PACKARD

ONE TWENTY
EIGHT - SUPER EIGHT
TWELVE

PACKARD MOTOR CAR CO
Service Dept

SHOP MANUAL

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FOREWORD

The reputation of Packard motor cars, Packard's ability to render good service, and Packard's integrity for fair dealing are without equal. These qualities are not only appreciated by Packard representatives in the field but by many thousands of satisfied Packard owners as well. This excellent reputation must be maintained by keeping our service men thoroughly acquainted with the mechanics of our product.

With these thoughts in mind, this Shop Manual has been prepared. Supplements will be added from time to time. In this Manual will be found correct information on adjustments, and light repairs on Packard's full line of cars and some helpful suggestions on diagnosing mechanical troubles in general. Purposely written briefly to conserve your time, it covers a wide field and contains information that is a basis for more detailed study and thought. It is fully illustrated and written to be easily understood.

A systematic study of this manual should be made. Immediately upon receipt of it, the distributer's service manager should conduct a series of meetings, probably in the evening, with his own shop men and those of his dealers. Special assignments should be made and every detail in the book covered so that all service men will have a thorough mechanical knowledge of Packard cars.

"Good Service Means More New Car Sales"

INDEX

A ROUTINE FOR TROUBLE SHOOTING:

Under the following ten headings are listed some causes of engine troubles. These are general troubles and can happen to all kinds and types of gasoline engines. Some symptoms are common to different ailments, these are listed under more than one heading. The ordinary motor tune-up will not take care of all motor ailments.

Always road test the car and, if possible, with the owner and have him point out the trouble.

The causes are listed in the order in which they are found to most commonly occur, so skipping about will not save time. A careful check and correction of each of the items suggested is certain to remedy the trouble.

4. In most cases the remedies are apparent from the causes. In these cases remedies are not given. If the proper procedure for the correction is not understood, reference should be made under the proper heading in the Technical Data Book, or the Mechanical Reference Book, which fully cover the subject, so that repetition here is not necessary.

In making the correction, always use Packard parts—remember, "A Packard, is a Packard, only, when Packard parts are used."

The following subjects are covered in the order listed:

1. Hard starting.
2. Gas consumption, excessive.
3. Oil consumption, excessive.
4. Poor idling.
5. Over heating, engine.
6. Lack of power, speed and performance.
7. Engine misses.
8. Engine stops.
9. Engine knocks.
10. Miscellaneous engine troubles.

HARD STARTING, GENERAL:

Instructions on starting probably are not being followed. Attach starting instructions to the light switch:

1. Check to determine if trouble is fuel or ignition.
2. Lack of fuel.
3. Water in gasoline.
4. Battery weak. Check gravity and voltage.
5. Cables, loose or corroded. Check from battery ground to starting motor switch.
6. Bad starting switch.
7. Bad ignition switch.

8. Fouled, broken or worn spark plugs.
9. Carburetor flooded. Possibly dirt under needle valve.
10. Choke out of order.
11. Accelerator pump out of order.
12. Dirt in fuel strainer.
13. Dirt in carburetor bowl.
14. Oil in gasoline.
15. Drain tube clogged.
16. Poor compression. Check vacuum.
17. Breaker points pitted.
18. Condenser short, open or leaky. Test.
19. Dirty distributor.
20. Tappets too close or too far apart.
21. Coil weak. Test high tension voltage.
22. High tension wire broken or leaking.
23. Faulty ignition. Be sure ignition switch is turned on and making contact. Check ammeter reading.
24. Broken connection in ignition primary circuit.
25. Throttle or choke valve stuck in carburetor. To function properly, the automatic choke must be perfectly free.
26. Starting motor not operating properly.
27. Brush dry, sticking and not contacting.
28. Bearings dry, worn and allowing armature to drag on field.
29. End play in armature shaft too great. Should not exceed .010".

Cold Starting:

1. Inoperative automatic choke.

2. Excessive friction in the linkage or bearings. NOTE—This trouble usually shows up by many false starts. (Starting and stopping.) The engine may finally be started by injecting gasoline into the intake manifold by means of the accelerator pedal, but the automatic choke should be repaired or replaced.

3. Gasoline not sufficiently volatile.

4. Oil too heavy. NOTE—Oil has frictional resistance and before it is warmed up and thinned, it is quite similar to molasses or glue, especially if it is heavy. Heavier oil than recommended should never be used.

Hot Starting:

After the engine has been driven very hard in hot weather, and allowed to stand a few minutes:

1. Throttle not wide open.
2. Gasoline too volatile.
3. Pumping the throttle

4. Carburetor float chamber dry from evaporation.

5. Drain tube ball sticking.

6. Vapor lock.

When a hot motor is stopped, the heat from the manifold often vaporizes the fuel in the float chamber so that it is necessary for the fuel pump to replenish fuel to the carburetor.

Weak or Continually Discharged Battery:

1. Lack of attention.

2. High consumption.

3. Slow speed night driving.

4. Short runs and frequent starting.

5. New battery (not cycled).

6. New battery not fully charged when delivered.

7. Generator not charging.

8. Low generator output. (For causes under this heading, see page 4.)

9. Leaky stoplight switch. NOTE—If the stoplight switch is leaking from external or internal conditions, the switch will be warm in the morning after the motor has become cool. A leaking stoplight switch will pass sufficient current to cause one stoplight to give a dull glow in a dark room when the other bulb has been removed.

10. Low water level.

11. Sulphated plate caused by low water level.

12. Frozen or buckled plates.

13. Partial or poor ground on battery.

14. A partial ground or a leakage from an occasional ground caused by a swinging wire, or chafing.

15. A broken or corroded battery or motor ground. The motor may not stop when the break occurs, but its roughness may be noticeable. The breaker points will become pitted and burnt, caused from the immediate rise in generator voltage—the lamps may flare up and burn out if this occurs at night. The motor will probably not start if stopped.

16. Out of balance use of accessories and lights.

NOTE—The use of radios, electric heaters, fans, cigar lighters, extra lights, matched horns and other electrical equipment requires considerable current. The owner must use judgment and balance the use of his accessories. If the generator were set to charge sufficiently high to supply current enough for the use of all accessories at once, run the motor and still charge the battery, the output, even though held at minimum by the voltage regulator, might be so high as to damage the battery if none of the accessories were in use.

The only remedy for this condition is to provide the owner with a small charger to keep his battery charged sufficiently to meet output requirements.

If the owner is distinctly a slow speed, short trip, driver, then a smaller generator pulley, part 304924, may take care of him.

If the owner is continually a long trip, high speed driver, then a larger generator pulley should be installed.

Low Generator Output:

1. Fuse on generator voltage regulator blown.
2. Oil or dirt on commutator and brushes.
3. Third brush not properly adjusted.
4. Poor seating of brushes.
5. Grounded brush holder.
6. Loose connection.
7. Voltage regulator out of adjustment.
8. Open or shorted armature.
9. Open or shorted field coils.
10. Commutator out of round or high mica.
11. Weak brush spring.

The charging current or rate of any generator cannot be increased without increasing the voltage and more rapid wear on the commutator, brushes and breaker points, will result. The lamp bulbs will have shorter life also.

Starting Motor Fails:

1. Loose, broken or corroded terminals from battery ground through battery to starter.
2. Battery discharged.
3. Sticky Bendix drive. Motor spins, but will not engage in flywheel.
4. Bendix gear jammed in flywheel.
5. Grounded terminal.
6. Grounded brush.
7. Faulty starting switch.
8. Shorted armature.
9. Shorted or open field coil.
10. Burned commutator.
11. Brush spring weak or sticking.
12. Poor fitting brush.

GAS CONSUMPTION, EXCESSIVE:

Before doing anything, determine first *to your own full satisfaction* whether or not the gas consumption is excessive. You should be guided by what the owner says, but it is wise to check every statement.

1. High float level.
2. Dirt under needle valve.
3. Late ignition timing.

4. Economizer jet stuck open by corrosion or dirt.
5. Economizer jet opening too soon.
6. Choke sticking. (Should fully release when motor is warm.)
7. Brakes dragging.
8. Carburetor float punctured.
9. Dirty air cleaner. (Cylinder wear will be increased if air cleaner is not given proper attention).
10. Motor idling speed too fast.
11. Accelerator sticking.
12. Gasoline too volatile.
13. Dirty spark plugs or incorrect gap.
14. Breaker points pitted, burned, or dirty.
15. Atmospheric condition. (Head wind.)
16. Heavy oil.
17. Under-inflated tires.
18. Oversize tires.
19. Gas tank vent.
20. Leak in fuel line or gasoline tank.
21. Fuel pump springs switched, pressure too great, also causes flooding.
22. Valves not seating.
23. Worn pistons and rings. NOTE—This only applies mainly to old cars. Rings and pistons should never be tampered with in new engines during "breaking in."

Excessive gas consumption may be due to short measure at gasoline stations, evaporation in the hot sun, pilfering, road and driving conditions.

Many excessive gas consumption complaints may be settled by the use of a gas-per-mile gauge tester with the owner driving. The owner may observe to his own satisfaction, how much faster the gas goes down on first and second speed acceleration and under high speed driving. Road conditions also play an important part, as well as short runs and long stops wherein the motor does not become sufficiently warm. A steady speed on a level predetermined test route at about 30 mph. gives best fuel economy.

OIL CONSUMPTION, EXCESSIVE:

Before proceeding to correct, determine first, *to your own full satisfaction* whether or not the oil consumption is excessive. You should be guided by what the owner says, but it is wise to check every statement.

To check for leaks, the oil must be in circulation under pressure. First, warm the motor then speed up to about 40 mile per hour driving speed. Run until the motor and oil are up to normal running temperature. This somewhat thins the oil. Check the pressure.

(a) Check for oil fumes and smoke at tail pipe. If an unusual amount of smoke is noted, then oil is passing through the combustion chamber. It may be caused by:

(a) Loose connecting rod bearings.

(b) Loose main or cam shaft bearing.

(c) Passing by inlet valve stems.

Usually a compression test will indicate whether or not the pistons and rings are in good condition. 3000 to 5000 miles is often necessary to perfectly seat rings.

Loose connecting rod bearings will throw more oil than perfectly fitting pistons and rings can handle and may ultimately carbon and gum the rings.

Other places for oil to leak out:

(a) Oil covers and gaskets.

(b) Windshield vacuum booster diaphragm leaking, sucking oil out of the crankcase. (Will cause smoking.)

(c) Through crankcase ventilating system.

(d) Around the distributor shaft.

(e) Oil pump gasket.

(f) At oil manifold plugs.

(g) Oil plugs in the block and crankcase oil galleries.

(h) Crankcase oil pan, and drain plugs.

(i) Bleeder vents.

(j) Chain cover.

(k) Chain cover drain plugged, causing over flow.

(l) Crankshaft oil slinger.

(m) Oil cooler.

A new motor usually takes a little more oil during the "breaking in" period than after. High speed driving and characteristics of different oils play an important part in oil consumption.

We do not recommend heavy oil, too light an oil will increase oil consumption.

POOR IDLING:

The proper idling speed of a motor should be about 300 r.p.m., or seven miles per hour. It may be possible to throttle a motor down so as to count the exhaust "puts" by using too rich a mixture and a retarded spark, but this is not advisable.

1. Dirt in carburetor.
2. Breaker points dirty, oily or pitted; too close or too far apart.
3. Mixture too lean, or too rich.

4. Carburetor low speed jet plugged or loose.
5. Throttle valves not synchronized.
6. Throttle valve not closing (adjust).
7. Choke valve sticking.
8. Early spark (rough motor).
9. Float level too high or too low.
10. Carburetor flooding. (Dirt under needle valve.)
11. Leaky float, or sticking float.
12. Air leak in carburetor or manifold gasket, or windshield wiper connection.
13. Economizer valve sticking from corrosion or dirt (replace).
14. A weak coil. (Replace).
15. A bad condenser. (Replace).
16. Fouled, broken, or improperly gapped spark plugs.
17. Poor compression; valves riding, poor seat, worn rings.
18. Insufficient valve lash.
19. Sticky valve stems.
20. Cross fire. (High tension leakage.)
21. Worn distributor-shaft or gear.
22. Dirty or cracked distributor cap.

OVER-HEATING, ENGINE.

1. Fan belt slipping, worn, or broken.
2. Lack of water or coolant.
3. Alcohol in warm weather.
4. Radiator shutters not opening.
5. Radiator core air openings clogged with insects and dust.
6. Water inlet or outlet hose disintegrated or clogged.
7. Water inlet hose too flexible—collapses under suction of pump.
8. Radiator core water passages restricted or clogged by alkaline deposit or possibly with pieces of rubber hose, rust, scale, etc.
9. Ignition timing late.
10. Lean mixture. Restriction in gas line. Dirty fuel pump screen. Stuck or dirty fuel pump valves.
11. Insufficient motor lubrication.
12. Dragging brakes.
13. Slipping clutch.
14. Air trapped in the cooling system, causing steam pockets, hot spots and over flow of radiator.
15. Water passages in cylinder block and head clogged with scale, causing poor circulation, over-heating, over-expansion of pistons and creation of internal motor friction.

16. Cylinder block distributing tube in side of the block damaged.

17. Improper or insufficient water pump lubricant.

18. Muffler clogged or passages restricted.

19. Restriction in tail pipe.

20. Distributor automatic advance not operating.

21. In new motor or overhaul job, bearings, pistons, etc., fitted too closely, will cause excessive friction and overheating.

22. Sticking thermostat.

23. Winter type high temperature thermostat used in a warm summer climate.

24. Water pump impellor loose on shaft.

Failure of radiator shutters to open may be due to inoperation of the shutter thermostat. It may have frozen or rusted joints or links, or it may be due to a leak in the cooling system.

Correct valve timing is important to proper cooling.

Air leaking into the cooling system because of a leaky pump gasket or pump packing accelerates rust and corrosion.

If a glycerine base is used in the coolant and leaks into the combustion chamber through the cylinder head, it is very likely to gum and stick up the motor. Keep the gaskets tight.

LACK OF POWER, SPEED AND PERFORMANCE:

1. Heavy oil.
2. Late spark, causing over-heating, low mileage, sluggish motor and burnt valves.
3. Dirty and restricted air cleaner.
4. Too rich a mixture. Carburetor out of adjustment.
5. Dragging brakes.
6. Wheel bearings too tight.
7. Obstruction in fuel line.
8. Excessive carbon deposit.
9. Engine over-heating. (Lack of oil or water. See overheating.)
10. Loss of compression. (Valves leaking, rings not seating.)
11. Dirty spark plugs.
12. Pitted points.
13. Tappets set too close or too wide.
14. Sticky valves.
15. Faulty or wrong cylinder head gaskets.
16. Weak coil.
17. Weak condenser. (Which also causes point pitting.)
18. Cross fire (high tension wire leakage.)
19. Restriction in muffler or tail pipe.

20. Tire pressure low.
21. Loose connection in primary circuit from battery to coil. (May be distributor, ammeter, ignition switch, or any other connection.)
22. Faulty valve timing.
23. Wheels out of alignment.

If check is made only for top speed, then the speedometer should also be checked. It may be reading slow.

ENGINE MISSES,

On Hard Pull or at High Speeds:

1. Spark too early.
2. Breaker points pitted, burnt, too close, or too far apart.
3. Spark plug gap too wide.
4. Fouled, worn out, burnt, cracked, dirty or broken spark plugs.
5. Weak coil.
6. Weak condenser.
7. Weak breaker-arm spring.
8. Fuel flow restricted in gas line, screen or connections.
9. Fuel pump not functioning, dirt under the valves seats. Weak pump spring.
10. Low or high float level.
11. Carburetor jets clogged.
12. Sticking valves, valves not seating.
13. One or more valve tappets too tight.
14. Poor compression in one or more cylinders.
15. Poor ground of distributor.
16. Cracked distributor cap.
17. Loose or broken wire in primary circuit from battery to coil.
18. Water in gasoline.
19. Over-heating. (See causes for over-heating.)
20. Cross fire. (High tension leakage.)
21. Weak valve spring.

Irregular Firing or Occasional Miss in Engine:

1. Cold motor.
2. Choke sticking.
3. Sticky, dirty or broken distributor points.
4. Distributor points not properly synchronized or set too close.
5. Broken or fouled spark plugs.
6. Poor compression.
7. Cracked or leaky wires.

8. Loose wire connections. (Anywhere from battery to ignition coil in the primary circuit and from the coil to the spark plugs in the secondary circuit.)

9. Worn distributor cam, shaft or gear.

10. Dirty or cracked distributor cap.

11. Valves sticking, or tappets too close.

12. Weak valve springs.

13. Poor distributor ground.

14. Battery terminals corroded.

15. Broken motor or battery ground.

16. Dirt in the fuel system. Note—In this case the entire fuel system should be checked, the gasoline tank cleaned, pipe lines blown out and thoroughly cleaned, the fuel pump and carburetor cleaned; all connecting joints tested for free passage of gas and tightness of connection.

17. Leaky or loose intake manifold.

18. Badly worn intake valve guides.

19. When the four inside or four outside cylinders miss, usually one set of the carburetor jets are clogged. The carburetor feeds the motor in two groups, the center four cylinders and the end four.

ENGINE STOPS,

Or Stops When a Quick Car Stop is Made:

1. Lack of fuel.

2. Water in gasoline.

3. Corroded battery terminal.

4. Broken or disconnected primary wire.

5. Flooded carburetor.

6. Lack of oil. (This will be preceded by knocking and the motor should be examined very carefully before starting again.)

7. Centrifugal force acting on fuel in rounding corners.

8. Idling speed set too slow.

9. Hot motor, causing boiling or percolation of gas in carburetor.

10. Dirt in gas tank or line, clogging the system.

11. Carburetor float punctured or too low or too high.

12. Idle system clogged.

13. Open circuit in distributor, coil, or ignition switch.

14. Bad air leak at manifold or carburetor.

15. Ball check valve in manifold drain pipe stuck. (Causes a sizzling sound.)

KNOCKS:

1. When an engine produces that well known gas knock, or ping when accelerating, check for the following:
   (a) Early spark.
   (b) Fast burning gas. (Select blend with higher anti-knock value.)
   (c) Carbon deposit.
2. Broken piston ring.
3. Over heating.
4. Tappet clearance too great. (Noisy valve mechanism.)
5. Hot spark plugs. (Use recommended type.)
6. Loose connecting rod.
7. Piston slap (cold).
8. Loose piston pin.
9. Faulty lubrication. (Oil dilution or lack of oil.)
10. Loose rivets in frame.
11. Loose body bolt.
12. Loose motor support.
13. Looseness in damper or flywheel.
14. Loose spark plug.
15. Sticking valve stem. (Squawk sound.)
16. Loose cylinder block.

MISCELLANEOUS ENGINE TROUBLES:

Coil Trouble:

A weak coil will cause lack of power, but will not burn the breaker points.

Condenser Trouble:

A weak condenser will cause loss of power, but distinguishes itself from a weak coil by burning the breaker points. Either a weak coil or a weak condenser may prevent starting the motor.

Flat Spots:

1. Rich mixture caused by restriction in air cleaner, or dirty air cleaner.
2. Choke sticking.
3. Low float level.
4. Carburetor out of adjustment.
5. Jets clogged.
6. Water in carburetor.
7. Late ignition timing.
8. Main metering jet loose.

Timing Early:

An early spark will cause motor vibration, motor roughness and a rolling at low speed.

Timing Late:

A late spark will cause heating and loss of power and low gas mileage. The intensity of the spark, or voltage of the coil, should be checked, also the automatic advance.

Rough Motor at Low Speeds Up to Thirty Miles per Hour:

1. Ignition too early. Roughness with gas ping.
2. Spark plug gap too close.
3. If this occurs after a hard pull or high speed run, the indication is excessive carbon deposit or tappets set too close.
4. Breaker points not synchronized.
5. Distributor cam worn.
6. Distributor shaft worn.
7. Low speed jets partially clogged.
8. Too much back lash in distributor driving gears.
9. Wires on wrong spark plugs.
10. Accelerator pump inoperative.
11. Manifold heat valve not functioning.

Rough Motor at High Speeds:

1. Synchronized vibration periods of two or more units.
2. Loose motor mount.
3. Loose body bolt. This gives a similar sensation to that of a rough motor.

Smoking:

1. Rich mixture.
2. Punctured or leaky vacuum pump diaphragm.
3. Too much oil in crankcase. Filling the motor with too much oil is killing the motor with kindness.
4. Choke sticking.
5. Loose connecting rod or main bearing, which may cause low oil pressure.
6. Loose pistons and rings.

Exhaust Valve Seat Cracked:

If one or more exhaust valve seats in a block are cracked, it is very likely that the motor has been run without water.

Spitting or Sputtering:

The car runs satisfactorily until high speed is reached, then after short time slows down with tendency to spit back into carburetor.

1. Fuel starvation.
2. Fuel line damaged or clogged.
3. Preignition.

4. Carbon in the combustion chamber.

5. Hot type spark plugs, cracked, broken or worn out.

6. Intake or exhaust valve holding open.

Car runs satisfactorily until high speed is reached, and then after a short time slows down and loses power, but does not spit back into the carburetor.

1. Valves holding open from lack of tappet clearance, called "valve riding."

2. Too volatile a gas.

3. Restriction in fuel system.

4. Poor distributor ground.

5. Wide spark plug gap.

6. Vapor lock (generally in Spring time).

7. Gas pump not producing sufficient pressure for high speed.

Motor Dies in Rounding Corner:

1. The centrifugal force in rounding corners under certain conditions may cause a swish of the gasoline in the float chamber and a movement of the float which starves the engine.

SPARK PLUGS:

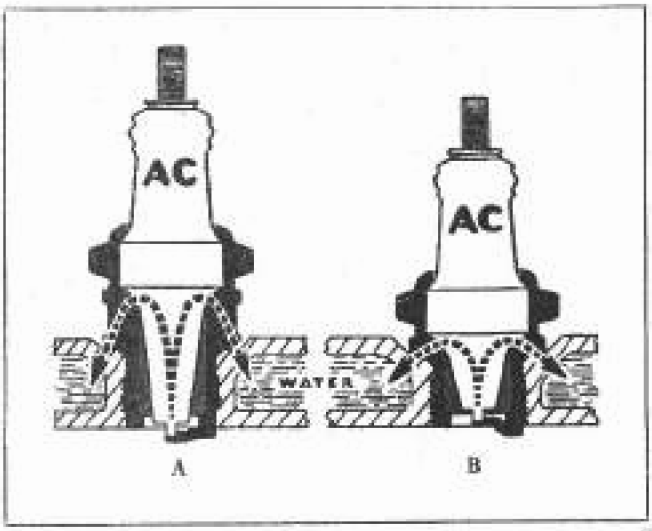
The Meaning of Hot and Cold Plugs:

To give the most satisfactory and economical performance, spark plugs must operate within a certain temperature range—not too hot, not too cool.

If the plug remains too cool, carbon will deposit on the insulator, causing fouling and missing. If the plug runs too hot, the insulator will become incrusted and the firing points will burn rapidly. In extreme conditions, they may cause a premature explosion, or preignition. They must operate hot enough to burn away the carbon. If the carbon is not burned up, it builds up. They should operate cool enough so as to give good serviceable life without fouling.

The engineering department has selected a type of plug which will operate within the right temperature range under all normal driving conditions. If other than recommended plugs are used, unsatisfactory performance may result.

Spark plugs run hotter or cooler according to the length of the insulation projection in the combustion chamber. The shorter the insulation the faster the heat is radiated to the metal, and consequently the cooler is the plug. The longer the insulation, the slower the heat is radiated, and consequently the hotter the plug.



Insulator A is longer, therefore will run hotter, B is shorter and will run cooler.

The numbers used by AC on their plugs indicate in sixteenths of an inch the length of the lower end of the insulator exposed to the heat of the combustion chamber. The lower the number, the cooler the plug—the higher the number, the hotter the plug.

All AC "K" plugs are 14 millimeter, therefore, an AC "K" 7 plug is 14 millimeter with $\frac{7}{16}''$ insulator.

Champion numbers corresponding to the heat characteristics of their plugs may be found in the following chart.

	AC Plug Number	Champion Plug Number	Types of Service
High Compression Uses Cold Plugs	K-4 K-5 K-6 K-7	J-12 J-11 J-10 J- 8 J- 9	Severe Service High Speed High Compression Heavy Load, Long Haul Minimum Stops & Starts Long Up-grade Hot Climate Motor Condition
Medium Compression	K- 8 K- 9 K-10	J-7 J-5 J-5C J-6	All Normal Motor Operation Normal Spd., Full Load Service
Cold Motor Uses Hot Plugs	K-14	N-2	Cold Type Motor Low Speed Low Compression Frequent Stops & Starts Governed Speed Cold Climate Motor Condition

Packard uses the coolest plugs advisable and they are sufficiently hot so that fouling is never a problem.

Non current cars up to Ninth Series takes $\frac{7}{8}''$—18 plugs. Champion C-4A (or equivalent).

The 734 speedster only, takes 18 millimeter plugs. Champion No. 13 (or equivalent).

Ninth, Tenth, Eleventh, Twelfth and Fourteenth Series, and the One Twenty use 14 millimeter, "K" 7 AC, Champion J-8 or the equivalent.

Spark plugs should be cleaned every 5000 miles and changed every 10,000 miles. Regap after cleaning.

Don't change plugs promiscuously. You will always be more nearly correct if you use only plugs recommended by the factory.

Only four things happen to spark plugs that impair engine efficiency: worn out, dirty, wrong gap, broken insulator.

Dirty Plugs:

Are caused by over-rich mixture, excess lubrication, faulty ignition or poor compression. Red, brown, yellow or blistered oxide deposits are conductors of electricity and short out plugs. They are the most prevalent cause of intermittent missing and plug failure in today's operating conditions. Ethyl gasoline often shows a colored deposit, but this deposit is not injurious and need not be scrapped off.

Wrong Gap:

A spark plug gap will gradually widen in normal service. If the wear is unusually rapid at low mileage, the plug may be operating "too hot."

The gap should be set exactly after cleaning. Don't guess, or use a "thin dime."

Important:

In regapping, adjust only the side electrodes. Never bend the center electrode, or breakage of the insulator will result from the strain on the electrode under heat.

Broken Insulator:

A cracked, or broken, upper end can never be caused by the engine. It is caused by an outside blow, or a poor fitting wrench.

A newly broken, or cracked insulator may not cause missing immediately, but as soon as oil or moisture penetrates the fracture, the plug will "cut out."

Breakage on the lower end of the insulator may occur when operating conditions are abnormally hot, but more generally the fault is caused when regapping by bending or straining the center electrode.

Spark Plugs as Indicators:

A badly carboned spark plug may indicate:

1. Low battery.
2. Corroded connection.
3. Broken connections.
4. Broken ignition cables.
5. Worn insulation.
6. Pitted, or incorrectly gapped breaker points.
7. Leaky or stuck valves.
8. Incorrect spark timing.
9. Rich mixture.
10. Excessive carbon content in gasoline or lubricating oil used.

Oily Plugs:

These may indicate:

1. Rich mixture.
2. Choke sticking.
3. Loose connecting rod or main bearing.
4. Plugged, stuck or poor fitting rings.

CARBURETOR ADJUSTMENTS

One Twenty

1. Check for air leaks in carburetor, manifold gaskets and windshield wiper vacuum connections.

2. A loose main metering jet will leak and cause a richer mixture on one bank or one group of 4 cylinders. This will cause poor gasoline economy, and if the leak is bad will cause the motor to be rough and cut out at high speed due to fouling of the plugs. A quick check to determine this condition may be made by removing the air cleaner, placing a light over the air horn and observing the operation of the main discharge jets with the motor operating at various speeds, from idling to 30 miles per hour. If the economizer valve is leaking the high speed jets will be in operation under 70 miles per hour. This also would ruin fuel economy.

   The economizer valve may not be seating, it may be gummed, stuck, or held open by dirt. It may also be opened by the pump plunger coming in contact too soon.

   When checking the carburetor, always examine the idling adjustment valve. If the screws are ridged they should be renewed.

3. Check float level.

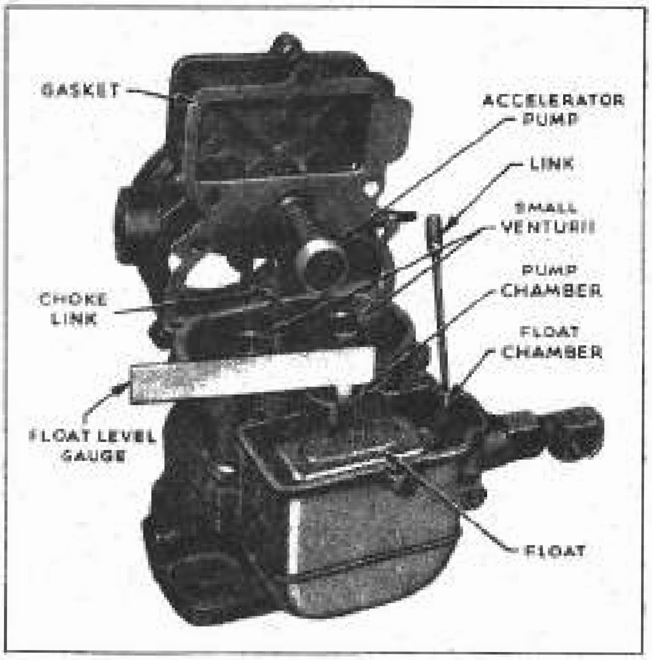
   A. Place the car on a level floor.

