of bearing and are selected so as to give a clearance of .0005 to .0015″. Undersize bearings can be obtained for use when the shaft has worn to a measurable extent. Care should always be taken to see that the thrust faces are in line and the end clearance is .004 and .010″.

The camshaft is mounted in the crankcase in five non-adjustable precision bearings. Replacement of these bearings requires special tools and should only be attempted by a Packard service station equipped for the work.

CAUTION: Never remove stock from connecting rod bearings, caps or rods. There is no method by which these bearings can be adjusted, and because of their low cost they are cheaply replaced.

Valves

The valves used in this engine are made from the best heat resisting steels—Chrome nickel is used in the intake valve and austenitic chrome nickel in the exhaust valves. The valves operate in an iron guide that is pressed in the block and finished with a tapered bore with the small diameter at the bottom. This construction allows fitting the valves closely when cold and gives a more nearly uniform clearance with a hot engine.

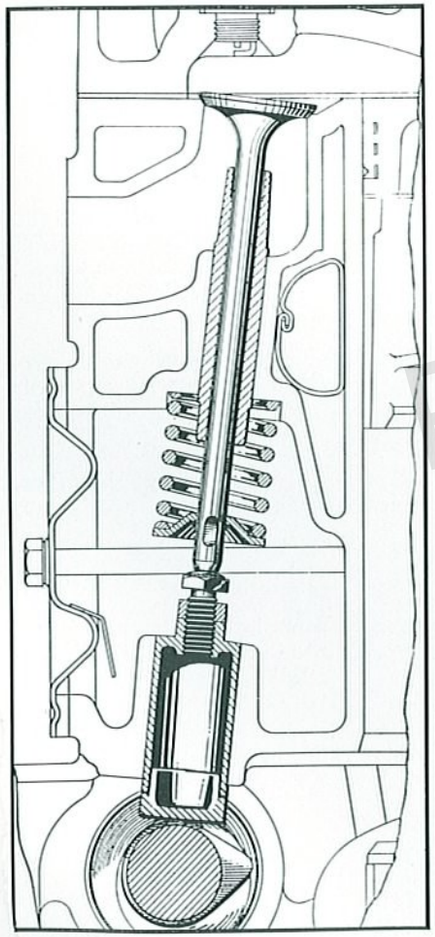
Valve Adjustment

The valve stem to tappet clearance should be .007″ for the intake and .010″ for the exhaust when the engine is hot. It is desirable to check the lash only after the engine has been run sufficiently long to normalize all parts and the work should be done with the engine idling.

A removable splasher has been fitted into the right front fender so that the valves can be more readily adjusted. To work on the motor it is necessary to raise the right front wheel support arm by some suitable safe means. Remove the wheel before attempting to work on the job. A special set of tappet wrenches should be used which has one extra thin wrench and can be purchased from the Packard Service Department. The thin wrench is used to hold the tappet from turning. The exhaust valves are the following: No. 1-4-5-8-9-12-13-16.

Valve Timing

For checking the timing it is first necessary to remove cylinder head. Then set the tappets to .006 clearance with the engine at room temperature. The engine should then be rotated in the direction of operation a short distance beyond the point where No. 1 cylinder exhaust valve has closed. Place an indicator on valve head and set it at zero. Rotate the engine in a reverse direction until the indicator reads about .010". Slowly rotate the engine in a clockwise direction until the indicator reads .006". (This operation of moving the engine in a clockwise direction is necessary to take up the lash in the system.) The pointer should now point between the second and third graduations past U. D. C. on No. 1 cylinder or 5° past upper dead center.

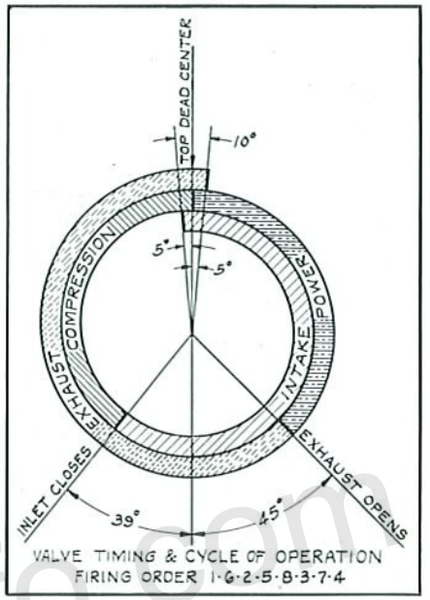


Valve Train Mechanism

After completing the timing check it is essential that the valves be reset to the correct clearance after warming the engine.

Timing Chain

The silent driving chain is of the latest type and drives only the cam-shaft sprocket. While it is non-adjustable, experience has shown that extremely long life may be expected. To remove the chain from the engine:



VALVE TIMING & CYCLE OF OPERATION
FIRING ORDER 1-6-2-5-8-3-7-4

1st. Remove the radiator and fender assembly in one unit.

2nd. Remove fan belt.

3rd. Place jack under engine in such a manner as to take load off front motor support.

4th. Remove motor support.

5th. Remove cap screw in center of vibration damper and pull damper off crankshaft.

6th. Remove timing gear case cover.

7th. Pull oil seal off crankshaft.

8th. Remove lock nut from camshaft.

9th. The chain and both sprockets can now be removed as a unit.

When installing the chain drive it is best to follow the outline given below so that everything will be correctly timed.

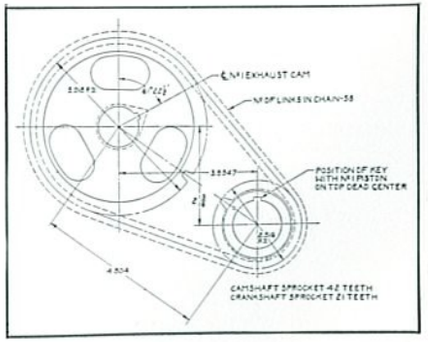
1st. Put No. 1 piston on top dead center.

2nd. Rotate camshaft until No. 1 exhaust valve is about closed.

3rd. Place the sprockets in the chain so that the timing marks are closest together and on a line between the center of the sprockets.

4th. Slide the chain and sprocket assembly on the shafts without allowing the sprockets to slip any teeth.

After assembling and before replacing the chain cover check the timing marks according to the figure in the book. If a service tool ST-5025 is available use it to make a positive check. Always make certain that the lock has been replaced and locked on the camshaft nut before finishing the job.



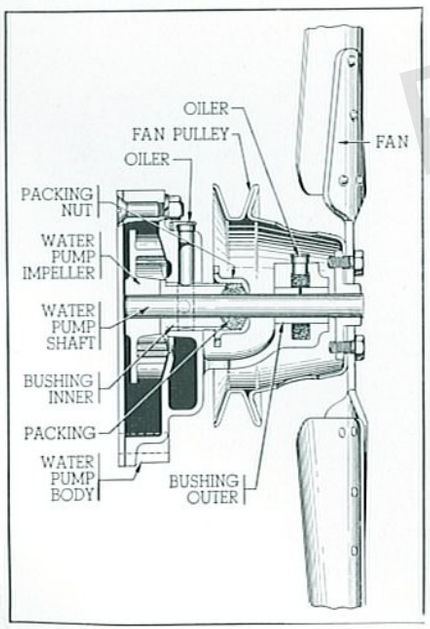
In removing the valve springs preparatory to grinding the valves it is advisable to use an adequate valve lifter so as to prevent damage to the springs. If the valve faces and seats are not in bad condition they may be touched up with compound. However, it is pre-

ferable to clean up the valve faces on a good grinder as the hard material used makes it difficult to grind any small irregularities out with compound. If the valve and seats show definite irregularities it is advisable to have a regular Packard Service Station reseat and reface the valves. They are equipped with the tools necessary for use with the tapered valve guides and utilize a special reseating grinder that produces a smooth accurate seat that is free of cutter marks. If desired the valves can be lapped in with fine compound for the final finish. After doing any work on the valves it is essential that all traces of dirt or compound are removed from the valves, guides or parts so that none can get into the moving parts. Always put some lubrication on the valve stems before assembling them in the block. When installing the valve keys in the stems take care to insert them with the short edge upward.

Oil Pump

The gear type oil pump is driven from the camshaft through a pair of spiral gears, and is attached to the outside of the right crankcase wall. This large capacity pump is fitted with a suction tube that has its intake located within a steel mesh screen at the deepest point in the oil pan. The screen is so designed that oil will be drawn over its edge should it become plugged with ice, etc.

The pump unit is bolted to the pump pad by two large cap screws that also assist in holding the cover in place. The relief valve is built into the cover and utilizes a piston type valve with a spring load. There is no provision for adjusting the valve spring and if damaged should be replaced with a new one. If necessary for checking, install a new spring and check the oil pressure with a gauge known to be accurate. This spring should support a load of six pounds when compressed to two inches. Caution: Whenever the oil pump is removed new gaskets should be installed after removing all traces of the old ones. If the oil pressure takes a decided drop and no other causes are apparent check the suction line and see that it is tight at the fitting in the case.



Water Pump

Water Pump

This compact high capacity, centrifugal type pump is driven, from the crankshaft by a large size Vee belt. It is attached to the cylinder block by four cap screws and is made in such a manner that it is entirely separate from the cylinder head. The pump outlet connects directly to the water manifold that is fitted in the block.

The impeller shaft is supported by the two special bronze bushings in such a manner that the load is divided between them. At the rear face of the rear bushing a large thrust bearing acts on the impeller hub to take the fan thrust. When the bushings are worn they can be pressed out and new ones put in. A special burnishing tool is needed for finishing the inside diameter of the bushings after they are in place. Caution: Never ream these bushings as the cutting destroys the bearing surface. When any pressure is applied in the process of rebushing, the pump body must be properly supported to avoid breaking the casting.

A screw driver or spanner wrench should be used to tighten the packing gland. Adjustments should only be made on hot engines at idling speed. Care should be taken not to over tighten as it is possible the shaft would overheat and score or overload the belt so it will wear unduly because of slippage. When the packing is worn so that the packing nut is at the end of its travel, back off the nut and install a service split type packing. It is not necessary to remove the old packing as the service part is designed to add to the old packing. This does not require disassembly of the pump.

Cooling System

The Packard motor is cooled by a circulation of water through the water jackets that surround the cylinders, combustion chambers and valve seats. A manifold inserted in the block between the cylinders and jacket wall on the valve side distributes water directly to the exhaust valve seats which equalizes cylinder temperatures and prevents hot spots and steam pockets.

The water temperature is automatically controlled by a thermostatic valve located in the water outlet of the cylinder head. This valve prevents the circulation of water through the radiator until the engine temperature has been raised to that point where maximum engine performance and economy are obtained. The thermostat starts to open at 150 degrees and should be fully opened at 170 degrees Fahrenheit. A drain plug is located in the radiator lower outlet casting and also at the rear of the cylinder block. Both of these should be opened to completely drain the system. The drain valve in the radiator outlet is of the compression type and requires approximately five turns of the tee handle to open it wide. It is not necessary to disturb the packing nut when opening or closing the valve.

Cleaning the Cooling System

The cooling system should be flushed out in the spring and fall to remove loose particles of rust and sediment that may have collected.

CAUTION: Never use caustic alkali radiator cleaners in this cooling system as they have a detrimental effect on the aluminum cylinder head.

Anti-Freeze Solutions

Anti-freeze solutions of ethylene glycol and water, or glycerine and water may be used. While alcohol solutions have a lower boiling point than water and are subject to evaporation, there is less tendency to spark knock. The hazard of injuring the car finish with alcohol is reduced by the location of the radiator filler under the bonnet. When alcohol solutions are used, eight ounces of soluble oil should be added as a rust inhibitor. The soluble oil is also beneficial to water pump packings. A good grade of soluble oil is obtainable from Packard Dealers. Ethylene glycol (Prestone) and glycerine (G. P. A.) contain soluble oil and therefore none need be added.

Trade marked anti-freezes are often sold mixed with water and rust inhibitors. When these are used follow directions on the cans, as above values do not hold.

It is advisable to shellac the inside of the hose connections when ethylene glycol or glycerine is used, as otherwise there may be a tendency to seep at the joints.

Either radiator glycerine (G. P. A.), ethylene glycol (Prestone) or alcohol should be used mixed with water in the following proportions by volume for the temperature expected:

Pure Methyl Alcohol	Denatured Alcohol	Ethylene Glycol	Radiator Glycerine	Freezing Point
13.0%	17.0%	16.0%	37.0%	20° F. Above zero
20.0	26.0	25.0	55.0	10° F. Above zero
27.0	34.0	33.0	70.0	Zero
32.0	40.0	39.0	81.0	10° F. Below zero
37.0	46.0	44.0	92.0	20° F. Below zero
40.0	53.0	48.0	100.0	30° F. Below zero

Important

Do not use a calcium chloride solution or an alkaline solution, or any anti-freeze which is compounded from the above materials, as these are injurious to the metal parts, will corrode the aluminum cylinder head, and are liable to clog the cooling system.

