SERVICE MANUAL

SECTION VI

CHASSIS

Packard Motor Car Company

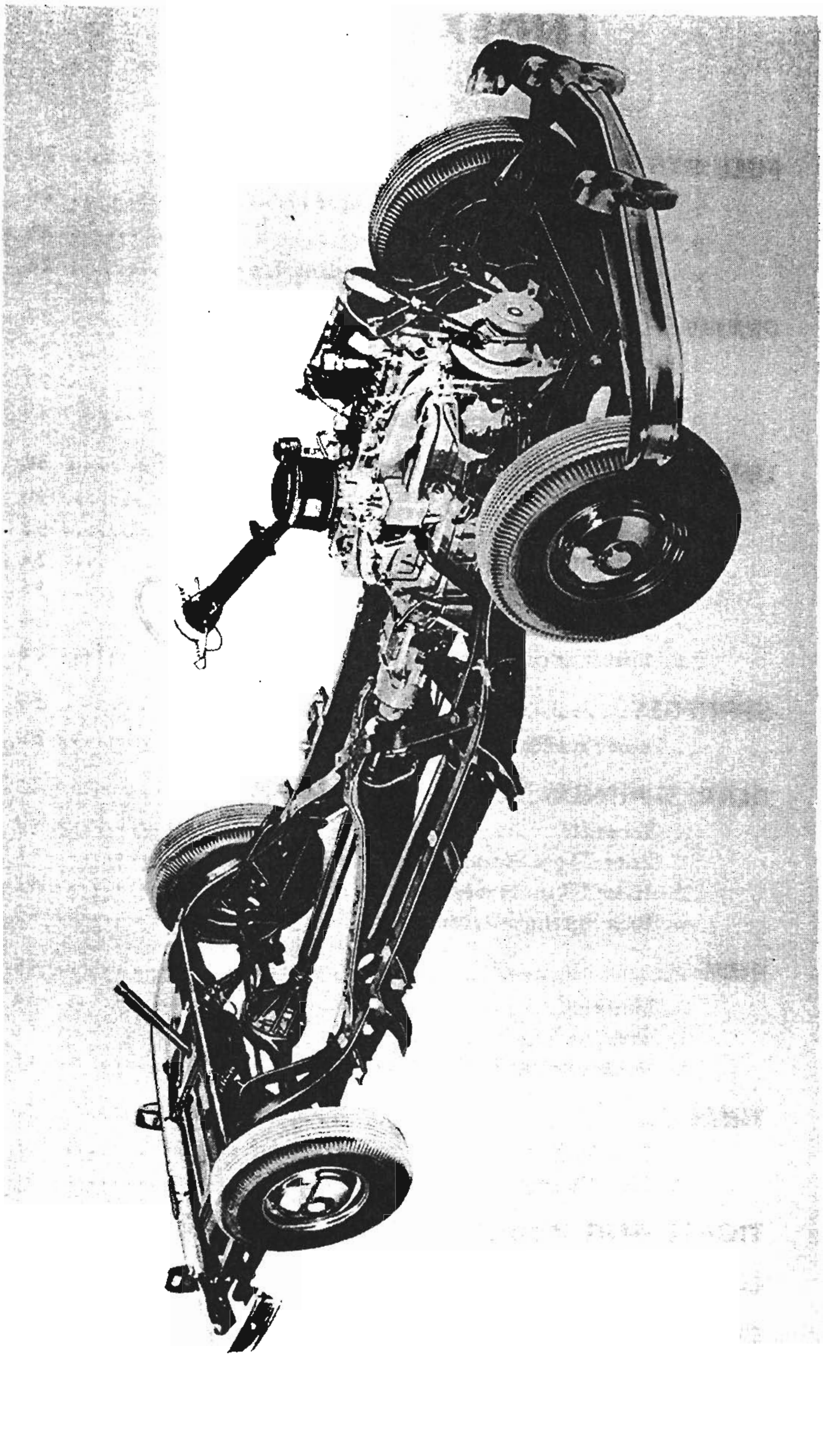
Detroit 32, Michigan

1st Edition—14M—9-49

Litho in U.S.A.

INDEX

INDEX (Continued)



INTRODUCTION

THE 22nd SERIES CHASSIS

This section of the Service Manual is essentially a ready reference book, and as such, has been designed to cover those troubles most common to the automotive chassis. An attempt has also been made to present the theory of operation of each major assembly, as two processes are involved which can't be learned from books. These are: trouble shooting, a reasoning process applicable only after a precise knowledge of operation has been acquired—and repair, a combination of manual skill, tools, and ingenuity.

BRAKING SYSTEM

GENERAL DESCRIPTION

The Packard braking system (figure 1) makes use of self-energizing hydraulic foot brakes as well as mechanical hand or parking brakes. The foot brakes are of the two shoe, internal expanding type and apply to all four wheels. The hand brake, through a cable and linkage arrangement, engages the rear wheel brakes only.

The foot brake system consists of the following major assemblies:

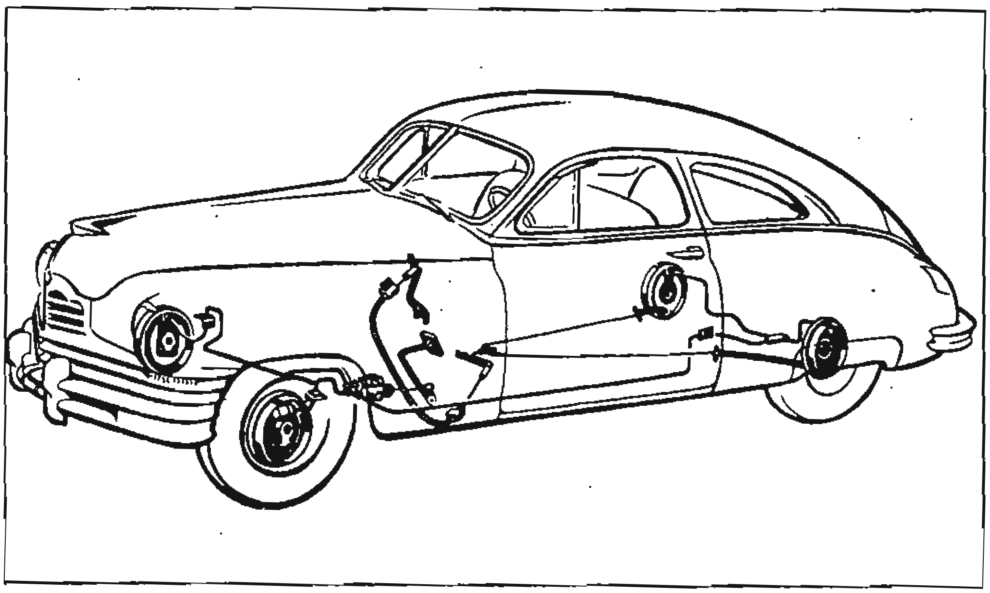


Fig. 1—The Packard Braking System Makes Use of Self-Energizing Foot Brakes and Mechanical Hand Brakes.

1. The foot brake pedal by means of which the initial force is applied.
2. The master cylinder which translates foot pedal force into pressure in the hydraulic circuit.

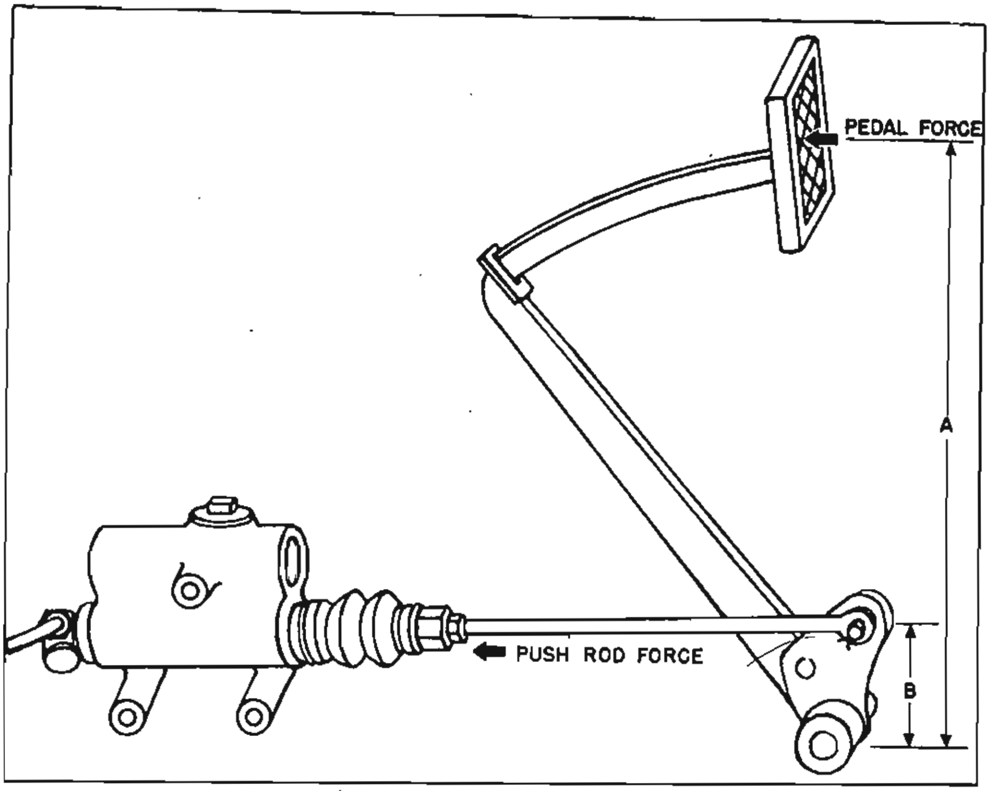


Fig. 2—The Arrangement of the Main Brake Pedal Arm and Its Bellcrank Supplies the Necessary Mechanical Advantage.

3. The lines or tubing through which fluid pressure is distributed to each wheel cylinder.
4. The wheel cylinders which translate fluid pressure back into a force to engage the shoes with the brake drums.
5. The brake shoes, supporting linings which contact the brake drums.
6. The brake drum and hub assemblies to which the wheels are attached.

A detailed description of each of these assemblies follows.

FOOT BRAKE PEDAL

Since distance A (figure 2) is about 5½ times distance B, it follows that the push rod force is about 5½ times the pedal force. This increase in force is passed on by the action of the master cylinder in the form of fluid pressure throughout the hydraulic system.

1. Adjusting Brake Pedal Free Play

A pedal free play greater than ½ inch will reduce the effective travel of the master cylinder piston, which in turn will reduce the effectiveness of the brakes.

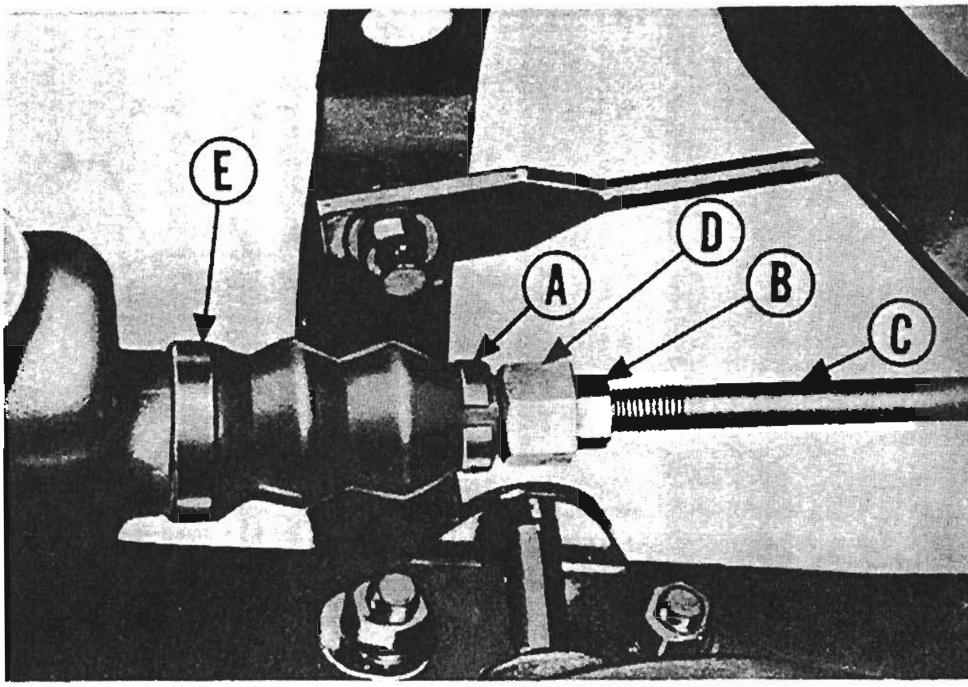


Fig. 3—Showing Parts Affecting Adjustment of Brake Pedal Free Play.

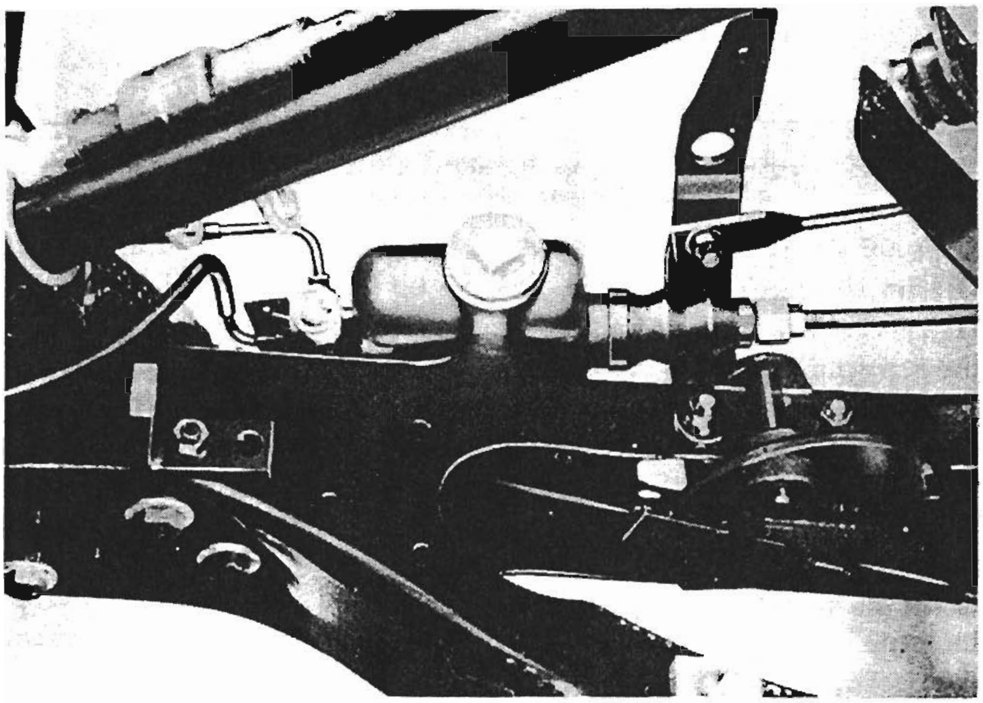


Fig. 4—The Brake Master Cylinder Is Bolted to a Secondary Member of the Frame, Just Forward of the Brake Pedal.