   B. Remove air cleaner.

   C. Disconnect throttle to pump link, and the choke link. Remove the 5 carburetor top screws and tip the top back towards the dash. It is not necessary to disconnect the choke vacuum piston link.

   D. Turn the engine with the starting motor until the float shuts off.

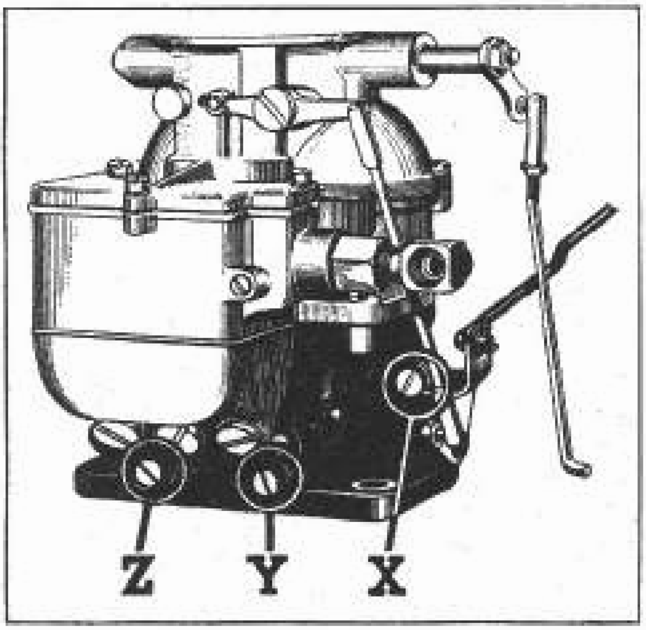
   E. Check the gas level by placing the gas level gauge in the accelerator pump well. The gas level is $\frac{13}{32}$" below top of carburetor well with the gasket removed.



Be very careful not to jar the float while checking the level, otherwise, a false float level measurement will result. If an owner complains of poor fuel economy the float level should be checked and re-set if necessary as it is common for all carburetor float levels to rise and enrich the mixture due to natural wear of the needle valve and seat.

NOTE—To correct the float level, bend the upright portion of the float lever arm.

CAUTION—Any effort to readjust the level will result in the gasoline remaining in the line under pressure to flow into the float chamber. Therefore, before making a second float level check, withdraw enough gasoline to cause the float valve to open and again turn the engine over with the starting motor until the float valve is shut off. This procedure is necessary if false readings are to be avoided.



4. Check gasoline lines for leaks from tank to carburetor.

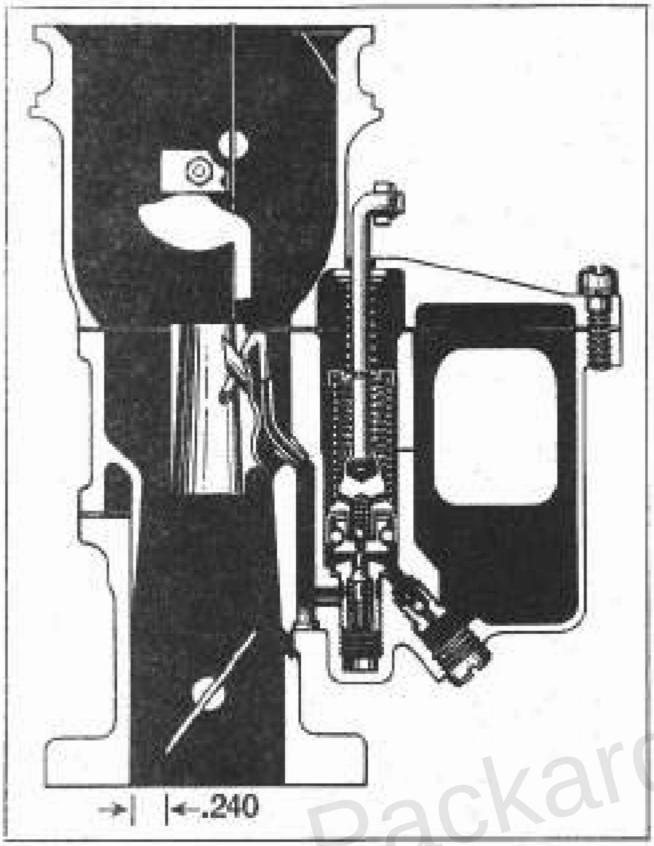
5. Set throttle adjustment screw "X" to 6 miles per hour on level road in high gear with engine warm. Turn idling screw "Y" IN slowly until engine begins to run irregularly, then OUT until engine begins to "roll," then IN to where the engine runs the smoothest. Repeat with screw "Z." Approximately one full turn OUT will give the best results. The idle adjustment is sensitive and care must be exercised to secure good results.

6. It may be necessary to re-adjust screw "X" to 6 miles per hour.

7. Poor gasoline may clog the carburetor and the small passages in the gasoline line fittings. The connections must be cleaned when clogged. To clean the carburetor jets, remove the carburetor and turn it up side down, blowing out each jet individually with clean compressed air.

   Water in gasoline accelerates corrosion which may be observed in the float chamber as a whitish or pinkish soggy paste when wet, or dust when dry. If this is found in a carburetor, it must first be cleaned out of the fuel bowl and great care exercised in blowing out the jets.

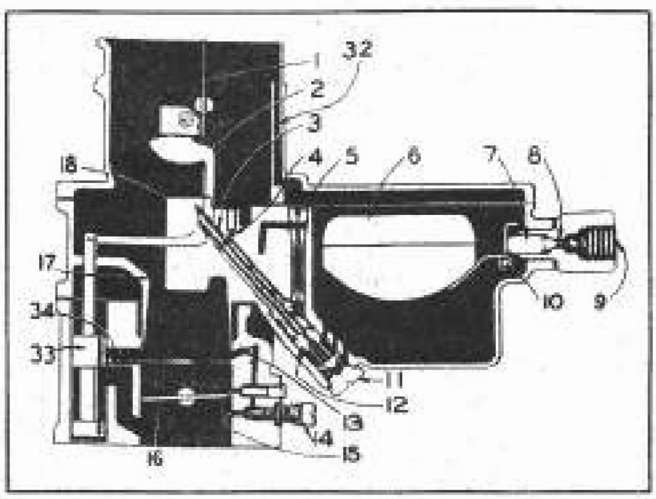
8. The economizer jet comes into operation only when the accelerator pump piston comes in contact with the economizer valve



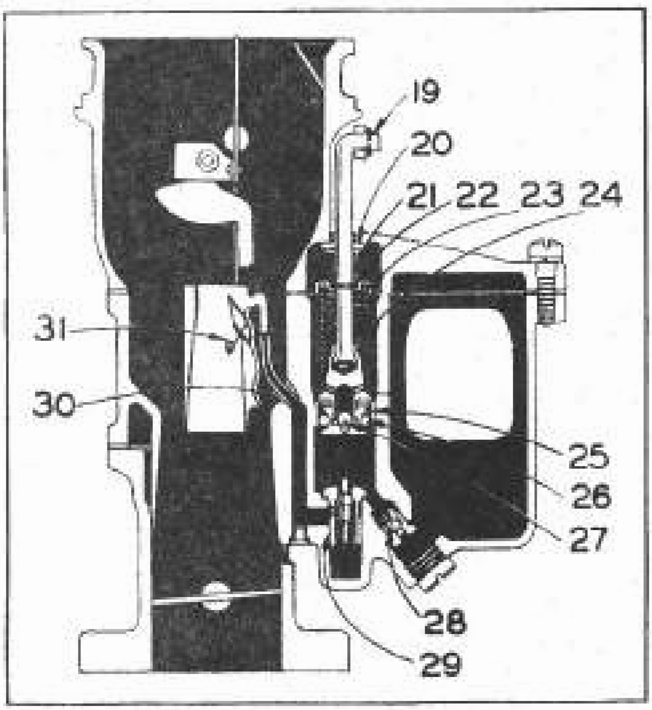
stem in the bottom of the pump well. This occurs only when accelerating, or driving above 70 miles per hour, at which time the throttle is opened far enough to admit a drill rod .240" in diameter between the throttle valve and the throttle body. The pump pivot arm ball may be bent upward slightly to retard the opening of the economizer valve or lowered to bring it into operation sooner.

Parts Indicated in Illustrations are as Follows:

1. Choke Valve
2. Vacuum Piston Link.
3. Main Discharge Jet.
4. High Speed Bleeder.
5. Idle Tube.
6. Float.
7. Float Needle Valve.
8. Float Needle Valve Seat.
9. Gasoline Inlet.
10. Float Fulcrum Pin.
11. Main Discharge Jet Plug.
12. Main Metering Jet.
13. Idle Air Bleeder.
14. Idle Needle Valve.
15. Idle Discharge Holes.
16. Throttle Valve.
17. Primary Venturi.
18. Auxiliary 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. Pump Piston Expansion Spring.
27. Pump Relief Valve.
28. Pump Inlet Check Valve.
29. Economizer By-Pass Valve.
30. Pump Discharge Nozzle Holder.
31. Pump Discharge Nozzle.
32. Float Chamber Vent. (Page 18.)
33. Automatic Choke Piston.
34. Fast Idle Air Passage.



Automatic Choke—One Twenty

Fig. No. 1. Choke Open—Slow Idle—Engine Hot.

Choke valve "A" is in wide open position as it will be when idling a hot engine or before a hot engine has cooled down after running. Fast idle passage "E" is closed by piston "B" and idling fuel is supplied by the normal idling system of the carburetor.

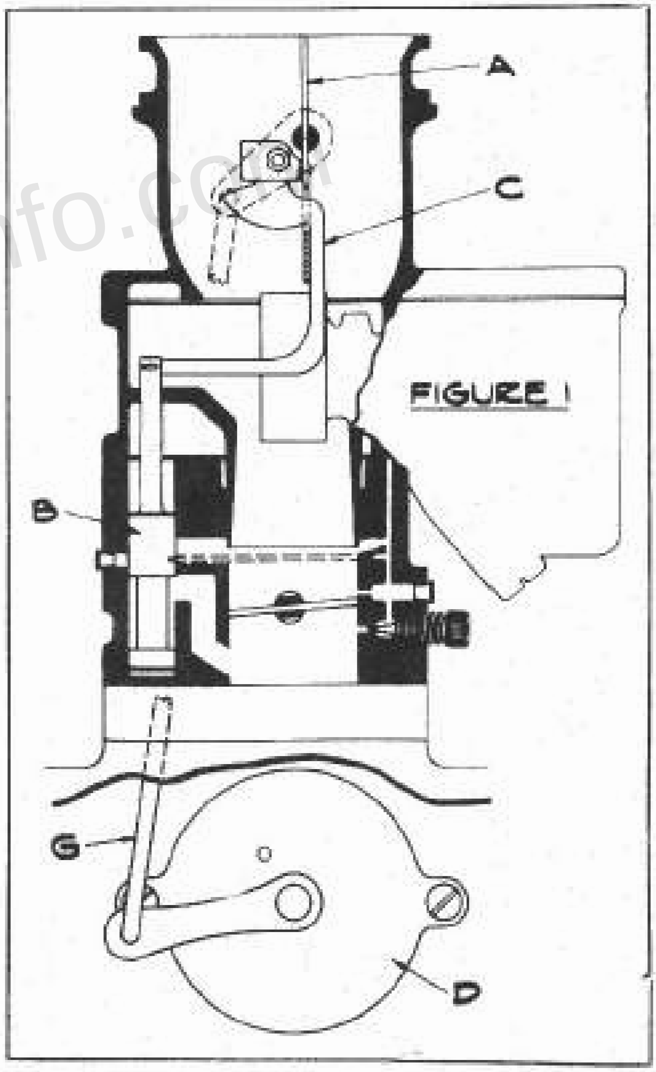


Fig. 1

Fig. No. 2. Engine Cold—Throttle Closed—Choke Closed—Fast Idle.

As the engine becomes cold the thermostat spring closes choke valve "A," raises vacuum piston "B" and opens idle passage "E." Idling mixture is now obtained through passages "E" and "F." The fast idle mixture follows the path of the arrow in by-passing the throttle.

Fig. No. 3. Choke Partially Open—Fast Idle—Engine Started.

As the engine begins to fire, manifold vacuum pulls down piston "B" opening the choke valve "A" to give sufficient air for running. Continued running raises the temperature of the thermostat in the manifold and causes it to release the choke progressively with increasing temperature.

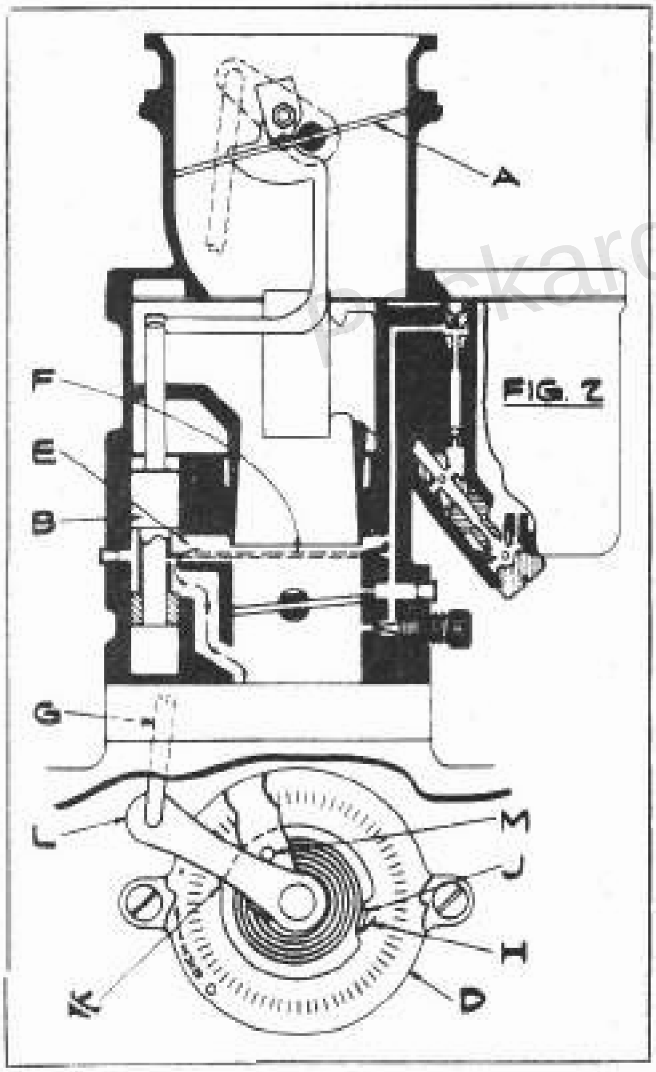


Fig. 2

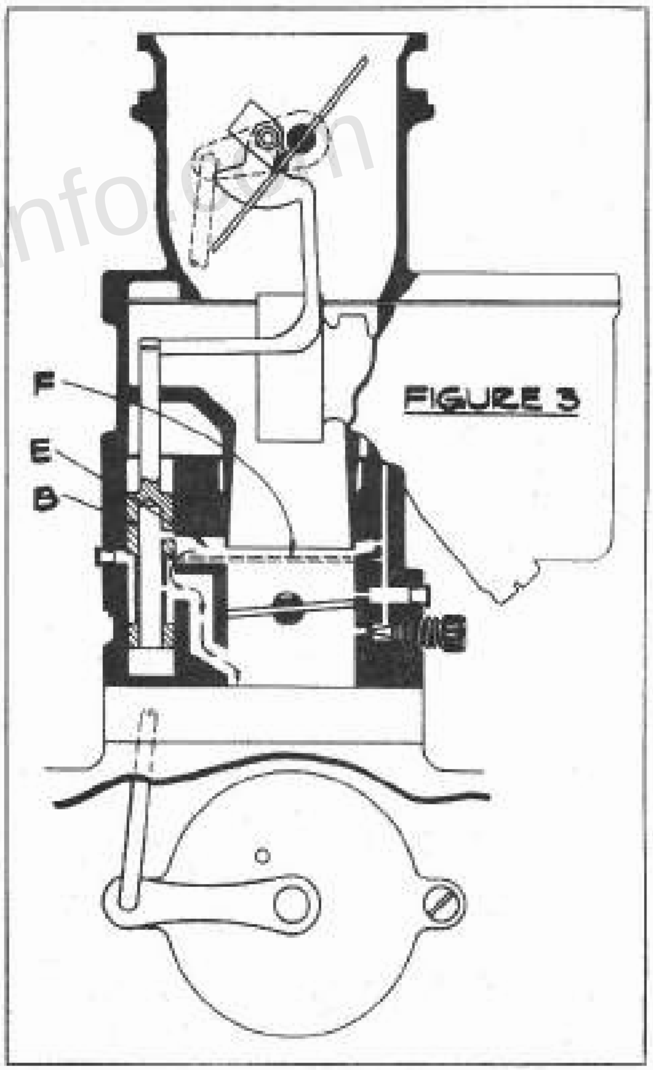


Fig. 3

Fig. No. 4. Slow Idle—Engine Warm.

Choke valve "A" is partially opened. Piston "B" has moved down with opening of the choke valve to close fast idle passage "E." Idling mixture is now supplied by the carburetor idle system "N." As the engine becomes still warmer, the choke will continue to open to the position shown in Fig. 1.

For further details see One Twenty Technical Data Book

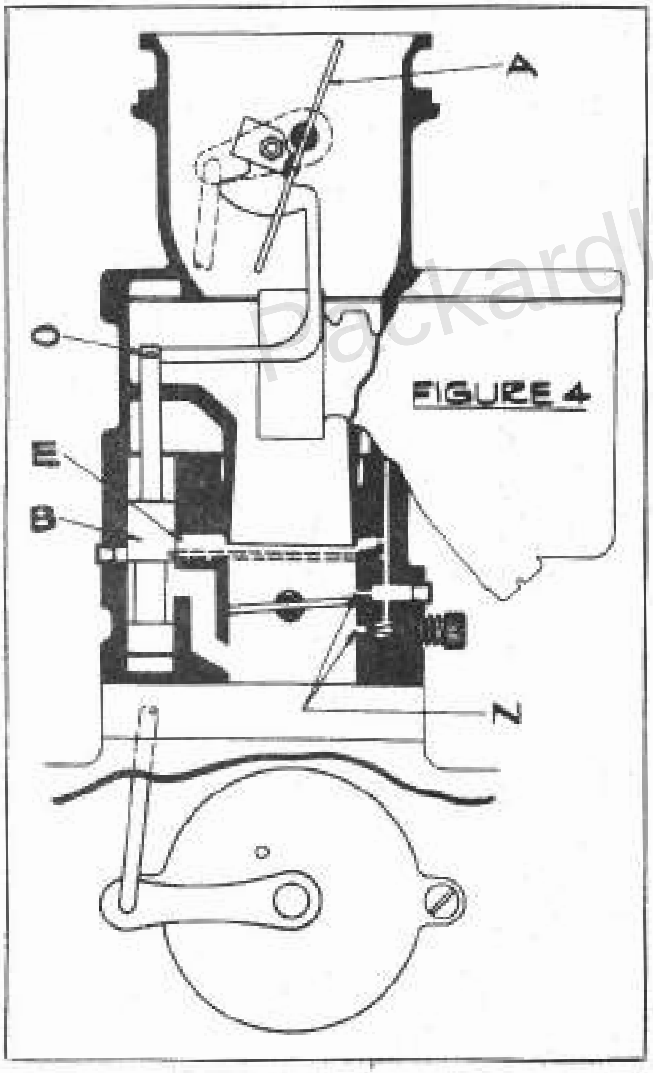


Fig. 4

Automatic Choke Adjustments— One Twenty

Most important is to see that the choke mechanism is clean and absolutely free in its operation. To check:

1. Disconnect link "G," Fig. No. 1.

2. Test operation of choke valve. When closed by hand it should drop open freely without the slightest hesitancy. If it doesn't, it must be cleaned and freed up.

3. Check thermostat spring. The earlier One Twenty thermostat springs were set with a 60° windup but since have been reduced to a 50° windup. Each graduation represents 5°. The factory setting is zero to punch mark. The choke linkage should not be oiled. Oil will collect dust and cause it to stick.

4. Check thermostat for free movement of lever. It should move freely without friction.

5. Adjust link "G," Fig. 2, so that the thermostat lever is $\frac{1}{16}''$ away from thermostat stop pin "M" when the choke valve is closed.

The choke thermostat may be adjusted to suit individual driving conditions, but under no circumstances should this be attempted before first having read and understood all

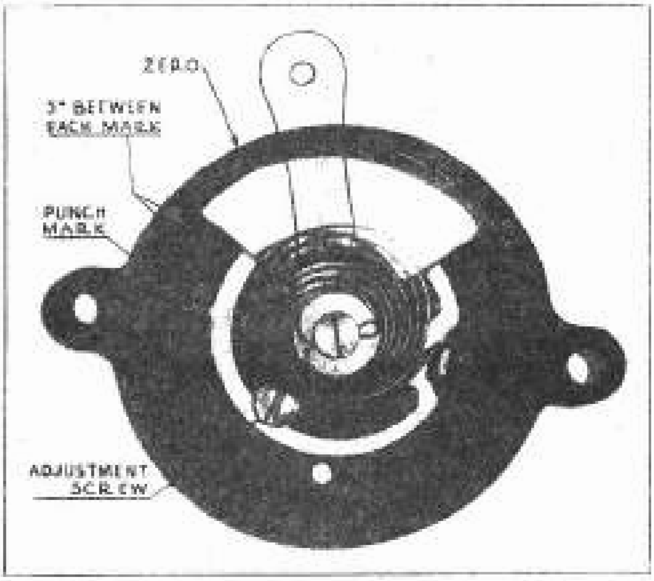


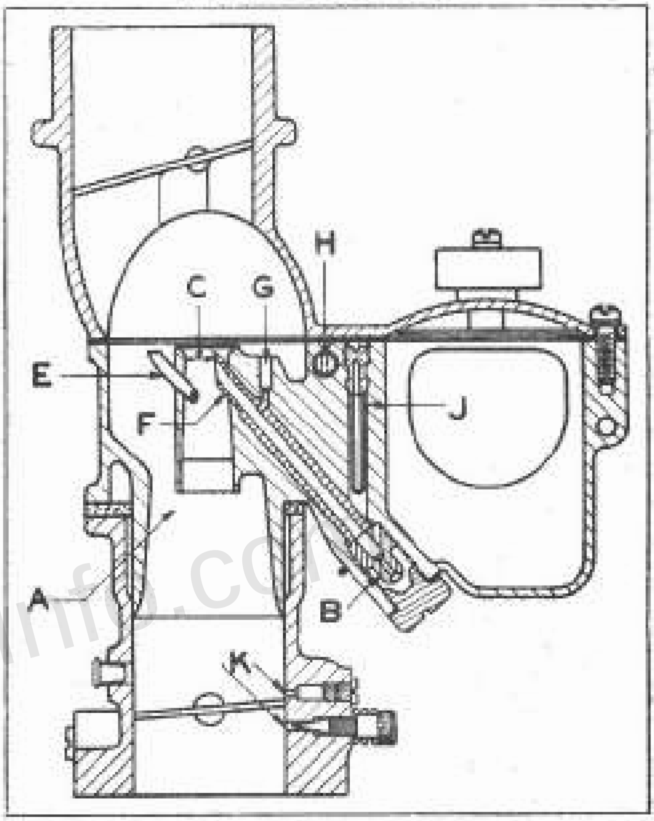
Fig. 5

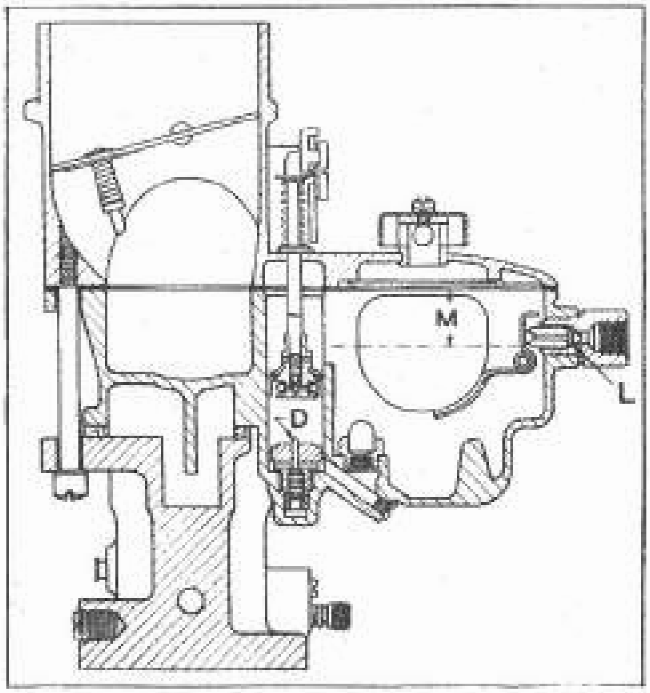
that is written on this subject in the One Twenty Data Book.

The two extreme conditions under which the choke may require adjustment are too rich or too lean. If an owner complains of loading up, the spring tension may be slightly decreased. If the owner complains of too lean a mixture, the spring tension may be increased. In making these adjustments, the thermostat spring should never be increased or decreased more than 5° or one notch at a time and the new condition checked.

Should the thermostat spring weaken from heat, caused by high speed or hard driving, it may be tightened in a like manner as above but replacement will be much more satisfactory if the unit is available.

JETS AND ADJUSTMENTS FOR ONE-TWENTY, EIGHT, SUPER-EIGHT AND TWELVE CARBURETORS





			VENTURI	METERING JET	MAIN DISCHARGE JET CLEARANCE	BY-PASS JET	PUMP JET	MAIN DISCHARGE JET	HIGH SPEED BLEEDERS	IDLE AIR BLEED	IDLE TUBES	IDLE DISCHARGE HOLES	NEEDLE VALVE SEAT	FUEL LEVEL
MODEL	YEAR	CARB TYPE	A	B	C	D	E	F	G	H	J	K	L	M
905-6	1932	EE-3	1 3/16	.064	19/64	.080	#60	#36	#65	#46	#70	#56-58	.140	9/16
1005-6 1107-8	1933 1934	EE-3	1 3/16	.058	17/64	.060	#65	#28-36	#65	#46	#70	#56-58	.140	9/16
1207-8 1407-8	1935 1936	EE-3	1 5/16	.060	17/64	.060	#62	#28	#65	#44	#70	#56-58	.140	9/16
1003-4 1103-4-5	1933 1934	EE-2 EE-22	1 3/16	.060	19/64	.060	#70	#36	#70	#42	#70	#56-60	.130	9/16
1203-4-5 1403-4-5	1935 1936	EE-23	1 3/16	.056	.030 .044	#54	#60	#28-36	#65	#44	#70	#56-60	.130	5/8
1001-2 1101-2	1933 1934	EE-2 EE-22	1 3/32	.055	19/64	.060	#70	#36	#65	#42	#70	#56-60	.130	9/16
1200-1-2 1400-1-2	1935 1936	EE-23	1 3/32	.052	.030 .044	#64	#60	#28-36	#65	#42	#70	#56-60	.130	5/8
120	1935	EE-14	1 1/32	.048	.265	#62	#65	#32-36	#65	#50	#70 upper #65 lower	#60-54	.113	15/32
120-B	1936	EE-14	1 1/32	.048	.281	#60	#65	#32-36	#65	#50	#70 upper #65 lower	#58-54	.101	15/32

NOTE-"C"-ON PACKARD 8 AND SUPER 8 "TIP TO COME FROM .030 TO .044 BELOW TOP OF SMALL VENTURI."

NOTE-"F"-DIMENSION #28-#36 REFERS TO TWO DIAMETERS IN ONE TUBE.

NOTE-"K"-SMALLEST HOLE AT TOP.

TWELVE CARBURETOR AND AUTOMATIC CHOKE

In principle and operation, the carburetors used on the One Twenty, Eight, Super Eight and Twelve are practically the same. The adjustments are similar and similarly located. In size and shape, the carburetors are slightly different. Following is a description of the operation and adjustment of the Twelve carburetor. Where there is a difference in the Eight and Super Eight, specific mention is made.

Description

The "EE-3" Stromberg is a double Venturi plain tube type down draft carburetor. It has a positive accelerating pump which delivers an enriched accelerating charge that is metered over a definite period of time. An economizer which insures a lean and economical mixture at normal driving speeds, and automatically richens the mixture necessary for maximum power and high speed (acceleration and wide-open throttle). The idle or low-speed jets are below the throttle. There is a relief poppet valve in the choke valve to prevent over-choking. The Eight and Super Eight do not have the poppet valve.

Float Adjustment

The float adjustment is made the same as on the One Twenty except the fuel level on the Twelve is maintained at 9/16" and on the Eights at 5/8".

Automatic Choke—General Description

The automatic choke, as used on all Packard cars, is a device that eliminates the hand-operated choke entirely. It is completely automatic.