A 16″ four bladed fan is mounted on the water pump shaft and driven by a Vee belt at 1⅛ times crankshaft speed. The water pump itself has, in effect, a straddle mounted shaft running in special bronze bearings and lubricated by oil reservoirs containing engine oil.

To Adjust Fan Belt

Loosen two generator pivot bolts, also hinge bolt and lock bolt on the adjusting link. Hook a spring scale to the bolt passing through the generator lug and pull in line with the link until pointer registers 25 lbs. Tighten all four bolts and remove scale. In the absence of a spring loaded scale for determining belt tension, adjust generator so as to provide one-half inch of slack in fan belt between generator and water pump pulleys.

Exhaust System

The exhaust system consists of an exhaust pipe 2¼″ in diameter, an improved design muffler unit and a 1¾″ diameter tail pipe assembled together.

This assembly is flexibly mounted so that the whole system oscillates with the motor which is supported in rubber. Due to the heavy gauge material in the muffler and connecting pipes and the fact that the muffler support bracket is attached to an insulating strip, very little noise is transmitted into the car. The muffler can easily be removed by loosening the exhaust and tail pipe clamps.

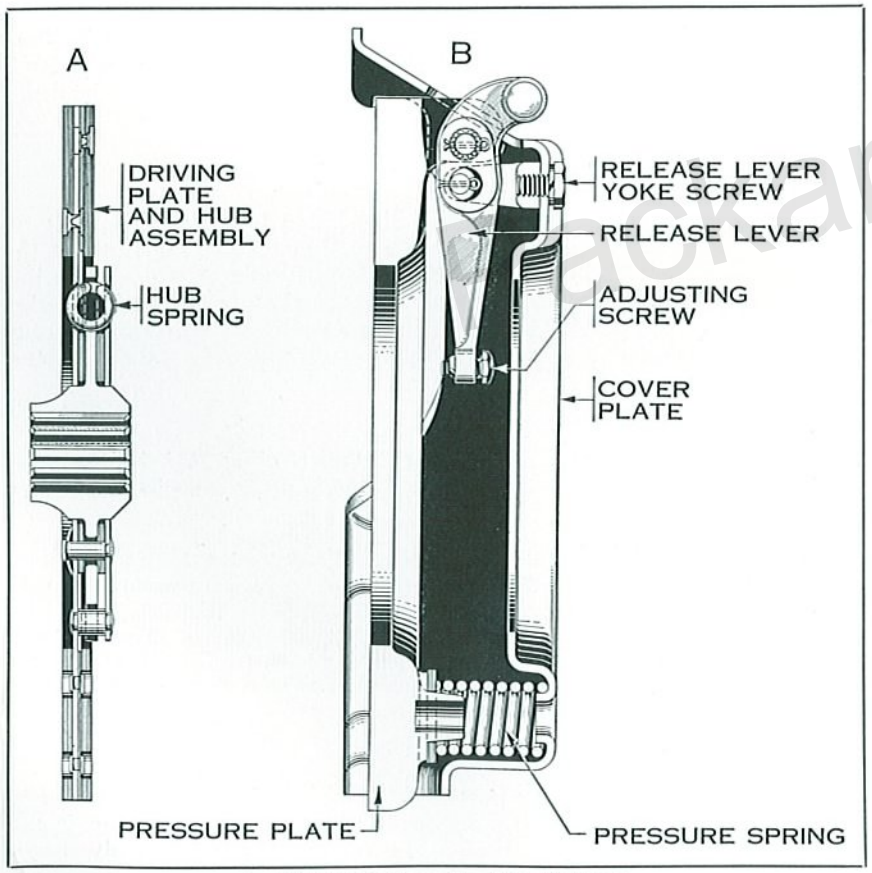
Engine Mounting

The Packard One Twenty power plant with its heavy crankshaft and balanced parts combined with the three point rubber mounting is unusually free from motor sensation. The mountings are extremely simple in design and can be easily replaced if necessary.

Clutch

The semi-centrifugal clutch is of the single plate, cushion drive dry disc type with a mechanical damper. The clutch pressure plate is provided with nine springs of 115 pounds load each, giving a total of 1035 pounds, but requires only 23 pounds pressure on the clutch pedal to operate. The clutch facings are of woven asbestos 10″ x 6″ x .137. They are unaffected by atmospheric conditions and require no lubrication.

The clearance between the clutch release bearing and the clutch plate release finger must be maintained at all times and is indicated by the free pedal travel. The correct pedal adjustment is 2 inch free pedal at the toe-board. To adjust, loosen lock nut and nut on clutch pedal to lever connecting rod. CAUTION: Do not ride the clutch pedal as this causes premature wear of the clutch facings and makes frequent adjustments necessary.



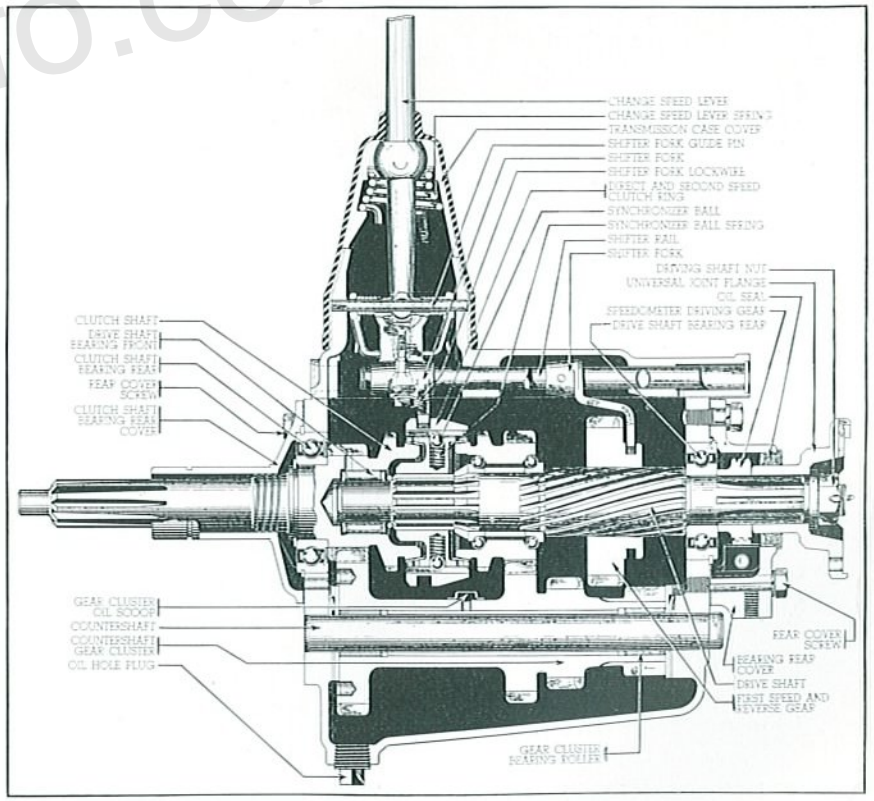
A—Clutch Hub B—Clutch Cover

Transmission

The transmission is a three-speed selective unit with a synchronized shift for second speed and direct drive. All gears are helical cut. The clutch shaft, second speed main shaft gear and rear end of main shaft are carried on ball bearings while the countershaft and front end of main shaft are supported on roller bearings.

The shifter mechanism is of the conventional design with the shifter rails in the transmission cover. A torsion spring is provided to urge the shifter lever always to the right side (2nd and high gear side) to facilitate the shift from first to second and to reduce the hazard of shifting into reverse unintentially. The interlocking device which prevents more than one gear being shifted at one time is also built into the cover. A scoop is welded to the countershaft gear cluster to force lubricant into the countershaft roller bearings.

One quart of gear oil is required to fill case to level. Use S. A. E. 160 gear oil in warm weather and dilute with ¼ pint of kerosene at the approach of cold weather.



Transmission Section

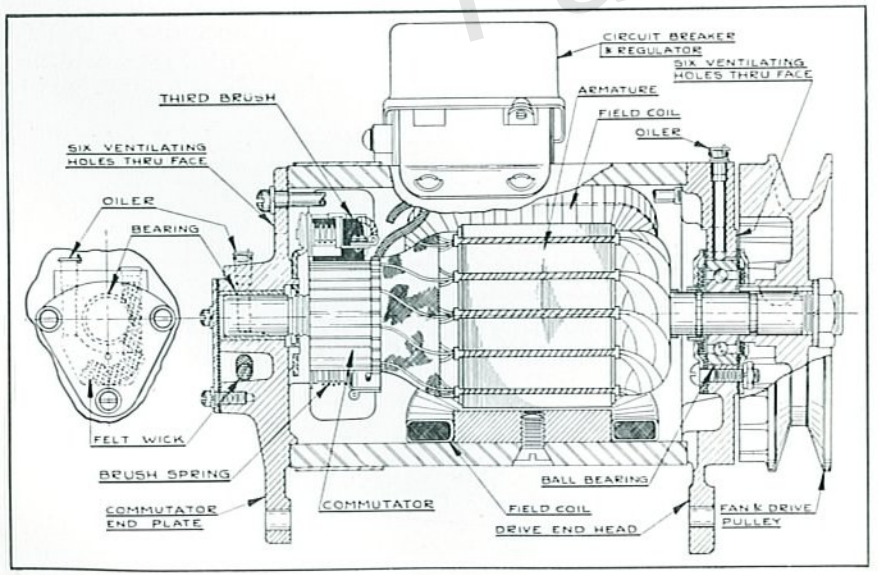
Electrical System

The electrical system is of the single wire or grounded return type. The positive battery wire is grounded to the frame and a negative wire leads to the starter motor terminal.

The battery is located in a protected cradle under the front seat and can be serviced easily by removing the front seat cushion and inspection plate in the floor.

The electrolite in the battery should always be maintained at the proper level and distilled water or if not available, rain water should be added to each cell of the battery until the solution is one-quarter inch above the top of the plates. Never add acid to the solution.

The most reliable method of gauging the condition of a storage battery is to test each cell with a hydrometer. With battery fully charged a reading of about 1.280 specific gravity will be obtained in each cell. A fully charged battery will not freeze in temperature ordinarily encountered. NOTE—Do not set the charging rate with a partially discharged battery in the circuit. Keep the filler plugs and connections tight and top of the battery clean. A coating of vaseline will protect the terminals from corrosion. It is also important that the battery be firmly secured in its cradle; if it works loose, broken cells and loose connections will result.



Generator

Generator

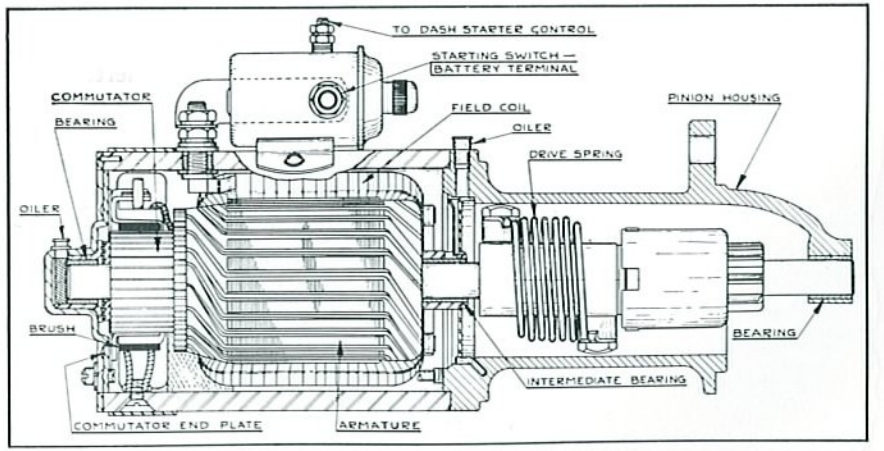
The generator is carried on the left front end of the motor and driven by a Vee belt that also drives the water pump and fan. On the back face of the pulley is a centrifugal fan which circulates air through the unit. This method of cooling permits a higher charging rate without danger of burning out the armature. The current control is by means of a third brush and the maximum rate is twenty-three amperes with a cold generator. Do not run the motor with the generator or battery wire disconnected. An attempt to do this may cause the lamp bulbs to burn out, damage the generator, or run down the battery. All terminals and binding post nuts should be kept tight and free from dirt and oil. The commutator should be kept clean and free from oil and grease. If it appears dirty or rough it should be cleaned with 00 sand paper. Emery cloth should never be used for this purpose. The brushes should move freely in the brush holders and the full contact area should bear on the commutator.