Free play less than ¼ inch will cause the piston primary cup to partly or completely stop off the master cylinder bypass port. When this happens, the fluid either cannot return from the lines or must return so slowly that the brakes will drag.

To adjust the brake pedal free play it is necessary for the master cylinder piston to be against its stop in the released position.

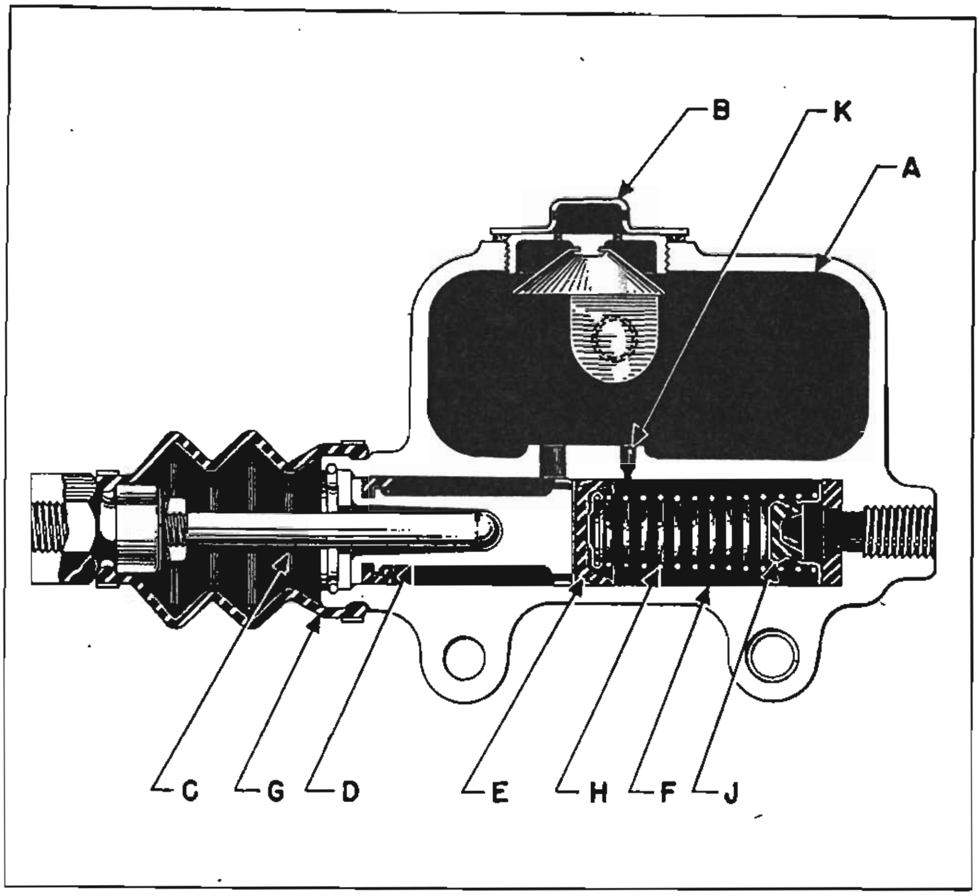


Fig. 5—Cutaway of Brake Master Cylinder Showing Position of Working Parts with Brakes Released.

Slide off the rear boot strap (A, figure 3) and loosen the jam nut (B) on the push rod link (C). Take up or back off adjusting nut (D) as necessary. Watch the boot—if it turns with the nut, probably the rubber has adhered to the nut and if so, the forward boot strap (E) should be slacked off and the entire boot allowed to turn around its boss on the master cylinder. The boot must not be allowed to twist since this would tend to pull on the cylinder push rod and spoil the adjustment. Remember that the travel of the pedal pad is much greater than the travel of the push rod, so a slight adjustment of the push rod is probably all that is needed. Now take up on the lock nut and check the pedal pad for ¼ to ½ inch free play before the beginning of the pressure stroke. After a satisfactory adjustment has been made, check the position of the boot and engage both boot straps.

MASTER CYLINDER

The brake master cylinder (figure 4) is bolted to a secondary member of the frame just forward of the brake pedal. A fluid reservoir (A, figure 5), located above the cylinder, is incorporated in the casting and its function is to compensate for minor losses, for any expansion or contraction of the fluid due to temperature changes, and to supply extra fluid as needed during brake application. It may be said then, that the brake master cylinder contains "compensating fluid" while the fluid in the cylinder and lines ahead of the master cylinder piston will be referred to as "working fluid" since it carries the pressure when the brakes are applied.

Brake fluid is added to the reservoir when necessary after removing the filler cap (B). Small holes in the filler cap serve to keep the surface of the compensating fluid always at atmospheric pressure.

The piston push rod (C) transmits force from the pedal and linkage to the piston (D). The primary cup (E) seals the piston in the cylinder (F) and, acting with the piston and cylinder, changes the push rod force into pressure in the lines while the secondary cup seals off the space in the cylinder behind the piston. This prevents the fluid which surrounds the piston from leaking into the boot (G). The piston spring (H) serves to hold the primary cup securely against the piston head at all times and also to return the piston to its normal position when the brakes are released.

The check valve (J) is spring loaded to six or eight pounds and maintains a corresponding pressure in the lines after the brakes have been released and the working fluid has returned to its normal place in the lines. It also functions as a seal to prevent seepage and is instrumental in keeping air out of the system during the bleeding operation. On the pressure stroke, the working fluid passes through holes in the cup retainer or cage and past the lip of the cup. When returning, the fluid forces the cup against the cage and seals the holes. This allows the valve assembly to move from its seat and permits the working fluid to flow back into the master cylinder until the pressure drop is sufficient for the valve to close.

When the brake pedal is depressed, the piston push rod forces the piston, along with the piston cups, to the forward end of the cylinder. Shortly after the beginning of piston travel, the primary piston cup covers the relief port thereby starting the pressure stroke and as the piston progresses from this point working fluid is forced out through the check valve with a resulting pressure in the lines and wheel cylinders.

When the brake pedal is released the piston returns at a much faster rate than that of the working fluid as good brake design demands quick recovery of the system. The pedal retracting spring and piston return spring combine to return the pedal to normal position quickly while the master cylinder compensates from the reservoir to keep the system always full of fluid. In the meantime, the shoe retracting springs are returning the working fluid more slowly from the wheel cylinders and as this fluid returns it displaces the compensating fluid back into the reservoir through the compensating port (K).

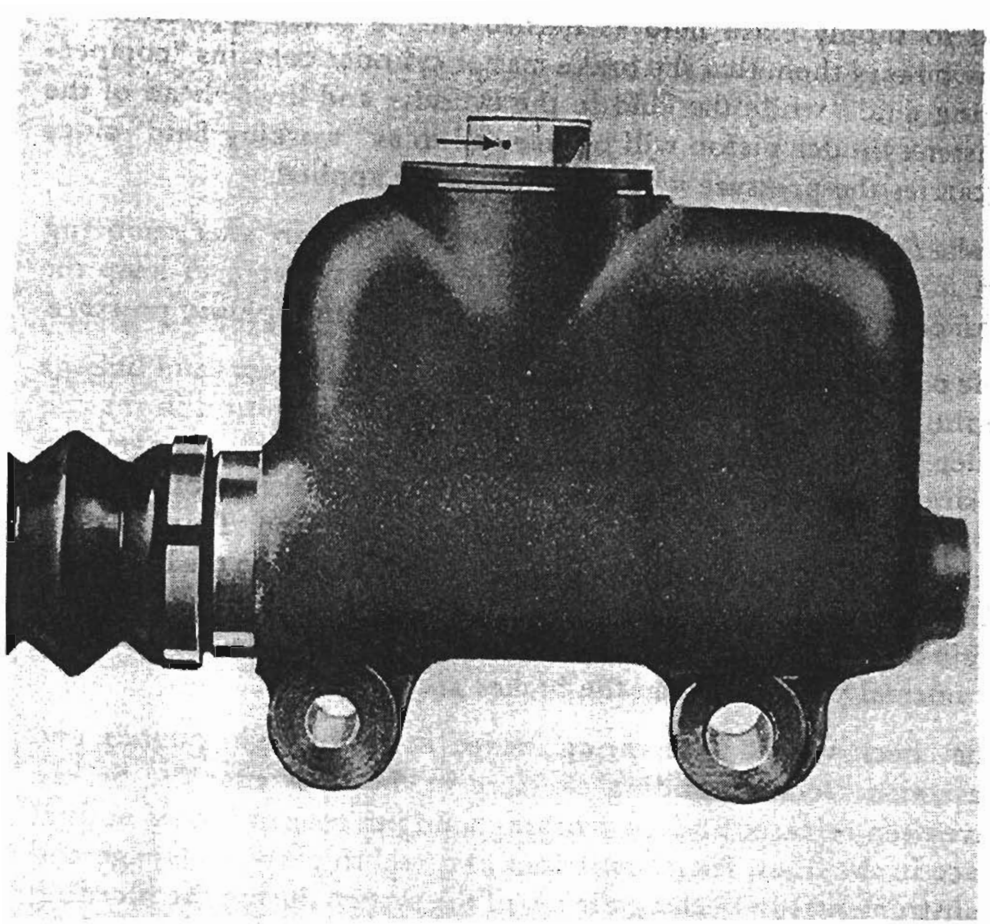


Fig. 6—The Filler Cap Incorporates Small Breather Holes to Maintain Atmospheric Pressure in the Reservoir.

1. Servicing the Master Cylinder

If it is necessary to recondition the master cylinder, remove it from the car before dismantling.

The filler cap incorporates small breather holes (figure 6) to maintain atmospheric pressure at the reservoir fluid surface. Run a small wire through the breather holes to clear them if they are sealed with dirt and oil.

Unless it presents a smooth surface, free of score marks, the master cylinder wall surface should be rehoned.

CAUTION

> Honing is essentially a polishing operation. A cylinder that has been honed to an excessive inside diameter may cause the cup lip to jam between the piston and the cylinder wall. It is good practice to discard a cylinder that shows deep score marks and replace it with a new one.

If the internal rubber parts are swelled, distorted, and very soft, it is probable that at least a trace of mineral oil has found its way into the system. All internal rubber parts in the master and wheel cylinder assemblies should be replaced if this condition is apparent.

BRAKE FLUID LINES

The metal brake fluid lines leading from the master cylinder are clipped to the frame. Connection to each front wheel cylinder and to the metal rear wheel line is effected by flexible rubber hose, since, the constant action of the wheels would soon rupture metal tubing if used at these points.

1. Fluid and Fluid Level

Many types of brake fluid are available under various trade names and some of these are definitely harmful to steel and rubber. For this reason, it is recommended that Packard Hydraulic Brake Fluid be used exclusively for bleeding and replenishing the hydraulic fluid supply.

Reservoir fluid level should be checked every 1000 miles. If addition of fluid is necessary, fill the reservoir to about ½ inch from the top of the filler plug opening. Carefully wipe the filler cap and shoulder clean before removal as a trace of oil or a quantity of dirt can have an adverse effect upon the entire system. Should the fluid level become too low, air will enter the system and bleeding will be necessary.

2. Bleeding the System

For all practical purposes, hydraulic brake fluid cannot be compressed, so as long as the liquid is confined and completely fills the hydraulic circuit, any pressure applied to the liquid will be relayed instantly and at full strength all through the system. Air is readily compressible however, and the presence of entrapped air (bubbles) in the system will invariably result in time lag and loss of braking force.

The presence of air in the lines is generally indicated by a soft, spongy pedal feel and this trouble may be caused by any of the following conditions.

A. When fluid level in the master cylinder is too low.

B. When the master cylinder, a wheel cylinder, or a section of the hydraulic line has been disconnected.

C. When the car has been driven for an extended period with the hand brake engaged or with an overly tight adjustment of the shoes. Either condition can cause overheating of the brakes to the extent of boiling the fluid in a wheel cylinder.