Two factors govern choke requirements. These are engine temperature and engine speed. It is obvious that when an engine is started cold and driven that the engine temperature is constantly rising and the engine speed almost constantly changing. Therefore, the amount of choke required is also constantly changing. The automatic choke, through the agency of a thermostatic spring, a vacuum piston and an unbalanced choke valve compensates for all changes in engine temperature and engine speed. This explains why it is so difficult, if not actually impossible, to provide the necessary amount of choke, at all times, by the manual method and why a very superior result is obtained through the use of the automatic device.

Technical data on the construction and calibration of the automatic choke unit is available but it is our purpose here to deal only with the method of securing the proper relationship between the automatic choke unit and the choke valve. Nearly all cases of faulty operation have been found to proceed from improper adjustment and it is therefore urged that the adjustment be checked in accordance with the following instructions.

Good results also require that the entire mechanism be as nearly frictionless as possible. Excessive friction in the choke valve shaft bearings, the linkage or the choke unit will produce poor results. However, it should not be oiled as oil collects dirt.

There may be occasions when it will be necessary to check the calibration of the choke unit. However, when it is found that the choke unit itself does not function properly it is strongly recommended that, wherever possible, a new unit be installed and the faulty instrument returned to the Packard factory for replacement.

The choke unit for the Eight and Super Eight are identical in every respect, whereas the choke unit for the Twelve is of a different type. The choke units for Eights and Twelves are not interchangeable.

The application of the automatic choke to all cars in the Packard line is very similar. The principle of operation is identical and the points to be observed in securing a proper adjustment are exactly the same.

The diagramatic drawing names those parts and emphasizes only those points involved in securing a proper adjustment. If the succeeding operations are followed literally, no one should have trouble in securing a proper adjustment. The method suggested is not the only method, but it is a good one and it is urged that the procedure outlined be adhered to.

A proper adjustment of the fast idle is not necessary to secure a proper adjustment of the automatic choke, but it is, nevertheless, MOST IMPORTANT that the fast idle be properly adjusted, within reasonable limits, to secure good performance during the early warm-up period. It is difficult to adjust the fast idle with the engine running. It is better practice to make the adjustment with the engine stopped.

When a hot motor is stopped and the throttle closed, the choke valve is wide open. As the engine cools, the thermostat tightens, closing the choke valve a predetermined amount. Fig. 1. The movement is governed by the operation of the choke and throttle levers, bringing the fast idle ear in contact with the fast idle adjusting screw.

To start, the throttle is opened to about a 20 mile per hour speed. This movement raises the adjusting screw, releasing its hold on the fast idle ear, allowing the choke to snap shut so that the position of the levers become changed, as shown, Fig. 2. As soon as the engine starts to run, the choke partially opens, due to manifold vacuum drawing on the choke piston.

Fig. 1
Choke Open--Motor Warm, (or Cold)--Slow Idle

Fig. 2
Choke Closed—High Idle

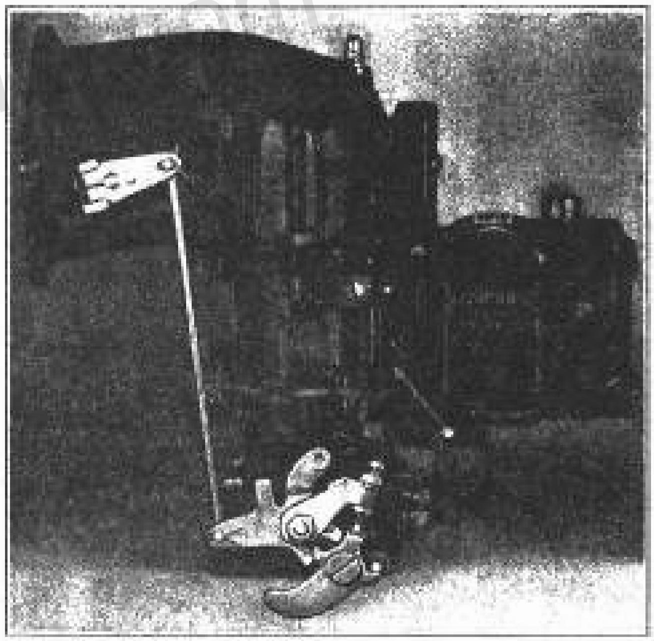


Fig. 3
Choke Partially Open—High Idle

When the throttle is closed, after the start has been made, it is prevented from returning to slow idle position by the fast idle adjusting screw, riding on the ear of the fast idle stop-weight, as shown, Figs. 2 and 3. This adjustment is set at the factory for a car speed of 10 miles per hour with a cold motor (approximately 32° above zero). Whether engine be cold or hot it is easier to make fast idle adjustment when engine is not running. When readjusting, with a hot motor, it is necessary to hold the fast idle stop weight in the position shown, Fig. 3, having fast idle adjusting screw on the ear of the fast idle stop weight.

Now loosen adjusting screw lock nut and unscrew the adjusting screw until it is no longer in contact with stop—with the fingers turn adjusting screw in until it just comes in contact with stop from this position turn adjusting screw in from two to two and one-half turns for the Twelve. The adjusting screw lock nut should now be securely tightened.

The slow idle should be set at eight miles per

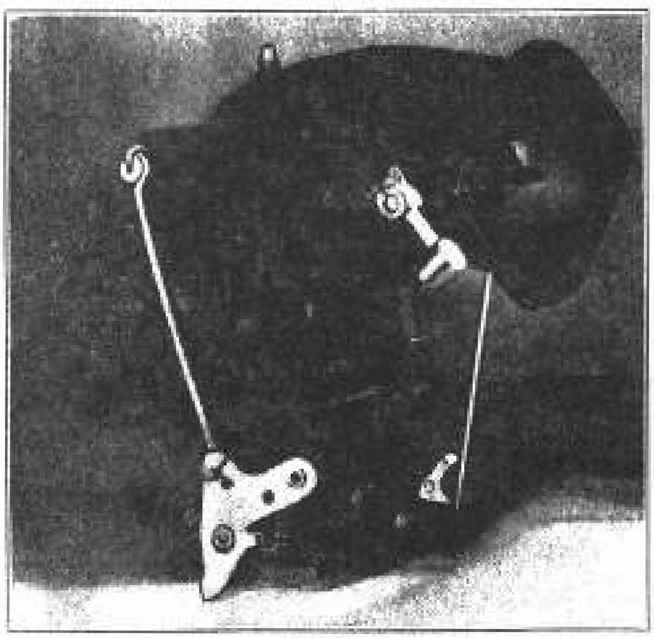


Fig. 4

hour when the engine has reached normal operating temperature and the choke valve is wide open. This adjustment is made by the throttle adjusting screw, shown Fig. 4.

After the motor has become warm, the choke and fast idle will assume their normal position, as shown, Fig. 1.

Fast Idle Adjustment for Eight and Super Eight

The fast idle adjustment on the Eight and Super Eight is made with the engine either hot or cold but not running.

When the engine is cold, that is cold enough for the choke to be closed, open and close the throttle. This allows the choke to close.

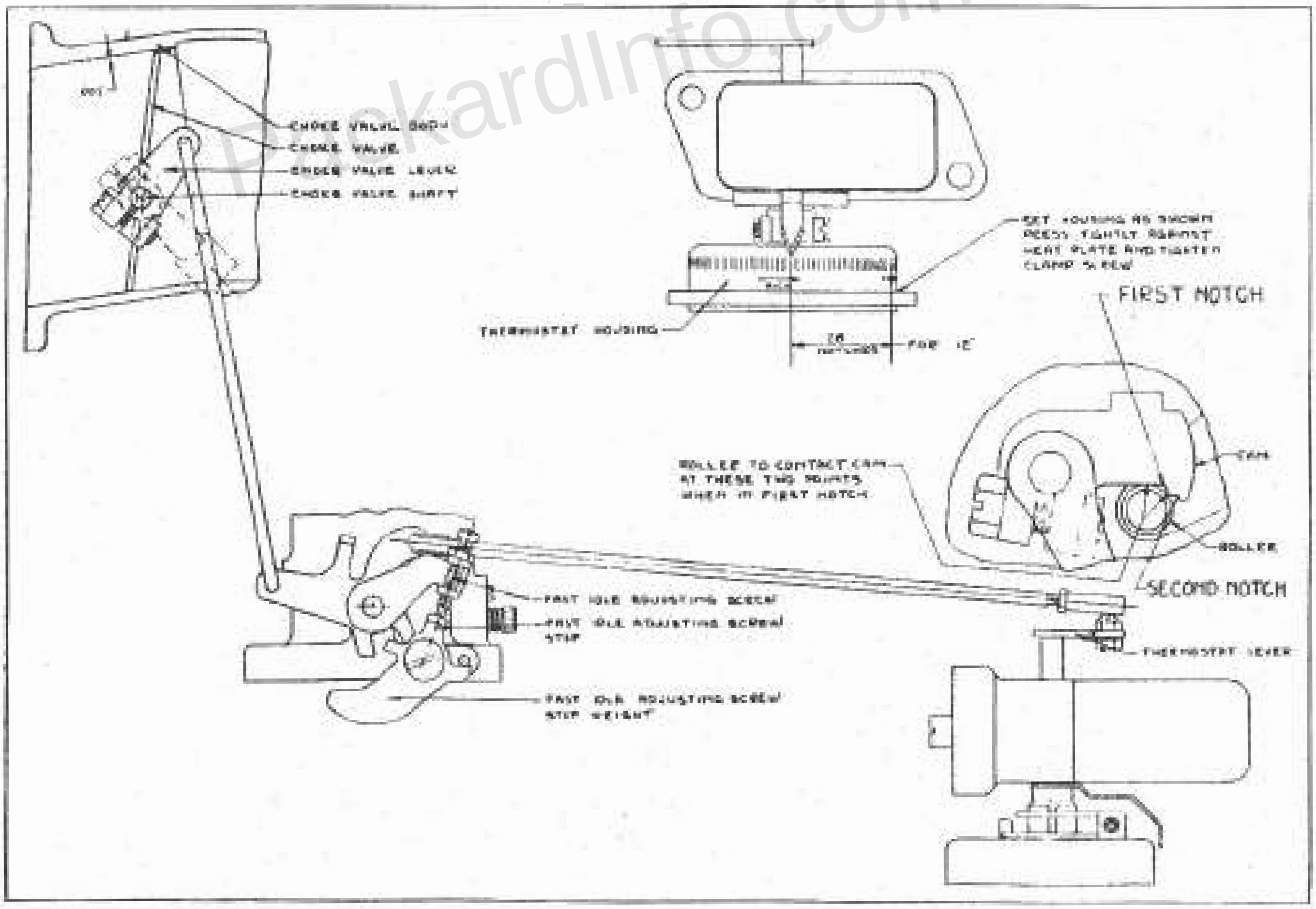
Back out the fast idle adjusting screw so that it is no longer in contact with the fast idle cam.

Turn the screw in slowly, noting position of slot at the instant it contacts with the fast idle cam and then continue 2½ to 3 turns in, (opening the throttle) beyond this point. This will be found to give approximately the proper high idle adjustment. When the motor is hot, open the throttle and close the choke manually, holding the choke closed by any convenient means and proceed as outlined for a cold motor adjustment.

In warm climates probably 2½ turns in, and in a cold climate 3 turns in, will be found to give the best results. Two and three-quarter turns will probably be found to provide a satisfactory compromise for all climates.

The diagrammatic drawing indicates the proper setting for the thermostat housing and represents the best possible universal adjustment for all climates. It is probable that a somewhat better result can be secured if the adjustment is altered slightly to suit the particular car and the particular conditions under which the car operates.

With respect to the warm-up period, (that period during which the automatic choke is operative—about five minutes after starting in cold weather) the adjustment of the thermostat housing should be treated as though it were a carburetor. If the mixture is excessively rich the housing should be turned a few notches in the lean direction—if the job is too lean the housing should be turned a few notches in the rich direction. The housings are plainly marked to show the direction of rotation for richer or leaner settings. It will be found that this adjustment is quite sensitive. Two or three notches, in either direction from the normal setting, makes quite an appreciable difference and probably, adjustment of the thermostat housing, in the field, should be held within these limits. Also, it should be remembered that an all-around result necessarily involves a slight tendency to richness during the early warm-up period.



Method of Securing Proper Adjustment of Automatic Choke

1. Remove air cleaner.

2. Remove cover of automatic choke unit.

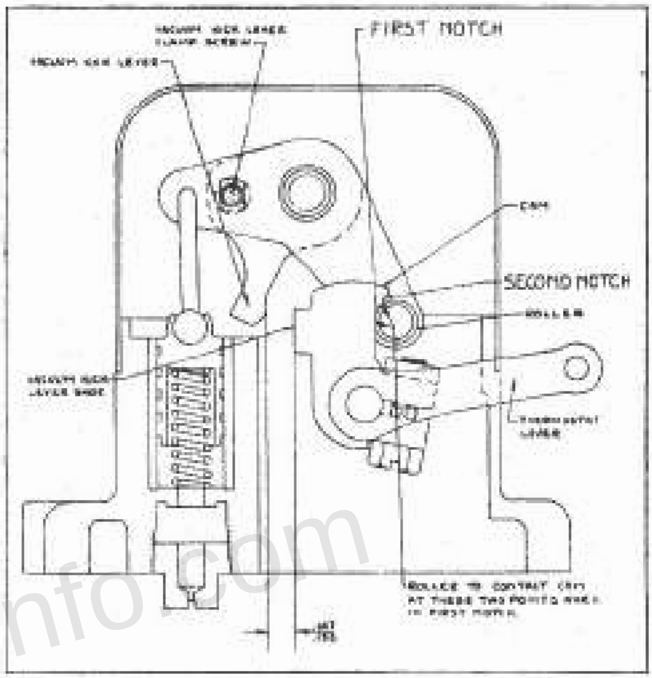
3. Loosen clamp screw on choke valve lever.

4. Open throttle slightly. Press down fast idle adjusting screw stop weight. Close throttle to bring fast idle adjusting screw in contact with fast idle stop. (Be certain these parts remain in this position until final adjustment is completed.)

5. The choke valve lever clamp screw should now be tightened to such a degree that the choke valve lever will remain in any position in which it is placed but which will permit rotation of the choke lever on the choke valve shaft by hand. (Experience will soon teach that the EASE with which an adjustment can be made is dependent upon securing about the right amount of friction between the choke valve lever and the choke valve shaft.)

6. Now place a piece of .005 shim stock, or a thickness gauge (preferably not more than ⅛" wide) between the edge of the choke valve and the choke valve body. With the .005 shim in this position hold the choke valve closed with one hand.

7. With the other hand rotate the choke valve lever so as to bring roller in contact with the FIRST notch of cam as shown.



8. With the parts in this position and using a wrench, rather than a screw driver, securely tighten choke valve lever to choke valve shaft. (It is at this point that the importance of having the right amount of friction between the choke valve lever and choke valve shaft, as pointed out in item 5, will become apparent. If enough friction has been provided to cause the choke valve lever to remain in the position in which it has been placed the final clamping can be easily accomplished.)

9. Remove the shim, or thickness gauge, that was placed between choke valve and choke valve body.

10. The automatic choke should now be perfectly adjusted, but for the purpose of checking the result, take hold of the thermostat lever and slightly rotate same so as to bring roller in contact with the FIRST notch of the cam as shown. In this position you should be able to insert the .005 shim, or thickness gauge, between the edge of the choke valve and the choke valve body. If found to be correct replace choke unit cover and air cleaner.

Adjustment of Stromberg Model EE-23 Carburetor Choke

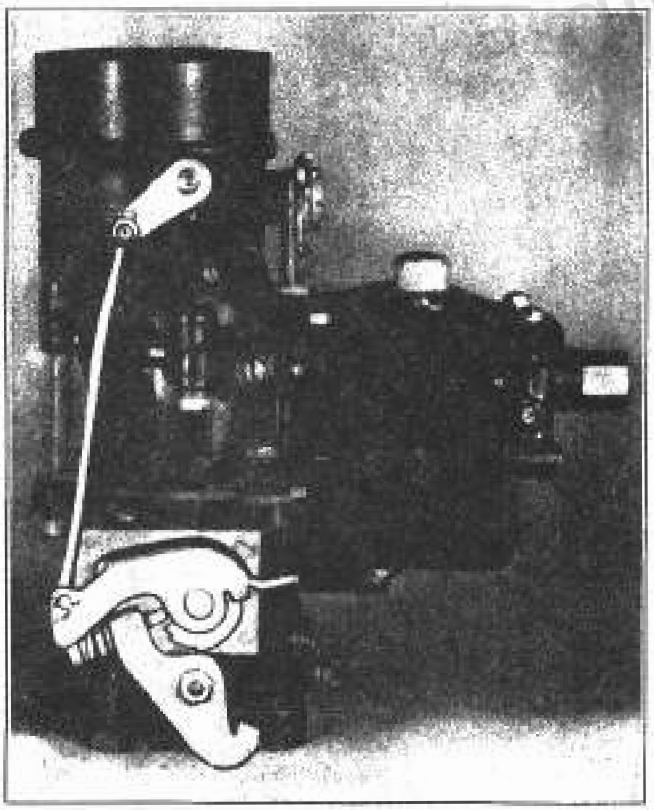


Fig. 1a

Choke Open—Slow Idle—Engine Hot (Or Cold)

With the motor cold, the normal operating position of the choke is closed. Fig. 1 shows the choke valve in wide open position, which will be the case when a hot motor is stopped, the throttle valve closed and the motor allowed to cool. Movement of the throttle will release screw "E" and the choke valve will snap shut when the motor is cold, Fig. 2a. In the Figs.

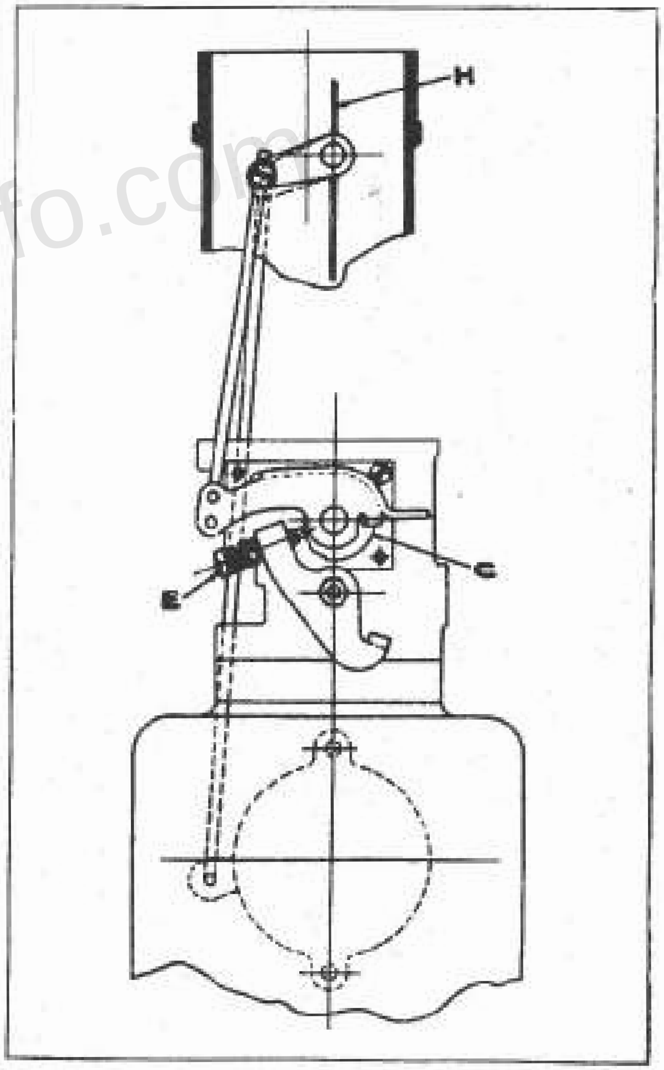


Fig. 1

1 and 1a the levers and adjustment screw positions are shown at slow (warm) or curb idle, which should be set at 7 miles per hour with the engine warm. As the engine becomes cold, the thermostat also cools and gradually gains tension, tending to close the choke valve. It is prevented from doing so by the fast idle adjustment screw "E," being engaged with the notch on the fast idle cam "C," as shown, Fig. 1a.

Choke Closed—Fast Idle

To make a cold start it is necessary to open the *hand* throttle about half way. With this movement adjustment screw "E" is lifted away from the fast idle cam "C," and allows the choke valve to snap shut raising lever "D." With the raising of this lever, ear "B," which is a part of the lever, rotates the fast idle cam "C" so that the adjusting screw "E" comes to rest on the extreme fast idle position of cam "C." During the cranking of the engine, the choke remains in the closed position as shown in Figs. 2 and 2a.

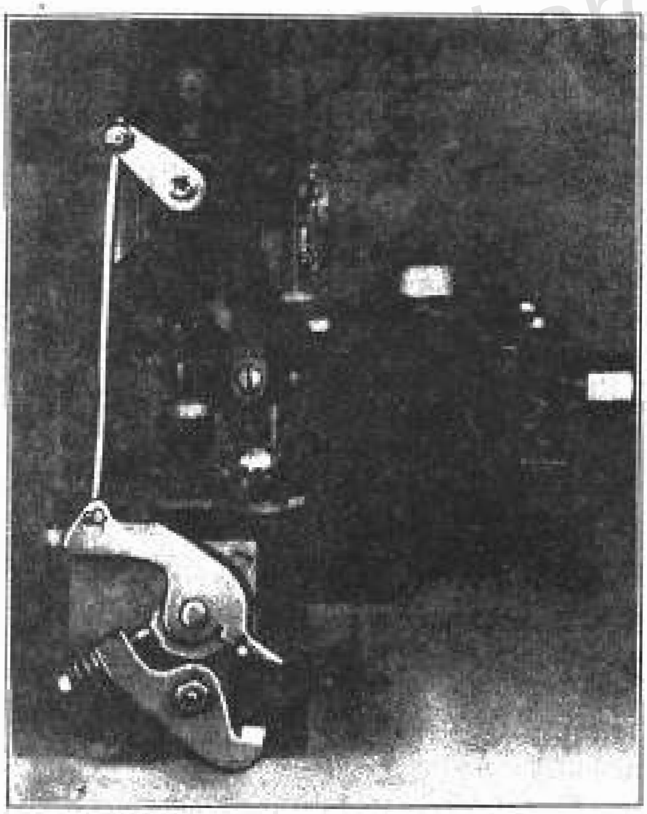


Fig. 2a

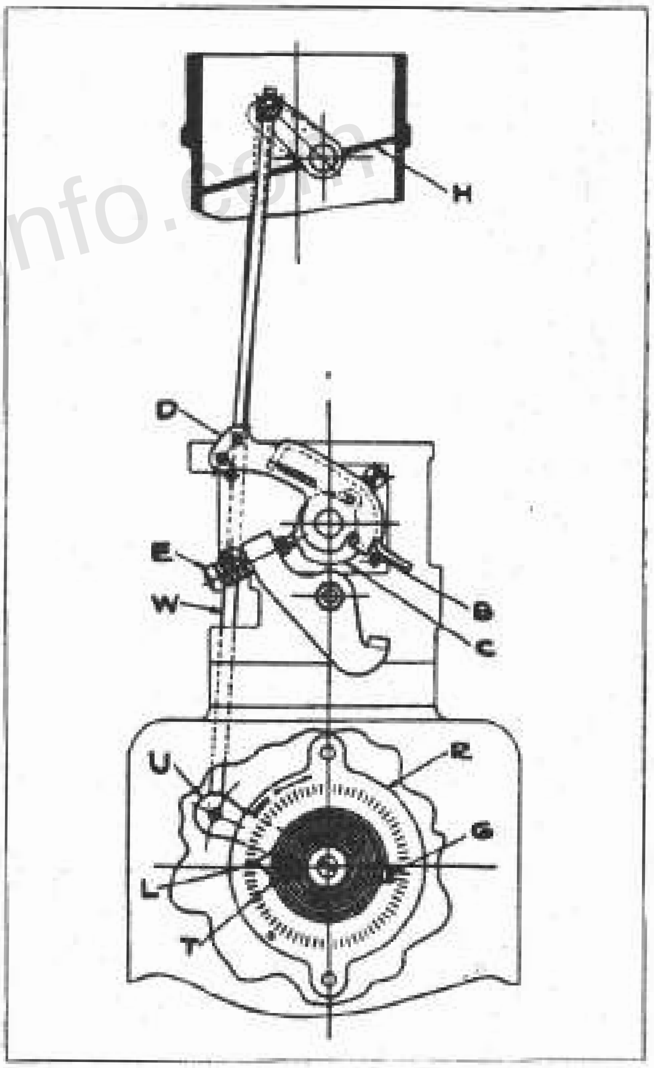


Fig. 2

Choke Partially Open—Engine Warm —Intermediate Idle

As soon as the engine begins to fire and a manifold vacuum is created, vacuum piston "J" is pulled down. Ear "P" contacts with dowel pin "Q," pulling down connecting rod "S" and forcing the choke valve to open a predetermined amount.

Fast idle cam "C" is then rotated by spring "Z," allowing adjustment screw "E" to assume slower idle position until it reaches the slow idle position, Fig. 1a. The choke valve in the carburetor being off center, is actuated by the inrushing air, which works against the tension of the thermostat until the thermostat absorbs sufficient heat to offer no resistance and the choke valve then opens wide. If for any reason it is necessary to replace piston sleeve or pin "Y," the pin should be adjusted so that a $\frac{5}{16}$" drill can be placed between the choke valve and body as shown at "X," with piston "J" in the down position. After pin is adjusted, lead ball "V" should be used to lock pin in position.

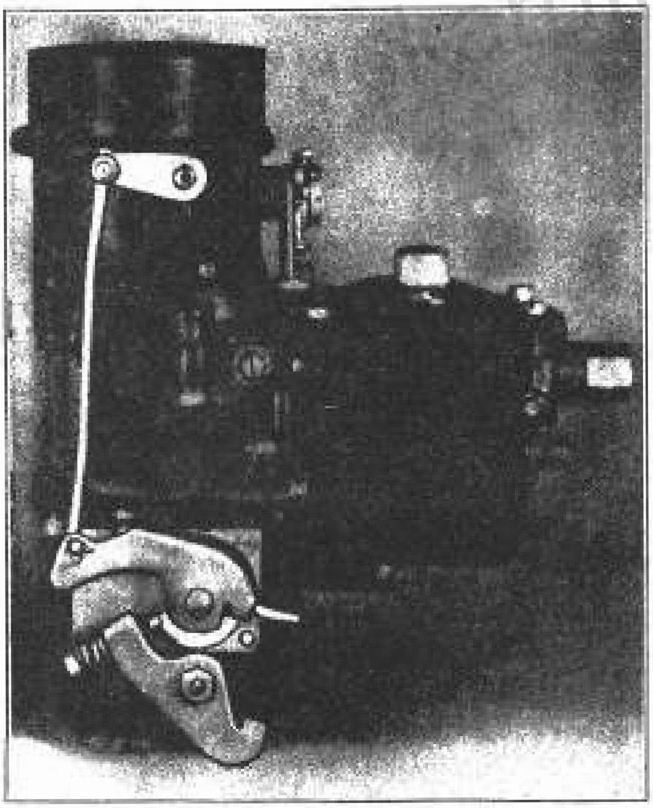


Fig. 3a

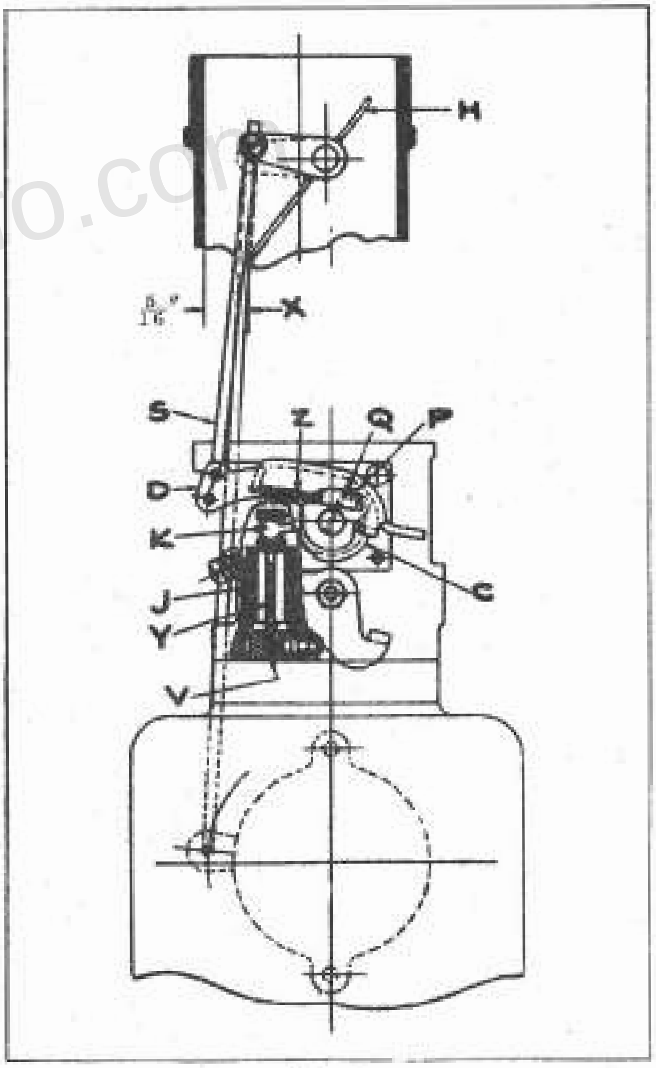


Fig. 3

Engine Flooded—Throttle Open

Should for any reason, the engine become flooded, the choke valve can be manually opened by fully depressing the foot throttle pedal. This action rotates throttle lever, bringing it in contact with ear "N," Fig. 4, of the choke lever, which partially opens the choke valve. The engine then may be cranked for a few times to clean out the manifold.