Circuit Breaker

The circuit breaker or automatic switch opens and closes the circuit between the generator and the battery. The points should close when the generator voltage builds up to 7 or 7¼ volts and should open on a discharge not to exceed one ampere.

Voltage Regulator

This control unit is mounted with a circuit breaker on the top of the generator and meters the charge to agree with the temperature of battery and load conditions. This greatly promotes the life of the generator and battery and at the same time protects the lamp bulbs, ignition points



Starting Motor

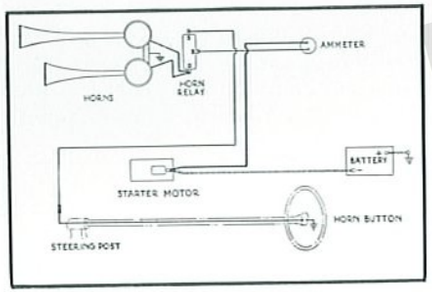
and entire electrical system from excessive voltage. A five ampere field fuse protects the generator from an overcharge or an open circuit. This fuse is located in the front side of the regulator.

Starting Motor

The starting motor is fitted to the front face of the flywheel housing on the left side of the engine and held in place by two cap screws. It is controlled by a relay switch on the top of the starter motor operated by a remote control button on the instrument board. The starter is equipped with a Bendix shifting mechanism carrying a nine tooth pinion which engages with a 140 tooth steel ring gear shrunk on the flywheel. Proper cleaning and lubrication of the Bendix drive is important. If the shaft becomes gummy, clean with kerosene and lubricate the threads with light engine oil. A light film of graphite grease should also be applied to the armature shaft where the pinion travels. In case of failure of this mechanism on the road it is recommended that a complete new Bendix drive unit be installed. Caution: Never press starter button when engine is running.

Manual Control of Starter Switch

In case the remote control on the instrument board fails to operate the starter, due to a broken switch or defective solenoid, the main switch contact can be made by removing the brass cap at the rear end of the starter switch and pressing the plunger underneath. This is also a convenient method for turning the motors over when adjusting the engine in the shop.



Horn Wiring

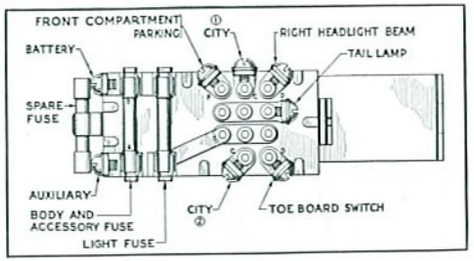
Horn

The horn is mounted on the dash and operated by a relay located on the horn bracket. This relay insures long life to the horn button contact. To remove horn button press down and rotate either right or left. This will allow the locking lugs to come up through the four slots and the coil spring will force the button out. The diagram shows the horn wiring circuit.

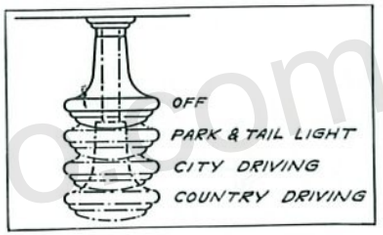
Lamps

The flex-beam headlamps have parabolic reflectors and prefocused incandescent main bulbs. By prefocused bulbs we mean those with a collar attached to the bulb which automatically locates the filament in exactly its proper position with relation to the reflector.

The main light switch is located behind the instrument panel and controlled by a button just in front of the driver. When the button is pushed all the way in the lights are off. When the button is pulled out to the first notch the parking, tail lamp and front compartment lights are turned on. Pulling the knob out another notch turns on the city driving beam. Pulling the switch all the way out turns on the country driving or meeting beam depending upon the position of the foot dimmer switch. The foot dimmer switch gives convenient control of the head lights when meeting vehicles on the highways.



Light Switch Connections and Spare Fuse



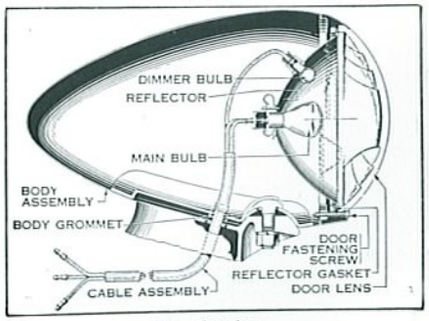
Light Switch Positions

The headlamps are identical except for the lens. The lenses are clearly marked right and left and if removed for any reason should be reinstalled as indicated.

To replace burnt out bulbs in the head lamps, release the locking screw at the bottom, pull bottom of door outward and upward, unhooking it from the top. Turn bulb counter clockwise to remove from its socket. Replace with only 32-32 candle power prefocused bulbs.

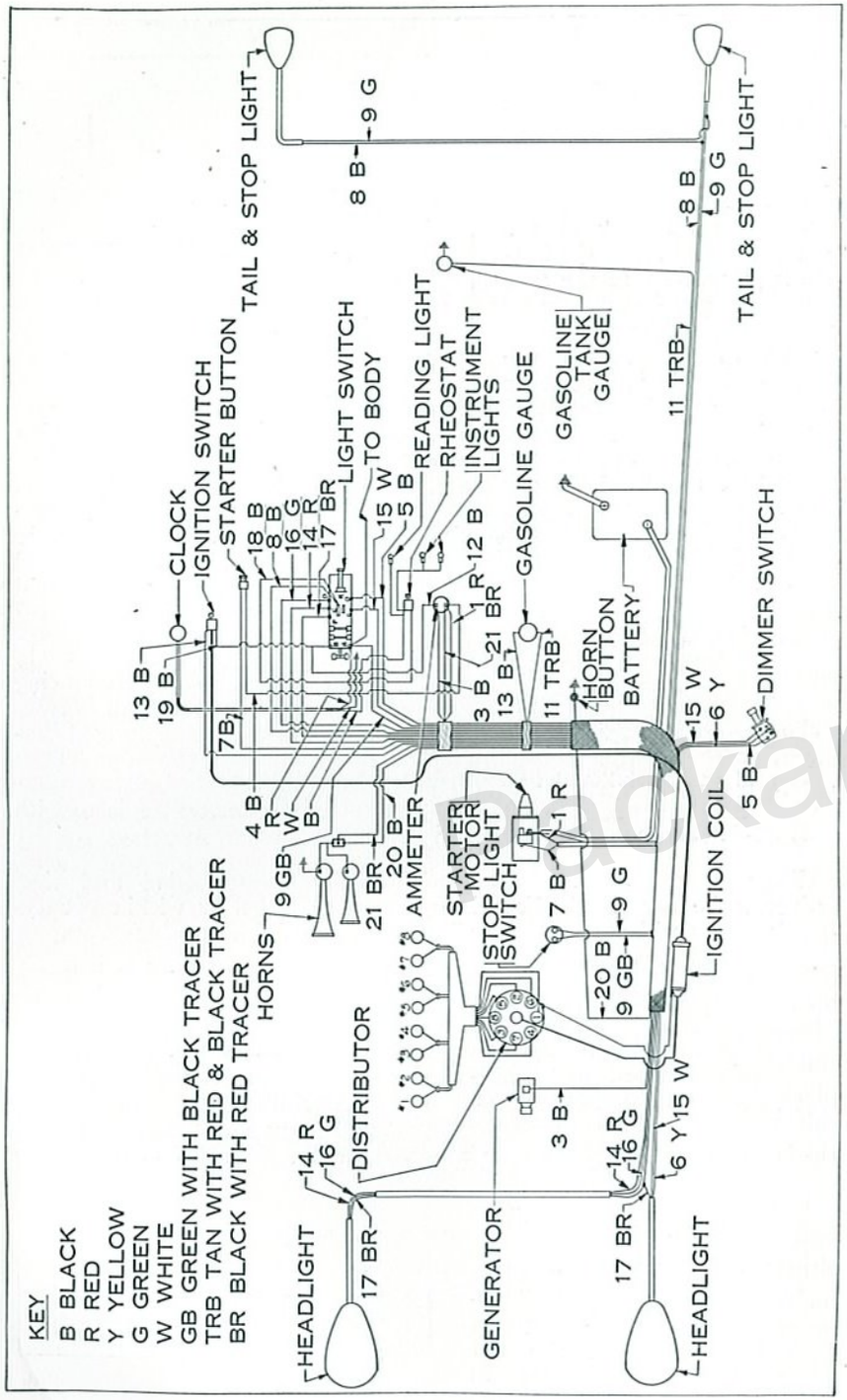
To adjust headlamp beam. With car fully loaded and tires inflated, the car should be driven on to a level floor within twenty-five feet of a white screen or wall. Adjust as follows:

Measure the height of the lamp centers above the floor level and stretch a ribbon across the screen at this height. By sighting through the exact center of the rear window and the radiator cap, determine a point on the screen corresponding to the center line of the car. Measure the distance between the centers of the lamps and place vertical markers at half this distance on either side of the center line.



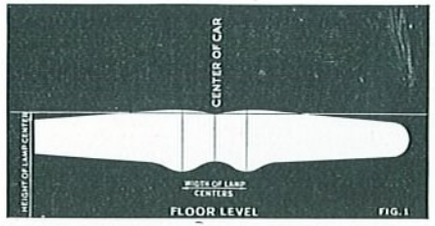
Headlight

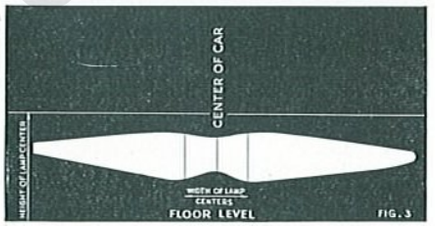
Cover the right lamp, place switch on "country drive" position, then aim the spot of high intensity from the left lamp so that it centers on



Wiring Diagram

the corresponding lamp center marker with its upper cutoff falling at the horizontal marker. Tighten mounting nut securely while lamp is in this position.





Headlight Charts

Having covered the left headlamp, proceed to aim the right lamp. In this case the upper cutoff falls at the horizontal ribbon but the spot of high intensity is moved so that its left margin falls on the right center marker as shown in illustration (Fig. 1). With headlamps tightened in these positions, the "city driving" and "country passing" beams will fall in their proper places. If the lighting in "country passing" position appears to be too blinding for oncoming traffic, loosen anchor bolt nut on right hand lamp and turn front end slightly towards curb.

To clean lamp reflectors use lamp-black and polish from the center to edge. Do not use a circular motion.

Fuses

Two 20-ampere fuses located in the holder attached to the lighting switch provide a safeguard against a short circuit. One covers the lighting system and the other the cigar lighter, heater and other accessories.

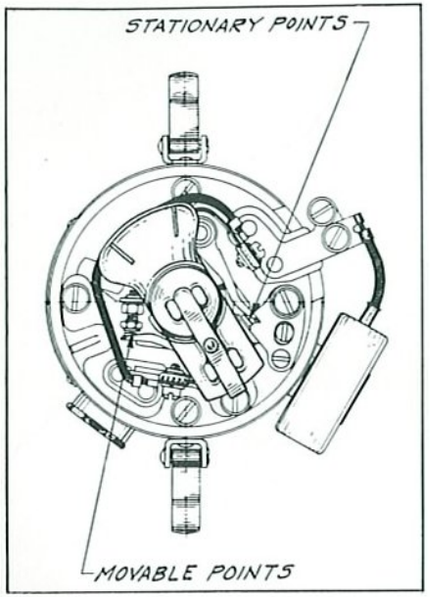
Ignition Distributor

The distributor is of the two breaker four-lobe cam type, located on the left side of the motor. The spark advance is 20 degrees full automatic, and there is no manual control. The fuel compensator should be set at zero for standard grade fuel. If you do not intend to use the regular run of gasoline see the nearest Packard dealer and have compensator adjusted.

Timing Ignition

The best results in timing a motor are secured by the use of a timing light. To reset the timing proceed as follows:

Check breaker points and make sure points are clean and square. Gap should be .018 to .022. Loosen fuel compensator thumb screw and place arrow at zero. Lock in place. Connect one of the leads from the timing



Distributor

light to ground on the cylinder block and the other lead to the primary terminal on the distributor. Jack up rear wheel and with motor in gear turn over slowly until the 5 degree mark before upper dead center is exactly underneath the pointer. At this point the bulb should light. If it does not, rotate the distributor until it does and lock in place.