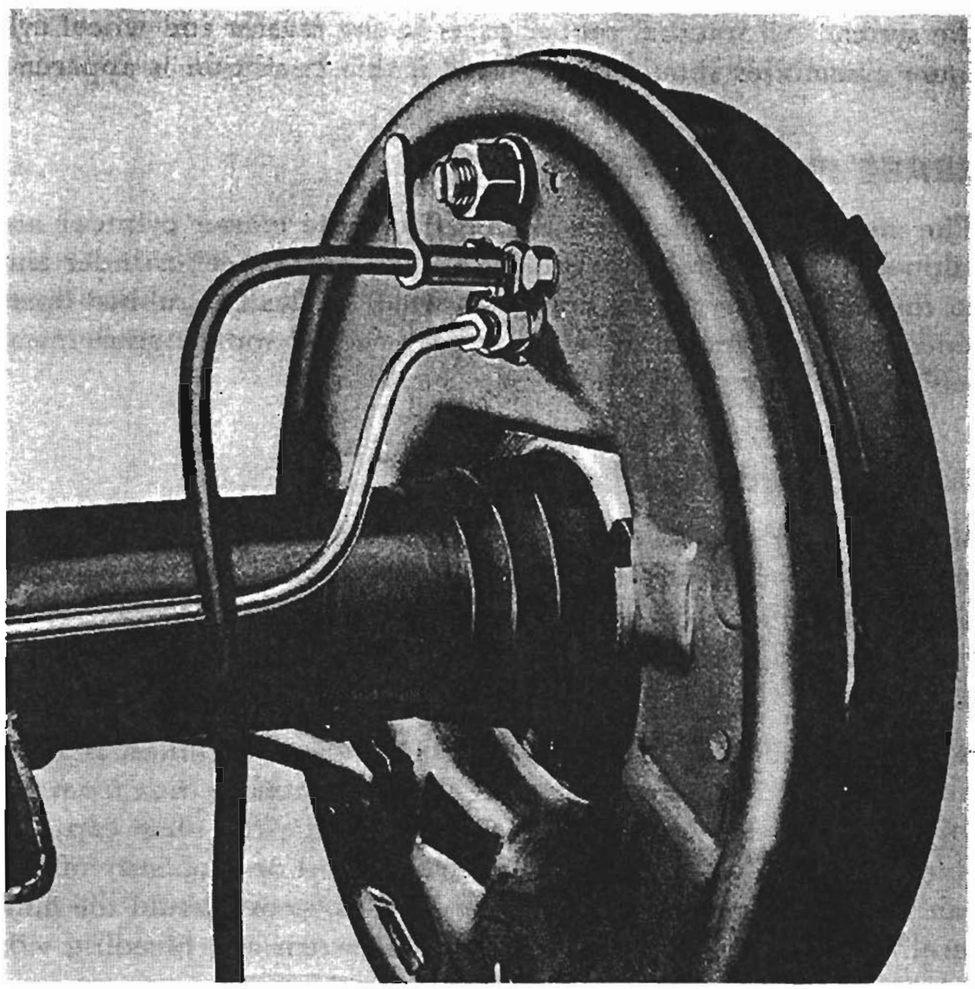


Fig. 7—Using the Bleeder Wrench J-627, Back Off the Bleeder One Full Turn.

D. When the master cylinder secondary piston cup has become excessively worn.

E. When the master cylinder filler cap vents have become plugged.

F. When a leak is found in the lines, connections, or cylinders.

G. When it is necessary to fill the system with new fluid.

Bleeding the brake circuit may be accomplished either by employment of specialized pressure bleeding equipment or by use of the brake pedal to pump fluid through the lines.

The pressure operation permits one man to do the job quickly since pressure and supply are provided automatically. Most shops, however, use the brake pedal pumping system and this procedure follows.

Before starting this operation, make sure that the fluid reservoir is completely filled otherwise air will enter the system through the master cylinder.

To bleed the system, remove the screw from the bleeder connection and thread in the brake bleeder tube, J-747, and place a container

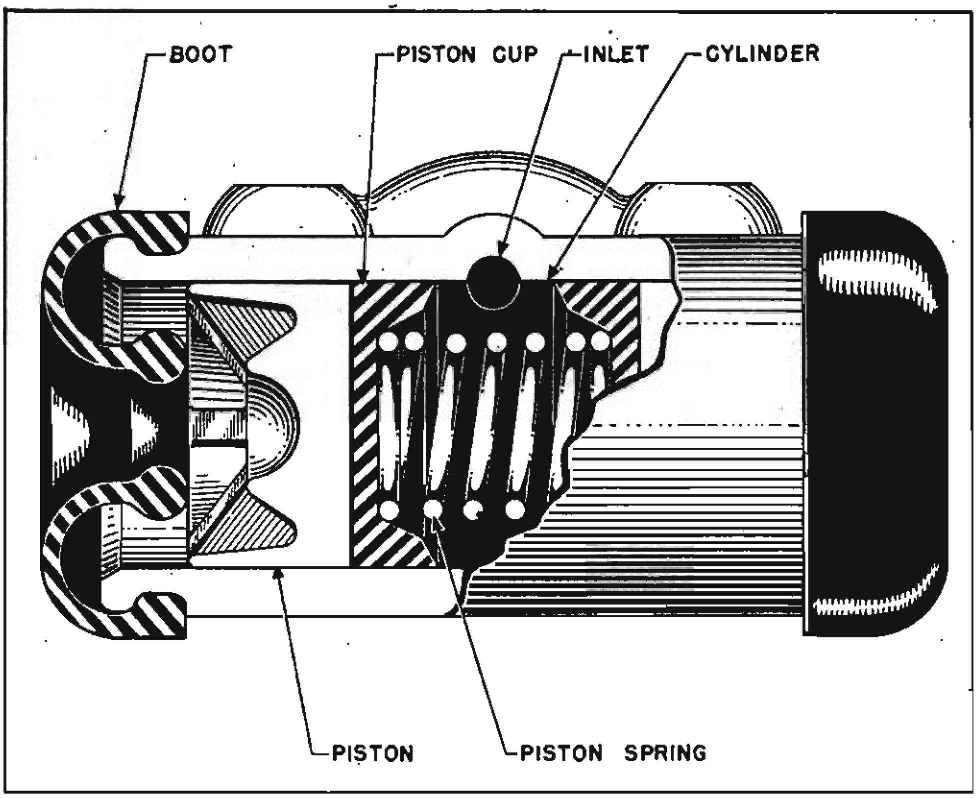


Fig. 8—The Wheel Cylinders Are of the Straight Bore Double Piston Type.

below the free end of the tube. Using the bleeder wrench, J-627, (figure 7) back off the bleeder one full turn and depress the brake pedal slowly. Allow the pedal to return sharply to its normal position making sure that the end of the bleeder tube is submerged in fluid in the container. Repeat this pumping action until no bubbles are observed in the fluid emerging from the hose, then close the bleeder connection and remove the bleeder tube.

Bleed only one wheel cylinder at a time.

CAUTION

> Remember to keep the fluid level well up in the reservoir when bleeding the system. Fluid withdrawn during this operation should be discarded.

WHEEL CYLINDERS

The wheel cylinders (figure 8) are of the straight bore type. They contain two pistons, each sealed off from the fluid in the cylinder by a rubber cup, the cups being held securely to the piston heads by a compression spring. On the pressure stroke, each piston operates a push rod to its respective brake shoe. One port located between the pistons and cups serves both for the admission and return of fluid on the pressure and return strokes. A molded rubber boot at both ends of each wheel cylinder serves to keep dust and dirt out of the cylinder.

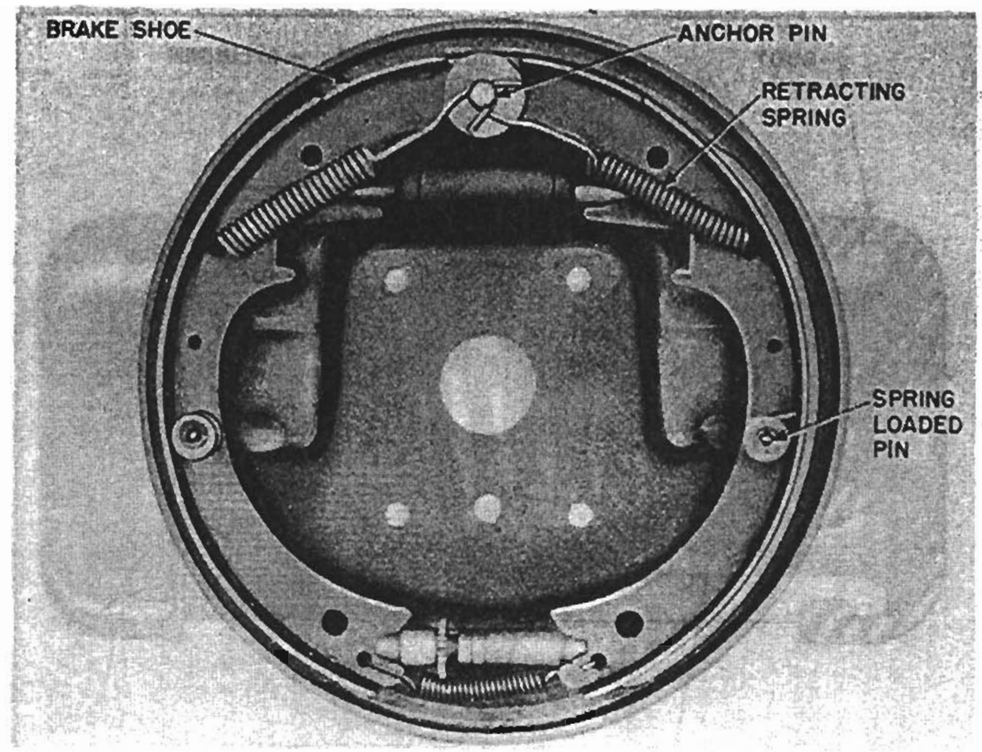


Fig. 9—Showing Flexible Method of Mounting Brake Shoes to the Support Plate.

1. Servicing the Wheel Cylinders

Wheel cylinder and cup servicing procedures are basically the same as those described for the master cylinder.

CAUTION

The linings and drums must remain absolutely free of brake fluid, grease, and oil. Be sure to control any dripping of fluid and wipe the hands clean before handling these parts.

BRAKE SHOES AND LININGS

The forward brake shoe is called the primary shoe while the rear shoe is the secondary.

Spring loaded pins hold both shoes flexibly at their centers to the brake support plate while the notched upper ends of the shoes butt to the anchor pin. See figure 9. The anchor pin guide plate, acting as a washer, and the connection arrangement of the retracting springs to the anchor pin complete such action as is necessary to hold the shoes in position.

On the pressure stroke, both shoe linings are forced outward to bear against the drum. The flexible mounting arrangement allows the primary shoe to follow the rotation of the drum for a short distance, and by doing so, it pushes on the secondary shoe through

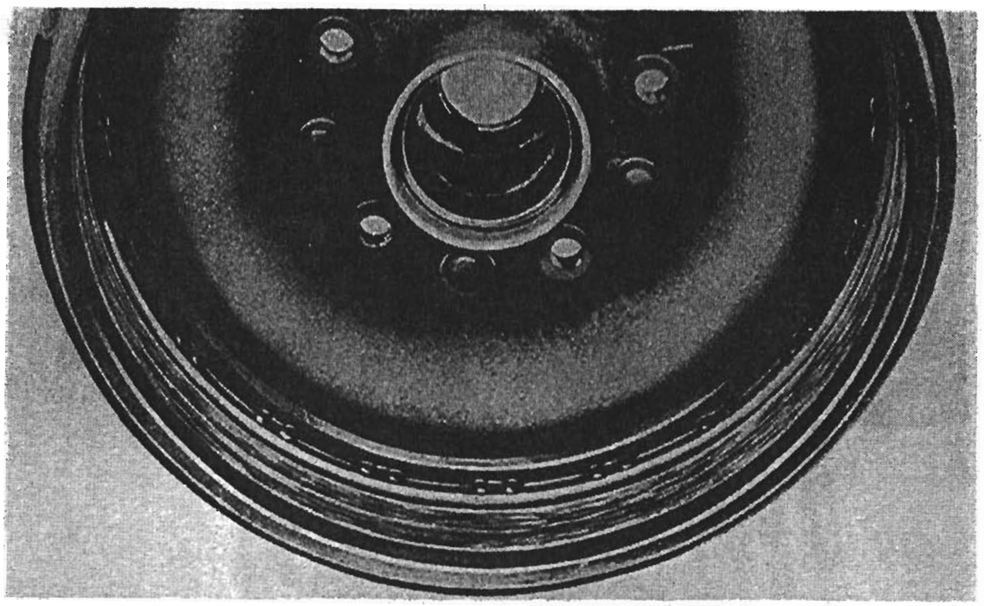


Fig. 10—It Is Necessary to Reface a Brake Drum if Its Braking Surface Has Become Deeply Scored.

the adjusting screw at the bottom. As far as forward rotation of the wheels is concerned, this force on the secondary shoe is applied *ahead* of the pin connection causing it to jam against the drum at a pressure much greater than that of the primary shoe. The action of the secondary shoe being far more severe than that of the primary, it is necessary that the secondary lining material be the more resistant to heat and wear for each lining to wear at essentially the same rate.

"Duo-Servo" or "Self-Energizing" is the name given the principle just described, since the combination of the speed of the car and its weight, or the potential energy of the car is put to work in stopping it. When the car is braked while going backward, the primary shoe becomes the secondary, the secondary becomes the primary, and the "Duo-Servo" principle applies as usual.

BRAKE DRUMS

By combining high temperatures with centrifugal force, molten cast iron is fused to the flange inner surface of the steel brake drums used in Packard cars. Known as the "Centrifuse" process, this permits the use of cast iron for its desirable braking surface properties while still retaining the structural advantages of steel.

1. Refacing the Brake Drums

It is necessary to reface a brake drum if its braking surface has become deeply scored. See figure 10. This condition is caused mostly by excessive wear of the brake linings, these thinning down

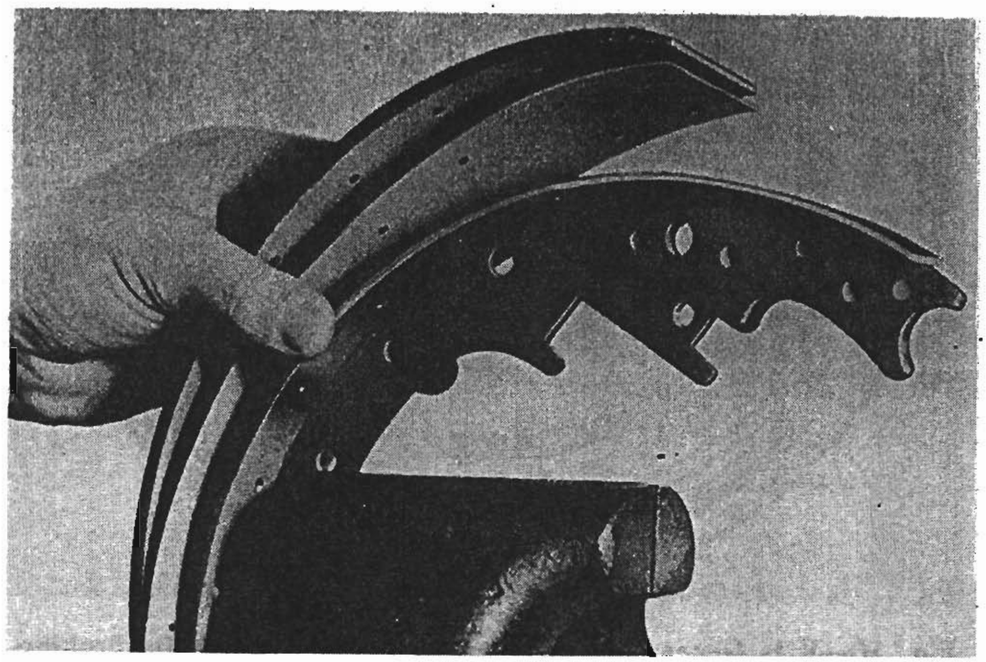


Fig. 11—Install Service Shims Between the Linings and Shoes to Compensate for Amount of Metal Removed from Drum.

until the rivet heads are exposed to the brake drum. Sometimes foreign matter (pebbles and the like) will find its way inside the drum, become imbedded in the lining, and score the drum surface.