Adjusting Thermostat

Should the thermostat not operate properly it is advisable to replace the unit. Should a unit not be available it may be adjusted as follows: Remove the thermostat unit from the manifold and proceed as follows:

1. Allow the thermostat to cool or warm until it has reached a normal room temperature of 70°. This precaution is necessary for a thermostat is practically a thermometer and travels approximately one radial degree for each temperature degree.

Fig. 4a
View showing choke open, throttle closed and warm idle screw adjustment

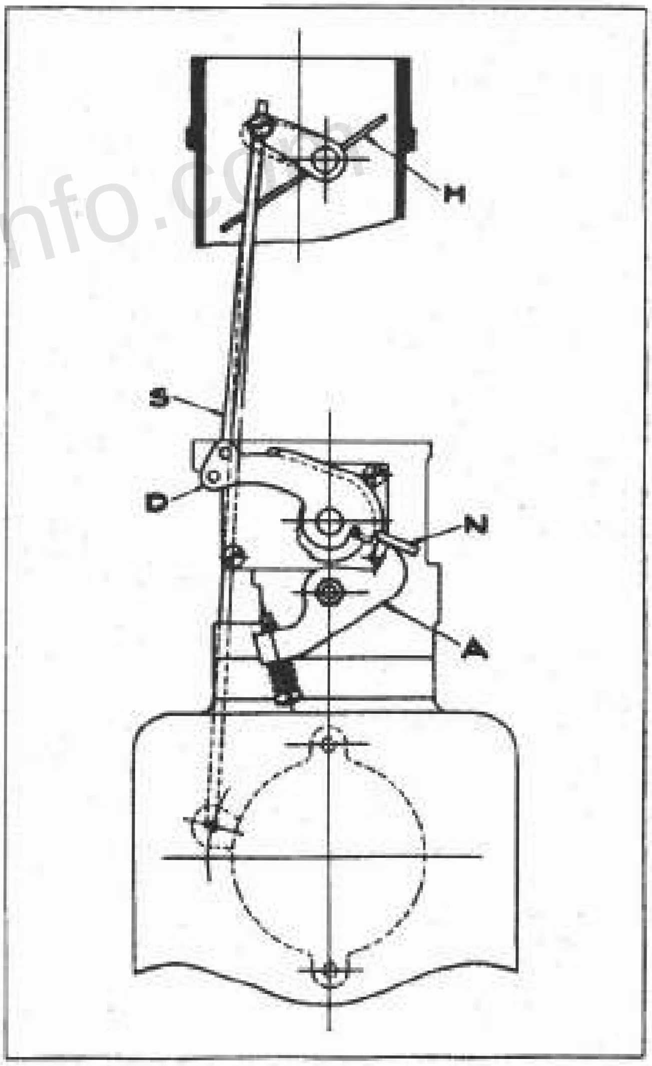


Fig. 4

2. After it has reached this temperature, unhook the thermostat from the prong "G," revolve indicator point "L" to the zero marking of the thermostat plate. In this position the hook of the thermostat should come flush with the prong "G" of the indicator.

3. Thermostat pointer should then be revolved to the prick punch marking which is eleven graduations rich, the original factory setting.

If the thermostat hook does not come against prong "G" when the pointer "L" is at the zero marking, it will be necessary to recalibrate the thermostat as follows:

4. With lever "U" held against screw "T," revolve pointer so that the hook of the thermostat comes flush with prong "G."

   This will then place pointer "L" at a different position and will be the new zero location. This should be stamped on the plate and the old marking obliterated.

5. Hook the spring onto prong "G" and from this point revolve pointer "L" winding up the spring eleven notches rich and lock in position.

6. Reinstall the thermostat unit in manifold and with choke valve closed and lever "U" against stop screw "T" attach rod "W."

Should the Motor Lack Speed and Power

1. Check throttle opening. Ear on lever should hit against body of carburetor when the accelerator pedal is pushed to the floor board. Fig. 4.

2. Choke valve should be in wide open position when engine has reached its normal operating temperature.

3. Make sure main metering and by-pass jets are free from water and dirt.

4. Make sure there is no water or dirt in float chamber.

Accelerating Pump—14th Series Carburetors

For smooth, snappy acceleration, an extra discharge of gas is necessary. During the Summer months, less pump discharge is required and the pump rod should be placed in the "Summer" setting. During the Winter it should be placed in the "Winter" setting to give a greater discharge. The hole nearest the throttle shaft center is for the "Summer" setting.

Carburetor Overflow Valve

All Packard down draft carburetors are equipped with an over-flow pipe containing a ball check valve.

This pipe permits excess gasoline to be discharged underneath the car, and prevents air from entering the carburetor because of the presence of a ball check valve in the pipe.

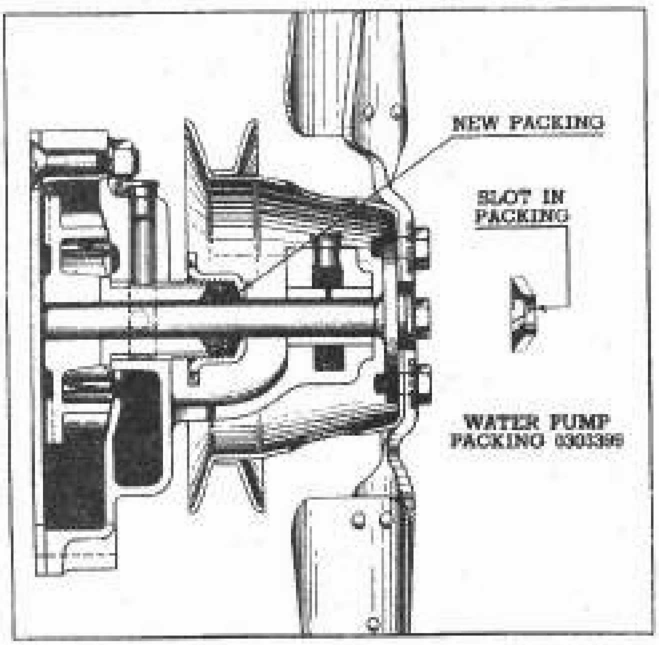
There is a possibility of air leakage if the valve does not seat properly, and this in turn will interfere with the idling of the motor.

The condition can easily be checked by stopping the end of the pipe with the motor running. If the idling result is changed, a leak in the valve is indicated.

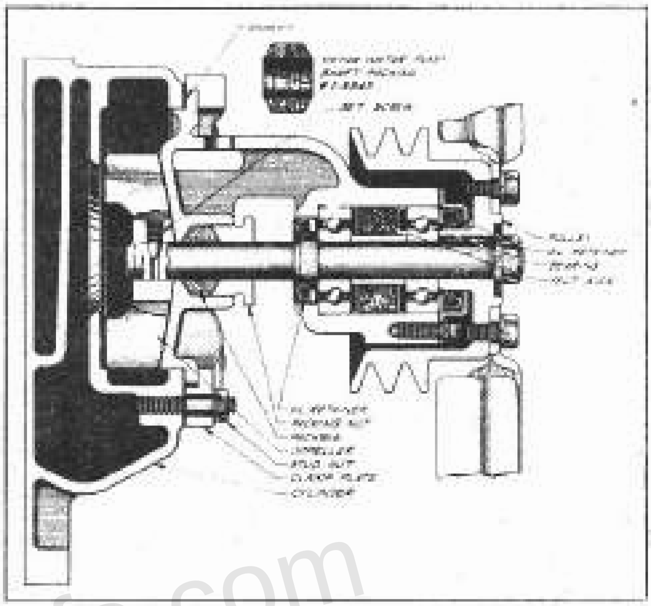
WATER PUMP:

The respective views are of the One Twenty Super Eight and Twelve. Renewal of the packing is different.

On the One Twenty remove water pump packing nut and snap new packing over the shaft as shown. Do not remove old packing.



120

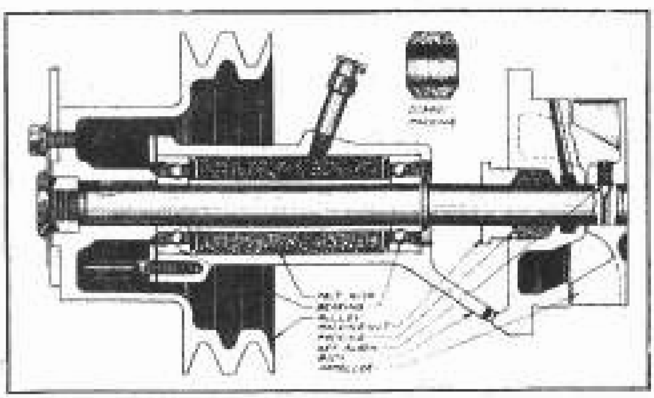


8 and S-8

On the Eight, Super Eight and Twelve, the old packing must be removed before the new packing is installed.

Pull the packing nut up just enough to prevent leaking.

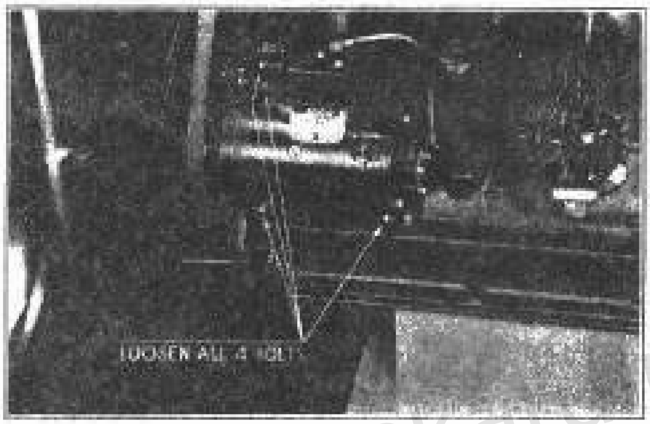
The above view shows the water pump used on the Eight and Super Eight and the packing used therewith.



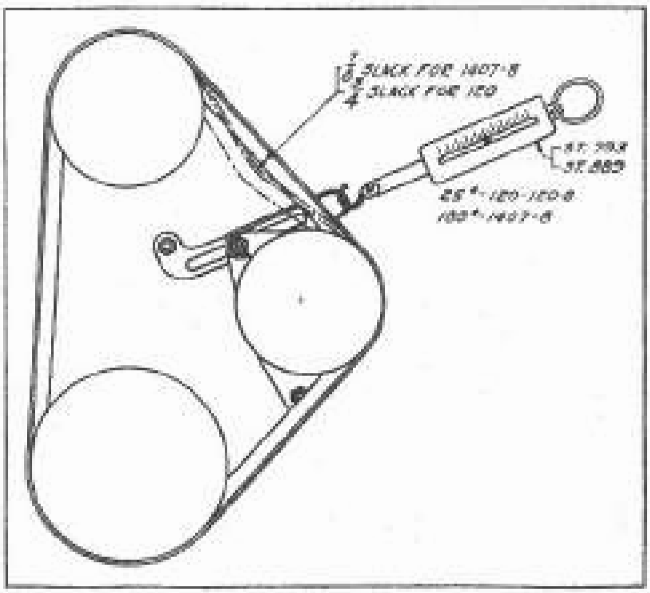
12

This view shows the water pump construction on the twelve cylinder and the packing used therewith.

FAN BELT ADJUSTMENT:
One Twenty and Twelve



1. Loosen all four generator bolts, as indicated by the arrows.
2. Hook a spring scale to lock bolt on generator lug and pull in line with the adjusting link, as indicated by the long arrow.

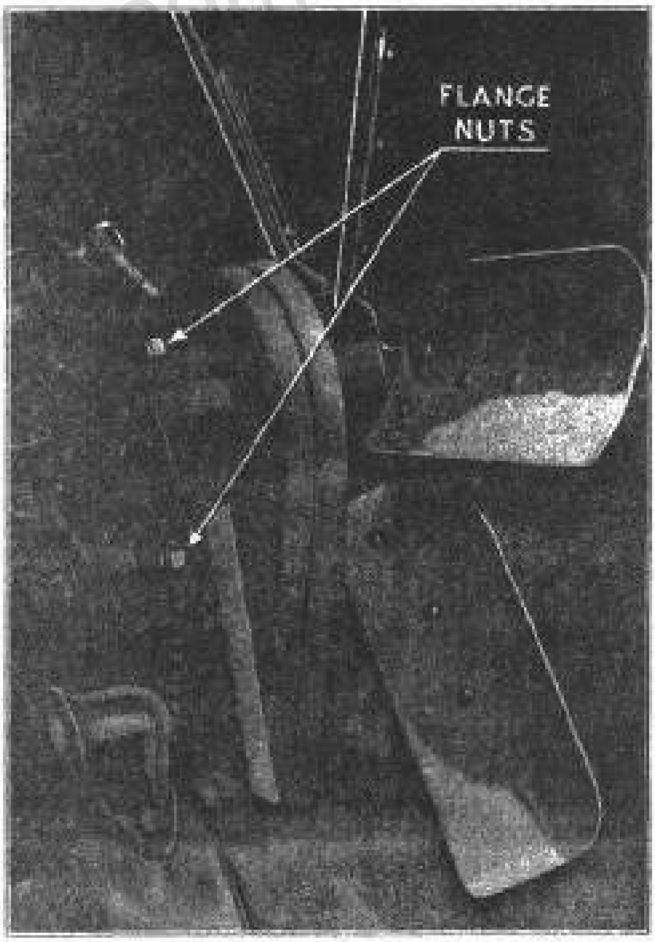


NOTE—On the 120 single belt, a 25 lb. tension on scale is equivalent to ¾" thumb deflection on the belt.

3. Tighten all four bolts and then remove the scale.

NOTE—On the 12 cyl. double belt, 180 lb. tension on scale is equivalent to ⅞" thumb deflection on each belt seperately.

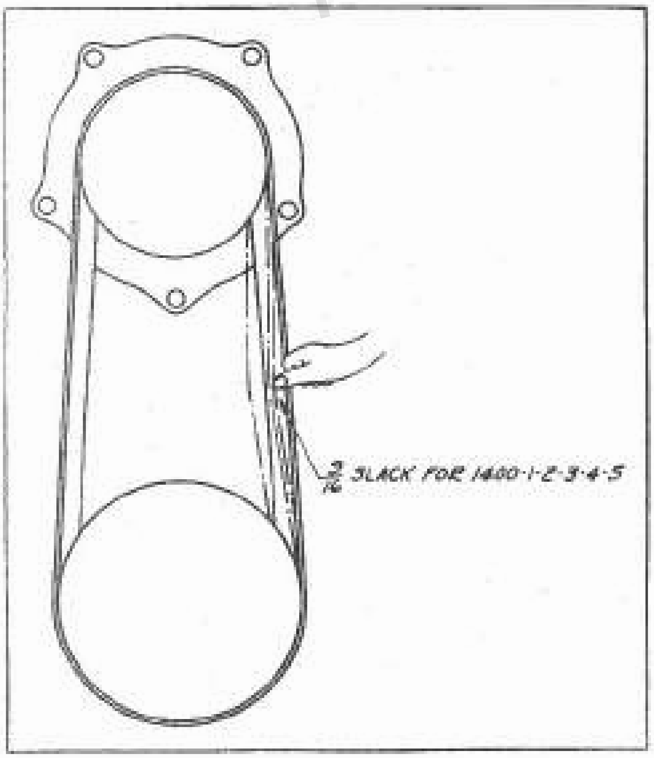
Fan belts wear fast when slipping and if too tight wear the bushings. New belts



do not stretch but should be adjusted after 500 miles to compensate for seating in pulleys.

Eight and Super Eight:

The water pump body on the Eight and Super Eight is mounted on an eccentric. To adjust the fan belt, loosen the five flange nuts and rotate the pump body. NOTE—Care must be exercised in making this adjustment, or the gasket will be damaged and the joint will leak. Be sure and tighten the five nuts after making the adjustment. The belt should be tightened to give not more than $\frac{3}{16}$th slack as indicated.



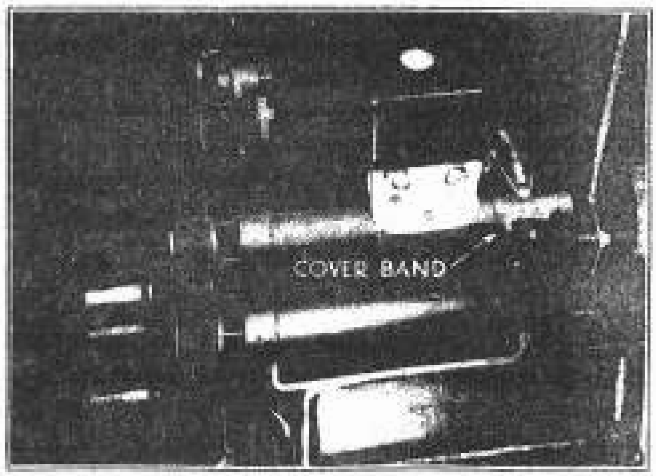
GENERATOR AND THIRD BRUSH ADJUSTMENT:

One Twenty, Eight, Super Eight and Twelve.

It is usually necessary to increase the charging rate during the winter and decrease it during the summer.

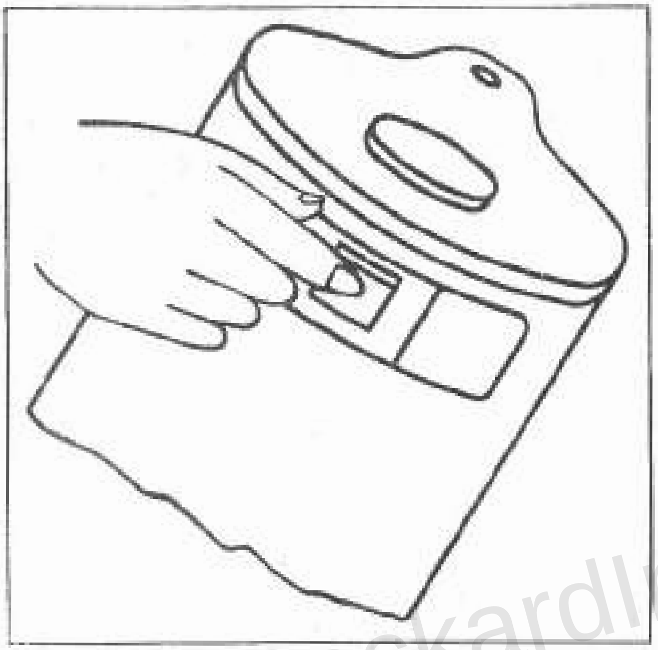
When the generator output is insufficient to keep the battery fully charged and also supply current necessary for ignition and accessories, the charging rate may be increased by moving the third brush in the direction of armature rotation.

One Twenty Generator.

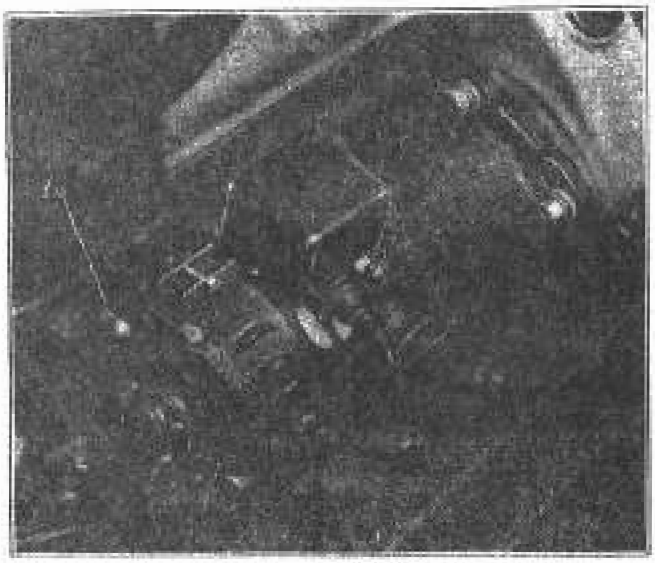


1. Remove the hand hole cover band.
2. The generator third brush is held on to end plate by a friction support and can

be pushed with the thumb or finger to any desired position. On the One Twenty, the third brush has no stop and may be



pushed against either brush. CAUTION—The third brush must never touch its next nearest brush but should be backed one segment away.



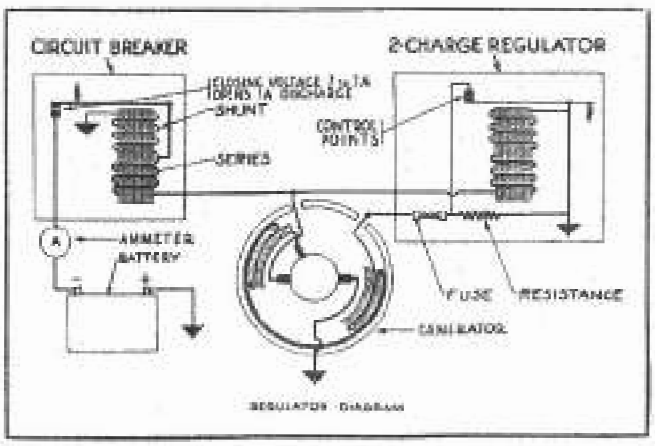
Eight, Super Eight and Twelve.

The third brush is regulated by screw "A." Its full rotation is one-quarter of a turn. Moving the brush in the direction of armature rotation increases the charging rate. Do not file or move the brush stop.

All generator commutators should be kept clean and free from oil and grease. If they appear dirty or rough they should be cleaned with 00 sand paper. Emery cloth should never be used.

All brushes should move freely in the brush holders and the full contact area should bear on the commutator.

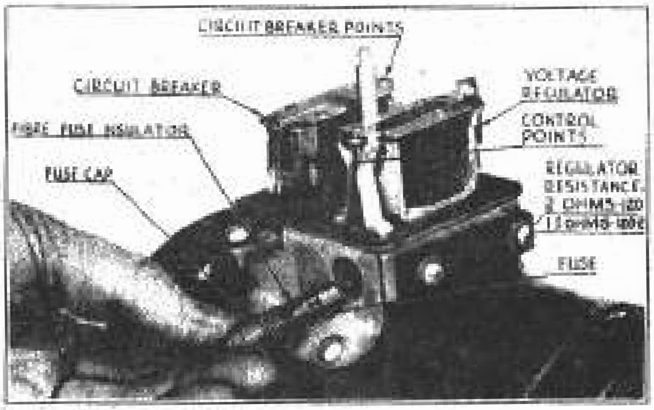
The circuit breaker is an automatic switch which opens and closes the circuit between the generator and battery. On the One Twenty, Eight, Super Eight and Twelve, the points should close when the generator builds up a voltage of 6¾ to 7¼ volts, and should open with a discharge not to exceed one ampere.



The preceding diagram shows the entire generator charging circuit. The voltage regulator used on the One Twenty operates as follows:

Normally the control points are closed and remain so while the generator is on high charging rate. When the battery is fully charged, or the current demands lessen, the points open, throwing resistance in the generator field circuit, cutting down the charging rate. This is called the magnetic type of voltage regulator. On the Eight, Super Eight and Twelve, the voltage regulator is of the thermostatic type.

As seen in diagram, there is a fuse in the generator field circuit. It is on the back side of the box. If the generator fails to charge, first look at the fuse. Note that the fuse is protected by a fiber insulator. Should the insulator be omitted, the fuse would be "cut out" and provide no protection.

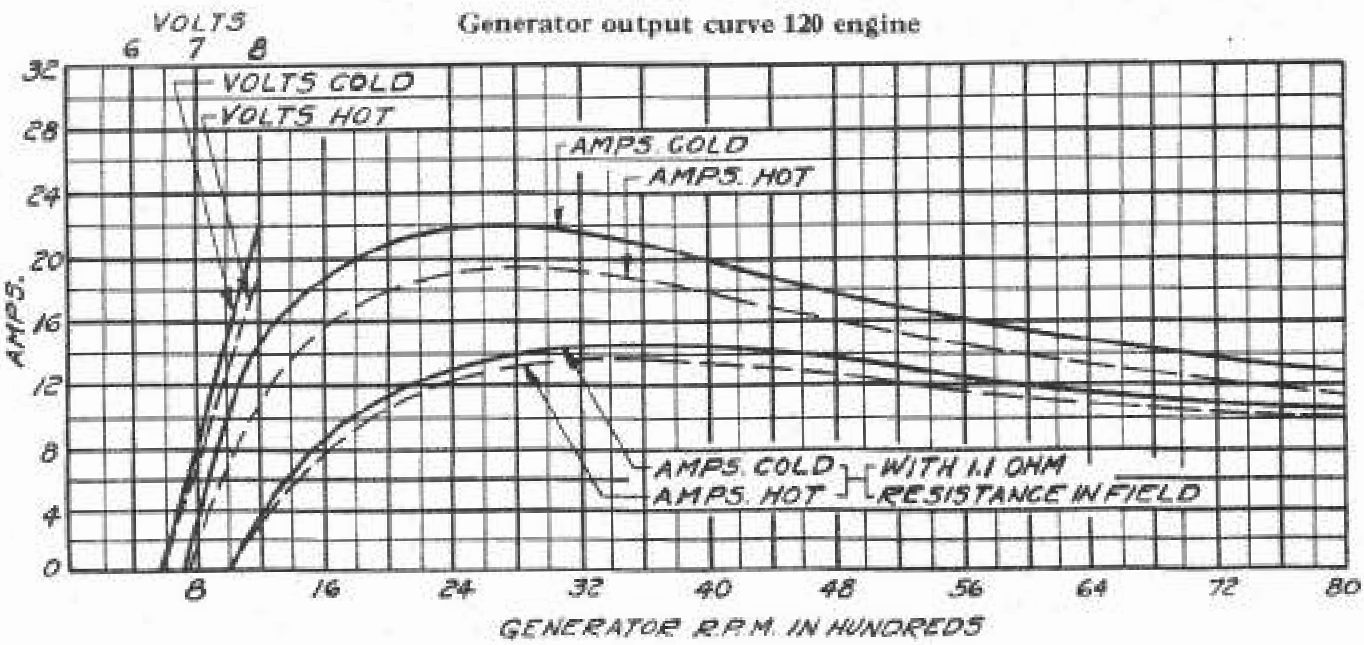


Never run the generator with the battery disconnected, or short circuited.

Neither the circuit breaker nor the voltage regulator should be adjusted. If either should fail to work properly, replace the unit.

The chart below shows the generator voltage and charging rate of the One Twenty under various generator speed and load conditions. The curve to the left shows how the voltage

Generator output curve 120 engine

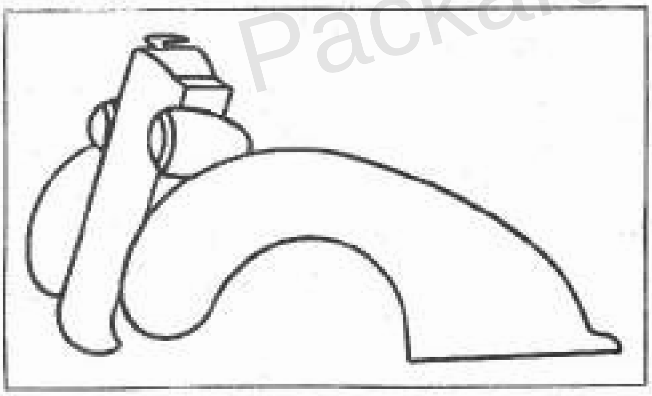


increases with generator current output. The heavy lines represent the generator charging rate when cold. (Points closed.) The dotted line represents the generator charging rate after the generator has been run and is hot. The lower heavy curve represents the generator charging rate with the voltage regulator points open and 1.1 ohms resistance inserted in the field circuit.

TO REMOVE DAMPER OR TIMING CHAIN AND REPLACE:

One Twenty.

Remove the radiator and fender assembly in one unit.