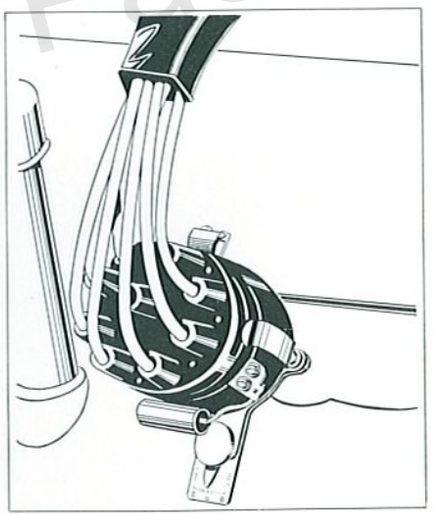
To set the second set or movable set of points in proper relationship to the stationary set, we recommend the use of a "synchronoscope" or some similar device, as this is a very accurate and efficient method and we believe more satisfactory than using the second set of markings on the flywheel.

The firing order for the motor is, 1-6-2-5-8-3-7-4.

The ignition switch is mounted on the instrument board and connected to the coil by a cable encased in a metal conduit. When the switch is turned "off" the circuit is broken through the coil making it impossible to start the motor. This switch is protected by a cylindrical type lock for which two keys are supplied. The coil will be found on the left side of the engine with a short lead to the distributor.

The spark plug gap should be .028 for all cars. Correct gap setting important for good engine performance.

In readjusting spark plug gap always make the adjustment by bending the side electrode—never bend the center electrode as this may break or crack the insulator.



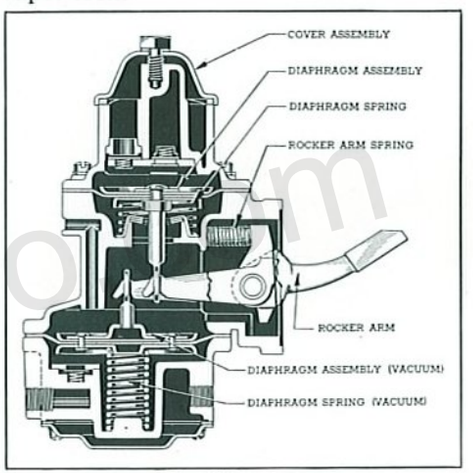
Fuel Compensator Setting

Fuel System

The fuel is carried in a twenty gallon tank at the rear of the car. The supply line intake is located in the sump of the tank, as is also the drain plug. A gas line with a flexible front connection permits fuel to be drawn from the tank into the reciprocating pump and from this point it is forced through a short lead into the carburetor.

Combination Fuel and Vacuum Pump

This diaphragm type pump is actuated by an eccentric on the camshaft. It is mounted on the right side of the engine near the cooling fan. A shroud above the pump and a ventilated mud pan below it obviate vapor lock.



Fuel Pump

There is no adjustment to the pump proper. However, if there is evidence of a lack of fuel in the carburetor, examine the gas line for leaks and obstructions to flow. Check and tighten all connections from tank to carburetor. Remove and clean the screen in the pump and check for leaks about the edge of the diaphragm. If leaky, tighten the cover screws alternately and securely. Do not use shellac or any other adhesive to stop leaks. Any other troubles should be referred to an authorized Packard service station.

To drain pump filter sump remove small screw just below inlet connection on the side away from the motor. To remove screen unscrew hex screw in the top of the pump and lift off cover. Care should be taken in removing and reassembling screen that the cork gasket is not damaged or the holes in the screen torn.

The vacuum pump acts as a stabilizing booster for the windshield wipers and provides sufficient vacuum to satisfactorily operate the wipers under all driving conditions.

Fuel Gauge

This is an electrically actuated gauge mounted on the instrument panel and connected to the electrical float unit located in the gasoline tank. It utilizes electricity from the battery for its operation and is connected to the ignition switch, so that it functions only when the ignition is turned on. The tank unit is attached to the tank by machine screws and a gasket is inserted to make a gas-tight joint. Should any leak occur, it would probably be due to a damaged gasket, which should be replaced. If further leaks are evident, the unit, itself, should be replaced.

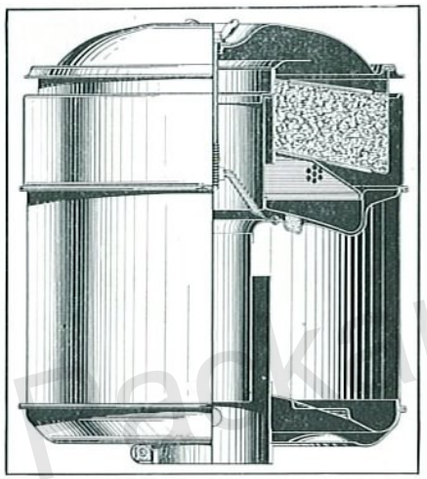
Automatic Choke

The engine is fitted with an automatic choke that is incorporated in the carburetor body, with a small actuating thermostatic spring set in the exhaust manifold. This device has a fast idle control that increases its efficiency and reduces the tendency of a cold motor to stall. The mixture is automatically enriched for starting and gradually leans out as the motor warms up, simplifying starting and eliminating excessive and improper manual choking.

There is no adjustment to the automatic choke mechanism, but the thermostat can be recalibrated. This should be done by an experienced Packard mechanic. The linkage of the choke should be free from any binding action, but should not be lubricated.

Air Cleaner

The air cleaner is incorporated in the unit that contains the intake silencer and functions on the wetted gauze principle. The copper mesh should be cleaned and re-oiled every 2000 miles, or oftener, depending upon the driving conditions encountered. Where most of the driving is done on dusty roads, cleaning may be necessary as often as every 250 miles.

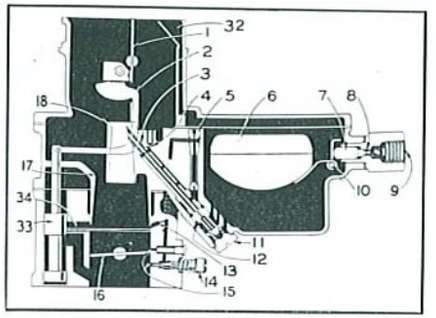


Special Oil Bath Cleaner and Silencer

To remove the unit for cleaning, the clamp at the carburetor air horn should be loosened and the cap screw holding the body to bracket removed. Then remove the thumb screw and the top plate, together with the felt deadener. The filter unit should then be dipped in gasoline until thoroughly clean. Dry thoroughly before attempting to re-oil it. Immerse the filter in clean, new S. A. E. No. 50 oil and allow the excess to drain off before reinstalling. For use in dusty territories a special combination oil bath air cleaner and intake silencer is used. In the summer use a pint of S. A. E. 50 and in the winter S. A. E. 30 after cleaning.

Heat Control

The intake manifold is designed so that exhaust gases are used to heat the risers and central junctions. There is a valve in the exhaust manifold, controlled by a counter-weighted thermostatic spring that deflects the hot exhaust gases into the heat jacket. This method of heating the intake gases decreases the amount of time required to warm up the engine in cold weather, thus increasing the gasoline economy and also decreasing the amount of crankcase dilution.



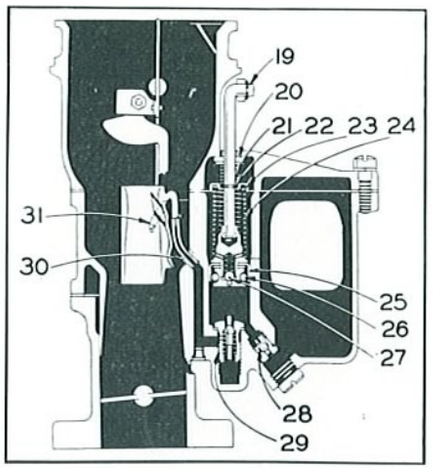
Carburetor, Side Section

Carburetor

The Packard 120 is equipped with a plain tube, multiple jet type, dual down-draft carburetor. This carburetor is in effect two carburetors built into one, so designed that a single float bowl, accelerating pump, air intake horn, and choke valve serves for both. The main metering jets are of the fixed type and should not be changed.

There are two adjustments possible which affect the idling speeds. They are the idle needle valves and the throttle shaft stop screw. The needle valves consist of two spring-loaded screws located on the lower part of the carburetor body. By turning the valves clockwise, the mixture will become lean, and, by turning counter-clockwise, a richer mixture is provided.

Before attempting any adjustment, warm the engine thoroughly and proceed as follows: Adjust one needle valve at a time. Turn it **in** slowly until the engine begins to lag or run irregularly, then slowly turn it **out** until the engine begins to "roll." Then turn the needle **in** just enough to make the engine run smoothly. Repeat this procedure for the other idle needle valve. If the engine runs too fast after the adjustment, the throttle stop screw should be turned counter-clockwise.



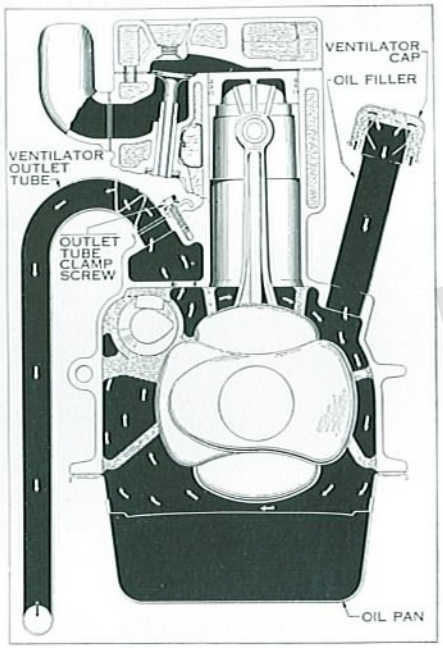
Carburetor, End Section

The fuel level is maintained by the float in the carburetor bowl which actuates a needle valve in the supply line, thus maintaining a definite fuel level in the bowl. If the engine runs rich at all speeds, it is probably due to a leaky float. Such a float can be determined by removing it from the bowl and shaking it near the ear. A leaky float will give out a slushing sound as the liquid inside moves. Flooding of the carburetor is caused by a jammed float or valve mechanism, or it may be due to dirt on the valve seat. The valve may be removed by unscrewing the fuel line and then removing the seat, which is screwed into the carburetor bowl.

If the above adjustments fail to make the motor operate smoothly, the jets should be removed and blown out with air. Always blow through the bottom end of the jet. Do not attempt to clean the jets with a wire, as anything hard would enlarge the holes and spoil the jets.

Carburetor Parts Shown in Illustrations

1. Choke Valve
2. Vac. Piston Link
3. Main Discharge Jet
4. High Speed Bleeder
5. Idle Tube
6. Float
7. Float Needle Valve
8. Needle Valve Seat
9. Gasoline Inlet
10. Float Pivot
11. Main Jet Plug
12. Main Metering Jet
13. Idle Air Bleed
14. Idle Needle Valve
15. Idle Discharge Holes
16. Throttle Valve
17. Primary Venturi
18. Aux. Venturi
19. Pump Piston Link
20. Dust Washer
21. Dust Washer Spring
22. Spring Retainer Lock
23. Spring Retainer Washer
24. Pump Duration Spring
25. Pump Piston
26. Ex. Spring
27. Relief Valve
28. Pump Check Valve
29. Economizer Valve
30. Pump Nozzle Holder
31. Pump Nozzle
32. Float Chamber Vent
33. Auto. Choke Piston
34. Fast Idle Air Passage



Engine Ventilation

Crankcase Ventilation

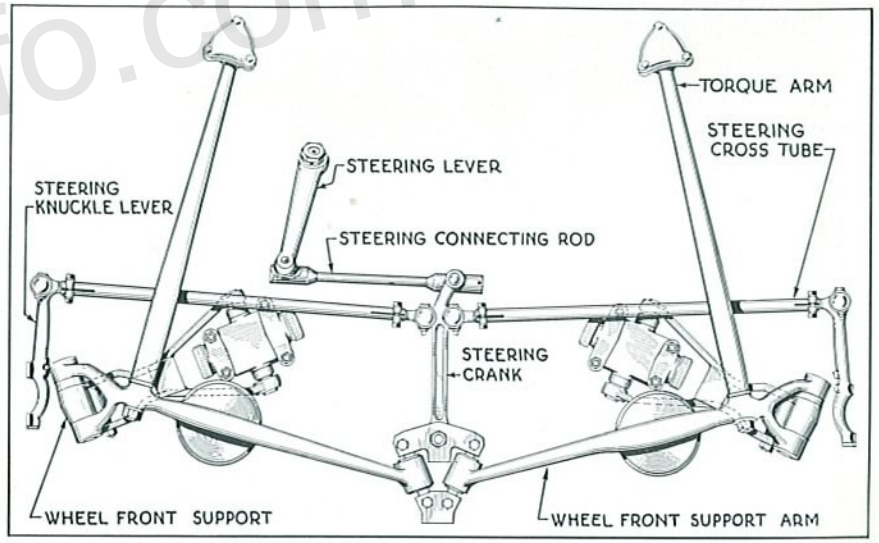
The engine is designed with a crankcase ventilation system that takes air in the oil filler tube through the crankcase and out at the outlet tube at the rear of the block. The oil filler tube is fitted with a copper mesh type of air cleaner built in the cap, which prevents dust and dirt from entering the crankcase with the air. This unit should be cleaned at the same time as the carburetor air cleaner, and in the same manner, repeating every 2000 miles, or oftener, depending upon the driving conditions. The unit should be dipped in gasoline until thoroughly cleaned. Then dry the unit and re-oil the mesh. Use clean, new, S. A. E. 50 oil and allow the excess oil to drain off before reinstalling the unit on the engine.