Whatever the cause, if the score marks are .020 inch or greater in depth, the drum should be set up on a lathe and turned down .020 inch all around (.040 inch on the diameter). If this does not substantially remove the score marks, the drum may be turned down another .010 inch (making a total cut of .060 inch on the diameter). If the score marks and scratches are still deep and numerous, after .030 inch depth has been removed from the face surface, it is well to discard the drum and replace it with a new one. Considerable braking area will be lost if the drum surface is not smooth and, in addition, the linings will wear much more rapidly. Service shims of either .020 or .030 inch should be installed (figure 11) between the linings and the shoes to compensate for the amount of metal removed from the drum.

BRAKE ADJUSTMENT

Brake adjustment procedures may be divided into two general classifications: these are the Minor Brake Adjustment and the Major Brake Adjustment.

The Minor Brake Adjustment compensates for normal lining wear and restores correct pedal reserve.

The Major Brake Adjustment is necessary when new linings have been riveted to the shoes, when anchor pin locations have been

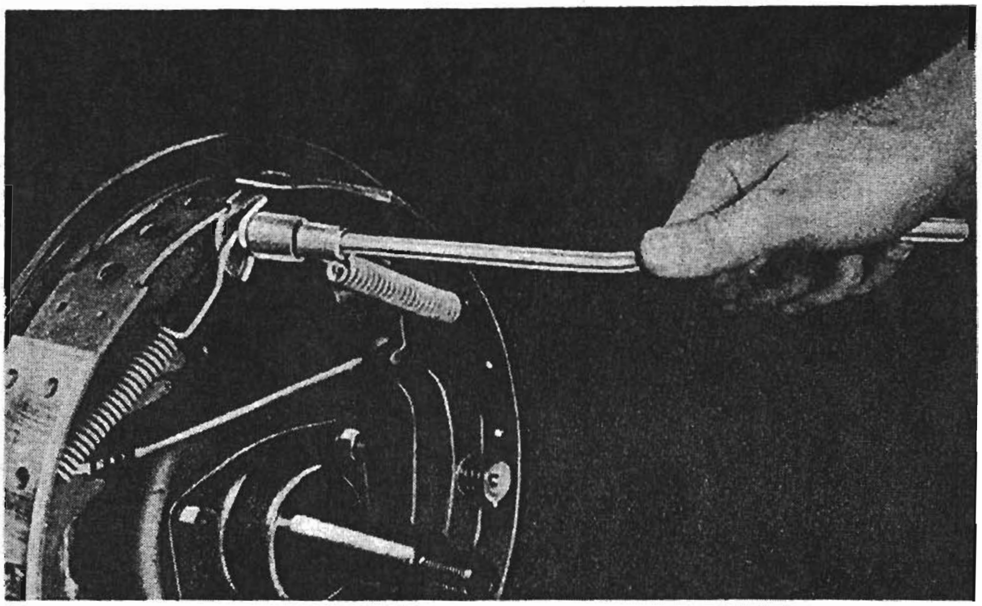


Fig. 12—Use the Wrench KMO-526 to Remove the Brake Shoe Retracting Springs.

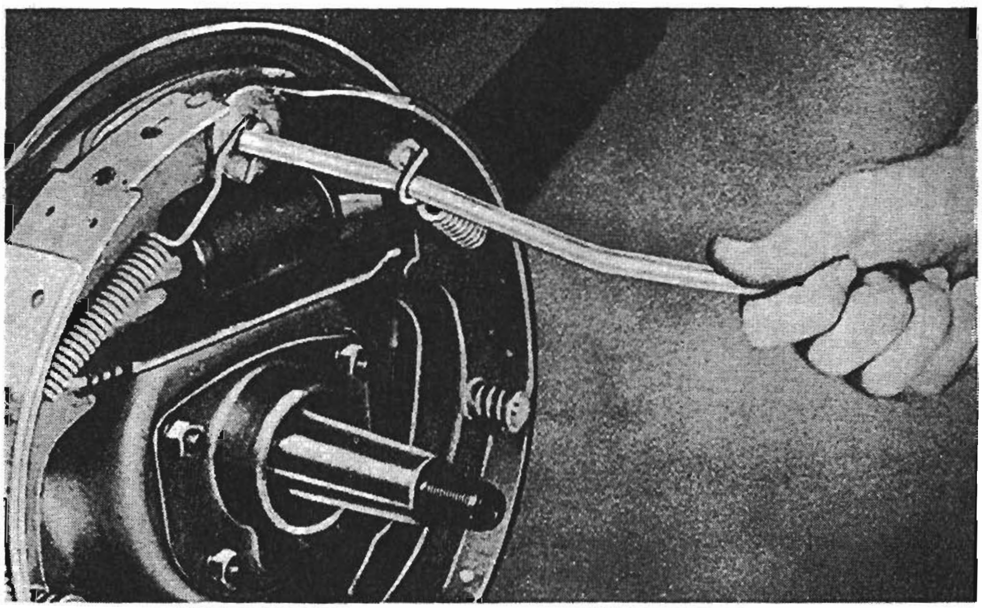


Fig. 13—Tool KMO-526 Also Is Used to Install Brake Shoe Retracting Springs.

disturbed, when brake drums have been refaced, and when satisfactory results are not obtained in the Minor Brake Adjustment.

If the brake shoes are to be removed, use the wrench, KMO-526, to remove the springs as shown in figure 12 and reinstall or replace them with the same tool as shown in figure 13. Use brake cylinder clamps, KMO-145, (figure 14) to prevent the pistons from being forced out of their cylinders by action of the wheel cylinder cup springs or from accidental movement of the brake pedal.

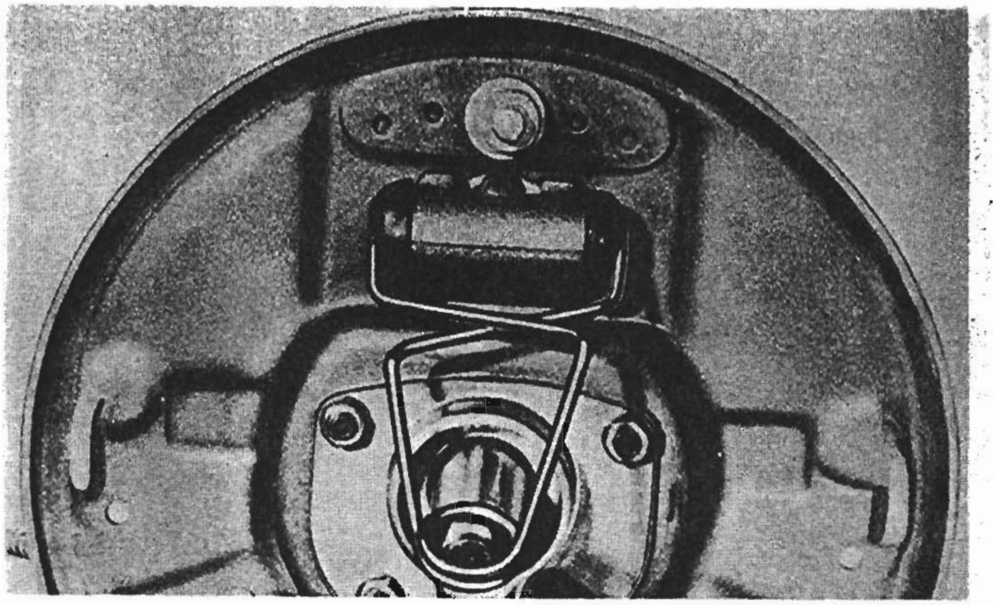


Fig. 14—Use Brake Cylinder Clamps KMO-145 to Prevent the Pistons from Being Forced Out of Their Cylinders.

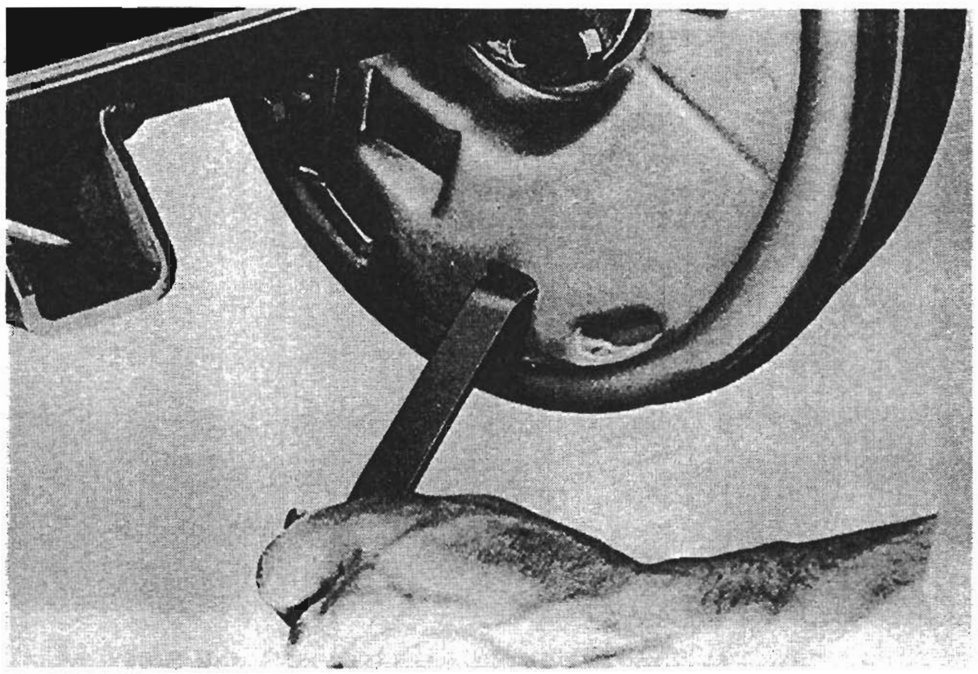


Fig. 15—Insert Brake Adjusting Wrench J-1028 Through the Adjusting Slot to Turn the Adjusting Screw.

1. Brake Adjustment—Minor

A. Jack up all four wheels and remove the adjusting hole covers from the brake support plates.

B. Disconnect the hand brake cable at the equalizer. Adjust the master cylinder piston push rod to allow $\frac{1}{4}$ to $\frac{1}{2}$ inch free movement of the pedal pad before pressure is reached in the cylinder. (See "Adjusting Brake Pedal Free Play.")

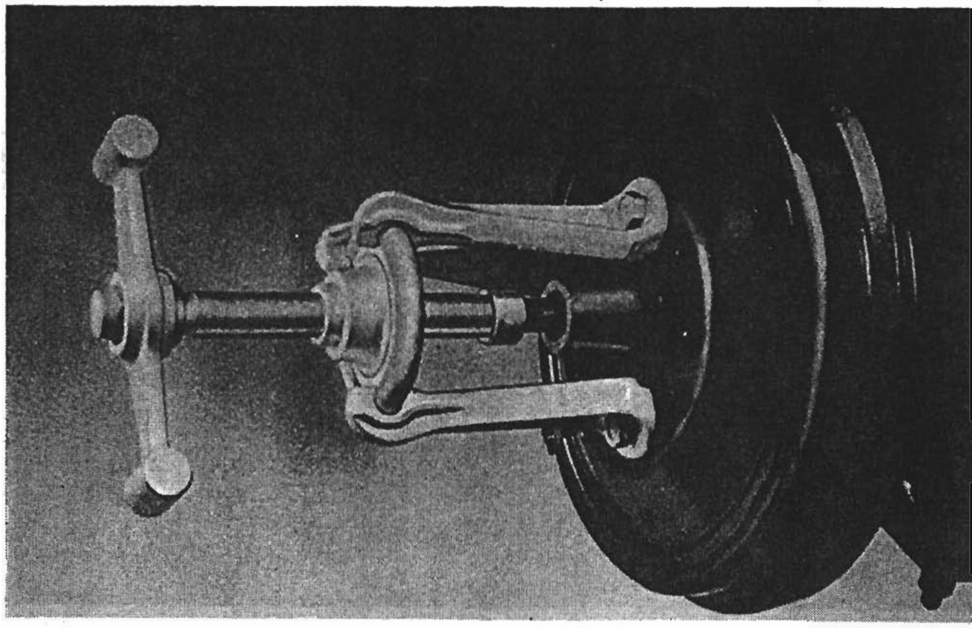


Fig. 16—Always Use a Wheel Puller of the Type Shown When Removing the Rear Brake Drums.

C. Insert brake adjusting wrench, J-1028, through the adjusting slot at the bottom of the brake support plate, as shown in figure 15, engaging a tooth on the shoe adjusting screw. By turning the adjusting screw downward, expand the shoes on each wheel until the drums can just be turned by hand.

D. Reconnect and adjust the hand brake cables at the equalizer.

E. Back off the adjusting screw 16 clicks on all wheels. Be sure that all drums are entirely free of brake drag.

F. Reinstall hole covers, check master cylinder reservoir for correct fluid level and road test the car.

2. Brake Adjustment—Major

A. Jack up all four wheels clear of the floor.

B. Remove the wheels and the hub and drum assemblies for inspection of drums, linings, and brake mechanism. Use a puller of the type shown in figure 16 to remove the rear drums. Never use a knockout type wheel puller as this may result in fracture of the rear axle shaft thrust block.