1. Remove 17 bolts and 8 clips as follows:

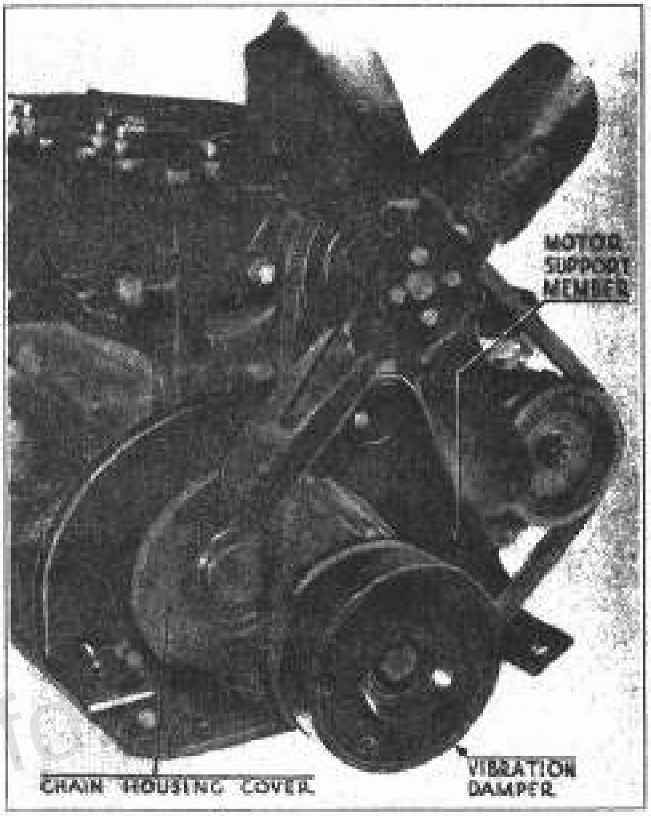
   6 bolts to body—3 each side.

   6 bolts to running board—3 each side.

   2 nuts—radiator to tie rod.

   2 bolts—fender to brace—one each side.

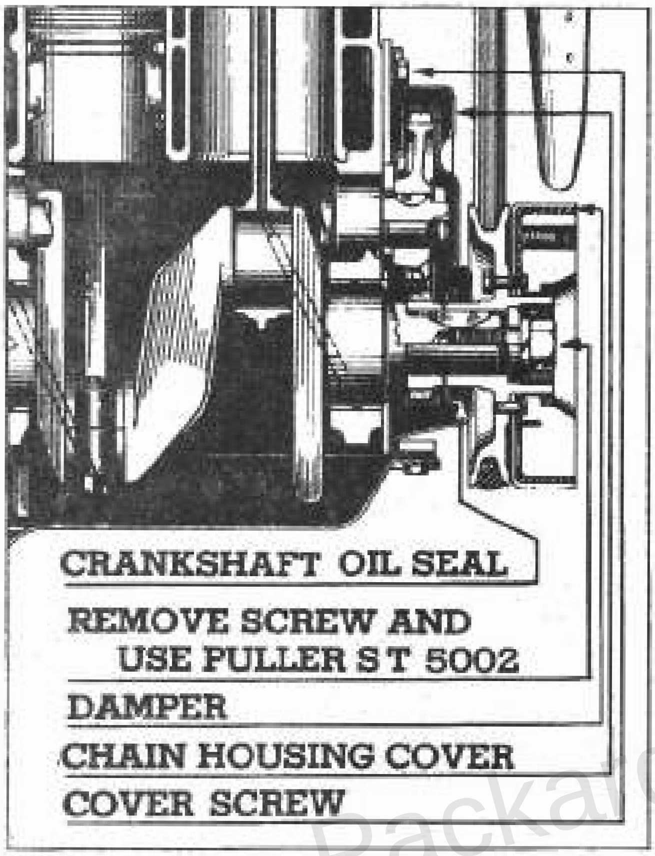
   1 bolt center of radiator core to front cross member, and

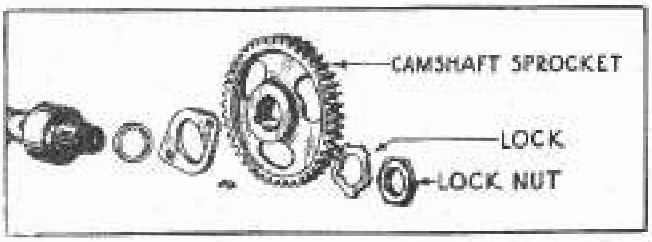


   8 clips from running board molding—4 each side.

   Lift off assembly.

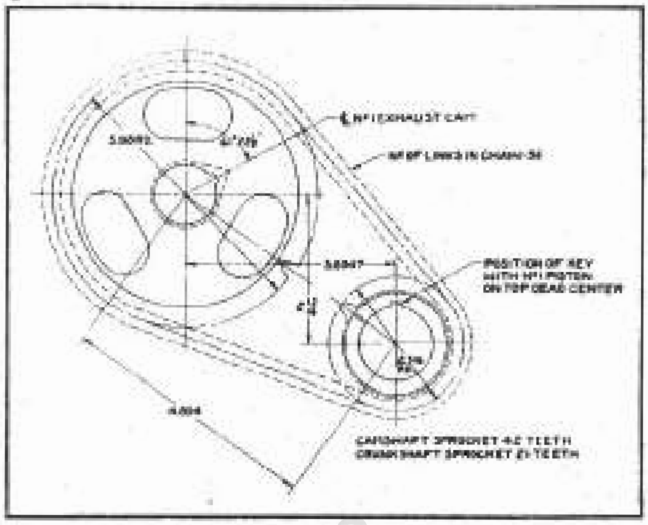
2. Remove fan belt.
3. Support the engine and remove the front motor support member.
4. Remove the vibration damper assembly.
5. Remove twelve screws and the chain housing cover.
6. Remove the crank shaft oil seal.
7. Remove cam shaft sprocket locking nut and lock.





8. The chain and sprockets may now be pulled off as an assembly. The reverse procedure is used in assembling, but it is necessary to time the drive as follows:

1. Put No. 1 piston on top dead center.
2. Put No. 1 exhaust cam at the finish of closing.
3. Line up the sprockets in the chain so that the timing marks are nearest each other and on the center line of the sprockets.



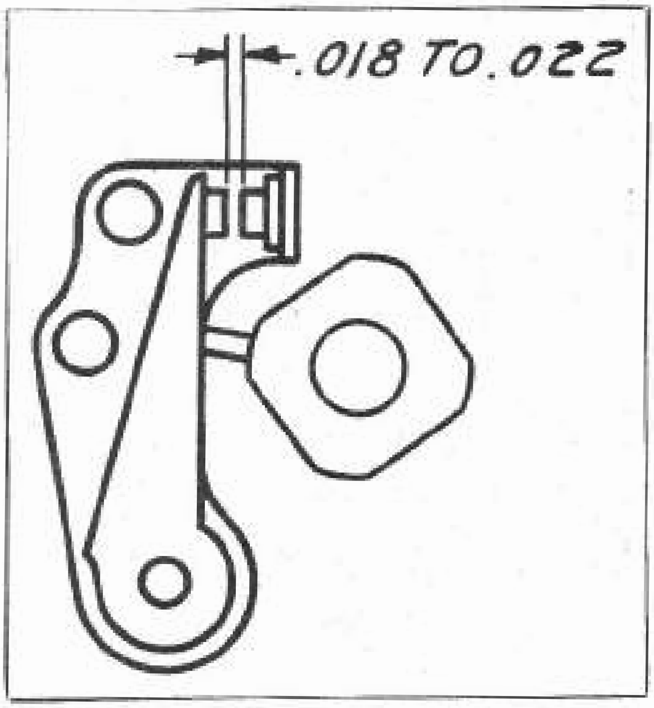
4. Slide the chain and sprocket assembly on the shafts.

After assembling and before replacing the chain cover, check the timing marks according to the diagram. If 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.

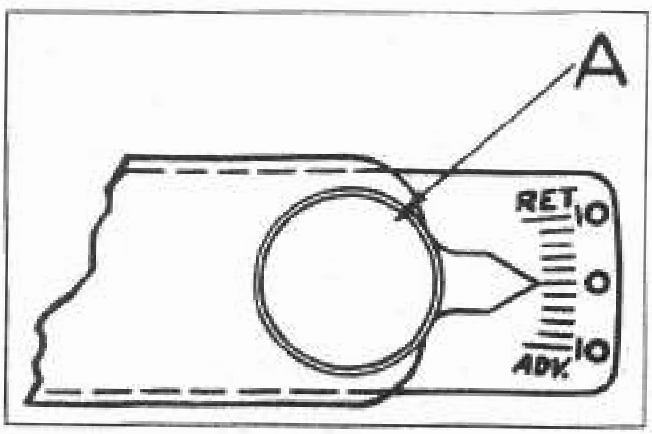
TIMING IGNITION:

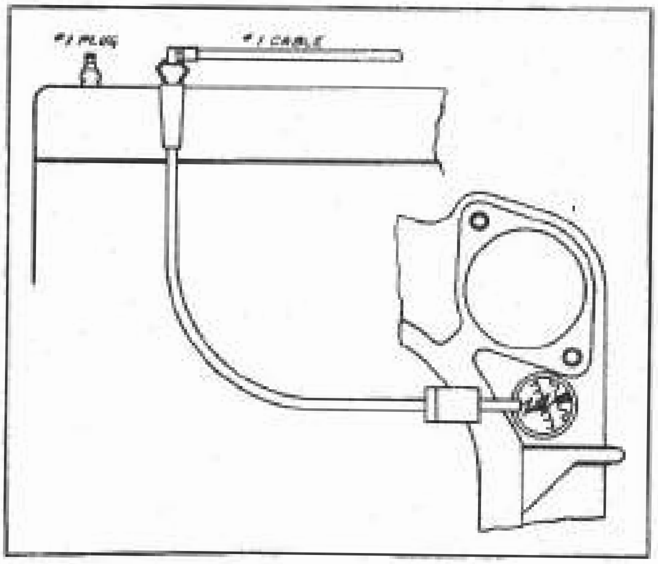
One Twenty, Eight, Super Eight and Twelve.

1. Make breaker points clean and square. Set gap .018" to .022".
2. Set fuel compensator at zero and tighten thumb nut "A."



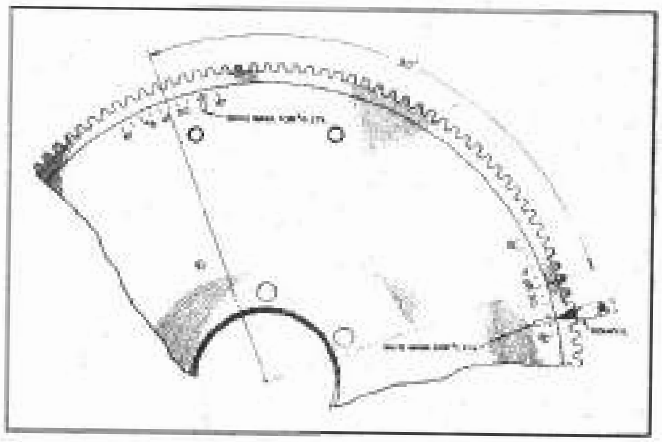
3. The best way to time an engine is while the engine is running. Attach a spark wire, or Neon timing light, to No. 1 spark plug wire. If greater intensity and brightness is desired, remove the spark plug wire from the spark plug. A spark will jump, or the light will flash, and illuminate the flywheel of the 120 or vibration damper marking



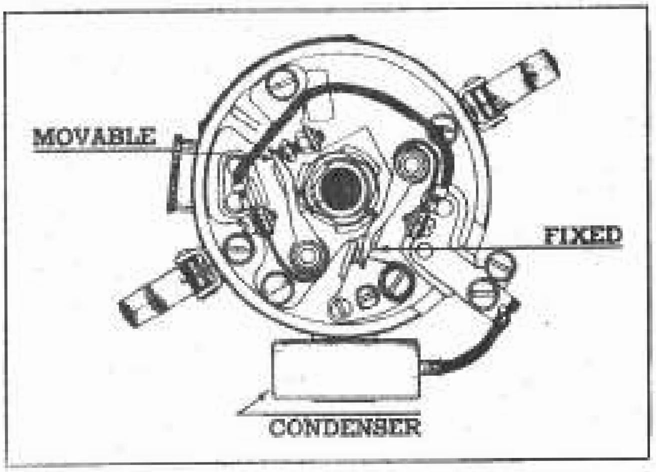


on the 8, Super 8 and 12 every time current is delivered to that spark plug wire.

4. With the motor idling, check the timing of the fixed set of breaker points to the white mark on the flywheel. This mark occurs at 7° B.T.D.C, 120; 6° on 8 and



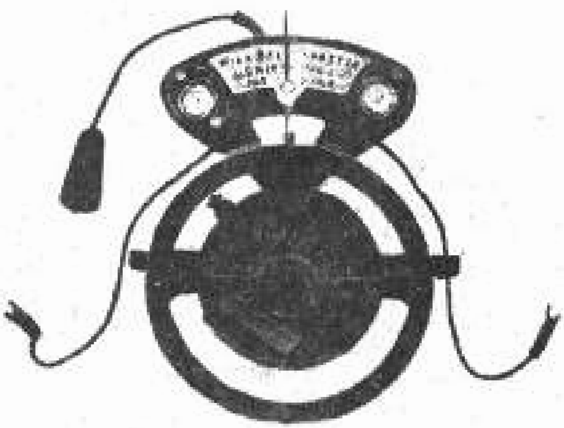
Super 8; 8° on 12. Note—If the timing is correct, the white mark on the flywheel will appear to stand still in line with the pointer attached to the flywheel housing. If it shows at either side of the pointer, rotate the distributor housing until the white mark lines up with the pointer. Lock the housing in place. (Do not move the fuel compensator—leave that at zero.)



On the 120, 8 and Super 8 this checks the firing of cylinders 1, 2, 8 and 7.

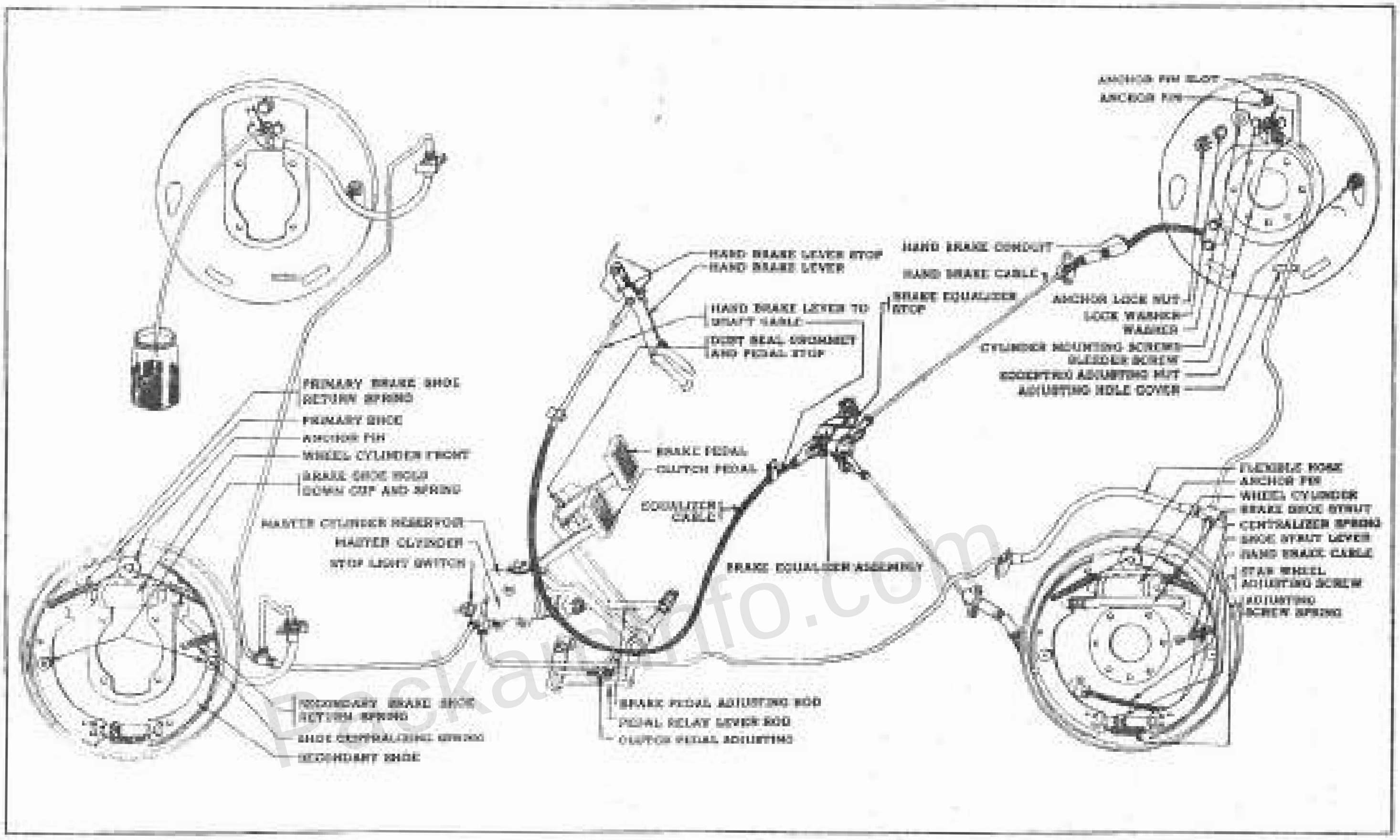
5. To check the movable set of breaker points firing cylinders 6, 5, 3 and 4, attach the timing light to No. 6 spark plug wire. If the breaker points are synchronized, the other white mark on the flywheel will appear to stand still in line with the pointer. If it doesn't, then use synchronoscope ST-913 and synchronize the movable points.

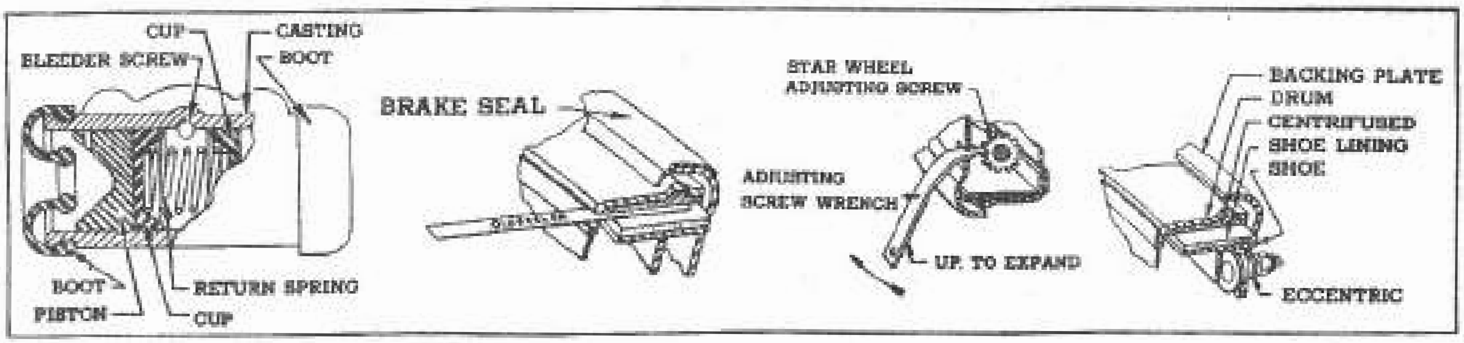
NOTE—In an eight cylinder, four-cycle motor, a spark occurs every 90 crankshaft degrees. Perfect synchronization is essential for a smooth running motor and can only be had by checking all cam lobes for wear.



6. Check condenser. The condenser should always be tested when work is done on the ignition system, or on motor tune-up jobs. We recommend the use of the Neon tube condenser tester, ST-945.

BRAKE ADJUSTMENT, 120:





ESSENTIAL TOOLS FOR THESE OPERATIONS

ST-847	Anchor Bolt Wrench	ST-5010	Fluid Filler.
ST-845	Eccentric and Star Wheel Adjusting Screw Wrench.	ST-846	.010 Feeler Gauge.
ST-5006	Bleeder Kit.		Clean Glass Jar.

Wear Adjustment for Foot or Service Brake 120

(a) Jack up all four wheels and fully release hand brake. Remove inspection hole covers from the brake drums and backing plates and see that the wheels turn freely.

(b) Check fluid level in master cylinder, fill only with Packard approved fluid. Adjust the brake pedal rod to allow ¼" to ⅜" free movement at brake pedal pad before the pistons in the wheel cylinders start to operate.

(c) If pedal is "spongy" there probably is air in the line which should be bled as follows: Remove screw from the end of bleeder connection at each wheel and attach bleeder tube. Dip end of tube in fluid in a clean glass jar. Unscrew bleeder connection ¾ of a turn, depress foot pedal forcing fluid out at the wheel cylinder, carrying with it any air present. Allow the pedal to return to its released position slowly, otherwise air may be drawn back into the system.

(d) Make the following adjustments at each wheel: Turn eccentric in direction of wheel rotation until a .010" feeler gauge inserted between the lining of the secondary (rear) shoe and brake drum is a snug fit at both ends of the shoe. If the clearance at the ends of shoe varies more than .003", adjust the anchor.

(e) Loosen the lock nut on anchor pin one turn. Tap the anchor pin slightly with a soft hammer up or down, to get proper shoe clearance, and turn the eccentric in the direction of forward wheel rotation to give clearance of .010" at both ends of the shoe.

(f) Adjust primary shoe by turning star wheel adjusting screw until a light drag is felt on the brake drum, then turn the screw in opposite direction until the drum is free from drag. Replace inspection covers.

Adjustment for Hand Brake:

(a) Release foot brake fully.

(b) Expand rear wheel brake shoes by turning star wheel adjusting screw until brake drums can just be turned by hand.

(c) With hand brake lever fully released and equalizer lever against stop, remove all slack from hand brake lever to equalizer cable.

(d) Set hand brake lever in first notch. Arrange the equalizer so that its edge is lined across the car and clamp in position. Pull rear wheel cables toward the equalizer. Remove slack so that the clevis pins will just enter freely. Lock clevis yoke jam nuts and insert cotter keys.

(e) Release hand brake lever.

(f) Release star adjusting screws until rear brake drums are free from drag.

(g) Pull the hand brake lever on one or two notches, and balance the brake drag by use of the star wheel adjusting screw, backing off the tight wheel. Replace inspection covers.

Brake Maintenance Hints One Twenty

1. Pedal goes to floor board or has "spongy" action.
   - (a) Normal wear of lining. (Minor adjustments).
   - (b) Leak in system. (Tighten connection.)
   - (c) Air in system. (Bleed brakes.)
   - (d) No fluid in supply tank. (Refill and bleed brakes.)
2. All brakes drag.
   - (a) By-Pass port hole closed. (Adjust pedal clearance.)
   - (b) Mineral oil in system. (Flush line with alcohol.)

Do not clean with anything but clean alchohol.

Do not allow the fluid in the supply tank to become low.

Do not attempt to salvage used brake fluid.

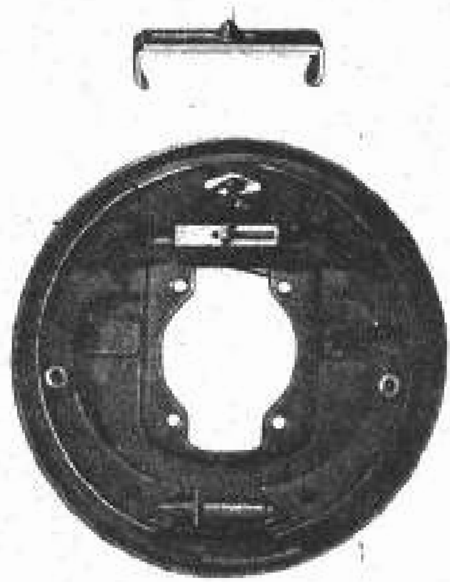
Do not use a substitute for Packard approved brake fluid.

Do not allow grease, paint, oil or brake fluid to come in contact with brake lining.

Be careful in removing and replacing piston cups to see that they are assembled correctly, not crumpled, and are functioning properly.

General Brake Information Pertaining to the One-Twenty

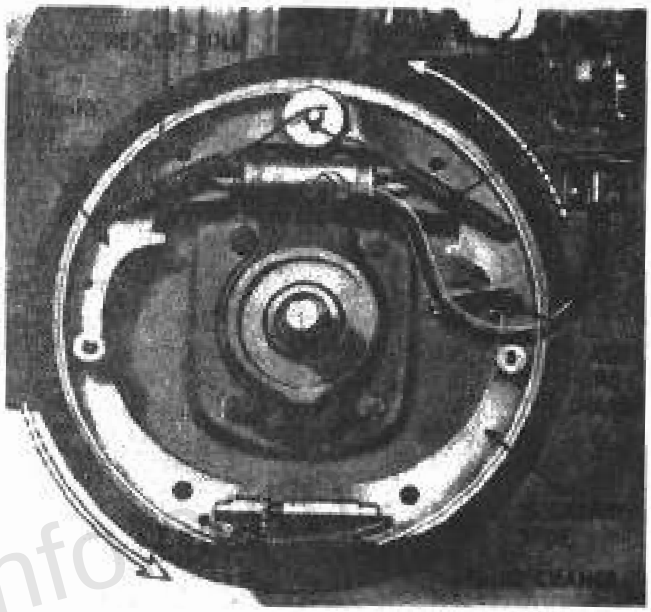
The bore of the brake cylinders on the two front wheels is $1\frac{1}{16}''$ and for identification painted white—on the two rear wheels it is $\frac{15}{16}''$ and painted brown. Interchanging these brake wheel cylinders will throw the brake system extremely out of balance. In replacing any of the internal wheel cylinder parts, such as the pistons and piston cups, care must be exercised never to place a small piston in a large cylinder. Both pistons and piston cups fit the cylinders snugly.

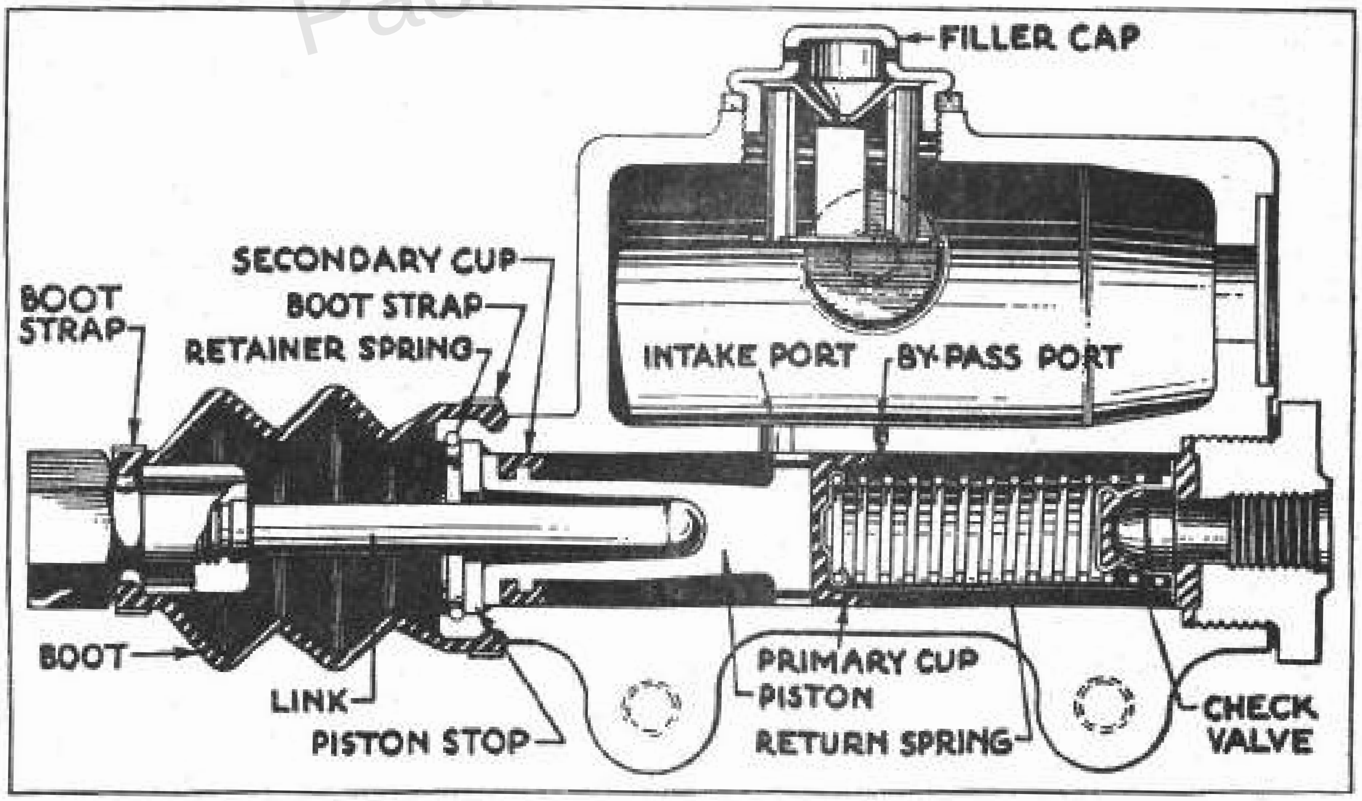


Use the brake cylinder clamp shown above whenever it is necessary to disconnect the shoe retracting spring, otherwise the pistons and cups will creep out of the cylinder. The cups are made of fairly soft rubber and are difficult to replace unless the bleeder valve is opened. When the rubber cups are replaced, be positive that the skirts are placed toward the center as shown, and that their edges are not turned over or wrinkled, otherwise fluid will leak by the cups.

When adding brake fluid to the master cylinder, check the vent holes in the filler cap. If they become plugged, heat may cause a slight expansion and brake drag.