Chassis Suspension

Front Suspension

The Safe-T-Flex independent wheel suspension as used on the new 120 is an exclusive Packard development which represents a very decided advance over previous conceptions. The suspension for each wheel is composed of two horizontal lever assemblies, a vertical wheel support member, a single helical spring, a steering knuckle assembly of the "reverse Elliot" type and brake support plate of conventional design.

The lower lever (called the support and torque arm assembly) is made up of two arms, the forward or support arm and the rear or torque arm. The support arm is a heavy steel forging with an integral pad on which the coil suspension spring rests. It is attached at its inner end to the heavily reinforced front cross member with a rubber bushing. The tubular steel torque arm is rigidly bolted to the support arm adjacent to the wheel and is attached to the box section side rail—at a point near



the dash—in a rubber bearing of spherical shape. These two rubber bearings form the axis about which the lower lever oscillates and the great spread or distance between them is very important in providing and maintaining proper wheel alignment. With such wide centers of support only very slight variations in alignment can occur.

Also of great importance is the fact that really adequate provision has been made for braking loads and for proper caster angle. The husky torque arm takes all braking loads—in fact, the high capacity of this member has permitted a higher percentage of braking effort on the front wheels than would otherwise be feasible. In addition, the torque arm

permanently fixes the king-pin caster angle. Owing to its great length only extremely small variations are possible and therefore no adjustment means is necessary. This lower lever assembly then, takes the spring load, the driving load, the braking load and a major part of all other reaction.

The upper lever is made up of double steel arms welded together in a single rigid unit. The main functions of this lever are, to position the wheel for proper camber angle, absorb lateral or thrust loads, actuate the shock absorber and limit rebound. At its outer end this lever has elongated holes into which bushings are fitted. These bushings may be changed to secure the proper camber angle when the cars are assembled at the factory and it should not be necessary to change them in service. The design of the upper lever gives it more than ample capacity for any thrust loads that can be imposed in normal use. At its inner end each of the two arms that make up the upper lever is attached to one end of the main shock absorber shaft, thus accomplishing actuation of the shock absorber. Near the center of the lever a right angle steel spacer and platform is welded which adds stiffness and rigidity to the lever and which also engages a rubber bumper attached to the frame side rail to limit rebound.

The shock absorbers are of the latest double-acting type with the main shaft supported in two long bearings which are lubricated from the main reservoir. Four widely spaced bolts attach it to the main frame at a point where it is heavily reinforced.

The vertical wheel support is a large forging whose function it is to connect the road wheel with the suspension levers. Since the major portion of the load is carried by the lower hinge point, the attachment of the wheel support to the lower lever is made by means of a horizontal king pin which employs two roller bearings to support the load and a ball thrust bearing to take driving and braking loads. Connection to the upper lever is made by means of a rubber bushing designed to prevent the transmission of braking or driving loads to the upper lever.

The large coiled springs of high-grade tempered steel are partially housed in the frame where the front cross member joins the side rails. The upper end is centered and seated in the cross member while the lower end is centered and seated on the integral pad of the support arm.

Inside the springs are large rubber bumpers which supplement the springs under extreme road conditions. The springs are designed for low stress and long life.

In connection with the rubber bushings used in the upper and lower levers, it should be pointed out that these oilless bearings function in a very unique manner that adds considerably to the fine results obtained with the Safe-T-Flex suspension.

For small wheel movement these bearings offer practically no resistance, but their resistance builds up very rapidly for larger wheel movement. This characteristic permits the use of a more resilient suspension spring than would otherwise be possible. In addition—being of live rubber—

these bushings have a pronounced effect in insulating or damping out road shocks that would otherwise be imparted to the frame. The combination of the soft suspension springs and the low resistance and insulation of the rubber bushings is largely responsible for the remarkably soft boulevard ride, while the high resistance of these same bushings to large wheel movement plus shock absorber restraint provides the necessary control for a comfortable and safe high speed ride over rough roads.

Rebushing King Pins

When the king pin bushings have been worn to the extent that it is necessary to replace them it is almost always necessary to replace the king pins as well.

1. Jack up the front end of the car.
2. Remove the wheels, brake drums, and brake backing plate.
3. Remove the plugs at the ends of the bearing bosses in the steering knuckle taking care not to damage the plug seats.
4. Withdraw the locking bolt.
5. Drive the king pin out.
6. Press the old bushings out.
7. Push in the new bushings so that the groove on the inside will be either to the front or the rear when the knuckle is in place on the car. This position brings one of the four holes in the bushing wall in line with the hole from the grease fitting.
8. Broach the bushings after inserting, with a special broach No. ST-5046. **Never ream these bushings.**
9. Before rebuilding, clean everything with gasoline and re-oil properly.

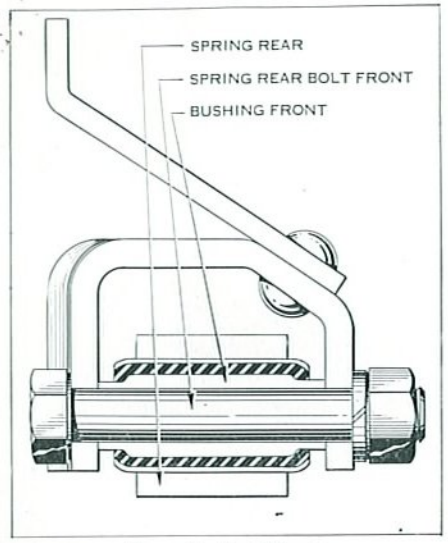
Wheel Alignment

The wheels must be in alignment to give steering ease and long tire mileage. Before attempting to check the car for toe-in the following rules should be followed.

1. Correctly inflate all tires.
2. Place the car on a smooth level floor.
3. Turn the wheels so they point straight ahead.
4. Adjust front wheel bearings. This can be done by tightening the nut and then backing it off two or three notches as measured by the locking washer.

The toe-in should then be measured with an accurate gauge, taking the measurements between the front wheel rims. Correctly aligned wheels show between "$\frac{1}{16}$" and "$\frac{1}{8}$" toe-in. If the wheels are not bent and do not check to the desired dimensions it will be necessary to adjust the cross tubes.

1. Loosen all clamps on cross tubes.
2. Turn both rods an equal amount so that they remain the same length.
3. Check tubes for length and correct them to make them equal if necessary.



Rear Spring Hanger

4. Securely tighten clamps when finished. Clamping screws should be vertical and to rear of tubes.

Front Wheel Caster and Camber

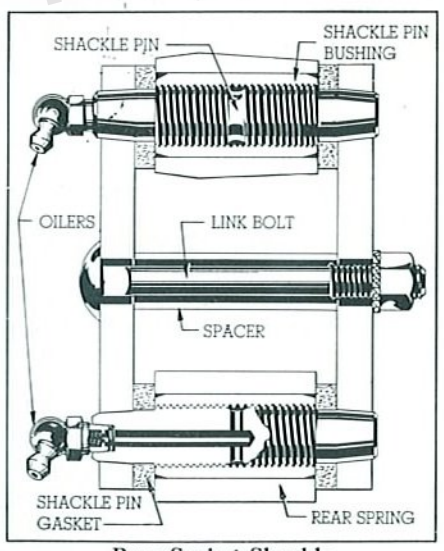
Experience has shown that with Safe-T-Flex suspension caster and camber remain permanently in adjustment. If for any reason it is desirable to check these items, it is **important** to remember that caster or camber should only be checked when the car has been loaded to bring the top of the frame side rails 18″ above the floor and parallel to it. The desired caster angle is 2° but a minimum of 1½° and a maximum of 2½° is allowable. However, the variation in caster angle between right and left knuckle should not exceed ½°.

The desired camber angle is 1° to 1¼° and each wheel should be within these limits. Machined reference points are provided on the vertical wheel support arm for checking caster. Camber should be measured at the wheel. Should readjustment be made necessary by accident or otherwise, it is decidedly advantageous to have the work done at an authorized Packard service station.

Rear Spring Suspension

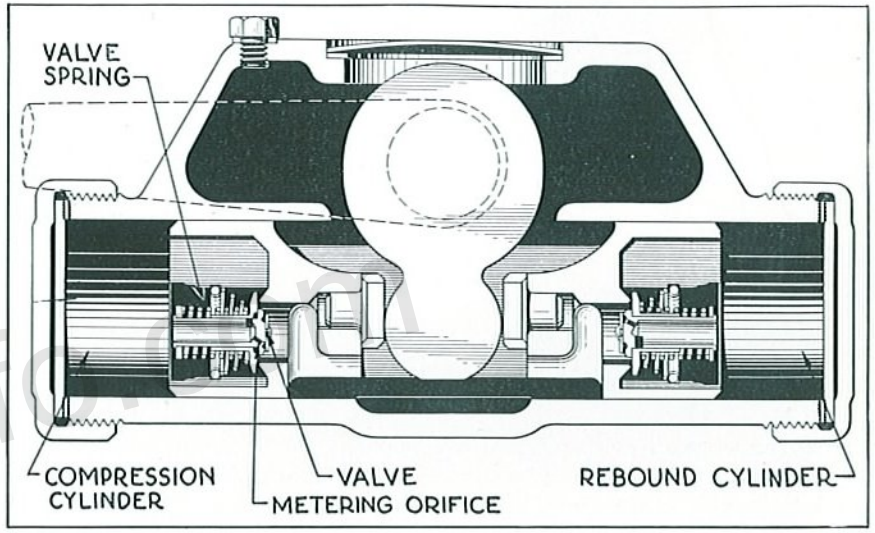
The rear of the chassis is supported by conventional semi-elliptic springs 1¾″ wide by 54″ long, provided with metal covers.

The front ends of the rear springs are mounted in rubber. In making replacements it is necessary to install the complete bushing assembly. This consists of an outer steel sleeve, a rubber bushing and an inner steel sleeve. The spring bolt should not be tightened until the spring is carrying its normal load as the flexing of the rubber affects the rate of action of the suspension spring.



Rear Spring Shackle

The rear ends of the springs are attached to the chassis by means of the new threaded type shackles. The shackle links are held in place by a draw bolt through the center which pulls the links tight on the taper ends of the shackle pins. Cork washers prevent lubricant from leaking out between the spring eye and the shackle link.



Front Shock Absorber

Shock Absorber

Heavy double action shock absorbers are standard equipment on Packard Cars. The rebound and compression valves are located in the piston heads and should not be changed until a thorough check has been made of all the other factors which affect the ride. Make sure shackles are free, spring clips tight, tire pressures standard and that the stabilizer bar is tight on the shock absorber levers before looking into the shock absorber unit itself. A special wrench is required to remove the shock absorber cylinder caps, (do not use a pipe wrench) and a special fluid is required to fill the chambers. CAUTION: Never use anything but Packard Lovejoy shock absorber fluid.

The stabilizer is a specially designed bar of steel assembled across the rear end of the chassis and attached securely to both rear shock absorber arms. When one side of the car tends to rise faster than the other, which would cause body sway, the torsional resistance of the stabilizer bar reacts on the shock absorbers to keep the body on an even keel.

Steering Gear

The Packard One Twenty steering gear is the latest worm and roller type. The worm is mounted on preloaded tapered roller bearings and keyed to the steering shaft which is guided by a ball bearing at the upper end. The cross shaft is mounted on two large graphite bronze bearings well spaced. The double tooth roller is mounted on two preloaded ball bearings at the inner end of the cross shaft. This construction gives the minimum of friction. There are two adjustments that can be made on the steering gear.

Adjustments

Preparatory to adjusting the gear, the front wheels of the car should be jacked up and the drag link removed from the steering gear ball arm. The wheels should be checked to see that they swing freely throughout their turning arc without tight spots. It should not require a pull of more than 10 pounds applied to the steering crank drag link ball stud to move the wheels in either direction. Loosen the frame bolts of the gear housing just enough to allow the steering gear to shift in the frame so that it assumes its natural position before tightening the bolts. Now loosen the bracket at the instrument board and allow it to shift to match the gear column position and retighten. This will correct any possible misalignment of the steering column.

The following is an outline of the method used to eliminate all play in the mechanism.