C. Check the condition of the brake linings. If they are worn down to the rivet heads or are grease soaked, they should be replaced. If these conditions are not evident, inspect the lining for imbedded foreign particles in surface, loose rivets, etc., and correct if necessary. If the shoes are to be removed, clamp the wheel cylinder pistons with wheel cylinder clamps, KMO-145. Inspect the brake drums. If they are scratched from

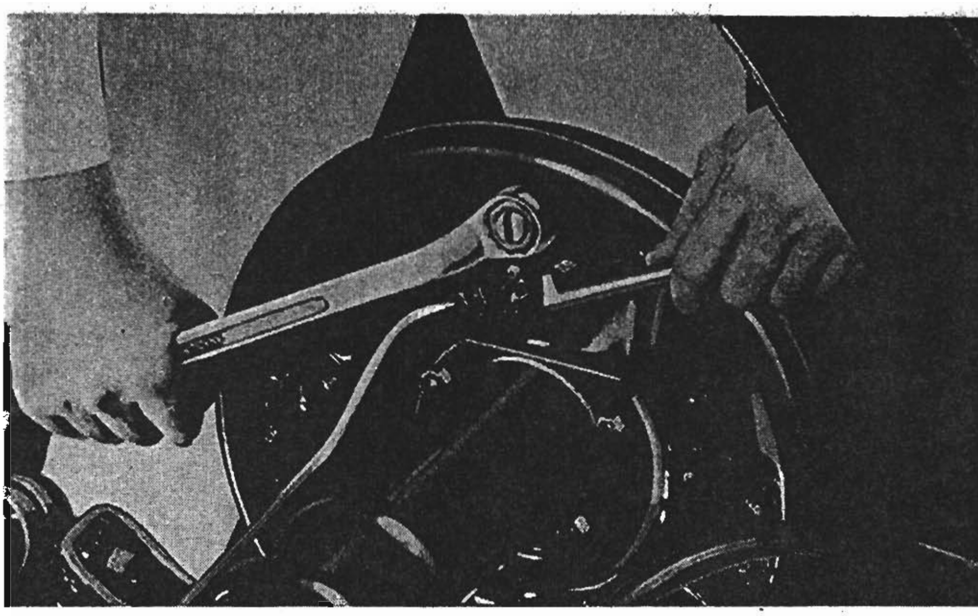


Fig. 17—Loosen the Anchor Pin Lock Nut and Free the Wheel by Turning the Anchor Pin Either Forward or Backward.

foreign particles imbedded in linings, smooth them with emery cloth. If badly scored, the drum must be refaced. (See "Refacing the Brake Drums.")

Check the rear bearing seals for leaks at this point of procedure and if leaks are apparent install new inner and outer seals.

D. Lubricate friction points on the support plates with Lubriplate and sparingly oil the hand brake strut lever on the rear wheel secondary shoes.

E. Disconnect the hand brake cables at the equalizer.

NOTE

Before reinstalling the hub and drum assembly, check the position of the anchor pin cam. Correct positioning of this cam is essential and may be determined by the location of the anchor pin nibs. The high nib must be on the rear side of the slot. If the anchor pin has been incorrectly installed previously so that the high nib is forward, it will be necessary to loosen the lock nut and turn the anchor pin 180 degrees.

F. Install hub and drum assemblies.

G. Turn the star wheel adjustment until the wheel is just locked and then loosen the adjustment six clicks.

H. Loosen the anchor pin lock nut (figure 17) and free the wheel by turning the anchor pin either forward or backward. When the wheel reaches its free point, tighten the lock nut.

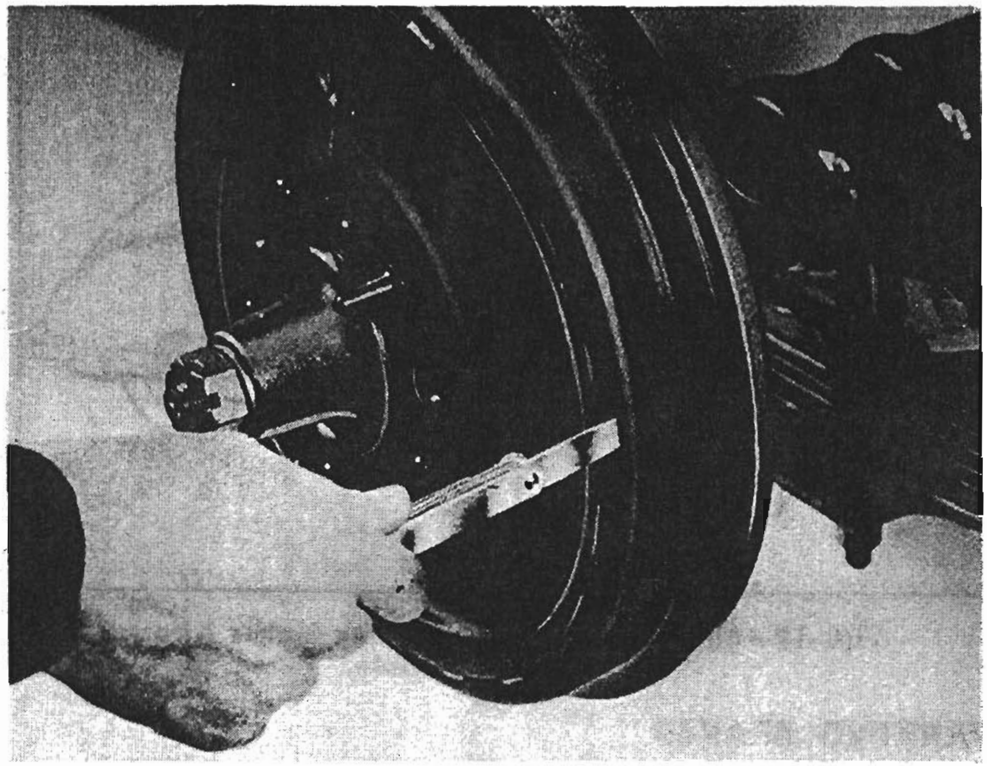


Fig. 18—Inserting a .010" Feeler Between the Drum and the Lining as a Final Check.

NOTE

Change the position of the anchor pin only when new shoes or linings have been installed or when satisfactory results are not obtained in the Minor Brake Adjustment.

J. Again tighten the brake by means of the star wheel adjustment until the wheel is just locked, then loosen the adjustment 16 clicks: this procedure will provide proper lining clearance. If desired, a .010 feeler gauge may be inserted between the lining and the drum as a final check. (See figure 18.)

(Steps K-1, L-1, and M-1 following are for seven-passenger sedan, limousine, hearse, and ambulance for rear wheels only.)

K-1. Loosen the eccentric lock nut and take up on the eccentric until the wheel is tight, then back off the eccentric just until the wheel turns freely and tighten the lock nut.

L-1. Loosen the anchor pin lock nut and turn the anchor pin in the direction of forward wheel rotation until a drag is noticeable when turning the wheel.

M-1. Turn the anchor pin in the opposite direction until the wheel just becomes free and then tighten the lock nut.

K. After making sure that the high nib on the anchor screw is at the rear of the slot (figure 17) reinstall the inspection and adjusting hole covers and replace the wheels.

L. Road test the car.

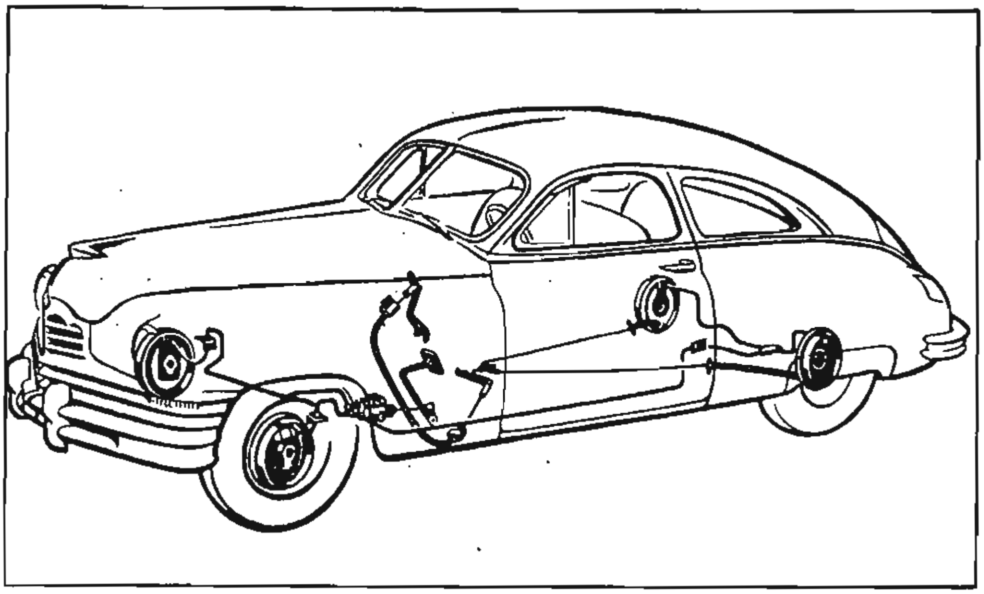


Fig. 19—Mechanical Hand or Parking Brakes Affect the Rear Wheels Only.

PARKING BRAKES

Parking brakes (figure 19) affect the rear wheels only. A pulling force on the hand brake lever is transmitted to the hand brake equalizer lever by means of a connecting cable and linkage arrangement. Divided by the equalizer lever or "bridle," this force is applied equally through a cable to the shoe strut lever of each rear brake assembly. The shoe strut lever (A, figure 20) is pinned to the secondary shoe at point "B," while the notched ends of the shoe strut (C) bear against the primary shoe (D) forward, and against the shoe strut lever at the rear and below the pivot plane. A force applied to the linkage first engages the primary shoe, then, the notched end of the shoe strut acting as a fulcrum, engages the secondary shoe. The "self-energizing" principle will apply as usual if the car is moving or has a tendency to move.

1. Lubricating the Parking Brakes

Disconnect the brake cables at the equalizer. Disconnect the cable from the shoe strut lever and, after sliding the conduit forward, apply Bendix Cable Lubricant sparingly to the cable. Now slide the cable back to within about 2 inches of its connected position and carefully wipe off excess lubricant before connecting. Following this procedure prevents excess lubricant from finding its way to the brake linings.

All points of contact between the brake support plate and the brake shoes should be brushed sparingly with Lubriplate. Never use grease or graphite as a lubricant for brake shoes or cables as these materials will almost invariably find their way to the linings and drums.

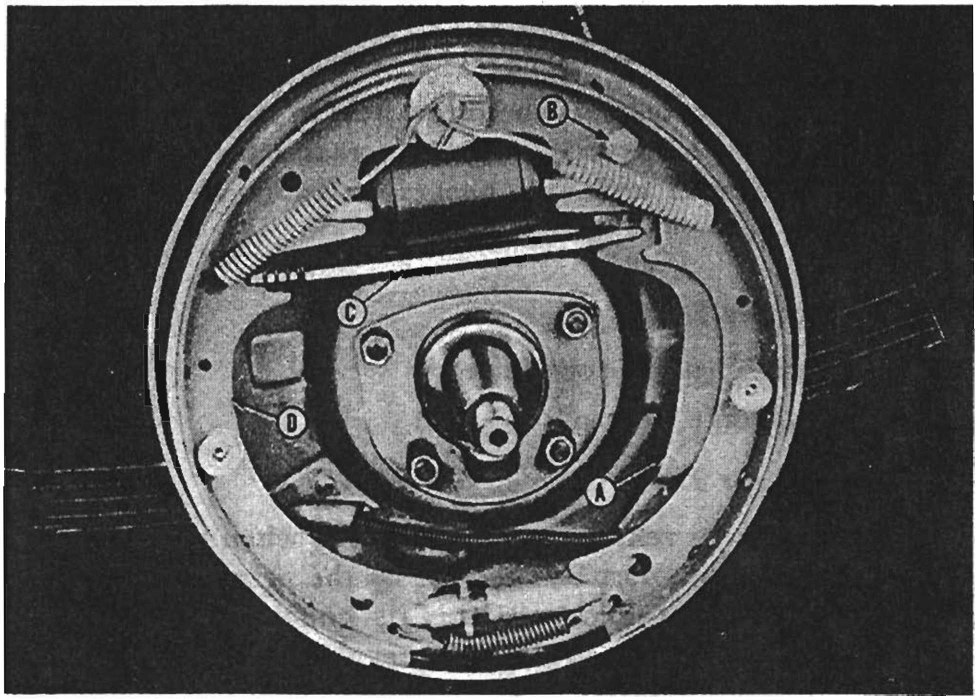


Fig. 20—Showing Rear Brake Support Plate and Parts Actuated by the Hand or Parking Brake Lever.

BRAKE TROUBLES AND CORRECTIONS

1. Pedal Goes to Toe Board

A. Low Fluid Level

Check the fluid level in the brake master cylinder. A very low reservoir fluid level is usually an indication of a leak somewhere in the system. Examine the lines and cylinders carefully and correct as necessary.

B. Brake Shoes Out of Adjustment

If pedal travel is excessive and the fluid level is normal, use the brake pedal to pump up the system. A solid pedal feel during and following this procedure usually means that the brake shoes require an adjustment.

C. Air in System

A soft, spongy pedal indicates that air has been admitted into the system and that bleeding of the lines is necessary. (See "Brake Fluid Lines"—2.)

D. Internal Leakage of Master Cylinder

If under normal pedal force the brake pedal sinks slowly to the toe board with no signs of external leakage, the master cylinder probably needs reconditioning. (See "Master Cylinder"—1.)

E. Pedal Improperly Set

(See "Foot Brake Pedal"—1.)

Free travel of the brake pedal should be held to ¼ to ½ inch before pressure is reached. Excessive travel decreases the length of the piston's active travel and will generally reduce effectiveness of the brakes.