The primary brake shoe return spring, No. 303837, has a pull of 63 pounds and is painted red. The secondary shoe spring, No. 303836, has a pull of 70 pounds and is painted yellow. In reassembling, be careful not to misplace these springs.





BRAKE ADJUSTMENTS:

Eleventh, Twelfth, and Fourteenth Series

TOOLS

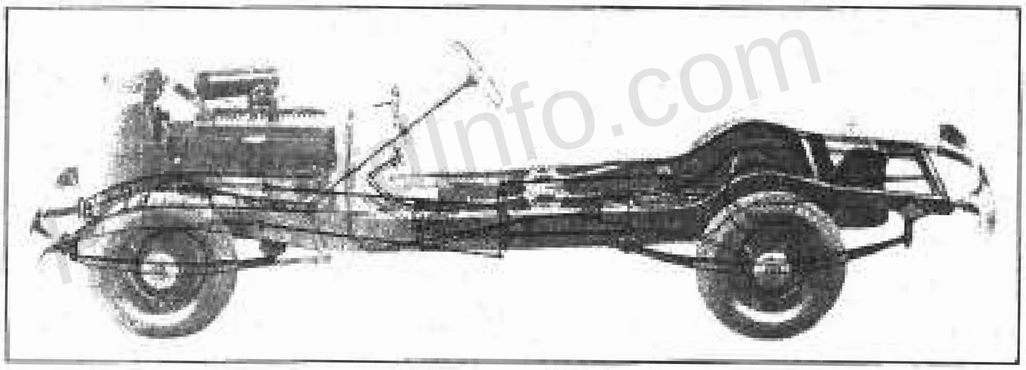
The same tools, except for the bleeder kit and fluid filler as used on the One Twenty, are used on the senior Packard wheel mechanism.

Wear Adjustments for Foot or Service Brakes:

(a) Proceed as in paragraph "A" under One Twenty.

(b) Make sure the brake pedal, cross shaft and cables are well lubricated and operate freely and that the brake pedal and cross shaft are in their fully released position. Pedal to toe board clearance should be ½". This adjustment is made at the clevis on the lower side of the booster valve.

(c) Disconnect all four cables at cross shaft lever.



The wheel adjustments on the Eight, Super Eight and Twelve are the same as those on the One Twenty. All senior Packard cars have power operated brakes. The brake pedal is connected to the wheel mechanisms by cable, commonly referred to as "mechanical brakes," whereas on the One Twenty the brake pedal is connected to the wheel mechanisms by hydraulics.

The linkage, or cables, should require adjustment only when the shoes are changed or replaced. The adjustments are as follows:

(d), (e), (f) The wheel adjustments are made as on the One Twenty under paragraphs D, E and F.

(g) By use of notched star adjusting wheel, expand the brake shoes in all four drums. With the cross shaft against its stop, pull both front and rear cables tightly toward the cross shaft levers to remove all cable slack, adjusting the clevises so that the clevis pin will just enter with no slack in the cable. (All four cables alike.) Lock the clevis jam nuts and insert the clevis pin

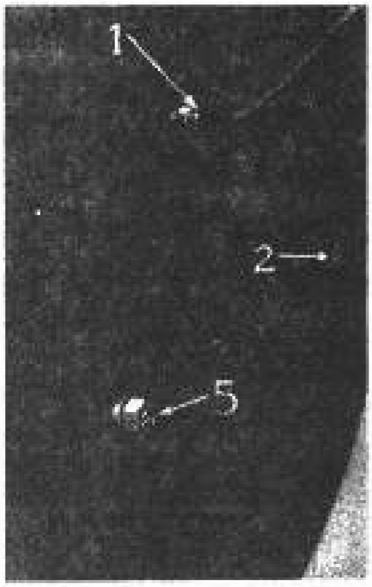


Fig. 1. FRONT AXLE

1. Eccentric Adjustment
2. Adjusting Screw
5. Anchor Pin Nut

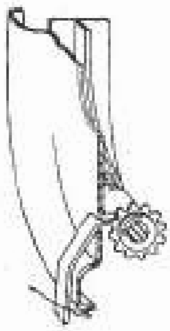


Fig. 2

cotters. Release the shoes by backing off the star adjusting screws until brakes are just free of drag. Replace inspection covers. Balance drag on tester, or road test, backing off the tight wheel.

The right front wheel should pull 650 to 675 pounds, while the other three wheels pull 500 pounds on a brake tester. The actual pull may vary with different brake testing equipment, but the ratio should remain the same.

Adjustment for Hand Brake:

The hand brake on the Senior Packards operates on all four wheels. Adjustment is made at cross shaft cable end with hand brake lever in fully released position and cross shaft against stop. All slack in cable should be removed but cable must not be tight enough to hold brake on.

Adjustments to compensate for sensitiveness, or slight pull to one side or the other, should not be made until after the drum lining has become burnished and smooth.

Brake Lubrication:

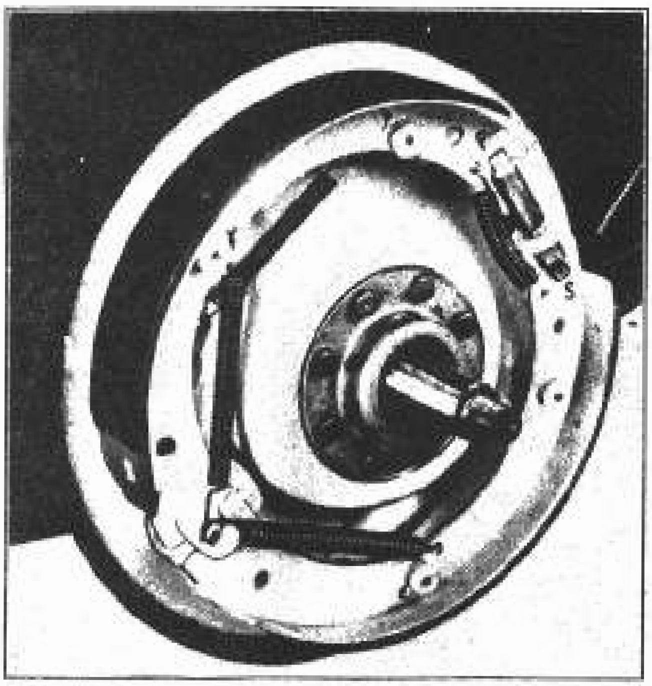
To hasten the release action of the brake control system, the uninformed mechanic may install return springs at various points in the system. This is detrimental to satisfactory brake performance. It will usually be found that correct lubrication and proper adjustment is the remedy. Replace only a weak or broken return spring.

If a click is heard in the rear brakes, usually after backing up, it is because the shoes are returning to their forward braking position against the anchor pin. Too great a shoe clearance is the probable cause and adjustment for shoe wear should be made. If this does not remedy the click a thin coat of Lubriplate applied in the wheel mechanism to the brake cam, anchor pin, backing plate shoe edges and any other points where there is metal to metal friction, will reduce or entirely eliminate this. You will find that Lubriplate deposits on each of the wearing surfaces a hard, smooth film. Lubriplate need not be applied to the cables and conduits.

The brake cables and conduits should be lubricated with No. 213½ Gredag graphite grease. The conduits may be greased by unfastening both ends of each cable, thoroughly cleaning the cable, applying grease and slowly pulling the cable back and forth through the conduit. This is a simple method and will liberally coat the inside of the conduit. A great deal of friction may be built up if these cables are allowed to become dry and very uneven brake action can result.

Avoid over-lubrication of the rear axle and the front wheel bearings. Oil or grease on brake linings ruins their effectiveness. A little oil or grease usually makes the lining very sensitive and grabby. Much grease causes a hard pedal.

Hand Brake Lever—Position Changes: 14th Series



The operating position of the hand brake lever may be moved two inches to the rear by changing the pawl, or hand brake latch, piece 228705.

To do this it will be necessary to remove the glove compartment in order to remove the hand brake lever assembly. After making the change, the linkage of the hand brake cable will need to be adjusted at the clevis on the lower end of the cable.

GENERAL BRAKE INFORMATION —ALL MODELS:

Assembling Brake Shoes:

Where two different types of brake lining are used in the same brakes, it is necessary that the linings and their respective shoes be assembled in a definite relation. The shoes are marked "S" and "P," abbreviating the words secondary and primary. Irrespective of the position in which the brake assembly is mounted on the axle, the primary brake shoe is always the one that comes in contact with the brake drum first during a forward brake application and transfers Servo action to the secondary shoe. The heavy return spring should always be connected with the secondary shoe.

Relining:

When lining renewal is necessary, it will be found much more satisfactory if genuine Bendix replacement brake shoes, fitted with factory specification linings, are used. These replacement brake shoes have been fitted with the correct lining, ground to proper radius. A special filler compound cements the brake linings to the shoes and forms a solid foundation for the lining, lengthening the intervals between adjustments and eliminating brake squeal. It costs no more than for the lining alone.

Always reline the brake in two wheels, either both front wheels, or both rear wheels, at the same time. Never reline the brake on one wheel or those on one side of the car at one time.

Brake linings on all new cars are rather sensitive and should not be abused. The high spots on brake linings have to be worn down just as motors have to be "broken in."

Where a shoe adjustment does not give perfect brakes, all brake shoes should be removed, inspected as to lining condition and the entire wheel mechanisms thoroughly cleaned and blown out. The linings should be cleaned with a stiff wire brush. Lubriplate grease should be lightly applied to the cable ramps, shoe support ledges on backing plates, eccentrics, shoe ends and all moving parts at frictional contact points, care being exercised to get no grease on the linings. Do not use Lubriplate on the cable and conduit.

VACUUM BOOSTER ON EIGHTS AND TWELVES:

Booster Part Names:

(a) Piston chamber front.

(b) Piston operating chamber rear.

(c) Cylinder nipple.

(H)
(H-1) Front bracket supports.
(H-2)

(j) Piston rod guide.

(k) Piston rod end.

(l) Piston rod end seal.

(m) Pressure adjustment clevis pin.

(p) Piston.

(v) Valve diaphragm.

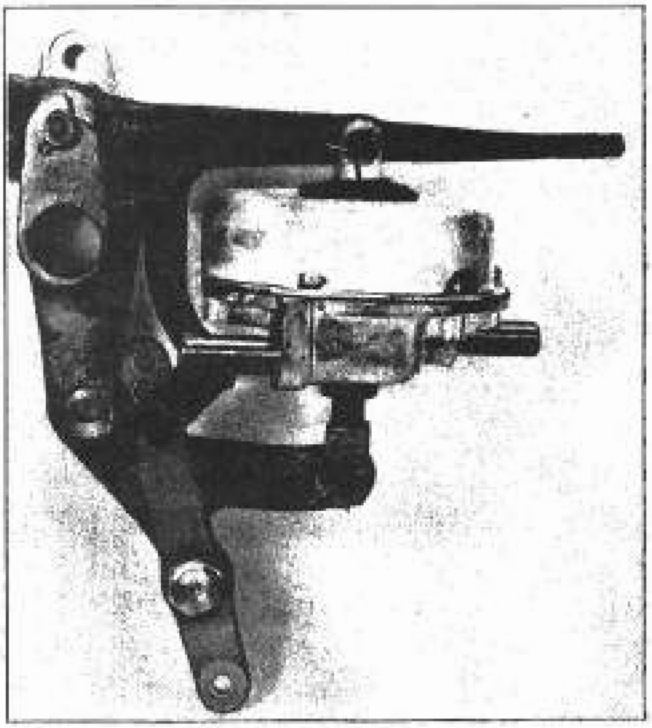
(w) Valve.

(x) Valve nipple intake.

(y) Valve nipple outlet.

(z) Stop.

Brake Vacuum Booster Adjustment:



Packard brake boosters aid the application of the brakes in direct proportion to the pedal pressure, so that the action of the brake is proportional to the pressure exerted on the brake pedal.

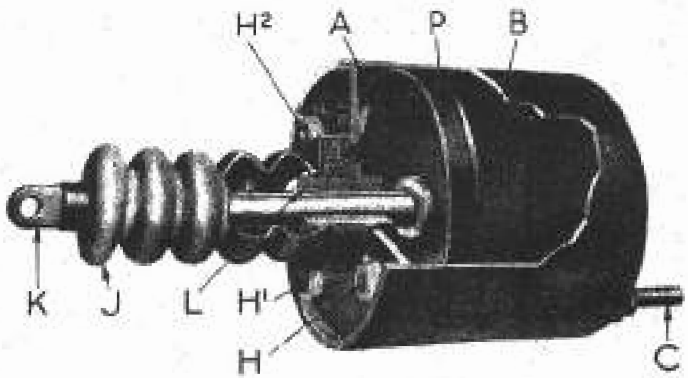
Note from the illustration that the vertical arm of the brake pedal is connected to a lever which operates by an adjustable link that may be connected to any one of three holes in the lever. Cars shipped from the factory have the links in the lower hole as shown.

When the brake lining is new and comparatively soft, very little pedal pressure is necessary and the initial setting is the one which develops the least automatic assistance.

As the brake lining becomes smooth, the pedal pressure will increase, so if a softer pedal is desired the result may be accomplished by the adjustment referred to. It will probably be sufficient to move the link up one hole to the center, although the upper hole may be used if an extremely soft pedal is desired.

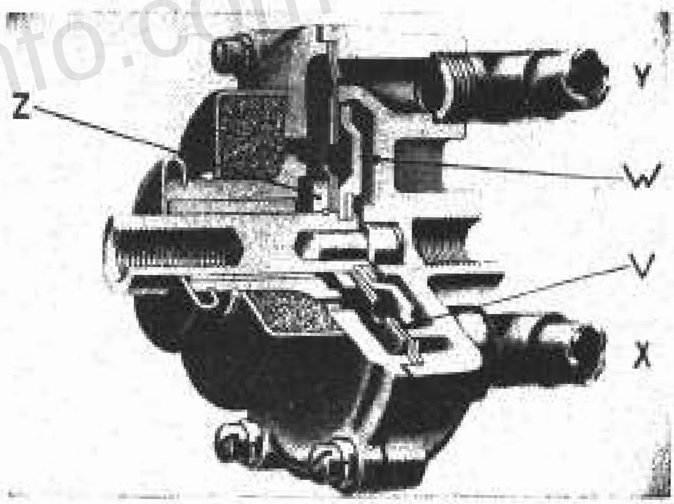
Operation:

The booster system consists of two main units—a vacuum control valve and a brake cylinder. The control valve on the Twelve is interposed between the brake pedal and the linkage. The brake cylinder is connected to the brake lever by a steel cable.



The cylinder on the Twelve is 6" in diameter and the piston has a surface of 28.4 sq. in. With 20" or 10 lbs. of vacuum the pull produced on the cable is 284 lbs.

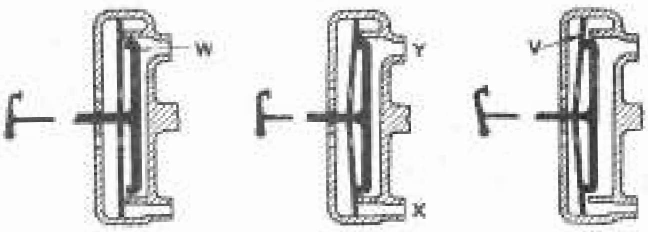
The Eight and Super Eight cylinders are 5¼" in diameter with surfaces of 21.6 sq. in. and with 10 lbs. of vacuum produces a pull of 216 lbs.



When the brake is in the "off" position there is atmospheric pressure on both sides of the piston. When the pedal is pressed, air is drawn from chamber "B," tending to create a vacuum so that the atmospheric pressure in chamber "A" causes the piston to move.

Of course, a perfect vacuum is never reached, but at sea level the difference in pressure on the cylinder chambers may reach eight to ten pounds per square inch.

Connection from chamber "B" to the booster valve is effected by copper tubing and a special grade of rubber hose connecting nipple "C" with nipple "X." Nipple "Y" on the valve is connected to the manifold from which the system gets its vacuum.



The three diagram views show the operation of the valve. Note the holes through the valve diaphragm and the air cleaners on both the valve and cylinder. The left hand view shows the "off" or "released" position of the valve mechanism and brakes. The diaphragm is seated, closing communication between the cylinder and the manifold. The atmospheric valve "W" is unseated, and open, establishing communication between the interior of the cylinder and the atmosphere, which equalizes the pressure on both sides of piston.

When the brake pedal is depressed, the atmospheric valve will be seated upon the diaphragm, as shown in the center diagram, closing communication between the operating chamber and the atmosphere. Further pressure on the foot pedal will move the valve diaphragm away from its seat, as shown in the diagram at the right, thus connecting one end of the cylinder with the vacuum, causing the air to be withdrawn from that end of the cylinder.

If the operator stops the forward movement of the brake pedal before all of the air is withdrawn from the cylinder, the valve casing, which is connected to the brake mechanism, will continue to be moved by the power of the cylinder until the valve casing has receded the diaphragm, as shown in the center figure. This will shut off the cylinder from the intake manifold and hold the brakes as applied. The valve diaphragm movement is $\frac{3}{32}$". When the brakes are fully applied, and the valve is wide open, as shown in the right hand figure, any further force exerted on the brake pedal will be transmitted through the stop "Z" to the valve casing and brake mechanism making a solid hook up from brake pedal to brake linkage.

When the operator releases the brake pedal, the atmospheric valve will open after the diaphragm has been seated, as shown in the diagram at the left. This opens the cylinder chamber "B" to atmospheric pressure balancing the pressure on both sides of piston and allowing brakes to release.

The brakes when applied will remain as applied provided the brake pedal is not moved to alter the position of the valve mechanism. Any leakage of air sufficient to cause the brakes to release will move the valve casing and reapply the brakes until the valve casing has been moved back to the neutral position, as shown in the center diagram.

Any leakage of air from the vacuum side of the cylinder, sufficient to cause the brakes to be further applied, will move the valve casing into the position shown in the diagram to the left. If the motor on the Eight and Super Eight stalls as the brakes are being applied, there will be no vacuum and the pedal will be hard.

The twelve cylinder car is provided with a clutch and brake booster vacuum tank capable of several applications after the motor has stalled.

The only adjustments on the brake booster mechanism are in the linkage at the clevis pin "M," and at the clevis on the lower half of the valve casing. If the valve adjustment is too tight, i. e., screwed in too far putting a load on the valve in its released position the brakes will drag.

The clevis on the lower half of the valve casing should be so adjusted that there is no load on the valve and that the brake pedal is held against its stop by the brake retracting spring.

To adjust piston cable: pull piston all the way out and adjust cable so that there is no slack with cross shaft against stop.

Brake Booster Troubles:

If an owner complains that his motor flutters and stalls when the brakes are applied, and that his brake power is poor, it is an indication that there is an air leak in the booster system, causing air to be admitted to the manifold in the "brake applied" position. This may be caused by a loose hose connection between the booster valve and booster cylinder—a dry piston seal in the booster cylinder, a cracked diaphragm in the booster valve, or dirt between the valve and diaphragm seat. A leak in the brake cylinder is usually caused by a dry piston seal.

To check the cylinder for an air leak:

1. Disconnect cable from piston rod end.
2. Disconnect hose from nipple "C."
3. Push the piston all the way in and then place a finger over nipple "C," plugging the hole. Endeavor to pull the piston out. If it is possible to pull the piston out with the finger over the hose connection, then the piston seal is leaking and should be lubricated.

   To lubricate the seal, remove the cylinder from the car, inject about two ounces of Bendix Vacuum oil at nipple "C." By holding the cylinder in a vertical position with the piston rod down, rotate the piston in the cylinder, working it in and out, at the same time, to distribute the oil around the piston seal, occasionally trying the piston by placing the finger over the nipple and attempting to pull the piston out.

If this does not remedy the trouble, it is obvious that the seal has lacked lubrication for so long that it has become hard and must be replaced.

To check the valves for leaks, remove the valve from the car; place the lips over the nipple marked "To manifold," and draw on it. If it is possible to draw air through the valve, this indicates that the valve diaphragm is not seating properly, or is cracked. It might also be due to the fact that the valve stem is rusted and sticking in the guide. When the valve is seating properly, it will not be possible to draw air through that connection.

Engine Continually Flutters and Stalls on Idle

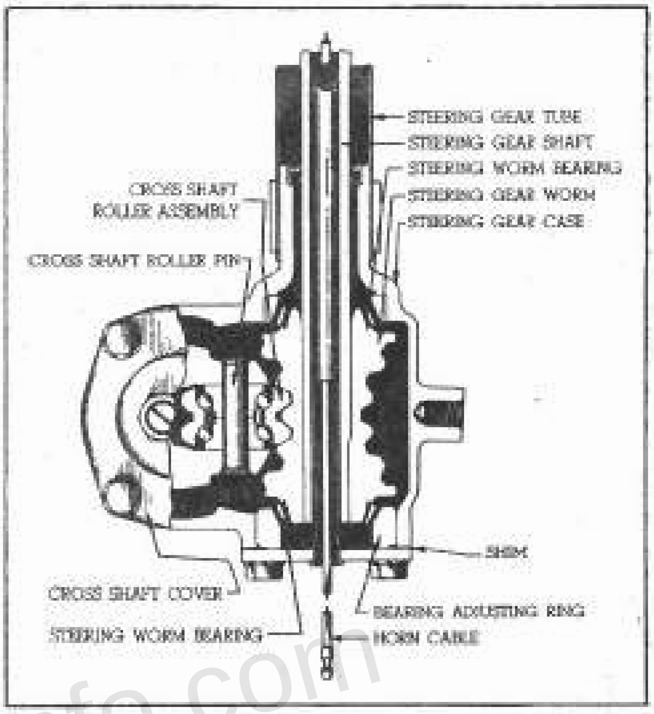
This indicates a leaky hose or loose hose connection from the manifold to the booster valve. It should be checked and tightened or replaced if necessary.

STEERING GEAR ADJUSTMENTS:

One Twenty:

There are three steering gear mechanism adjustments and they must be made in the following sequence:

1. Adjust steering gear post for end play.
2. Adjust gear lash.
3. Adjust lever shaft end play.



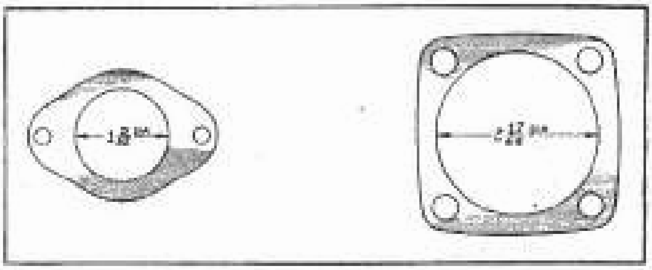


Fig. No. 1 Fig. No. 2

1. Adjust steering gear post to remove end play or bind. Use shim as shown in Fig. No. 2.

   NOTE—These shims come in two thicknesses—part 302239 is .005″ thick—part 302238 is .010″ thick.

   The combined adjustments for gear lash and lever shaft end play are as follows:

2. Shim adjustment for gear lash. For this adjustment use shim as shown in Fig. No. 1.

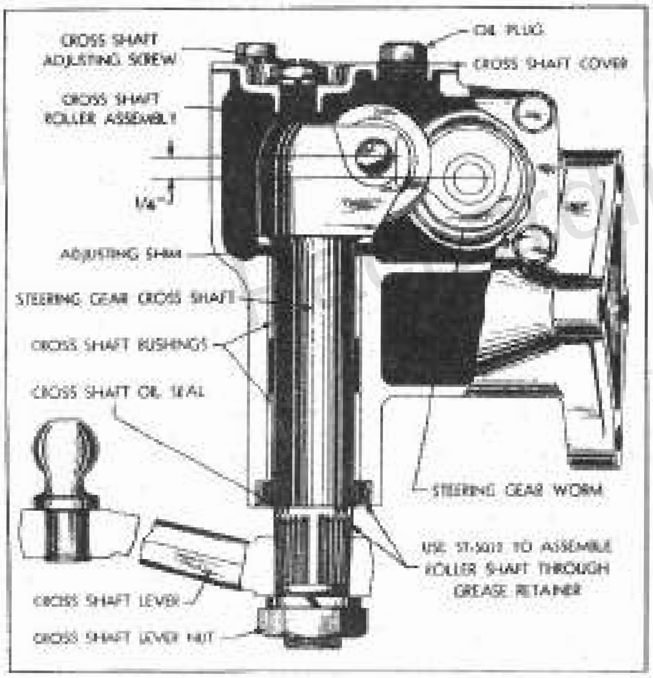
   Piece 304611 is .005" thick.

   Piece 302883 is .010" thick.

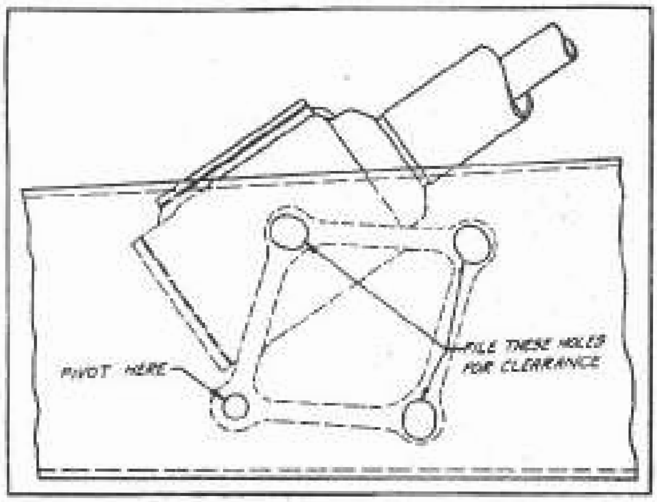
   Piece 302882 is .030" thick.

3. End play adjustment for lever shaft. This is made by cross shaft adjusting screw.

   NOTE—That the worm roller is off center ¼", and that the worm and roller are preloaded when the wheels are in their straight ahead position. Make sure the cross shaft adjusting screw is not binding and also that there is no end play in the shaft when the steering wheel is turned to extreme right or left.



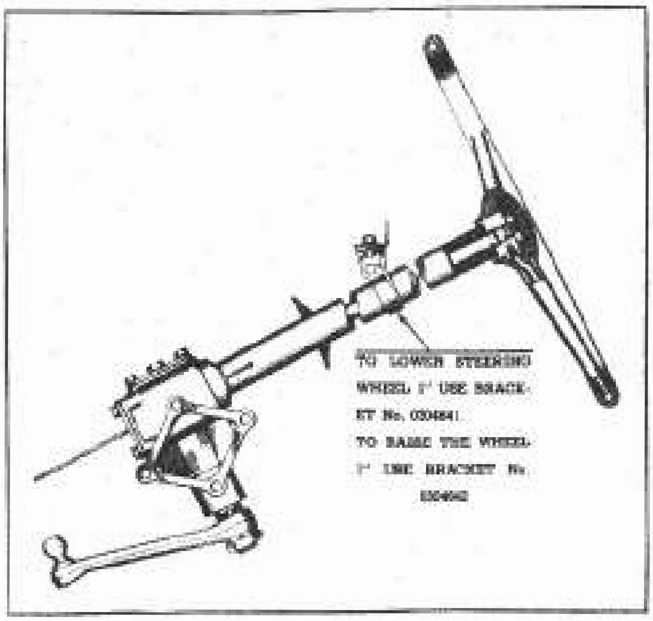
For further detail see One Twenty Technical Data Book.



To raise or lower the steering wheel, proceed as follows:

1. Remove the steering gear assembly from the car.

2. File out three of the four holes in the frame to give sufficient movement. If this is not done, the steering gear shaft may be sprung and binding will occur in the gear.



3. Using the front lower hole as the pivot point, replace the steering gear assembly in the car with the proper instrument board bracket and tighten in place by first tightening the instrument board bracket.

4. Tighten all other bolts and connections and make sure they are locked and cottered as required.

   Note—In radio equipped cars the steering gear cannot be raised.

STEERING GEAR ADJUSTMENTS—GENERAL INSTRUCTIONS:

Ninth, Tenth, Eleventh, Twelfth and Fourteenth Series Packard Twelves and Eleventh, Twelfth and Fourteenth Series Eights and Super Eights

Tools:

ST-135 Steering lever puller.

ST-653 Steering cross tube ball joint puller.

ST-195 Steering knuckle plug wrench.

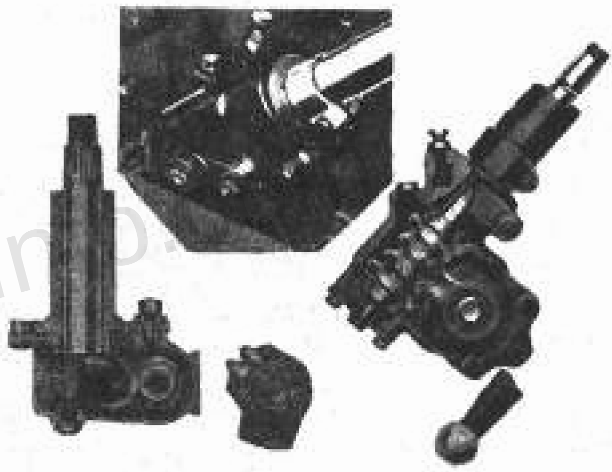
ST-704 Steering knuckle pin puller.