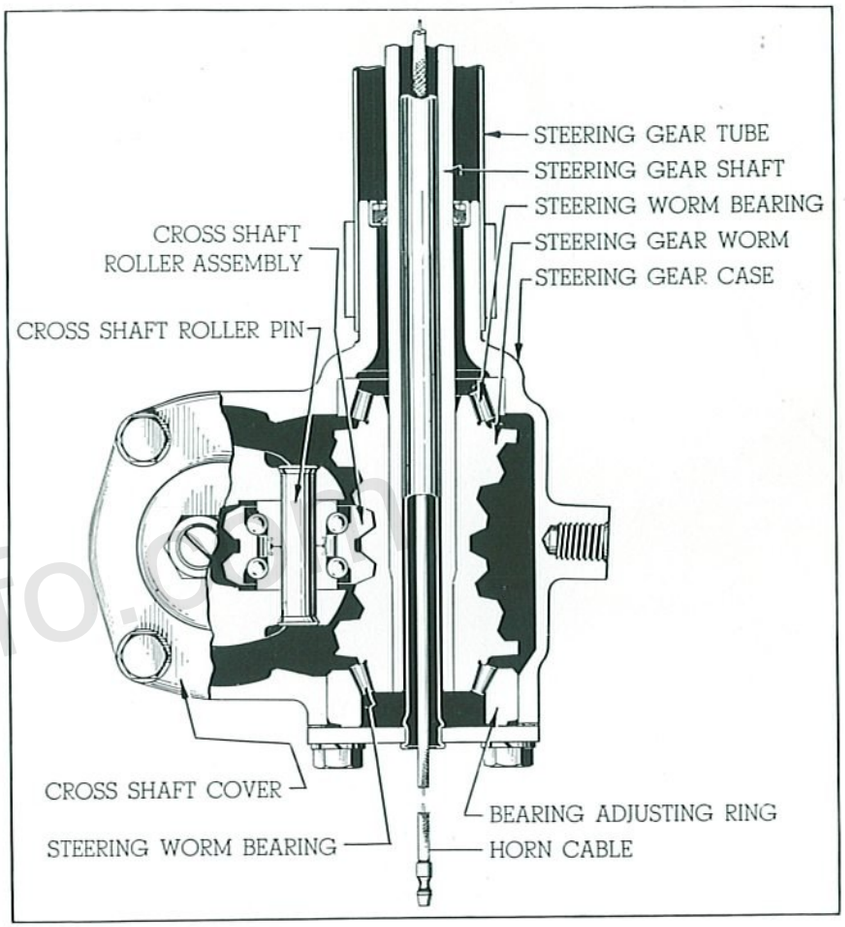
1st.—Remove end play in worm shaft as follows:

Turn the steering wheel to either stop and back up one-eighth turn so that there is lash between the worm and roller. This leaves the column bearings free of side thrust. The lower roller bearing may now be adjusted with shims between the bottom cover and the steering gear housing. When the bearing is properly adjusted, the pull on the rim of the steering wheel should be 1 to 1½ pounds.

2nd.—Adjusting contact between the roller and the worm.

It will be noticed that the roller sector is ¼ inch off the worm center. This construction allows for control of the loading between the roller sector and worm.

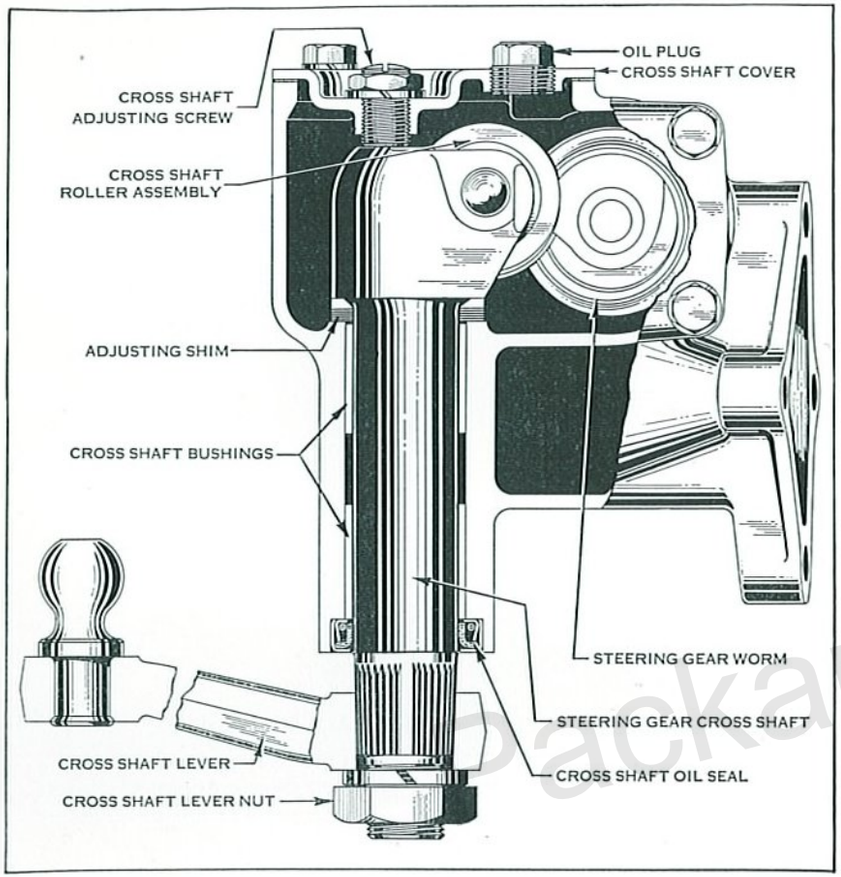
When the steering gear is in straight ahead position, there should be no lash between the worm and roller, but a definite preloading. A correct preload between them increases the drag on the steering wheel rim to a total of 2½ to 3 pounds. An adjusting screw on the top cover



Steering Gear Worm and Roller

plate forces the roller into the worm. When the cross shaft is properly adjusted there is no end play at any time in the cross shaft, and neither should there be any preloaded thrust. This may be determined by feeling the drag on the cross shaft when the steering gear is in its extreme positions.

CAUTION: All thrust between the worm and the roller must be taken against the adjusting screw. The shims employed between the gear housing and the hardened spacer on the cross shaft are useful only in preventing end play when the gear is at its extreme positions. Care must be taken in replacing the cross shaft as the sharp splines will cut the leather oil seal unless a protecting thimble is used. This tool is



Offset of Worm and Roller for Back Lash Adjustment

carried in our special tool division under piece number S.T.-5032. The oil seal should be checked every time the car is lubricated to see that it is not leaking.

Steering Connecting Rod

The steering connecting rod is provided with a spring loaded ball socket at the steering gear end. Adjustment is made by means of the slotted plug, which is threaded into the steering gear end of the drag link tube.

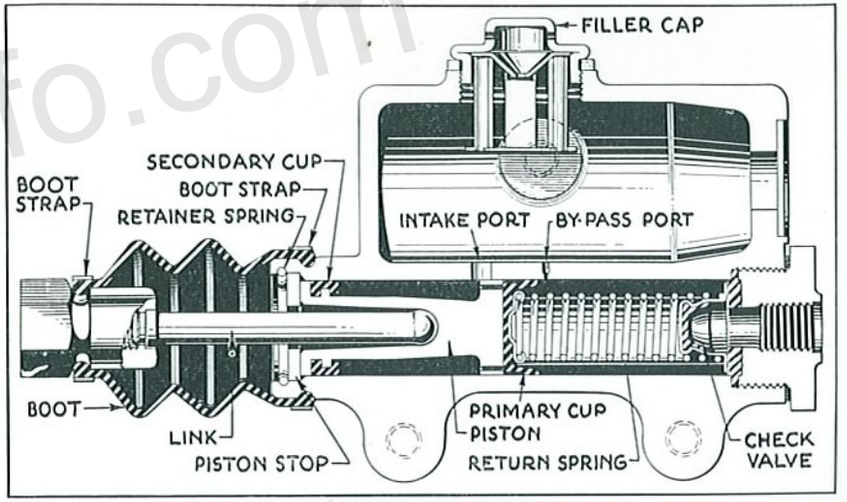
When adjustments are made on the steering connecting rod ball sockets, the parts should be thoroughly cleaned when removed and lubricated when built up again. After building up the assembly, the plug should be screwed up tight and then backed off approximately 1½ turns to line up for cotter pin.

Brakes

The Packard One Twenty is equipped with Servo sealed hydraulically actuated service brakes. The brake system consists of a master cylinder (connected with the brake pedal) in which hydraulic pressure is originated, a wheel cylinder operating the brake shoes against each wheel drum, a supply or reserve tank by which the operating fluid is maintained at a constant volume and the necessary tubing and fittings to connect the master cylinder to the wheel cylinders.

The master cylinder is fitted with a piston, and the wheel cylinders are each fitted with two opposed pistons, all of which are provided with special rubber cup packings, which act as seals to maintain pressure and to prevent loss of brake fluid.

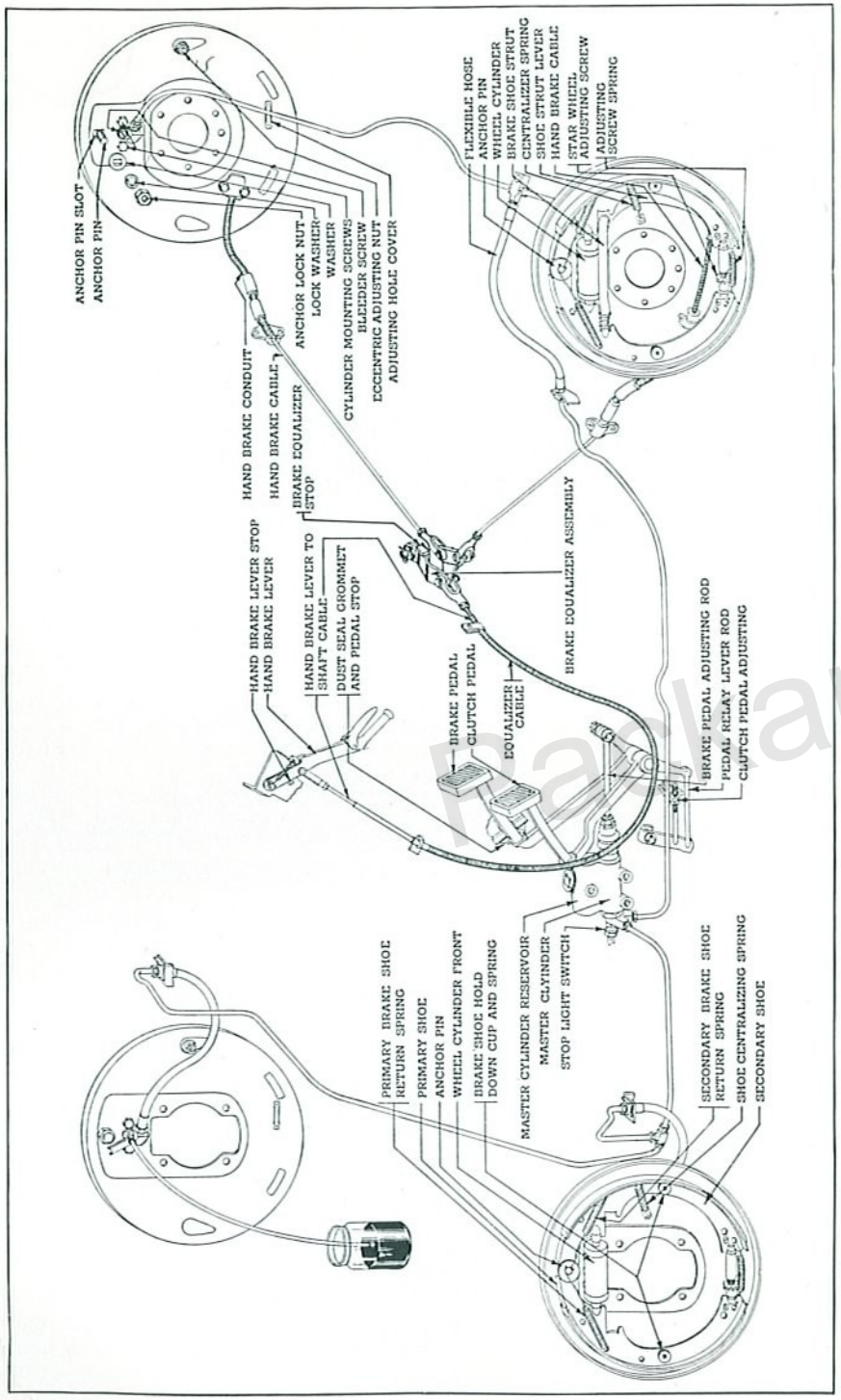
The brake pedal when depressed moves the piston within the master cylinder thus forcing the brake fluid from the master cylinder through the tubing and flexible hose connections into the four wheel cylinders.