2. All Brakes Drag

A. Shoes Adjusted too Closely

(See "Brake Adjustment"—1.)

B. Improper Pedal Setting

The master cylinder relief port must be open when the brakes are released. Should this port be blocked by the primary piston cup, the master cylinder cannot perform its compensating function. Correct pedal adjustment will insure that this port is open on the return stroke. (See "Foot Brake Pedal"—1.)

C. Mineral Oil in System

Engine oil, kerosene, anti-freeze containing rust inhibitor, or any other fluid with a mineral base will attack natural rubber causing it to become sticky and to swell and distort. Even so much as a trace of these fluids will prove detrimental to natural rubber. If the presence of oil in the hydraulic circuit is indicated, the rubber parts should be replaced and the system drained and flushed thoroughly with methyl alcohol. Always use Packard Brake Fluid for refilling. (See "Brake Fluid Lines"—1.)

3. One Wheel Drags

A. Shoes Set too Close to Drum

(See "Brake Adjustment"—1.)

B. Weak or Broken Retracting Spring

Brake shoe retracting springs may become weak for several reasons. They may have fatigued, taken a set, rusted excessively, or they may have softened from too much heat. Retracting springs should be replaced if any of these conditions exist.

C. Sticking Cylinder Pistons

Sometimes rust or foreign particles will cause pistons to stick in the master or wheel cylinders. If this condition exists, check the cylinder wall for scoring. (See "Master Cylinder"—1.)

If foreign matter is discovered in the system or if the rubber parts show distortion, flush the system and refill with clean Packard Brake Fluid.

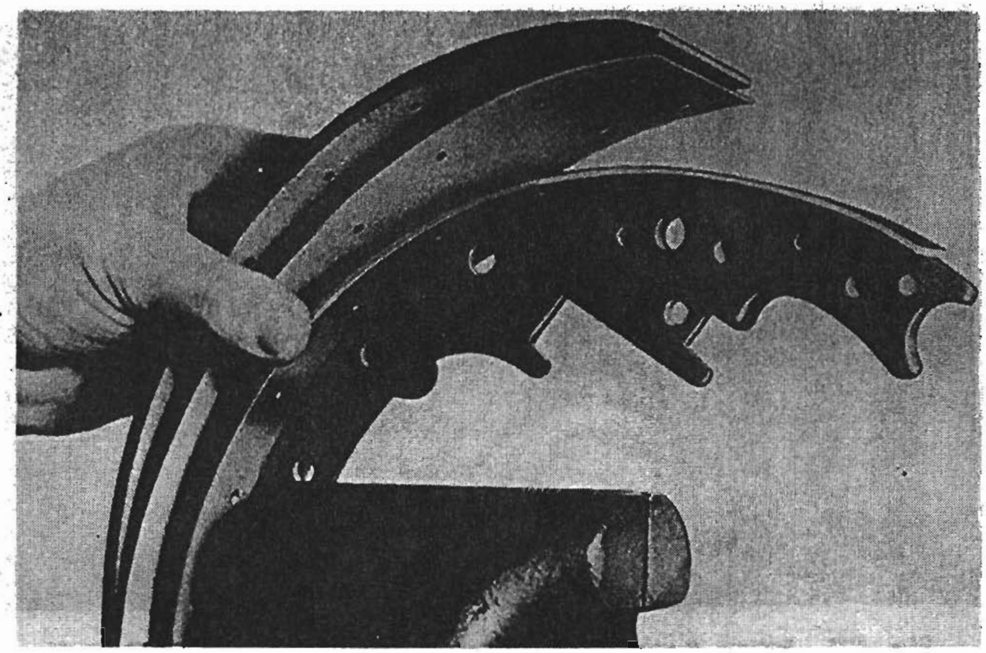


Fig. 21—After Refacing Drum Place Service Shims Between the Linings and Shoes to Compensate for Metal Removed.

D. Loose Wheel Bearings

Front wheel bearings should be adjusted so that they neither bind nor permit the wheels to shake.

On models which use a single adjusting nut, the nut should be tightened to a torque of 20 ft. lbs., or snugly tightened with a 10-inch wrench, backed off one hex, and the cotter pin installed. If the cotter pin slot in the nut and the hole in the spindle do not line up after the nut is backed off, the nut should be turned either forward or back to line up with the slot closest to the hole in the spindle.

On models which use an inner and an outer adjusting nut and a locking washer, the inner nut should be torqued or snugly tightened, backed off 2 to 3 holes measured on the locking washer, the outer nut tightened, and the cotter pin installed.

4. Soft, Spongy Pedal Action

A. Air in System

(See "Brake Fluid Lines"—2.)

B. Improper Anchor Setting

If the setting of the anchor pin is disturbed, the relationship between the lining surfaces and the drum will be changed. This generally results in a tendency to spring the shoes and bear the lining against the drum with poor pressure distribution. In addition, it will cause greater pedal travel and, in most cases, dragging of the heel or toe of the lining. If adjustment is necessary, see "Brake Adjustment"—2.

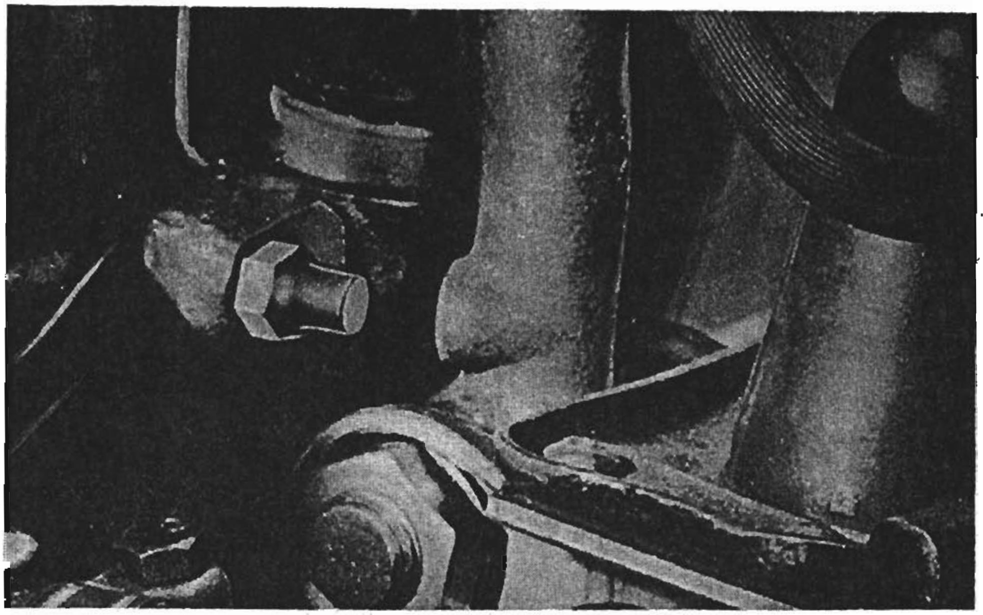


Fig. 22—When Assembling Front Brake Support Plate, Install Retaining Screw with Raised Head in Plate Lower Rear Hole.

C. Lining Does Not Match Drum Diameter

If it has been necessary to reface the drum surface, be sure to place a shim of the same thickness as the depth of cut between the linings and shoes. See figure 21. If a shim is not used after drum refacing, the arcs of the lining and drum surfaces will differ and the lining will wear unevenly.

5. Car Pulls to One Side

A. Support Plate Loose on Axle

Loose support plates will allow the brake assembly to shift on the locating bolts. This alters the relationship between the shoes and the brake drum, causes unequal pressure distribution, and usually results in grabbing of the shoes.

Tighten the support plate and then readjust the shoes as described under "Brake Adjustment"—2.

CAUTION

When assembling the front brake support plates, the retaining screw having the raised head should be installed in the lower rear hole in the plate. See figure 22. This screw acts as a stop and interchanging it with one of another type will adversely affect the turning radius of the car.

B. Different Makes of Lining

Packard brake linings have been designed to do a specific job for a specified Packard model and it is strongly recommended that they be used exclusively for that job.

If it is necessary to install new brake linings at one wheel, always duplicate the work on the opposite wheel.

C. Dust in Drum

Dust in the brake drums will impair braking efficiency. Clean all drums with compressed air.

D. Tires Not Properly Inflated

Inflate tires to recommended pressure.

E. Weak Retracting Springs at One Wheel

(See "Brake Adjustment"—2.)

F. Restricted Flow of Fluid to Wheel Cylinder

Drain the system and check the internal condition of the three rubber hoses. Sometimes a small rubber flap will develop on the inner surface of a hose and will act as a check valve. Flush the system and fill with Packard Brake Fluid.

EXHAUST SYSTEM

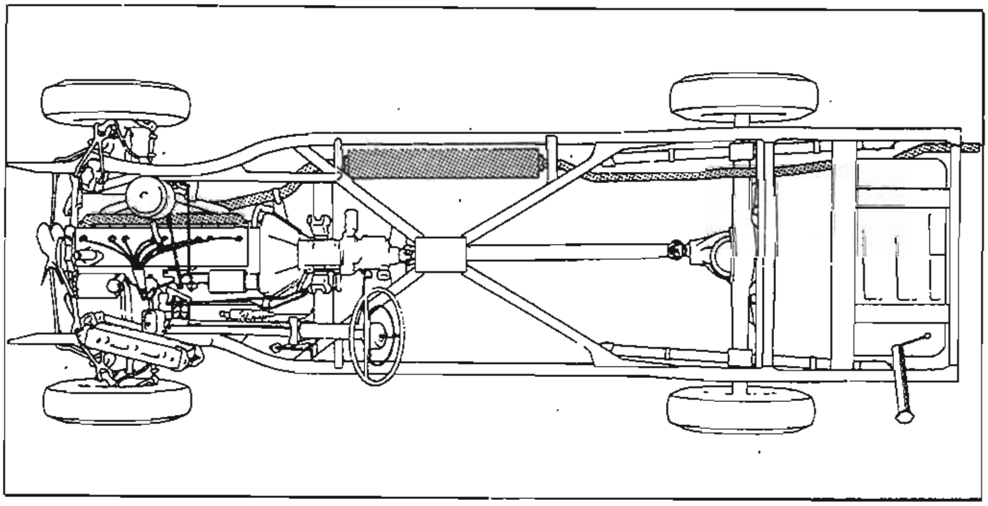


Fig. 23—The Exhaust System Consists of Four Major Parts: the Manifold, Pipe Assembly, Muffler, and the Outlet Tube.

GENERAL

The Packard Exhaust System (figure 23) consists of four major parts:

1. The engine exhaust manifold
2. The exhaust pipe assembly
3. The exhaust muffler
4. The exhaust muffler outlet tube

REPLACEMENT OF PARTS

When exhaust gas leaks are evident, they will usually be found in the exhaust pipe assembly, in the muffler, or in the muffler outlet tube. Premature failure of any of the above mentioned parts may justify replacement of only the part affected; however, if any of them have rusted to the point of failure, it will generally prove more beneficial both to the owner and to the shop to replace all of them at one time.

Occasionally a leak will be found at an exhaust manifold gasket and, if the leak cannot be stopped by tightening the manifold retaining nuts to the specified torque, replacement of all exhaust gaskets is necessary.

Check the condition of all flexible supports and if they have sagged, replace them with new parts.

NEUTRALIZING THE EXHAUST SYSTEM

When it is necessary to replace parts in the exhaust group the system should be adjusted to clear anything that it might rattle against. To keep the system from settling with normal road vibration, the following procedure is recommended:

Assemble the exhaust pipe, muffler, and outlet tube in position and snugly tighten all connections. Start the engine and disconnect three or four spark plug leads to make engine performance very rough. After allowing the engine to run for a short time, turn off the ignition switch and tighten all fittings. This procedure will allow the system to seek its neutral position and eliminate rattles and exhaust vibrations.

FUEL SYSTEM

FUEL TANK AND MAIN FUEL LINE

The fuel tank (figure 24) consists of two steel stampings or shells roll-welded together at their flanges to form an integral unit. A depression in the lower shell serves as a sump for water, dirt, and foreign particles. To permit sump drainage, a copper plated boss threaded for a drain plug is spun into the bottom of the sump depression.

The outlet tube is located in the central area of the tank in a transverse depression in the lower shell. This tube, soldered to the tank floor for a short distance, rises to a position in the forward wall just below the seam line where it is soldered to a threaded, copper-plated boss spun into the shell wall to provide the connection for the main fuel line.

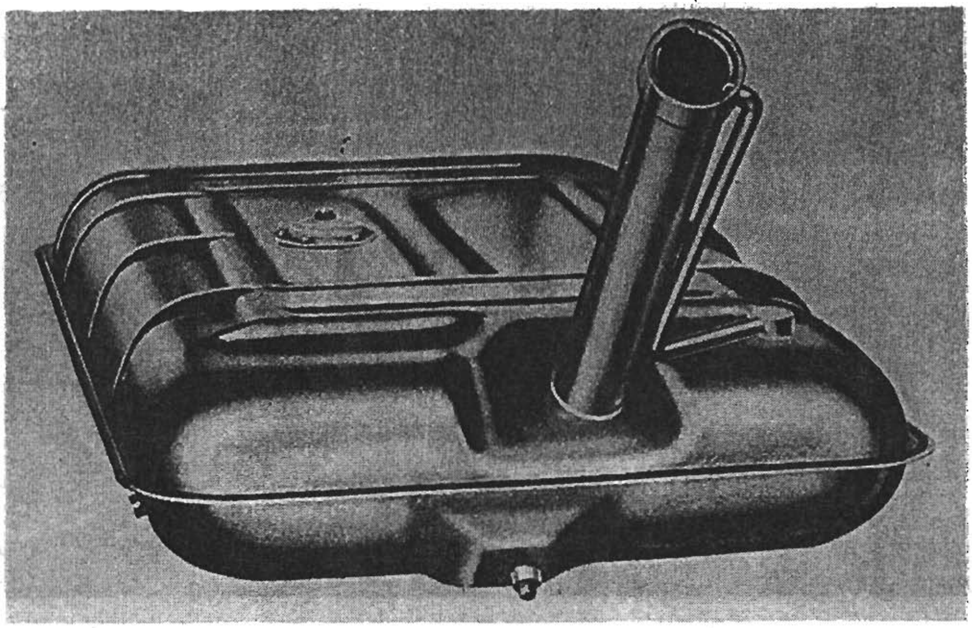


Fig. 24—Two Steel Stampings Roll-Welded Together at Their Flanges Form the Fuel Tank Shell.