ST-938 Steering wheel puller.

ST-128 Wheel gauge.

Steering gear adjustments are usually made to eliminate excessive play, rattles, or stiff action. They should be made in the following order:

1. Jack up front end of car.
2. Place wheels in straight-ahead position, noting position of steering wheel spokes while driving so that true straight-ahead position is assured during adjustment procedure.
3. Disconnect drag link from steering arm.
4. Adjust end play in column shaft.



The Ninth and Tenth Series Twelves and Tenth Series Super Eights have a screw adjustment for end play located in a boss on the steering gear housing just above the filler plug, as shown. Care must be exercised not to cock the cone in making this adjustment in these series cars. On all Eleventh, Twelfth and Fourteenth Series Packards this adjustment is made by a nut.

5. Turn wheel to full travel in one direction and then back up ⅛ turn. This leaves column bearing free of side thrust.

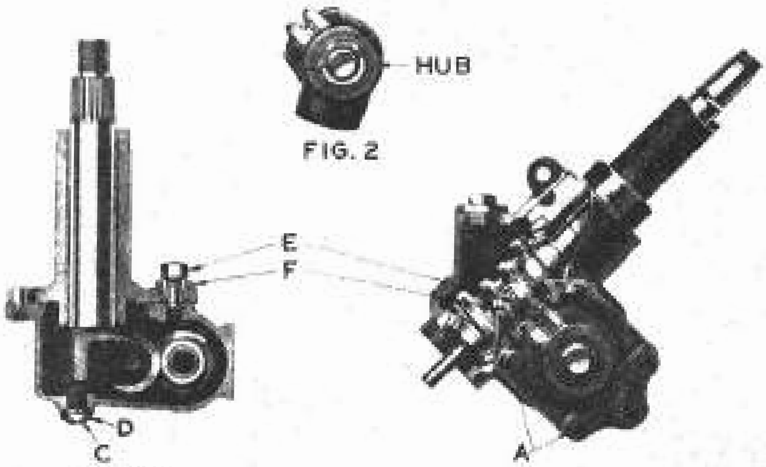


FIG. 2 FIG. 3 FIG. 1

6. Loosen the jam nut on adjusting screw and back off the screw ½ turn.

7. Loosen housing clamp bolt until the lock washer is partially clamped. Tighten adjusting screw snugly with 6" wrench and then back off 1/16 turn. Hold in this position and lock jam nut. Tighten clamp bolt securely and turn steering wheel throughout full travel for test of stiffness. The drag on the O. D. of steering wheel should be about 1 to 1½ pounds. On the Eights and Super Eights the adjustment for column shaft end play is made by turning the column nut after the clamp bolt has been loosened. A slight drag should be felt when turning the steering wheel.

8. Adjust end play in cross shaft.

   The cross shaft in the Twelve, beginning with Ninth Series and in 8 and Super 8 beginning with 11th Series is made by first turning the steering wheel to either extreme and then ⅛ turn back and adjusting all play out by means of adjusting screw "C" at side of housing next to the motor. Be sure to lock securely with lock nut "D" and reinspect for freedom of rotation and end play. This adjustment should increase the drag on the steering wheel O. D. to 2¼-2½ pounds.

9. Adjustment for back lash between roller tooth and worm. This adjustment should be last and never made without first having checked the other two. The steering gear worm and roller tooth are generated to give a close mesh in center position and a gradual release toward each end.

Place the steering wheel in the straight-ahead position, as indicated by steering wheel spoke before drag link was disconnected.

The amount of back lash should be determined by movement of the steering arm fore and aft by hand. Loosen housing cover nuts "A" one-quarter turn and eccentric jam nut "E" one-half turn. Turn the eccentric adjusting sleeve "F" clockwise very gradually, checking for back lash. Adjust sufficiently tight to eliminate all lash, being sure to finish movement of eccentric in a clockwise direction. With drag link disconnected the maximum pull on steering wheel O. D. should not exceed 3 lbs. With wheels connected but raised off the ground the maximum pull should not exceed 10 lbs. Back lash from steering wheel to road wheels should not exceed 1" at steering wheel O. D.

Tighten eccentric adjusting sleeve jam nut "E" securely and follow likewise with housing cover nut "A." Turn steering wheel throughout full travel to test freedom of operation. If too tight slack off and readjust.

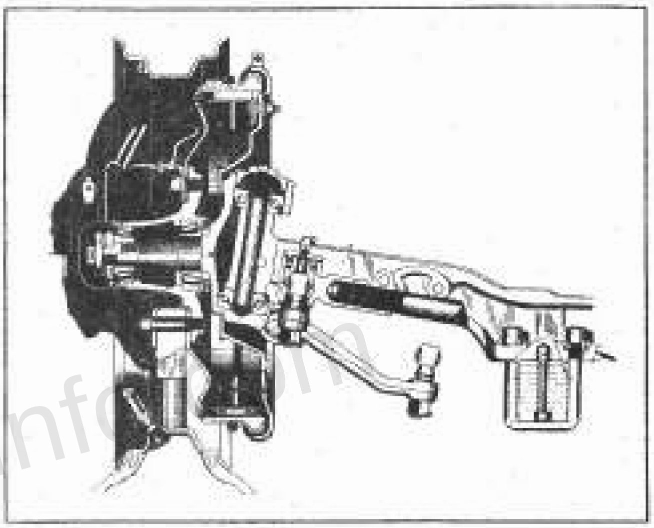
Tight or Stiff Steering:

With the front wheels jacked up, the steering mechanism should operate freely throughout the entire turning radius. If it does not, disconnect the drag link—check both steering gear and wheel mechanism for bind. The front wheels should swing through their turning radius freely and without tight spots.

Should there be a bind in the wheel mechanism, it may be from lack of lubrication or dirt, or some member may have been bumped and sprung.

If the steering gear binds, it may be from improper adjustment, or a misalignment in the steering gear shaft. To align the steering gear shaft, loosen the steering gear housing and the column at the dash bracket, allowing the steering gear to adjust itself to its natural position, and retighten.

If the gear still operates too stiffly, the upper steering gear bushing may be the source of trouble and should be replaced. The steering gear and steering mechanism should be well lubricated with transmission lubricant, as specified on the lubrication chart.



Steering Knuckle:

The ball bearings on which the king pins are mounted are packed with grease. They are carefully sealed and will operate for a long period without further attention. No Alemite connectors are provided at these points because a pressure lubricator is likely to blow out the oil seals. The plugs may be removed and elbow type Alemite fittings temporarily installed for use with hand gun to inject a limited quantity of heavy oil, or cup grease. After this has been done, the Alemite fittings should be removed and the plugs replaced so there will be no possibility of damage through the use of high pressure guns.

We suggest that these be lubricated annually or about every 10,000 miles.

Looseness in Steering:

This may occur anywhere in a steering mechanism because of wear due to lack of lubrication. Wheel bearings, also, become loose and give the same effect as loose steering. There should be no excessive play in a steering mechanism and yet it should not be so tight as to cause wander and require constant steering.

FRONT END TROUBLE SHOOTING:

In General Any Type Car:

This is a diagnosis chart and since the correction for the trouble is apparent from the reason or cause of the trouble, the remedy is not given.

Hard Turning:

1. Too much caster.
2. Tight or bent spindle.
3. Sagging springs.
4. Low or unequal tire pressure.
5. Tight steering assembly.

Loose Steering:

1. Loose wheels.
2. Worn king pins and bushings.
3. Loose or worn bearings.
4. Play in steering assembly.

Wander or Weave:

1. Too little, reverse, or unequal caster.
2. Low or unequal tire pressure.
3. Looseness in steering assembly.
4. Front wheel bearing too tight.
5. Worn or loose bearings.
6. Worn king pins or bushings.
7. Bent spindle.
8. Tight steering assembly.
9. Wheel balance—drop center tire may be off-rim.
10. Load shift.
11. Tires of different tread and weight.
12. Weak rear spring or over-lubricated spring.
13. Sprung frame.
14. Incorrect toe-in.
15. Loose spring shackles or U-bolts.
16. Play in spring saddles.
17. One weak spring.
18. Loose front cross member.
19. Bent spindle or steering arm.

Shimmy

1. Too much or too little caster.
2. Bent spindle.

3. Bent or twisted axle, or equivalent.
4. Low or unequal tire pressure.
5. Eccentric or unbalanced wheel. (Boots in tires.)
6. Worn king pins or bushings.
7. Worn or loose bearings.
8. Improper toe-in.
9. Unequal camber.
10. Loose U-bolts or spring shackles
11. Uneven action of shock absorbers.
12. Weak springs or too well oiled without sufficient shock absorber control.
13. Tire wobble (lateral).
14. Weak spring in tie rods.

Scuffed Tires

1. Wrong camber.
2. Wrong toe-in.
3. Worn king pin, bushings or bearings.
4. Bent spindle, arms or frame.
5. Bent or twisted axles or equivalent.

Cupped Tires

1. Dragging brakes.
2. Eccentric or unbalanced wheels.
3. Too much or too little caster.
4. Bent or twisted axles or equivalent.
5. Bent spindle arms or frame.
6. Worn king pins, bushings or bearings.
7. Under inflation of tires.

It may be found that many of these troubles do not occur on Packard cars of either conventional or independent springing, but the chart may be found useful in the reconditioning of used cars.

Regarding Tires

The selection of tires for each Packard model is based upon extensive experimental investigation, and in most cases, changing the standard equipment for tires of different size or type will deteriorate rather than improve the riding or handling characteristics—or both. In the case of the Model 120, six-ply tires may be substituted for the standard four-ply, but only at the expense of ride harshness. It is not feasible—or safe—to try to compensate for the greater stiffness of the six-ply by using pressures lower than those recommended for this type. The usual effects of underinflation are certain to occur.

ONE TWENTY

Rebushing King Pin:

When the king pin bushings have been worn so that they need to be replaced, it is usually necessary to replace the king pins as well:

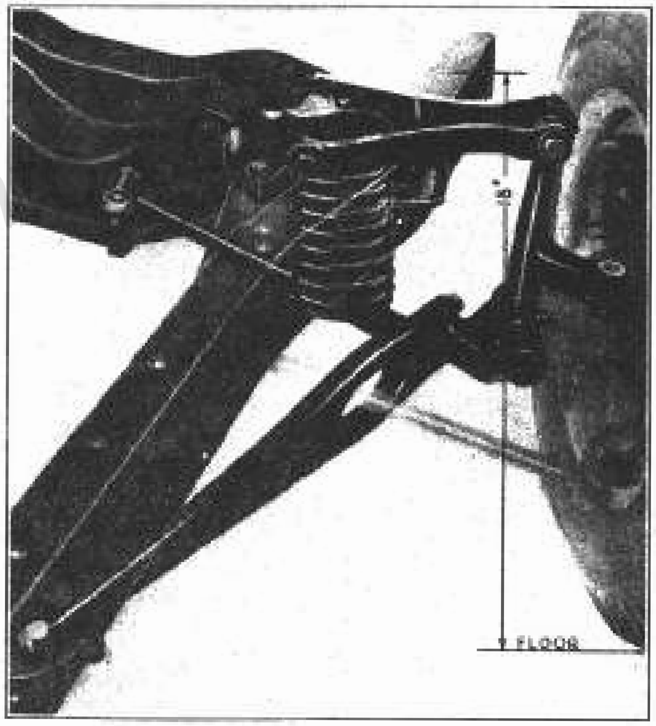
1. Jack up front end of car.
2. Remove wheels, brake drums and brake backing plate.
3. Remove plugs at the ends of the bearing bosses in the steering knuckle. (Take care not to damage the plug seat.)
4. Withdraw the locking bolts.
5. Drive the king pin out.
6. Press the old bushings out.
7. Push in new 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 with a special broach, ST-5046 after inserting. (Never ream these bushings.)
9. Before assembling, clean everything with gasoline and reoil properly.

Wheel Alignment:

The factors of steering are so interdependent upon each other that any specific trouble may arise from a number of different causes. It will usually be found that not one but several factors are out of line and, of course, all must be corrected before the car can be expected to operate properly.

Before attempting to check a car for caster, camber, toe-in or toe-out:-

1. Correctly inflate all tires.
2. Place the car on a smooth level floor.
3. Load the car to bring the top of the frame side rails 18" above the floor and parallel with it.
4. Turn the wheels so they point straight ahead.



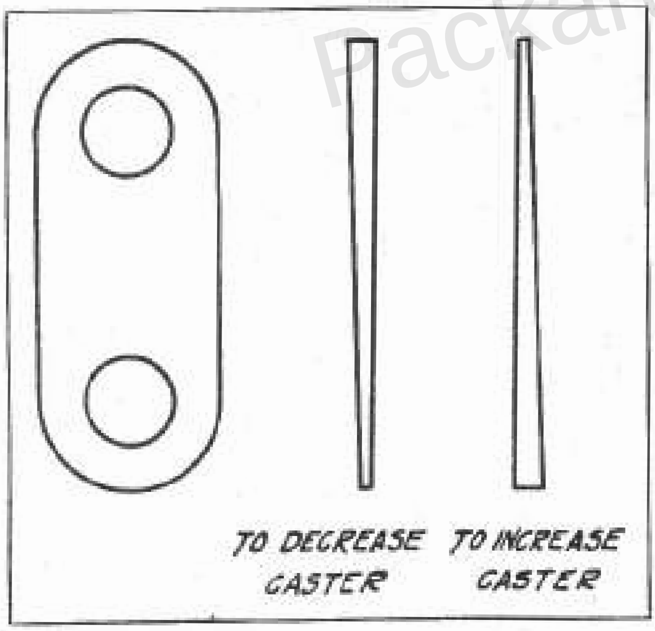
5. Adjust the front wheel bearings. This should be done by tightening the nut then backing it off 2 or 3 notches as measured by the locking washer.
6. Check shock absorber fluid level, refilling if necessary.

7. Check for damage to any front end or steering part.
8. Make sure that all connections are tight, but not too tight, and properly locked or cottered before leaving the job.

Caster:

The desired caster angle is 2°. It may be plus or minus ½°, that is, 1½° minimum and 2½° maximum, but the variation in caster angle between the right and left knuckles should not exceed ½°.

Machined reference points are provided on the vertical support arm for checking caster.



The above is a caster correction shim. It is wedge shaped. Two are provided for service.

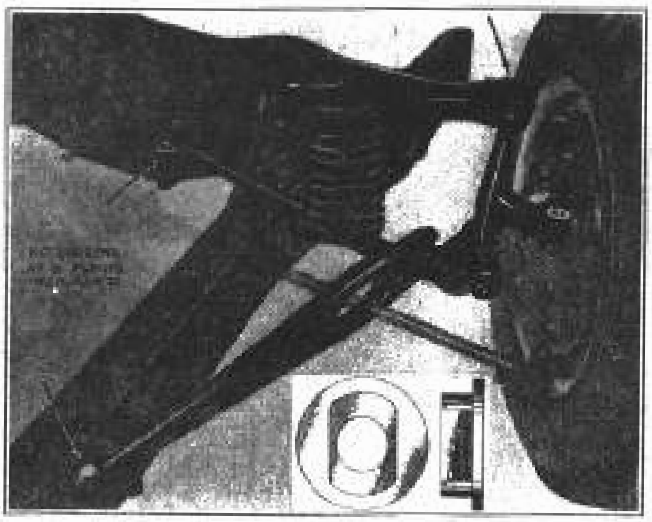
0304699 tapers ½°
0304698 tapers 1°

After the front end has been checked and found to require a caster correction, proceed as follows:

1. Jack up front end.
2. Remove 3 screws from the torque arm socket rear.
3. Remove 2 nuts from front end of torque arm, disconnecting from the load carrying arm.
4. Remove the torque arm.
5. Insert a shim of the correct taper on the torque arm studs and reassemble.

Caster may be increased or decreased according to the way the shims are used.

There are 3 points where each wheel support assembly is attached to the chassis. All points are supported in live rubber bushings. The front end should move freely.



CAUTION—After making a caster correction, make certain that there is no binding or strain on the shock absorber link bushing, the wheel support arm bushing at the center, or the torque arm bushing at the rear. See arrows.

Camber:

There are 4 offset pilots used for changing wheel camber. All but one has the hole offset from the center. (See insert above.) Anyone may be used to increase or decrease camber, depending on the way it is used.

303075—0 offset
303076—$\frac{1}{16}$ offset
303077—$\frac{1}{8}$ offset
303078—$\frac{3}{16}$ offset

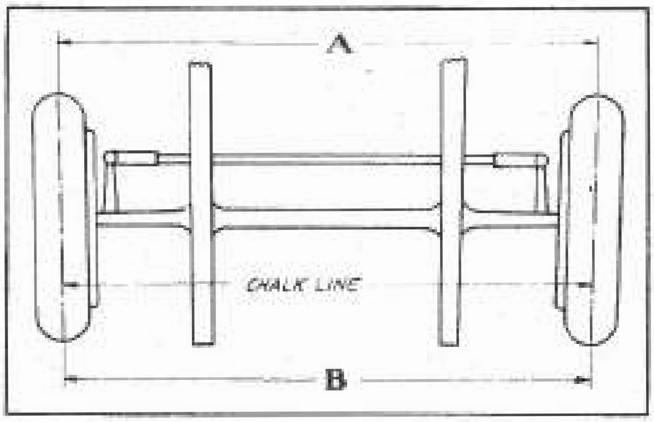
To change the camber in a One Twenty wheel:

1. Remove the shock absorber link bushing bolt and pilot.
2. Replace the pilot with one of the above service pilots designed to increase or decrease the camber as desired.

To increase camber, use pilots that will tip the wheel farther out at the top and lock in place. Camber may be reduced in a like manner by using pilots that will tip the top of the wheel in closer to the frame.

Toe-In:

Spin the wheels. Chalk mark a line on the outside center of each wheel. Correctly aligned wheels show between $\frac{1}{16}$ and $\frac{1}{8}$ inch toe-in. If



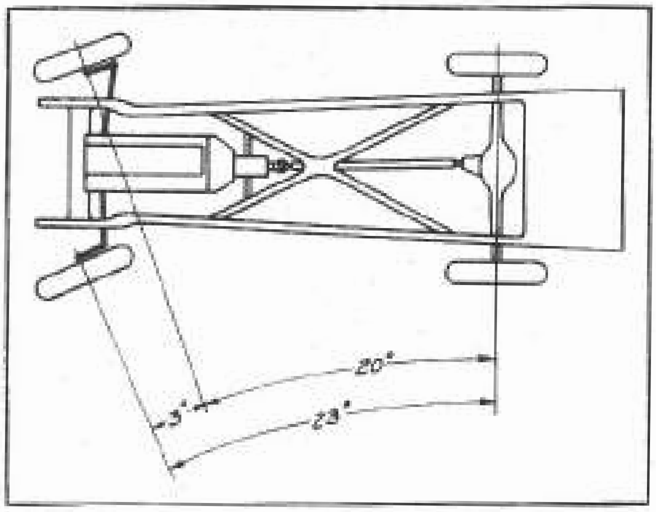
the wheels are not bent and do not check to the desired dimensions, it will be necessary to adjust the cross tubes:

On One Twenty:

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 to make them equal if necessary.
4. Securely tighten clamps when finished. Clamps and screws should be vertical and to rear of tube.

Toe-Out or Steering Geometry:

Toe-out or steering geometry is the mechanics of keeping the front wheels in their proper alignment under all driving conditions and particularly as the wheels are turned right or left from their straight-ahead course. Due to camber, it is necessary that the wheels "toe-in" slightly when the car is in its straight-ahead course, but when driving on a curve, it is



necessary that the wheels go into a "toe-out" position—that they are farther apart at the front of the tire than they are at the rear. This increases with the sharpness of the turn. Packard One Twenty has a turning radius of 19½'. When the car is turning in this short radius the front wheels at the circumference are much farther apart at the front than they are at the rear.

The above view shows this relationship of the front wheels. On the One Twenty when the outside wheel has turned through an arc of 20° the inside wheel must have turned an arc of 23° or there will be slippage of the inside wheel. This applies on either a right or left hand turn. The angles are in the same relationship. If the angles do not check as above, it is probable that one or both of the steering knuckle levers (steering arms) have been bent and should be replaced to correct the steering geometry.

If the right arm is bent, usually the left tire shows excessive wear and vice versa.

MECHANICAL SPECIFICATIONS—STANDARD SIZES and ADJUSTMENTS

	Packard Eight Models 1400-1401-1402	Packard Super Eight Models 1403-1404-1405	Packard Twelve Models 1407-1408	One-Twenty	One Twenty "B" (Differences)
ENGINE:					
Type	Vertical L-head	Vertical L-head	Modified L-head	Vertical L-head	
Make	Packard	Packard	Packard	Packard	
Cylinders	8 in line	8 in line	12—67° V.	8 in line	
A. M. A. rating—h. p.	32.5	39.2	56.7	33.8	
Maximum brake h. p.—r. p. m.	130 at 3200	150 at 3200	175 at 3200	110 at 3800	120 at 3800
Bore	3 3/16"	3 1/2"	3 7/16"	3 1/4"	
Stroke	5"	5"	4 1/4"	3 7/8"	4 1/4"
Reground oversizes	.003 to .045	.003 to .045	.003 to .045	.005 to .040	
Displacement	320	384.8	473	257.16 cu. in.	282.04
Compression ratio—Standard	6.5	6.3	6.4	6.5 to 1	
Compression ratio—Optional	6.00	6.00	6.00	7.0 to 1	None
Compression ratio—Optional	7.00	7.00	7.00	None	
Compression at 125 r. p. m.—Std.	110 lbs.	110 lbs.	110 lbs.	110 lbs.	
Firing Order	1-6-2-5-8-3-7-4	1-6-2-5-8-3-7-4	1R-6L-5R-2L-3R-4L-6R-1L-2R-5L-4R-3L	1-6-2-5-8-3-7-4	
Fixed points—Fire	1-2-8-7	1-2-8-7	1R-5R-3R-6R-2R-4R	1-2-8-7	
Suspension	Rubber mounted	Rubber mounted	Rubber mounted	3 point—rubber	
Weight with clutch and trans.	992 lbs.	1070 lbs.	1327 lbs.	715 lbs.	754 lbs.
Manifold vacuum at idling speed	19" to 20"	19" to 20"	19" to 20"	19" to 20"	
CRANKCASE:					
Type	Separate casting	Separate casting	Integral with cyl.	Integral with cyl.	
Upper half material	Aluminum	Aluminum	Cast iron	Cast iron	
Lower half material	Aluminum	Aluminum	Aluminum	Steel stamping	
Oil capacity	8 qts.	9 1/2 qts.	10 qts.	7 qts.	
VALVES:					
Arrangement	L-head	L-head	Modified L-head	L-head	
Lift	.358	.358	.312	.300	
Material—Inlet	Chrome nickel	Chrome nickel	Chrome nickel	Chrome nickel	
Material—Exhaust	Austenitic cr ni	Austenitic cr ni	Austenitic cr ni	Austenitic cr ni	
Length	7 13/32"	7 13/32"	6 23/32"	5 5/8"	
Head diameter—Inlet	1 23/32	1 11/16	1 23/32	1 1/2	
Head diameter—Exhaust	1 17/32	1 11/16	1 23/32	1 13/32	
Stem diameter—Inlet	.3405	.3405	.3405	.340	
Stem diameter—Exhaust	.3405	.3405	.338	.340	
Stem clearance—Inlet	.0025	.0025	.0025	.001 at lower end	
Stem clearance—Exhaust	.004	.004	.005	.001 at lower end	
Stem clearance at bottom of guide				.0005—.0010	.0005—.00175
Tappet clearance—Warm, Inlet	.004	.004	Automatic takeup	.007	
Tappet clearance—Warm, Exhaust	.006	.006	Automatic takeup	.009	.010
Inlet opens	30° BTDC	30° BTDC	ATDC	5° BTDC	
Inlet closes	65° ALDC	65° ALDC	45° ALDC	30° ALDC	
Exhaust opens	65° BLDC	65° BLDC	35° BLDC	45° BLDC	
Exhaust closes	30° ATDC	30° ATDC	10° ATDC	5° ATDC	
Seat angle—Intake	45°	45°	45°	30°	
Seat angle—Exhaust	45°	45°	45°	45°	
Width of contact—Inlet	.062	.062	.062	.040	
Width of contact—Exhaust	.062	.062	.062	.040	

MECHANICAL SPECIFICATIONS—STANDARD SIZES and ADJUSTMENTS

	Packard Eight Models 1400-1401-1402	Packard Super Eight Models 1403-1404-1405	Packard Twelve Models 1407-1408	One-Twenty	One Twenty "B" (Differences)
Valve Springs:					
Type	Double	Double	Single	Single	
Tension—closed	73 lbs. at 3 1/16"	73 lbs. at 3 1/16"	70 lbs. at 2 3/32"	40 lbs. at 1⅝"	
Tension—open	159	159	145	110	
Exhaust Pipe					
Diameter	2¼	2½	2¾	2¼	
Muffler					
Diameter	4¾	5½ and 7"	5½ and 7"	6"	
Overall length	49	45	51	24	
FRONT END (CAMSHAFT DRIVE)					
Type	Silent chain	Silent chain	Silent chain	Silent chain	
Make	Morse No. 1866	Morse No. 1866	Morse No. 1866	Morse 1866 R.X.	
Chain Length	32"—64 links	32"—64 links	28"—56 links	58 links	
Width	1¾"	1½"	1¾"	1"	1¼"
Pitch	.500	.500	.500	.375	
Adjustment	Yes	Yes	None	None	
Cover	Steel stamping	Steel stamping	Aluminum casting	Steel stamping	
Camshaft					
No. bearings	8	8	4	5	
Bearing clearance	.001-.003	.001-.003	.001-.003	.001-.003	
End thrust	.001-.004	.001-.004	.002-.006	.002-.004	
Timing	zero on crankshaft gear and on camshaft gear must be adjacent and on a line passing through camshaft and crankshaft centers.				
PISTON:					
Material	Alum. alloy, strut	Alum. alloy, strut	Alum. alloy, strut	Alum. alloy, strut	
Weight	18.7 oz.	21.9 oz.	21.7 oz.	17.6 oz.	17.5 oz.
Installed	Slot on valve side	Slot on valve side	Slot on valve side	Slt. away from vlv.	
Clearance to wall	.0015	.0015	.0015	.0015	
Lbs. pull on ½" feeler .0015 thick	3 to 5 lbs.	3 to 5 lbs.	3 to 5 lbs.	3 to 5 lbs.	5 to 7 lbs.
No. oil drain holes	12—⅛ holes	12—⅛ holes	12—⅛ holes	12—⅛ holes	12—3/32 holes
Pin hole finish ream	.87515-.87485	.87515-.87485	.87515-.87485	.87515-.87485	
Sizes	Std.	Std.	Std.	Std.	
	.003"	.003"	.003"	.005"	
	.005"	.005"	.005"	.010"	
	.010"	.010"	.010"	.020"	
	.015"	.015"	.015"	.030"	
	.020"	.020"	.020"	.040"	
	.025"	.025"	.030"		
	.030"	.030"	.045"		
	.035"	.035"			
	.045"	.045"			
Pins					
Type	Floating	Floating	Floating	Floating	
Diameter	⅞"	⅞"	⅞"	⅞"	
Oversize diameter	.003-.006	.003-.006	.003-.006	.003-.006	
Length	2 21/32	3 1/16	2 21/32	2 11/16	
Lubrication	Full pressure	Full pressure	Full pressure	Full pressure	