Brake Master Cylinder

The brake fluid enters each of the wheel cylinders causing the pistons to move outward against the brake shoes, bringing the shoe linings into contact with the drums. As pressure of the brake pedal is increased, greater hydraulic pressure is built up within the wheel cylinders, and consequently greater force is exerted against the shoes.

When the pressure on the pedal is released, the retraction springs on the brake shoes return the wheel cylinder pistons to their normal or "off" position, thus forcing the brake fluid back through the lines into the master cylinder.



Brake Hookup

Parking Brake

The Parking Brake is operated by a hand lever connected by steel cables to the two rear wheel brake assemblies. This lever is attached to a bracket in the left side of the cowl and equipped with a locking ratchet to hold the brakes in the "on" position while the car is parked.

Master Cylinder

The master cylinder, mounted on a sturdy frame bracket immediately in front of the brake pedal consists of a supply tank cast integral with the master cylinder proper, in which the standard compensating features are incorporated.

This unit, in addition to providing the brake actuating pressure, also performs two other functions. One function is to maintain a constant volume of fluid in the system at all times, regardless of expansion or contraction, due to heat or cold. The other function is its action as a pump during the bleeding operation.

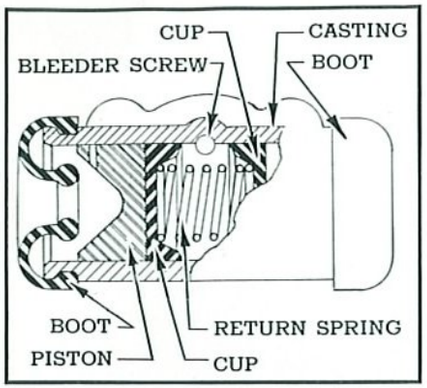
The return of the piston and primary cup to its released position is much faster than the return of the fluid through the lines into the master cylinder. A partial vacuum is created in the master cylinder and additional fluid is drawn into the system from the reserve chamber through the drilled holes in the piston and past the lip of the cup. Any excess is returned through the by-pass port into the reservoir, thus we have a cylinder full of fluid for every brake application.

It is imperative that the piston rod, which is attached to the brake pedal rod, be adjusted for clearance where it seats in the piston. There should be ¼ of an inch free movement of the brake pedal pad before the pressure stroke starts.

The primary cup must be clear of the by-pass port when the piston is in its released position, otherwise the compensating action of the master cylinder will be destroyed and the brakes will drag. This can be determined by assuring yourself that there is a slight amount of free movement of the brake pedal before the piston starts to move. The secondary cup prevents fluid from leaking out of the master cylinder into the boot. The supply tank filler cap is conveniently located under the bonnet for checking the fluid level. The supply tank should be kept at least half full of fluid. CAUTION: Before removing the supply tank filler cap extreme care must be used to prevent dirt from entering the master cylinder. Use only new clean Packard brake fluid.

Wheel Cylinder

The wheel cylinder is the unit which changes the applied hydraulic pressure into mechanical force. The wheel cylinder assembly is composed of a cast barrel, two boots, two pistons with cups and a wheel cylinder



Brake Cylinder

spring. At the upper center is located the bleeder connection used to expel air from the system.

To remove wheel cylinders for inspection, honing or repairs, disconnect the tube from the hose at the frame bracket. Remove the hose spring clip and the two cylinder fastening screws on the rear of the backing plate. Remove the brake shoe retracting springs which permit the shoes to move outward. Remove the connecting links between the cylinder pistons and brake shoes. The cylinder and hose may then be withdrawn as a unit. Before reassembling clean all parts with alcohol. **Do not** use gasoline or oil.

Bleeding Air from the Lines

Whenever the main pipe line is removed from the master cylinder, the brake system must be bled at all four wheels. Whenever a line is disconnected from any individual wheel that wheel cylinder **only** must be bled.

Fill the supply tank with genuine Packard approved brake fluid before commencing this operation, and keep the tank at least half full of fluid during the bleeding operation.

Remove the screw from the end of the bleeder connections and attach the bleeder tube. Allow the tube to hang in a clean container, such as a pint fruit jar. Unscrew the bleeder connection three-quarters of a turn and depress the pedal by hand, allowing the pedal to return to its released position slowly. This gives a pumping action which forces fluid through the tubing and out at the wheel cylinders, carrying with it any air that may be present.

CAUTION: After the brake pedal is depressed, it must be allowed to return slowly, otherwise air may be drawn back into the system.

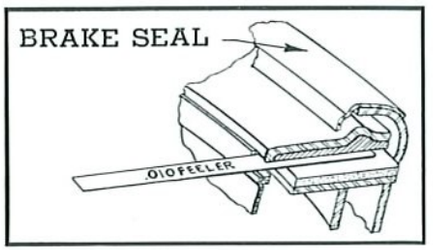
Watch the flow of fluid from the hose, the end of which should be kept below the surface of liquid in the pint jar. When all air bubbles cease to appear, tightly close the bleeder connection.

Fluid withdrawn in the "bleeding" operation should not be used again. Fluid should be replenished in the supply tank after each cylinder is bled. Should the supply tank be drained, during the bleeding operation, air will enter the system and "rebleeding" will then be necessary. When the bleeding operation is completed the supply tank must be refilled. Inspect for correct fluid level in the master cylinder each two thousand miles.

Brake Adjustments

The adjustment of the brake shoe for wear of the facings should be made as follows:

1st. Jack all wheels clear of the floor.



2nd. Disconnect parking brake cables at equalizer. (If cables have been adjusted too short the rear brake shoes will not rest against the eccentric when in the released position making the correct adjustment impossible.)

3rd. Uncover adjusting holes, and feeler gauge holes in brake drums at each wheel. Loosen eccentric lock nut and insert .010 inch feeler gauge between the lining of secondary (eccentric controlled) shoe and brake drum. Turn the eccentric adjustment in the direction of forward wheel rotation until .010 inch feeler is just snug at anchor and adjusting ends of secondary shoe. Tighten eccentric lock nut.

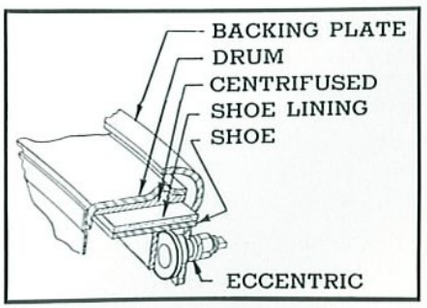
The clearance at both ends of secondary shoe should not vary more than .003 of an inch. Should the variation be greater than this it will be necessary to relocate the anchor pin. The method is described under "Anchor Pin Adjustment."

4th. Expand the brake shoes at all the wheels by turning notched adjusting screw until brake drum can just be turned by hand. With hand brake lever in off position adjust cable connecting hand brake to brake equalizer lever so that no slack exists, then set hand brake lever in **first** application notch, and pull parking brake cables toward equalizer. Adjust clevises so that clevis pin will enter freely. Lock clevis jam nuts and insert clevis pin cotter keys. Release hand brake.

5th. Release adjusting screw at each wheel until brake drums are completely free of drag. Replace adjusting screw and feeler gauge hole covers.

Anchor Pin Adjustment

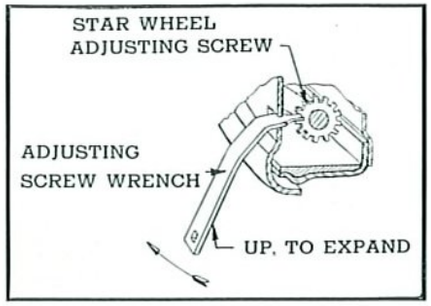
When it becomes necessary the anchor pin should be adjusted as follows:



1st. Loosen the anchor pin nut one turn.

2nd. Remove adjusting hole cover plate and with a screw driver or other suitable tool, turn the notched wheel of the adjusting screw toward the rim of the backing plate until the

two shoes are expanded against the brake drum sufficiently to cause enough brake drag so that the wheel can barely be turned with both hands. Then, using a soft hammer, tap the anchor pin on the threaded end to insure its assuming a correct position. (The anchor pin will shift in its elongated hole when shoes are expanded). Check anchor adjustments as in paragraph on brake adjustments.



3rd. Tighten anchor nut as tightly as possible with a sixteen inch wrench.

4th. Back the adjusting screw until the wheels are just free of brake drag. Make preceding adjustments at each of the four wheels.

5th. Follow the adjustment instructions given under "Brake Adjustments."

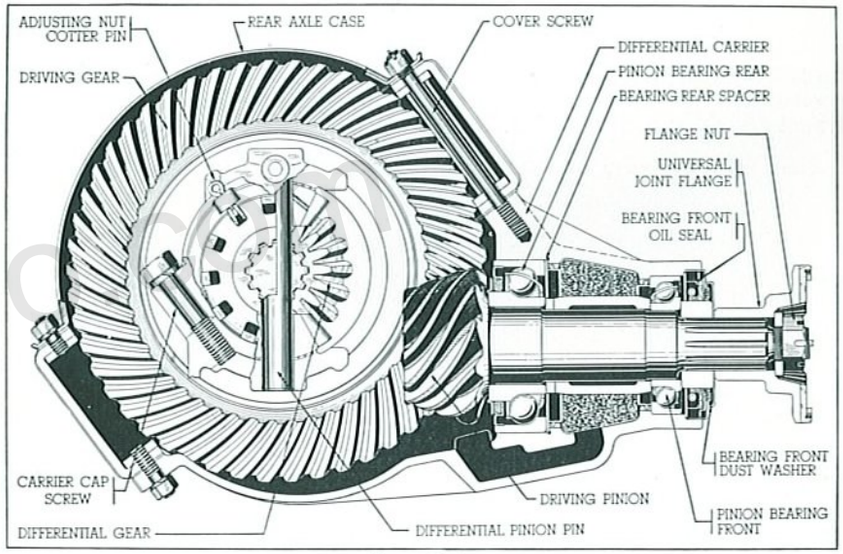
CAUTION

When breaking in a new car it is advisable to apply the brakes gently for the first 250 miles to allow the lining to seat in the drums. This will avoid scoring of the drums.

All friction surfaces will burnish themselves to that high polish so essential to durability, quietness and smoothness if not too highly stressed or loaded during the break-in period. Observance of this suggestion will pay big dividends in ultimate satisfaction.

Rear Axle

The rear axle used on the Packard car is a semi-floating, angle-set unit with hypoid driving gears. The standard gear ratio is 4.09 to 1 with an optional ratio of 4.54 to 1. In the hypoid gear set the center of the pinion is 1¾ inch below the center of the ring gear. Hypoid gears have greater tooth contact area and therefore longer life without the necessity for frequent adjustment. It is in fact difficult to properly adjust hypoid gears without proper gauges, and it is therefore decidedly advisable to have such work performed by an authorized Packard service

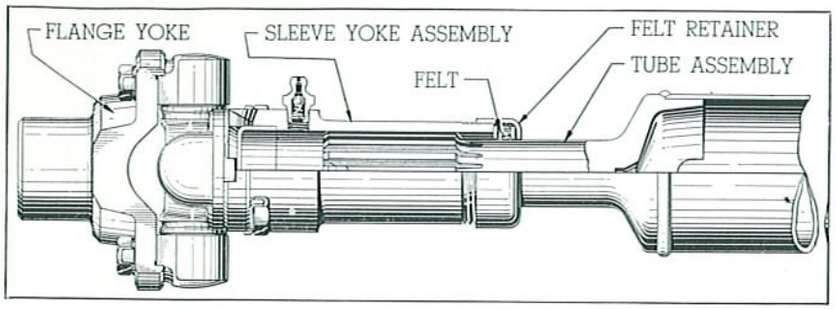


Rear Axle

station. The oil should be drained from the differential housing every Spring, or every 10,000 miles and replaced with fresh lubricant. A special gear oil is required for hypoid gears. See Packard dealer for approved lubricant.

Universal Joint

Two roller bearing universal joints with a tubular propeller shaft between connect the transmission to the rear axle. This type universal joint is packed with lubricant, closed and sealed when assembled and under normal conditions the journal bearings should not require lubrication for 20,000 or 30,000 miles. The slip yoke spline should be lubricated every 10,000 miles. If for any reason the slip yoke is removed from the shaft, be sure that the arrow on the yoke sleeve lines up with the



Universal Joint

arrow on the propeller shaft when reassembling. Assembling with the arrows out of line may cause an unbalanced condition with consequent roughness in the driving line.

Wheels and Tires

The wheels are 16″ drop center steel disc type of a new design which does not drum or magnify axle noises. The disc pilots on the hub and is held in place by five bolts. The chrome-plated hub shell cover is held in place by snap springs attached to the wheel.