The filler pipe fits into a hole in the web of a support bracket on the lower shell, the necessary rigid support of the filler pipe being completed by soldering this member to its flanged opening in the upper shell. As fuel is added to the tank, displaced air must be expelled through the vent whistle and the vent tube and into the upper end of the filler pipe.

The large opening in the upper shell for the fuel gauge sending unit incorporates a copper-plated reinforcement, drilled and tapped to match mounting holes in the flange of the sending unit.

All parts used in the fuel tank assembly are either tern or copper plated steel and, with the exception of the shell seam, all fuel tank parts are soldered in position.

The main gasoline tube is flared at its tank end for connection to the tank outlet tube boss, while a threaded male fitting is brazed to its forward end. The fuel pump inlet hose, made of synthetic rubber, provides the necessary flexible connection between the main gasoline tube clipped to the frame and the fuel pump which is mounted on the engine.

FUEL GAUGE SYSTEM

The electric-bimetal type fuel gauge system employs a sending unit at the fuel tank and a receiving unit at the instrument panel.

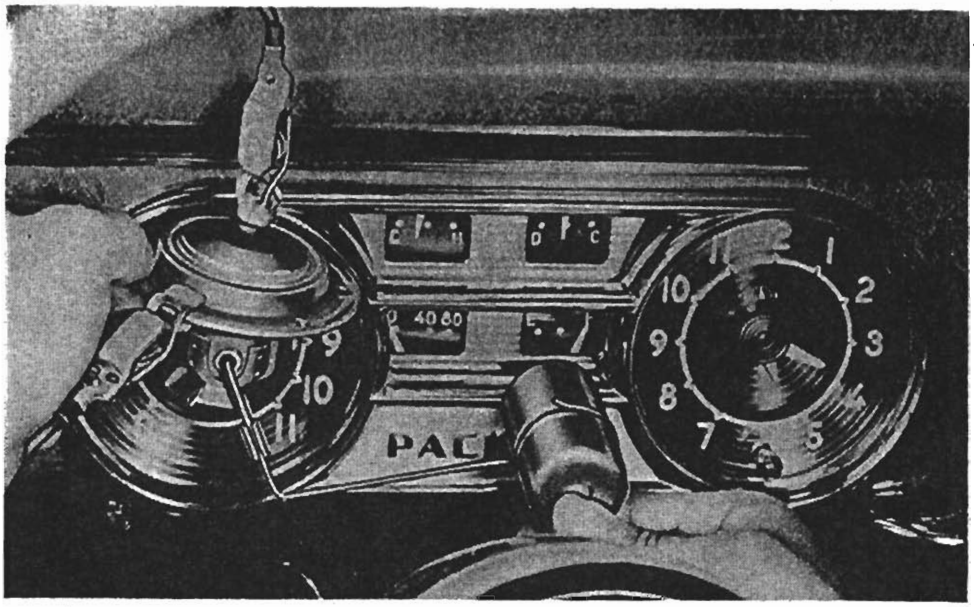


Fig. 25—Raise Sending Unit Float to Top Position and Hold It There Until the Pointer Comes to Rest.

1. Checking the Fuel Tank Sending Unit

As two units are required to register the quantity of fuel in the tank, it is logical practice to determine which of the two is at fault if the gauge does not read correctly. Check all wiring at the terminals and, if they are tight and the gauge pointer does not register correctly, the following procedure is recommended:

Select a new tank sending unit from stock and make up two insulated test leads about 10 feet long, equipped with clip terminals at each end.

After separating the wire at the connector under the left rear corner of the trunk floor, clip one test lead to the end of the wire which leads to the gauge unit and clip the opposite end to the terminal on the stock sending unit. Clip the other lead from the flange of the stock sending unit to ground, completing the fuel gauge circuit. Now turn on the ignition switch. Raise the sending unit float by hand to its top position (figure 25) and hold it there until the gauge pointer comes to rest. The pointer should register at the "F" mark on the gauge. Now lower the float to its bottom position; the pointer should rest at the "E" mark.

If the gauge pointer registers properly, this localizes the trouble in the tank sending unit and the unit should be replaced.

If the gauge pointer registers improperly or doesn't register at all, the trouble is in the instrument panel receiving unit and its replacement will be necessary. Check the new receiving unit with the stock sending unit before installing it in the instrument panel.

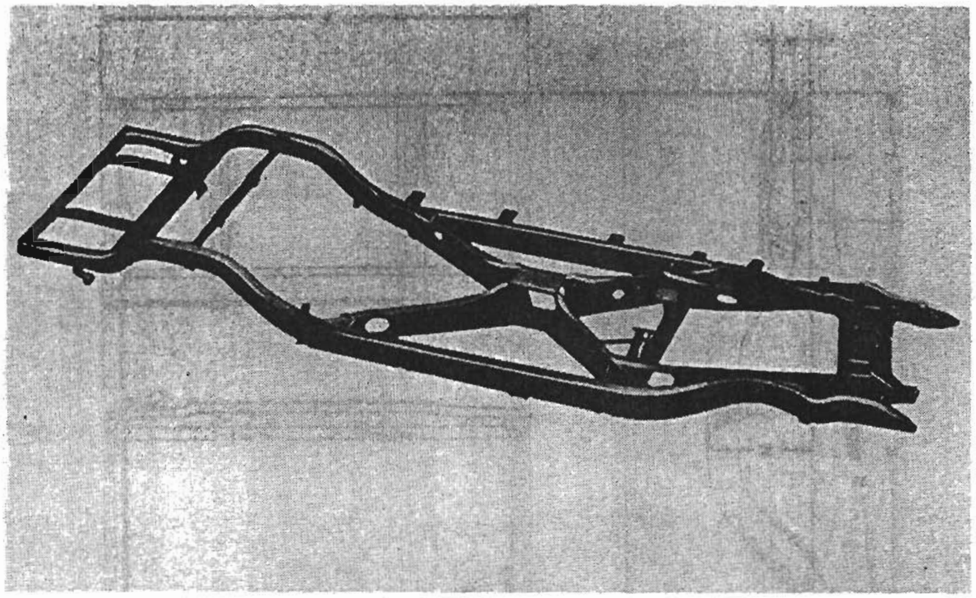


Fig. 26—The Frame Side Channels Are Reinforced by a Deep "X" Member and Various Cross and Secondary Members.

FRAME

GENERAL

Double drop side channels, five lateral cross members, a deep, tapered "X" member, and various secondary members are riveted and welded in position to make up the Packard frame structure. See figure 26.

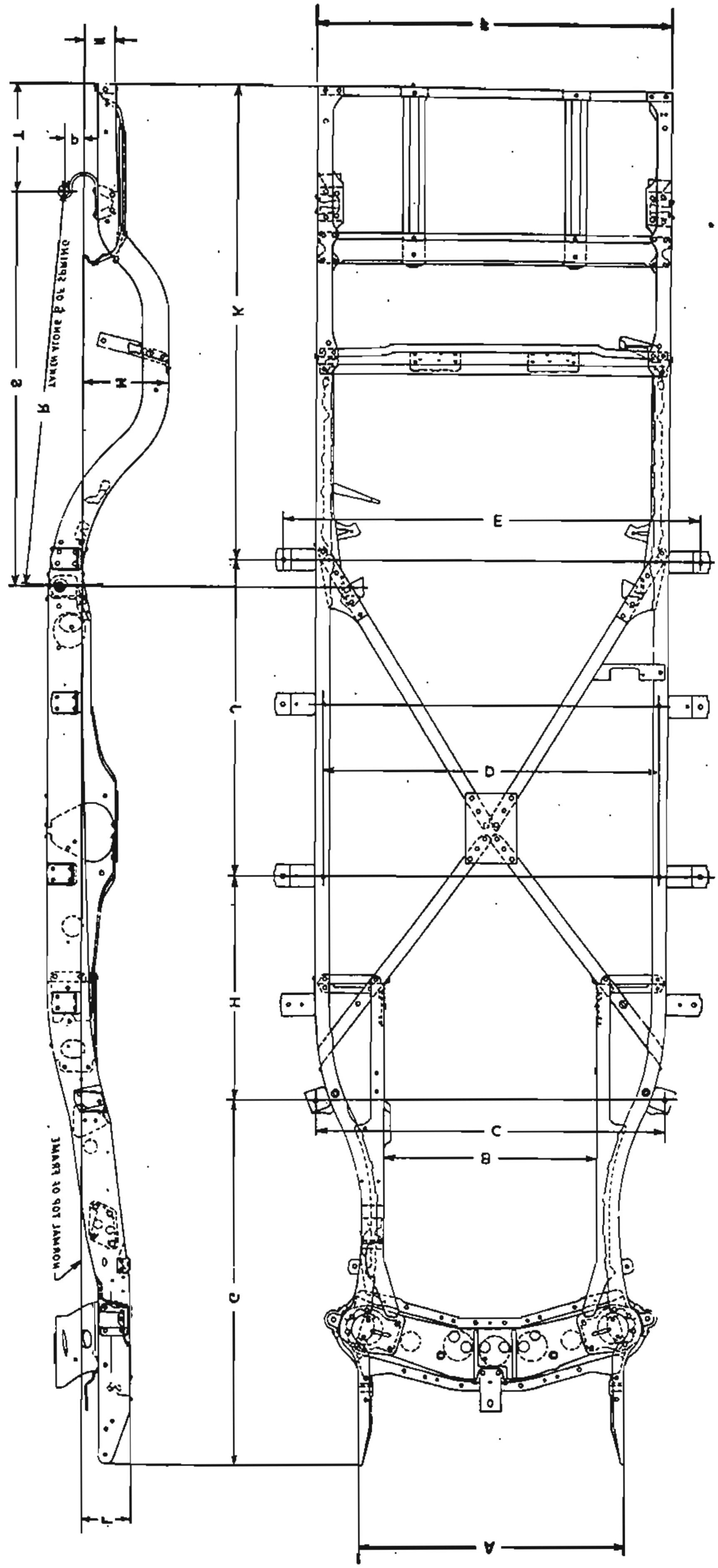
Conventional enclosed models absorb a good part of the road stresses through their body panels making heavy frame reinforcement unnecessary except for those models having an exceptionally long wheelbase. The additional weight of the long wheelbase models, along with the longer span of their side channels, makes it necessary to reinforce these frames heavily to counteract the resulting greater bending and twisting moments.

Convertibles need extra-heavily reinforced frames since they have fewer body panels capable of helping out with road stresses.

FRAME ALIGNMENT

A distorted frame is usually caused by collision. As many different makes and types of straightening equipment are available and many specialized problems are involved, full coverage of frame repair is beyond the scope of this manual. However, a few general notes apply to any Packard frame aligning job.

Local use of heat is usually necessary when realigning frames, but the temperature of the area heated should remain below 1200°F



The Frame Chart following includes frame checking dimensions for all 22nd Series models.

FRAME DIMENSIONS—22ND SERIES

DIMENSION	2201-02-11-32-40	2220-22	2206-33	2226	2213
A	36	36 1/16	36	36 1/16	36 1/8
B	29	29	29	29	29
C	47 9/16	47 5/8	47 9/16	47 5/8	55 3/8
D	45 3/4	45 3/4	45 3/4	45 3/4	45 3/4
E	56 7/8	56 15/16	56 7/8	56 15/16	56 15/16
F	48	48 1/16	48 1/16	48 1/16	48 1/16
G	43 3/16	43 1/4	50 3/16	50 1/4	50 5/16
H	30 3/4	30 3/4	30 3/4	30 3/4	30 3/4
J	43 15/16	64 15/16	43 15/16	54 15/16	72 15/16
K	64 3/4	64 3/4	64 3/4	64 3/4	74 3/4
L	6 9/16	6 9/16	6 9/16	6 9/16	5 3/16
M	11 5/8	11 5/8	11 5/8	11 5/8	10 3/16
N	4 1/2	4 1/2	4 1/2	4 1/2	3 1/16
P	2 5/16	2 9/16	2 5/16	2 9/16	4 1/2
R	53 15/16	53 15/16	53 15/16	53 15/16	53 15/16
S	53 7/8	53 7/8	53 7/8	53 7/8	53 7/8
T	14 5/8	14 5/8	14 5/8	14 5/8	24 5/8

(cherry red away from direct light). A greater temperature may weaken the member at this point and allow it to fail under normal loads.

Keep heat away from the rear spring shackle brackets as these members are tempered to perform a specific job important to rear suspension.

Replacing sheared or distorted rivets will sometimes introduce difficult rivet bucking problems. It is permissible to ream rivet holes to the next larger bolt size and to use S.A.E. thread bolts and nuts to replace rivets. If this is done, do not use lockwashers. Burr the bolt threads or peen them over to permanently lock the nut.

The "X" member is the basic "tie in" member of the frame structure, and is held in position for assembling by means of a heavy fixture. A new frame should be installed if this member cannot be straightened while still attached to the side channels or if it has been damaged beyond repair.

Lateral cross members may be replaced if necessary.