MECHANICAL SPECIFICATIONS—STANDARD SIZES and ADJUSTMENTS

	Packard Eight Models 1400-1401-1402	Packard Super Eight Models 1403-1404-1405	Packard Twelve Models 1407-1408	One-Twenty	One Twenty "B" (Differences)
PINS—Continued					
Fit	Palm push at 160°	Palm push at 160°	Palm push at 160°	Palm push at 160°	
Pin to con. rod clearance min.	.0002	.0002	.0002	.00025	
Height—C.L. to top of piston	2.500	2.500	2.693	2.125	
RINGS					
No. per piston	Four	Four	Four	Three	
No. oil	One	One	One	One	
Location	Above pin	Above pin	Above pin	Above pin	
Width comp	1/8"	1/8"	1/8"	1/8"	
Width oil	3/16"	3/16"	3/16"	3/16"	5/32"
Groove depth (oil)	.145	.161	.161	.161	
Gap comp.	.007-.012	.007-.012	.007-.012	.007-.012	
Gap oil	.007-.015	.007-.015	.007-.015	.007-.015	
Min. side cl'ance in groove (top)	.002	.002	.002	.002	
(Second)	.0015	.0015	.0015	.0015	
(oil)	.0015	.0015	.0015	.0015	
CONNECTING RODS:					
Material	Steel forging	Steel forging	Steel forging	Steel forging	
Weight	2 lbs. 8 1/4 oz.	2 lbs. 15 3/4 oz.	2 lbs. 8 5/8 oz.	1 lb. 13 1/2 oz.	2 lbs. 1/2 oz.
Max. variation in one motor	1/4 oz.	1/4 oz.	1/4 oz.	1/4 oz.	
Assembled	Oil hole toward camshaft	Oil hole toward camshaft	Oil hole on starter motor side	Oil hole toward camshaft	
[illegible] to center	10 5/8"	10 3/4"	9"	7 3/4"	7 11/16"
[illegible]ad to piston pin	Rifle drilled	Rifle drilled	Rifle drilled	Rifle drilled	
Type of crank pin bearing	Removable steel backed shell	Removable steel backed shell	Removable steel backed shell	Steel backed babbitt lined	
Bearing material	Copper-lead alloy	Copper-lead alloy	Copper-lead alloy	Babbitt	
Bearing clearance to crank pin	.0005-.002	.0005-.002	.0005-.002	.0005-.0025	
End play on crankshaft	.003-.006	.003-.006	.005-.013	.003-.006	
End play on piston (nominal)	1/8"	1/8"	1/8"	1/8"	
Caps attached	Bolts and nuts	Bolts and nuts	Two nuts and Integral bolts	Bolts and nuts	
CRANKSHAFT:					
Type	Counterbalanced	Counterbalanced	Counterbalanced	Counterbalanced	
Material	Steel forging	Steel forging	Steel forging	Steel forging	
Weight	97 1/2 lbs.	112 1/2 lbs.	120 lbs.	90 lbs.	95 lbs.
No. main bearings	9	9	4	5	
Main bearing diameter	2.625	2.625	2.750	2.740	
Main bearing lengths					
No. 1	2 1/8"	2 5/8"	2 1/16"	1 1/2"	
No. 2	1 1/16"	1 1/16"	1 1/4"	1 1/32"	
No. 3	1 3/8"	1 3/16"	1 1/4"	1 31/32"	
No. 4	1 1/16"	1 1/16"	2 3/32"	1 1/32"	
No. 5	1 13/16"	1 13/16"		2 3/16"	
No. 6	1 1/16"	1 1/16"			
No. 7	1 3/8"	1 3/16"			
No. 8	1 1/16"	1 1/16"			
No. 9	2 1/16"	2 1/16"			
Total main bearing area	66.55 sq. in	72.13 sq. in.	44.55 sq. in.	56.6 sq. in.	
Pin bearing diameter	2.1875	2.1875	2.5000	2.004	

MECHANICAL SPECIFICATIONS—STANDARD SIZES and ADJUSTMENTS

	Packard Eight Models 1400-1401-1402	Packard Super Eight Models 1403-1404-1405	Packard Twelve Models 1407-1408	One-Twenty	One Twenty "B" (Differences)
CRANKSHAFT—Continued					
Pin bearing length	1 1/16"	1 1/4"	2 1/4"	1 5/8"	1 1/4
Thrust taken on	No. 7	No. 7	No. 1	No. 3	
End play	.003-.005	.003-.005	.003-.005	.003-.008	
Clearance on main bearings	.001-.002	.001-.002	.001-.002	.001-.003	
VIBRATION DAMPER					
Type	Lanchester	Lanchester	Lanchester	Lanchester	
LUBRICATION:					
Motor System	Full pressure	Full pressure	Full pressure	Full pressure	
Pump-type	Gear	Gear	Gear	Gear	
Pressure (normal)	35 lbs.	35 lbs.	35 lbs.	35 lbs.	
Capacity	8 qts.	9½ qts.	10 qts.	7 qts.	
Filler location	Left side	Left side	Left side	Left side	
Ventilation	L. H. side	L. H. side	L. H. side and valve compartment	Both sides	
Oil Temperature regulator	L. H. side	L. H. side	R. H. side		
RECOMMENDED MOTOR LUBRICANTS:					
Below —10°	S.A.E. 10W plus 10% Kerosene	S.A.E. 10W plus 10% Kerosene	S.A.E. 10W plus 10% Kerosene	S.A.E. 10W plus 10% Kerosene	
—10° to +45°	S.A.E. 10W	S.A.E. 10W	S.A.E. 10W	S.A.E. 10W	
+10° to +85°	S.A.E. 20W	S.A.E. 20W	S.A.E. 20W	S.A.E. 20W	
+25° to +85°	S.A.E. 20W or 20	S.A.E. 20W or 20	S.A.E. 20W or 20	S.A.E. 20W or 20	
+40° or over	S.A.E. 30	S.A.E. 30	S.A.E. 30	S.A.E. 30	
+90° or over	S.A.E. 40	S.A.E. 40	S.A.E. 40	S.A.E. 40	
CHASSIS LUBRICANT:					
Drag link	Pressure gun grease	Pressure gun grease	Pressure gun grease	Pressure gun grease	
Cross tube	Pressure gun grease	Pressure gun grease	Pressure gun grease	Pressure gun grease	
Water pump	S.A.E. 30	S.A.E. 30	S.A.E. 30	S.A.E. 30	
Distributor	No. 3 cup grease	No. 3 cup grease	S.A.E. 30	No. 3 cup grease	
Bijur lubricator	Special oil	Special oil	Special oil		
Steering gear—Summer	S.A.E. 160	S.A.E. 160	S.A.E. 160	S.A.E. 160	
Winter	S.A.E. 90	S.A.E. 90	S.A.E. 90	S.A.E. 90	
Clutch	....	....	....	....	
Transmission—Summer	S.A.E. 160	S.A.E. 160	S.A.E. 160	S.A.E. 160	
Winter	S.A.E. 90	S.A.E. 90	S.A.E. 90	S.A.E. 90	
"U" joints	Pressure gun grease	Pressure gun grease	Pressure gun grease	Pressure gun grease	
Rear axle	See Service Dept.	See Service Dept.	See Service Dept.	See Service Dept.	
CLUTCH:					
Type	Single plate	Single plate	Single plate—vacuum booster	Single plate	
Facing material	Raybestos No. 250	Hyco-Dv-1866	Hyco-Dv-1866	U.S. Asb. 733	
No. of facings	2	2	2	2	
Size of facings	7" x 12" x .140"	7" x 12" x .140"	7" x 12" x .187"	6" x 10" x .140"	

MECHANICAL SPECIFICATIONS—STANDARD SIZES and ADJUSTMENTS

	Packard Eight Models 1400-1401-1402	Packard Super Eight Models 1403-1404-1405	Packard Twelve Models 1407-1408	One-Twenty	One Twenty "B" (Differences)
CLUTCH—Continued					
Pedal free movement	1″ to 1½″	1″ to 1½″	1″ to 1½″	1½″ to 2″	
Hub clearance on clutch shaft	No perceptible lash	No perceptible lash	No perceptible lash	No perceptible lash	
Throw-out bearing lubrication	Bijur system	Bijur system	Bijur system		Packed
Throw-out lever lubrication	Bijur system	Bijur system	Bijur system		
No. springs	12	12 double	12 double	9	
Spring pressure	125 lbs. at 1 [illegible]″	In. 80 lbs.-1 [illegible]″ Out. 100 lbs.-1 [illegible]″	In. 50 lbs.-1 [illegible]″ Out. 115 lbs.-1 [illegible]″	115 lbs. at 1 [illegible]″	
Total pressure	1500 lbs.	1850 lbs.	2000 lbs.	1035 lbs.	
Balanced to	½ oz. in	½ oz. in	½ oz. in	½ oz. in	
TRANSMISSION:					
Type	Selective synchronized	Selective synchronized	Selective synchronized	Selective silent synchronized	
Forward speeds	3	3	3	3	
Ratio—high	4.36- 4.69 std.-5.07	4.06- 4.41 std.-4.69-5.07	4.06- 4.41 std.-4.69-5.07	4.36/1 and 4.54/1	4.09/1
second	6.65- 7.15 std.-7.63	6.21- 6.74 std.-7.15-7.63	6.21- 6.74 std.-7.15-7.63	6.67/1	6.25/1
first	10.71-11.53 std.-12.49	10.01-10.86 std.-11.53-12.49	10.01-10.86 std.-11.53-12.49	10.60/1	9.92/1
reverse	12.56-13.5 std.-14.61	11.72-12.71 std.-13.5-14.61	11.72-12.71 std.-13.5-14.61	13.87/1	12.98/1
Oil capacity	2¼ qts.	2¼ qts.	2¼ qts.	1 qt.	
Gear backlash	.004-.006	.004-.006	.004-.006	.004-.006	
Indicator reading crankshaft flange at 2″ rad. to run true within	.001	.001	.001	.001	
Indicator reading pilot bore to be concentric with crankshaft within	.001-.002	.001-.002	.001-.002	.001-.002	
FRAME:					
Type	Taper double drop box type front side rail	Taper double drop box type front side rail	Taper double drop box type front side rail	Taper double drop box type	
Depth	8″	8″	8″	6″	
Thickness	[illegible]″	[illegible]″	[illegible]″	[illegible]″	
No. cross members	5, X member	5, X member	5, X member	5, X center reinforced box section	
FRONT SUSPENSION:					
Type	Conventional	Conventional	Conventional	Independent Packard parallellogram	
Make	Packard	Packard	Packard	Packard Safe-T-Flex	
Tread	60″	60″	60″	59″	
Axle end	Reverse Elliot	Reverse Elliot	Reverse Elliot	Reverse Elliot type	
Axle section	I-beam	I-beam	I-beam	No axle	
Caster	2½°	2½°	1½°	2° ± ½°	
Camber	1°	1°	1°	1° ± ¼°	

MECHANICAL SPECIFICATIONS—STANDARD SIZES and ADJUSTMENTS

	Packard Eight Models 1400-1401-1402	Packard Super Eight Models 1403-1404-1405	Packard Twelve Models 1407-1408	One-Twenty	One Twenty "B" (Differences)
FRONT SUSPENSION—Cont'd.					
Toe in	at rim 1/16" to 1/8"	1/16" to 1/8"	1/16" to 1/8"	1/16" to 1/8"	
Strg. geometry (toe out on turn)	22½°-23° to 20°	22½°-23° to 20°	22½° in to 20° out.	23° in to 20° out.	
King pin inclination	9°	9°	9°	1°-30'	
Wheel bearing adjustments	Tighten nut tight, back off ½ turn and lock	Tighten nut tight, back off ½ turn and lock	Tighten nut tight, back off ½ turn and lock	Tighten nut tight, back off ½ turn and lock	
Tire pressure	33 lbs.	35 lbs.	38 lbs.	24 lbs.	
Tire pressure, convertible coupe				22 lbs.	
STEERING GEAR:					
Type	Worm and roller	Worm and roller	Worm and roller	Worm and roller	
Make	Packard	Packard	Packard	Packard	
Ratio	18.6—1	18.6—1	18.6—1	18.4—1	
Wheel diameter	18½"	18½"	18½"	18"	
Turning radius	1400—22 ft. 4 in. 1401—23 ft. 4 in. 1402—23 ft. 9 in.	1403—22 ft. 6 in. 1404—23 ft. 8 in. 1405—24 ft. 4 in.	1407—24 ft. 6 in. 1408—25 ft. 6 in.	19½ ft.	
Hard over left to right	5 turns	5 turns	5 turns	4½ turns	
Wear adjustments	3	3	3	3	
Column adjustments	2"	2"	2"	2"	
King pin bearing—upper	Ball brg.	Ball brg.	Ball brg.	Oilite bronze	
King pin bearing—lower	Ball brg.	Ball brg.	Ball brg.	Oilite bronze	
Thrust bearing	Ball brg.	Ball brg.	Ball brg.	Oilite bronze	
ELECTRICAL:					
Source	Battery 21-plate rbr. rib-Hi-level	Battery 21-plate rbr. rib-Hi-level	Battery 21-plate rbr. rib-Hi-level	17 Plate Battery	17 Plate Battery Hi-level
Location	Rear L. Floor	Rear L. Floor	Rear L. Floor	L. Front Seat	
BATTERY CAPACITY	144 amp. hrs.	144 amp. hrs.	144 amp. hrs.	110 amp. hrs.	114 amp. hrs.
Length	12 11/16"	12 11/16"	12 11/16"	10 3/16"	
Width	7"	7"	7"	7"	
Height	9 3/16"	9 3/16"	9 3/16"	8 11/16"	
Hydrometer—charged	1250 Hi Level	1250 Hi Level	1250 Hi Level	1285	1250 Hi Level
Grounded terminal	Positive	Positive	Positive	Positive	
GENERATOR TYPE	Dyneto CO-1300	Dyneto CO-1300	Dyneto CO-1304	Auto-lite GAR	Autolite GBR 4601-5
Type of drive	Silent chain	Silent chain	Fan belt	Fan belt	
Cut-in speed, battery low—regulator points closed	600 r.p.m.	600 r.p.m.	800 r.p.m.	11 m.p.h.	9 m.p.h.
Cut-in speed, battery high—regulator points open				20 m.p.h.	16 m.p.h.
Max. charging rate—cold	30-33 amps.	30-33 amps.	30-33 amps.	23 amps.	
Max. charging rate—hot	27-30 amps.	27-30 amps.	27-30 amps.	20 amps.	
Voltage to close cut-out	6¾—7¼ volts	6¾—7¼ volts	6¾—7¼ volts	6¾—7¼ volts	
Field fuse	5 amp. ¼" x 5/8"	5 amp. ¼" x 5/8"	5 amp. ¼" x 5/8"	5 amp. ¼" x 5/8"	
STARTER-TYPE	Max 4014	Dyneto DN 1298	Dyneto DN 1299	Auto-lite Max4006	
Type drive	Bendix shift	Bendix shift	Bendix shift	Bendix shift	
Stall torque	20 ft. lbs. 3.4 vts. 750 amps.	39 ft. lbs. 3.5 vts. 810 amps.	39 ft. lbs. 3.5 vts. 810 amps.	20 ft. lbs. 3.4 vts. 750 amps.	

MECHANICAL SPECIFICATIONS—STANDARD SIZES and ADJUSTMENTS

	Packard Eight Models 1400-1401-1402	Packard Super Eight Models 1403-1404-1405	Packard Twelve Models 1407-1408	One-Twenty	One Twenty "B" (Differences)
ELECTRICAL—Continued					
Free running	3500-4000 r.p.m. 6 vts. 60 amps.	3000 r.p.m. 6 vts. 50 amps.	3000 r.p.m. 6 vts. 50 amps.	3500-4000 r.p.m. 6 vts. 40 amps.	
Type flywheel gear	Steel—shrunk on	Steel—shrunk on	Steel—shrunk on	Steel—shrunk on	
No. flywheel teeth	148	118	118	140	
No. teeth in Bendix pinion	9	10	10	9	
Starting switch	On inst. board	On inst. board	On inst. board		
IGNITION TIMING STD. HD.	6° B.T.D.C.	6° B.T.D.C.	6° B.T.D.C.	7° B.T.D.C.	
H. C. head	4° BTDC (adv.)	4° BTDC (adv.)	4° BTDC (adv.)		
L. C. head	8° BTDC (adv.)	8° BTDC (advc.)	8° BTDC (adv.)		
No. coils	1 Delco on cyl. hd.	1 Delco on cyl. hd.	2 A.L. on gear cvr.		
Spark control	Full automatic	Full automatic	Full automatic	Ful automatic	
Spark advance begins	600 r.p.m.	600 r.p.m.	600 r.p.m.	600 r.p.m.	
Max. spark advance	24° at 3600 r.p.m.	24° at 3800 r.p.m.	22° at 2400 r.p.m.	27° at 4400 r.p.m.	
Spark plug size	14 mm.	14 mm.	14 mm.	14 mm.	
Spark plug gap	.028-.030	.028-.030	.028-.030	.028-.030	
Breaker point gap	.018-.022	.018-.022	.018-.022	.018-.022	
LIGHT CONTROL	Steering Wheel	Steering Wheel	Steering Wheel	Instrument bd. and foot switch	
Lamp bulb—head	32-32 c.p.	32-32 c.p.	32-32 c.p.	32-32 c.p.	
Park	1 c.p.	1 c.p.	1 c.p.	1 c.p.	
Stop	15 c.p.	15 c.p.	15 c.p.	15 c.p.	
Tail	3 c.p.	3 c.p.	3 c.p.	3 c.p.	
Dome	6 c.p.	6 c.p.	6 c.p.	6 c.p.	
Instrument board	3 c.p.	3 c.p.	3 c.p.	3 c.p.	
Pilots	8 c.p.	8 c.p.	8 c.p.		
All others	3 c.p.	3 c.p.	3 c.p.		
Circuit control (chassis)	Thermostatic relay	Thermostatic relay	Thermostatic relay	Fuse	
Head lamp fuse	25 V.-20 amp.	25 V.-20 amp.	25 V.-20 amp.	25 V.-20 amp.	
Body light fuse	25 V. 20A.—11/32 x 1½	25 V. 20A.—11/32 x 1½	25 V. 20A.—11/32 x 1½	25 V. 20 A.—¼ x 1¼	
Head lamp lens diameter	7¼"	7¼"	7¼"	7 5/16" O. D.—6 11/16" inside bezel	
Wired for radio	Yes	Yes	Yes	Yes	
HORN MAKE	Sparton—2 used	Sparton—2 used	Sparton—2 used	Sparton—1 used	
Location	Radiator tie rod	Radiator tie rod	Radiator tie rod	Center of dash	
Current to operate					
COOLING SYSTEM:					
HEAD	Aluminum	Aluminum	Aluminum	Aluminum	
RADIATOR CORE	Tubular	Tubular	Tubular	Cellular	
Capacity	20 qts.	22 qts.	40 qts.	16½ qts.	18 qts.
Gravity flow per minute	30 gals.	30 gals.	50 gals.	22.6 gals.	25.8 gals.
Hose—upper	6½ x 1¾ I.D.	6½ x 1¾ I. D.	13 by 1½ short 14 x 1½ long	10 x 1½ I. D.	
Hose—lower	10 x 1¾ I. D.	6½ x 1¾ I. D.	11 x 2 I. D.	3 x 1⅝ I. D.	

MECHANICAL SPECIFICATIONS—STANDARD SIZES and ADJUSTMENTS

	Packard Eight Models 1400-1401-1402	Packard Super Eight Models 1403-1404-1405	Packard Twelve Models 1407-1408	One-Twenty	One Twenty "B" (Differences)
COOLING SYSTEM—Continued					
SHUTTERS	Automatic	Automatic	Automatic		
Temperature to open	155°	155°	155°		
WATER PUMP	Centrifugal	Centrifugal	Centrifugal	Centrifugal	
Drive	Fan belt	Fan belt	Fan belt	Fan belt	
FAN	4 blade	4 blade	4 blade	4 blade	
Clearance to radiator core	1″	1¼″	1½″	1″	
Driving pulley	On crankshaft	On crankshaft	On crankshaft	On crankshaft	
Ratio	.95-1	.95-1	.81-1	1.3 to 1	
FAN BELT—TYPE	45° Vee	45° Vee	45° Vee	42° Vee	
Length and width	39⅝″ x ¹¹⁄₁₆″	39⅝″ x ¹¹⁄₁₆″	49½″ x 1¹¹⁄₁₆″	42⅝″ x ¾″	
No. required	2	2	2	1	
Adjustment	At water pump	At water pump	At generator	At generator	
Range of Adjustment	¾″	¾″	¾″	1½″	
HEAT INDICATOR	On inst. board	On inst. board	On inst. board	On inst. board	
THERMOSTAT SETTING—starts to open	See Shutters	See Shutters	See Shutters	145°-150°	
Fully open (std.)	See Shutters	See Shutters	See Shutters	170°	
GASOLINE SYSTEM:					
CARBURETOR—MAKE	Packard Stromberg	Packard Stromberg	Packard Stromberg	Stromberg	
Type	Duplex dwn. drft.	Duplex dwn. drft.	Duplex dwn. drft	Duplex dwn drft.	
Size (nominal)	1¼″	1¼″	1½″	1″	
Manifold heat control	Thermostatic	Thermostatic	Special	Thermostatic	
Idling adjustment	Needle	Needle	Needle	Needle	
Throttle stop adjustment	Screw	Screw	Screw	Screw	
Economizer jet opens at	70 m.p.h.	70 m.p.h.	70 m.p.h.	70 m. p. h.	
TANK CAPACITY	25 gals.	25 gals	30 gals.	20 gals.	
GASOLINE GAGE	Electric	Electric	Electric	Electric	
FEED	Mechanical pump	Mechanical pump	Mechanical pump	Mechanical pump	
PUMP MAKE	AC	AC	AC	AC	
Pump drive	Off camshaft, left	Off camshaft, left	Off camshaft, frt.	Off cmshft., fwd.	
Filter	Visible-screen type	Visible-screen type	Visible-screen type	In top fuel pump	
AIR CLEANER AND SILENCER—Std.	AC	AC	AC	AC	
Opt.	AC oil bath	AC oil bath	None	AC oil bath	
UNIVERSAL JOINTS:					
Make	Roller bearing	Roller bearing	Roller bearing	Roller bearing	
No. required	2	2	2	2	
Assembling	Arrows on shaft and sleeve must be in line.				

MECHANICAL SPECIFICATIONS—STANDARD SIZES and ADJUSTMENTS

	Packard Eight Models 1400-1401-1402	Packard Super Eight Models 1403-1404-1405	Packard Twelve Models 1407-1408	One-Twenty	One Twenty "B" (Differences)
REAR AXLE					
Type	Angleset, semi-floating	Angleset, semi-floating	Angleset, semi-floating	Angleset, semi-floating	
Make	Packard	Packard	Packard	Packard	
Tread	61"	61"	61"	60"	
Drive	Hypoid gears	Hypoid gears	Hypoid gears	Hypoid gears	
Propulsion	Through springs	Through springs	Through springs	Through springs	
Wheel bearings	Taper roller	Taper roller	Taper roller	Single row ball	
Ratio (Std.)	4.69—1	4.41—1	4.41—1	4.36—1; 4.54—1	4.09—1
Axle housing	Pressed steel—Banjo type	Pressed steel—Banjo type	Pressed steel—Banjo type	Pressed steel—Banjo type	
Oil capacity	6 pts.	6 pts.	6 pts.	4½ pts.	
Backlash—gear to pinion	.003-.005	.003-.005	.003-.005	.003-.005	
Minimum road clearance to engine oil sump	8⅝"	8½"	9"	8¾"	
SPRINGS, SHACKLES, SHOCK ABSORBERS:					
Springs—Type—front	Semi-elliptic	Semi-elliptic	Semi-elliptic	Coiled helical	
Outside diameter				5¼"	5¼"
Effective coils				7¾"	7¾" to 9¼"
Length and width	42 x 2¼"	42 x 2¼"	42 x 2¼"		
Covers	Metal	Metal	Metal		
Rate Std.				90 lbs. per in.	75 lbs. std. 110 export 130 BA Commercial
Springs—Type—rear	Semi-elliptic	Semi-elliptic	Semi-elliptic	Semi-elliptic	
Length and width	60½ x 2¼"	60½ x 2½"	60½ x 2½"	54" x 1¾"	
Covers	Metal	Metal	Metal	Metal	
Shackles—Type	Metal	Metal	Metal	Steel "V" thread	
Shock Absorbers	Hydraulic—2-way adj. from front compt.—static control valve	Hydraulic—2-way adj. from front compt.—static control valve	Hydraulic—2-way adj. from front compt.—static control valve	Hydraulic—2-way	
BRAKES:					
Type	Internal-expand.	Internal-expand.	Internal-expand.	Internal-expand.	
Operation—Service	Mechanical with vacuum booster	Mechanical with vacuum booster	Mechanical with vacuum booster	Hydraulic	
Drum diameter	14" centrifuse with dust shield	14" centrifuse with dust shield	15" centrifuse with dust shield	12" centrifuse with dust shield	
Shoe clearance to drums	Free	Free	Free	.010"	
Lining material—primary	Raybestos 451	Raybestos 451	Raybestos 451	U.S. asb. 714	
Lining material—secondary	Hyco DV 1391	Hyco DV 1391	Hyco DV 1391	U.S. asb. 589	
Size of lining					
Left front	15⅛ x 1¾ x ¼"	15⅛ x 1¾ x ¼"	16⅛ x 1¾ x ¼"	13 x 1¾ x 3/16"	
All others	15⅛ x 2¼ x ¼"	15⅛ x 2¼ x ¼"	16⅛ x 2¼ x ¼"	13" x 1¾ x 3/16"	
Linings per car	8	8	8	8	

MECHANICAL SPECIFICATIONS—STANDARD SIZES and ADJUSTMENTS

	Packard Eight Models 1400-1401-1402			Packard Super Eight Models 1403-1404-1405			Packard Twelve Models 1407-1408		One-Twenty	One Twenty "B" (Differences)
BRAKES—Continued										
Effective area	240⅜ sq. in.			240⅜ sq. in.			283⅝ sq. in.		182 sq. in.	
Setting hand brake	See Instructions			See Instructions			See Instructions		See Instructions	
Effective area	240⅜ sq. in.			240⅜ sq. in.			283⅝ sq. in.		91 sq. in.	
WHEELS:										
Type	Wire			Wire			Wire or wood		Disc	
Tire size	7.00 x 17—6 ply			7.00 x 17—6 ply			7.50 x 17—6 ply		7.00 x 16—4 ply	
Tire pressure	33 lbs.			35 lbs.			38 lbs.		24 lbs.	
Tire pressure—convertible coupe									22 lbs.	
BODY:										
Make	Packard			Packard			Packard		Packard	
Panel material	Steel			Steel			Steel		Steel	
Upholstery material:										
Closed cars	Broadcloth			Broadcloth			Broadcloth		Broadcloth	
Open cars	Colonial leather			Colonial leather			Colonial leather		Colonial leather	
Convertible cars	Optional			Optional			Optional		Colonial leather	
Glass	Non-shatterable			Non-shatterable			Non-shatterable		Non-shatterable	
Windshield wiper	Vacuum, tandem			Vacuum, tandem			Vacuum, tandem		Vacuum, tandem	
Trunk rack	Special equipt.			Special equipt.			Special equipt.		Special equipt.	
Wired for radio	Yes			Yes			Yes		Yes	
Chassis weight	3580	3625	3655	3690	3745	3775	4340	4405	2520	2645
Coupe 2									3400	3300
Coupe 2-4	....	4720	....	....	4935	....	5485	....	3435	3435
Coupe 2-4 (conv. roadster)	....	4725	....	....	4950	....	5500	....	3385	3400
Coupe 5	....	4760	....	....	5010	....	5495	....	3455	3460
Cabriolet 7	....	....	....	....	5300	....	5900	....	....	....
Sedan Touring	....	....	....	....	....	....	....	....	3550	3600
Sedan 5 Club	....	4820	....	....	5100	....	5040	....	3515	3455
Sedan 5 formal	....	5030	....	....	5215	....	5735	....		
Sedan 5—4 door	4815	4975	....	5080	....	....	5695	....	3510	3535
Sedan 5 convertible	....	....	5140	....	....	5390	....	5945		
Sedan 7	....	....	4955	....	....	5300	....	5810		
Limousine 7	....	....	5045	....	....	5380	....	5890		
Phaeton 4	....	4880	....	....	5080	....	5480	....		
Phaeton 5 sport	....	....	....	....	5200	....	5785	....		
Touring 7	....	....	5000	....	....	5200	....	5460		
Town car 7	....	....	....	....	....	5525	....	5950		
Victoria 5	....	4830	....	....	5100	....	5600	....		

MECHANICAL SPECIFICATIONS—STANDARD SIZES and ADJUSTMENTS

	Packard Eight Models 1400-1401-1402			Packard Super Eight Models 1403-1404-1405			Packard Twelve Models 1407-1408		One-Twenty	One Twenty "B" (Differences)
WHEEL BASE:	127 3/8	134 3/8	139 3/8	132 3/8	139 3/8	144 3/8	139 3/8	144 3/8	120"	
LENGTH OVER BUMPERS:	205 7/8	212 5/16	217 5/16	211 5/32	218 5/32	223 5/32	218 5/32	223 5/32	194"	194 5/8"
OVERALL HEIGHT:	70 3/4	70 3/4	70 3/4	71	71	71	71	71	67 1/2"	
OVERALL WIDTH:	74	74	74	74	74	74	74	74	72"	

CHART SHOWING RELATIVE UNIT SPEEDS TO MILES PER HOUR

Car	Rear Axle Ratio	At Car Speed M.P.H.	Motor Revolutions Per Minute: Crank-shaft	Motor Revolutions Per Minute: Camshaft	Motor Revolutions Per Minute: Distri. shaft	Generator Speed R.P.M.	Fan Speed R.P.M.	Starter Gear Ratio	Wheel Rev. Per Mile	Motor Rev. Per Mile
120	4.54	10	533	½ of crankshaft revolutions	½ of crankshaft revolutions	730	693	9-140	705	3200
120B	4.09	10	480			893	624	9-140	705	2883
120A	4.70	10	552			750	717	9-140	705	3313
120BA	4.70	10	552			986	717	9-140	705	3313
1400	4.69	10	526			614	500	9-148	672	3151
1401	4.69	10	526			614	500	9-148	672	3151
1402	4.69	10	526			614	500	9-148	672	3151
1403	4.41	10	494			576	470	10-118	672	2963
1404	4.41	10	494			576	470	10-118	672	2963
1405	4.41	10	494			576	470	10-118	672	2963
1407	4.41	10	483			508	394	10-118	657	2897
1408	4.41	10	483			508	394	10-118	657	2897