The Packard One Twenty is equipped with 7.00 x 16 4-ply balloon tires. These tires are balanced and marked for identification. The front tires which are balanced to closer limits than the rear are marked with a square red mark at the valve stem. The rear tires can be identified by a round red mark at the valve stem. The tires should be inflated to 24 pounds pressure for all models except the Convertible Coupe. This car requires 22 pounds only.

The lower half of the rear compartment is designed to hold the spare wheel. Wheels should be placed so the tire valve is in register with the hole in the luggage compartment floor provided to facilitate checking and inflation. For the Club Sedan and Touring Sedan, the opening will be found under the rubber mat in the trunk compartment.

The wheel is held in place by a clamp against the tire secured by a bolt to which the wheel wrench can be fitted. Unfasten this clamp and the tire and wheel can easily be removed. There is no lock on the clamp, theft protection being provided by lock on the rear compartment door.

The following standard tools are furnished: Screw driver, pliers, spark plug wrench, wheel wrench and screw jack with handle. These are stored in the spare tire compartment.

Care of Body and Finish

It is essential to use clean sponges, loosening and softening dirt and mud with water before rubbing off. Lacquer, which is polished to give it a bright lustre will scratch and precautions must be taken not to destroy the smooth surface.

The car after exposure may lose some of its lustre and become dull or have a spotted appearance. The lustre may be restored by polishing with a good grade of polish such as Packard Body Polish.

The polishing of a lacquer finish at regular intervals is absolutely essential if the finish is to retain its full lustre and beauty.

The directions for the use of polish given on the bottle should be followed. Care should be taken not to rub too hard or too long over stripes as they are applied over the lacquer and may be rubbed off.

The washing and polishing operations may show traces of color remaining on the cloth. This should cause no alarm as it is a perfectly natural condition with all lacquers and simply represents a slight weathering which does not affect the life of the finish.

Lacquer finishes are resistant to acid and alkali materials, but alcohol anti-freeze solutions will spot lacquers if spilled upon the finish and allowed to remain. If immediately wiped off, no damage will result.

When grease or oil is found on the lacquer surfaces it may be removed with Packard Body Polish applied with a clean cloth. The polish should be applied only to the grease spots and then removed with another clean cloth.

If an enclosed body is exposed to low temperature shortly after having been washed, the water banked up at the lower edges of the windows may freeze and prevent their being operated. This will not occur if the windows are opened slightly for a short period to enable the water to drain away.

Wash the under parts of the car with cold or luke warm running water, soaking mud off as much as possible. Grease and oil on the under part of the chassis exclusive of wheels and motor can be removed by washing with gasoline or kerosene and drying with a clean cloth.

Care of Upholstery

The upholstery material in closed cars is exposed to conditions which will cause it to become soiled if it is not given proper care. It is desirable at least once a month to clean the upholstery with a vacuum cleaner and a whisk broom.

If the material becomes spotted Packard Fabric Cleaner should be used to remove the spots.

Leather upholstery may be washed with pure soap and water, rinsing off the soap and drying with a moist chamois. Never use gasoline on leather upholstery.

Care of Tops

Dust on the outside of tops should be removed with a damp sponge. The inside or cloth side should be dusted with a whisk broom or stiff brush. Never fold an open car top when it is damp.

Ordinary top dressings and gasoline are generally injurious to the top as they eventually cause the material to harden.

Engine Corrections

Fails to start

1. Choke open. To function properly the automatic choke must be perfectly free. Failure to start when motor is cold may be due to inoperative automatic choke caused by excessive friction in the linkage or bearings. In such case the choke should be opened manually by pressing downward on the connecting link or levers at the back of the carburetor. While the warm-up will be quite imperfect the engine can be started in the following manner. Fully depress the accelerator pedal several times, which will inject gasoline into the intake manifold. With throttle only **slightly opened** turn on ignition and starter in usual manner. Several false starts (start and stop) may occur but by repeating the procedure the engine can be made to run. The faulty automatic choke should be repaired or replaced at the earliest opportunity.

2. High temperatures. When the car has been driven very hard in hot summer weather and allowed to stand for some minutes the engine can be most easily started with the foot throttle fully opened. **Do not** pump the throttle—simply open it to the wide open position and hold it there until the engine starts.

3. Lack of fuel or water in gasoline—check at carburetor.

4. Carburetor flooded—due to dirt under float valve—tap lightly with wooden screw driver handle.

5. Battery run down or faulty ignition. Be sure ignition switch is turned on. Check for broken or loose connections, and pitted breaker points.

6. Fouled or broken spark plugs. Clean or replace. If they have been in use over 10,000 miles replace complete set.

7. Check to make sure throttle opens at carburetor.

Stops

1. Lack of fuel—check at carburetor.
2. Disconnected wire—check at terminals.
3. Flooded carburetor—check carburetor float valve.
4. Lack of oil—will be preceded by heavy knocking. Motor should be examined by competent mechanic before being started again.

Misses

1. Fouled spark plugs—clean or replace defective plugs.
2. Spark plug points improperly set. Check to .028-.030 gap.
3. Broken or disconnected wiring.
4. Carburetor out of adjustment—see Packard dealer.
5. Water in gasoline—drain tank and blow out lines.
6. Overheating—check water level in radiator. Check fan belt for tightening. Check distributor, it may have slipped into retard position.

Overheats

1. Lack of water or an obstruction in the water circulating system.
2. Slipping fan belt.
3. Defective water pump.
4. Dirty cooling system.
5. Late ignition.
6. Lean mixture.
7. Lack of motor oil.

Knocks

1. Loose connecting rod bearing.
2. Loose main bearing.
3. Faulty lubrication due to diluted oil or lack of oil.

4. Loose piston.
5. Loose piston pin.
6. Broken piston ring.
7. Carbon in cylinder head.
8. Overheating.
9. Spark advanced too far.
10. Tappet clearance too great.

Lack of Power—Engine will run but will not pull full load.

1. Too rich mixture. Restricted air cleaner. NOTE: This unit should be cleaned every 2000 miles under normal conditions.
2. Loss of compression due to leaky valves.
3. Tappets set too close.
4. Sticky valves.
5. Faulty cylinder head gasket.
6. Ignition too late.
7. Obstructed fuel line.
8. Lack of oil or water.
9. Engine overheating.
10. Rings not seating.
11. Dragging brakes—wheel bearings too tight.
12. Tire pressure too low.

STANDARD SIZES AND ADJUSTMENTS

BRAKES	
Clearance around Drum	.010″
Length of Lining	13″
Make of Lining—Primary	U. S. Asbestos No. 714
Make of Lining—Secondary	U. S. Asbestos No. 589
Width and Thickness	1¾″ x 7/32″
Shoes per Vehicle	8
Setting Hand Brake	1/8″ Free Travel with Brake Released in Rear Wheel Brake Assembly
CLUTCH	
Number of Driving Surfaces	2
Size of Driven Facing	6″ x 10″ x .137″
Clearance of Hub on Clutch Shaft	No Perceptible Backlash
Total Clutch Pressure	1035 Lbs.
Number of Springs	9
Pressure of Springs	115 Lbs. at 1 1/16″
Clutch Pedal Shank to Toeboard Clearance—Clutch Engaged	¾″
Free Movement of Pedal	2″
ELECTRICAL SYSTEM	
Generator Charging Rate—Cold	23
Battery Capacity	17 Plate—110 Ampere Hours
Lamp Bulbs—Headlamp	32-32 Candlepower
—Parking	1 Candlepower
—Instrument Board	3 Candlepower
—Stop	15 Candlepower
—Tail	3 Candlepower
—Dome	6 Candlepower
Spark Timing—Manual Setting	7° B. T. D. C.
Breaker Point Gap	.018″ to .022″
Spark Plug Gap	.028″ to .030″
COOLING SYSTEM	
Capacity	18 Quarts
Radiator Gravity Flow per Minute	25.8 Gallons
Clearance Fan to Radiator Core	3/8″
Thermostat Valve Starts to Open at	135°
Fan Belt	42° Vee Type
Fan Belt Length and Width	42⅜″ x ¾″
Fan Belt Adjustment	Loosen All Generator Support Bolts and Swing Generator. 25 lbs. pull required.
Range of Adjustment	1½″
GASOLINE SYSTEM	
Tank Capacity	20 Gallons
Inside Diameter of Carburetor Throat (each barrel)	1 1/16″

STANDARD SIZES AND ADJUSTMENTS—Continued

MOTOR	
Compression at 125 r.p.m.	110 Lbs.
Firing Order	1-6-2-5-8-3-7-4
Front End Chain	1¼″ Wide, ⅜″ Pitch—58 Links
Front End Chain Adjustment	Non-adjustable
Camshaft End Play	.002″-.004″
Camshaft Bearing Clearance	.001″-.003″
Piston Pin Fit in Piston	Palm Push Fit at 160° Heat
Clearance Bearing to Crankpin	.0015″
End Play Connecting Rod on Crankshaft	.004″—.010″
Connecting Rod Assembled	Oil Hole Toward Camshaft
Diameter of Crankpin	2 3/32″
Clearance on All Main Bearings	.001″—.003″
Crankshaft End Play	.003″—.008″
Diameter of Main Journals	2¾″
Length of Main Bearings—No. 1	1⅜″
—No. 2	1 7/32″
—No. 3	1 11/32″
—No. 4	1 7/32″
—No. 5	2 5/16″
Diameter of Cylinder Bore	3¼″
Diameter of Piston Pin	⅞″
Piston Pin Oversizes	.003″—.006″
Piston—Install in Motor	Slot Away from Valves
Width of Ring—Compression	⅛″
—Oil	3/16″
Clearance—Piston to Cylinder Wall	.0015″ Minimum
Ring Gap—Compression	.007″—.012″
—Oil	.007″—.015″
Pressure required to close Ring to Correct Gap	10 Lbs.
Piston Sizes	Standard .005″ Oversize .010″ " .020″ " .030″ " .040″ "
Valve Tappet Clearance	In. .007″—Motor Warm Ex. .010″—Motor Warm
Valve Stem Clearance at Bottom of Guide	.0005″—.00175″
Valve Lift	.300″
Tension of Valve Springs—Valve Closed	40 Lbs.
Oil Pump Pressure—Normal	35 Lbs.
Crankcase Oil Capacity	7 Qts.
Valve Timing—Inlet Opens	5° B. T. D. C.
—Inlet Closes	39° A. L. D. C.
—Exhaust Opens	45° B. L. D. C.
—Exhaust Closes	5° A. T. D. C.
Setting Camshaft	00's on Crankshaft and Camshaft Sprockets Should Be Nearest Together and Line Up with Shaft Centers

STANDARD SIZES AND ADJUSTMENTS—Continued

REAR AXLE		
Tread	60″	
Oil Capacity	4¼ Pints	
Backlash—Driving Gear to Pinion	.003″—.005″	
SPRINGS		
Front—Coil	5¼″ Dia. 7¾ Effective Coils	
Rear—Leaf—Semi-Elliptic	54″ x 1¾″	
STEERING		
*Front Wheel Camber	1°	
Front Wheel Toe-in	0″ to ⅛″	
*Front Wheel Caster	2°	
Front Wheel Tread	59″	
Minimum Turning Radius	19½′	
Front Wheel Bearing Adjustment	Tighten Nut as Tight as Possible, Back Off One-half a Turn and Lock	
Recommended Tire Pressure—Except	Convertible Coupe 24 Lbs.	
Recommended Tire Pressure—	Convertible Coupe 22 Lbs.	
Shock Absorber Adjustment	Fixed	
TRANSMISSION		
Oil Capacity	1 Quart	
Ratio to Rear Wheels—High	4.54 to 1	4.09
—Second	6.96 to 1	6.25
—First	11.04 to 1	9.92
—Reverse	14.44 to 1	12.98
Backlash—Clutch to Rear Wheels	Maximum .003″	

*See Page 40.

Commercial Chassis

These instructions cover the commercial chassis with the following exceptions:

Front spring (coil)	1925 lb. load 130 lb. rate
Rear spring (leaf)	1400 lb. load 170 lb. rate
Tire size	—16 x 7:00—6-ply
Tire pressure	—36 lbs. Rear—28 lbs. Front
Tire carrier	—On right side
Rear axle ratio	—4.7 to 1
Chassis weight	—2855 lbs.
Maximum load Including body	—2500 lbs.
Wheelbase	—158″
Turning radius	—25′ 8″

Universal Joint—Three roller bearing universal joints in the driving line, with self-aligning intermediate bearing.

A pressure gun fitting provides a means for lubricating the intermediate bearing. The universal joints are packed with grease and the slip yoke is lubricated in the same manner as the standard 120 chassis

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