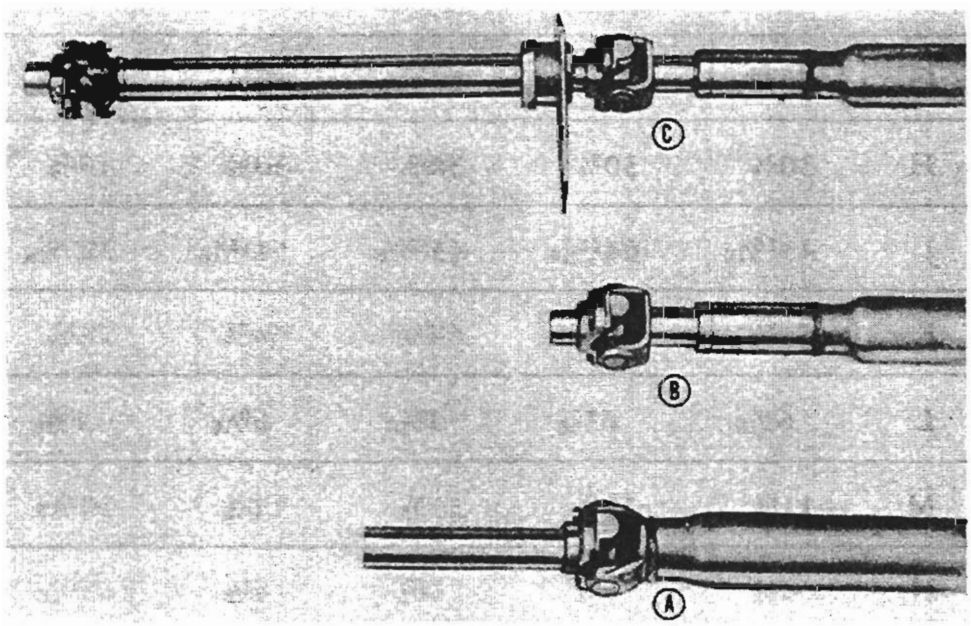


Fig. 27—Showing the Three Basic Types of Universal Joint and Propeller Shaft Assemblies.

UNIVERSAL JOINT AND PROPELLER SHAFT

GENERAL

Shaft assembly "A" (figure 27) shows a universal joint and propeller shaft assembly of the type used on 120-inch and 127-inch wheelbase vehicles without overdrive. This assembly incorporates

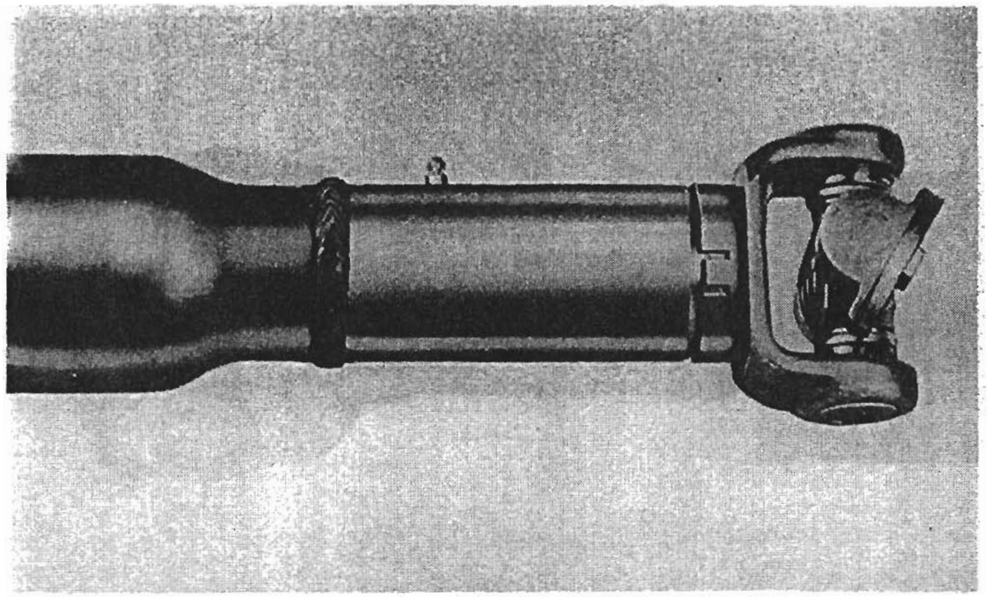


Fig. 28—The "Mechanics" Universal Joints Incorporate a Journal Cross, Two Round and Two Wing Type Bearing Retainers.

a single shaft with a universal joint at each end. The front universal joint is attached to the flange of an internally splined slip yoke which is free to move in a fore and aft direction on the externally splined transmission driving shaft.

Shaft assembly "B" (figure 27) shows a universal joint and shaft assembly of the type used on 120-inch and 127-inch wheelbase vehicles equipped with an overdrive. In this assembly, the shaft has a universal joint at its rearward end and a slip yoke and universal joint assembly at its forward end. The front universal joint is attached to a driving shaft flange which is not free to move on the overdrive main shaft, the fore and aft movememt of the propeller shaft being compensated for in the slip yoke. On overdrive equipped vehicles, the propeller shaft may be either a "Mechanics" or a "Spicer" shaft assembly.

Shaft assembly "C" (figure 27) illustrates the two-section propeller shaft, universal joint, and intermediate bearing assemblies used on long wheelbase vehicles. The rear shaft assembly is similar to that used on overdrive equipped vehicles in that shaft fore and aft travel is compensated for in the slip yoke assembly at the forward end of the shaft. The front shaft or "jackshaft" assembly incorporates a universal joint which attaches to the transmission (or overdrive, if so equipped) driving flange at the forward end. The rearward end of the shaft rotates in a ball bearing in the intermediate bearing and support assembly. The shaft is splined at the rear to accommodate a flange for attaching the universal joint and slip yoke of the rear shaft assembly.

All universal joints are of the needle roller bearing type. The "Mechanics" universal joints (figure 28) incorporate a journal

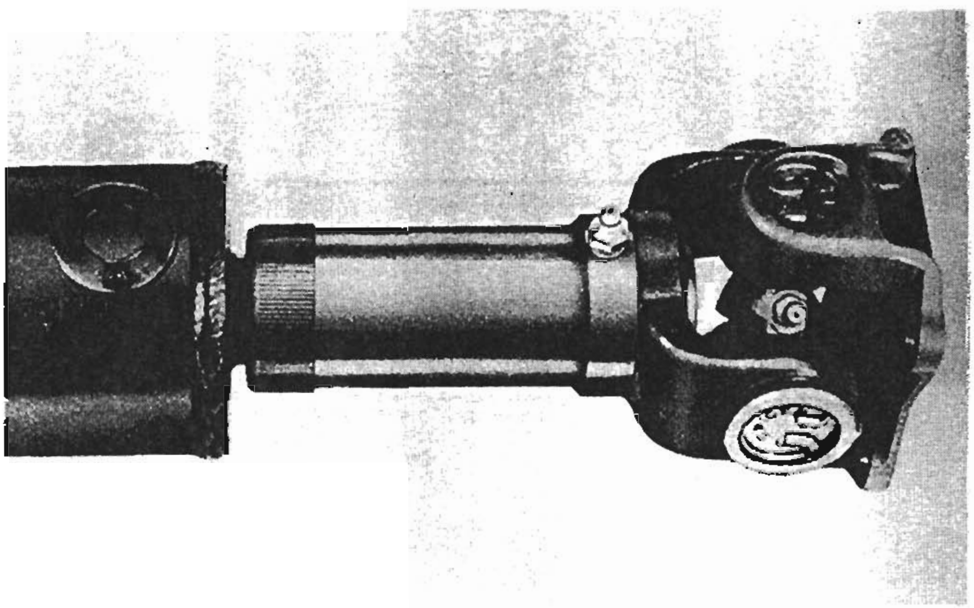


Fig. 29—The "Spicer" Universal Joint Consists of a Journal Cross and Four Round Type Bearing Retainers.

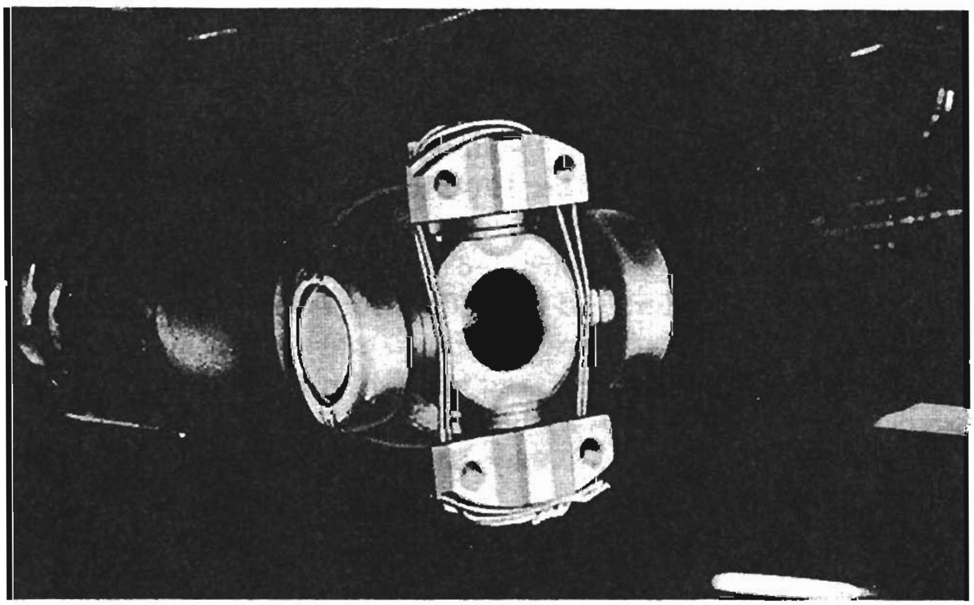


Fig. 30—Wire the Wing Type Bearings Together Before Removing the Assembly from the Car.

cross, two round type bearing retainers held in position by snap rings, and two flanged or wing type retainers. The "Spicer" joint (figure 29) consists of a journal cross and four round bearing retainers held in position by snap rings.

DISASSEMBLY

Wire the wing type bearing retainers together (figure 30), disengage the lockplate tabs, loosen the cap screws which hold the joint shaft assembly to the flanges at each end, and remove the assembly from the car.

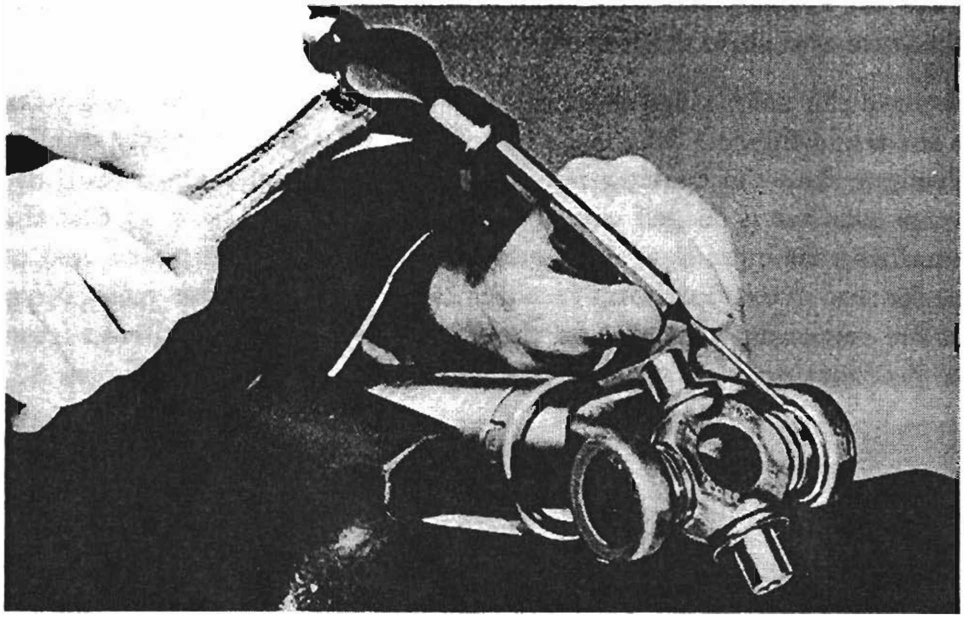


Fig. 31—Removing Snap Ring from Round Type Retainer (Mechanics Universal Joint Shown).

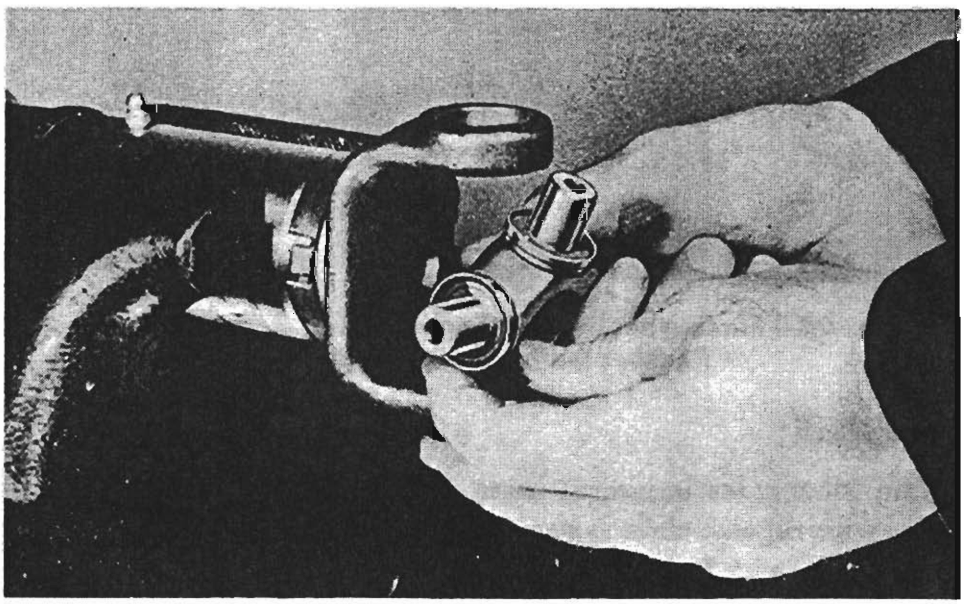


Fig. 32—After Removing Round Type Bearing Retainers, Lift Out the Journal Cross as Shown.

Wash the journal cross, the bearing retainers, and the needles in gasoline or kerosene and examine them carefully for wear, brinneling and flat surfaces. If the bearing surfaces or needles show the effects of considerable wear, it is best to discard the entire cross and bearing assembly and replace with new parts.

The Spicer type joint and shaft assembly is disassembled in the same way except that round type retainers are used exclusively. These are held in position by means of snap rings which may be removed with snap ring pliers, KMO-630.

If the car is equipped with overdrive, loosen the dust cap from the slip yoke and slide the slip yoke from the shaft.

Remove the snap rings from the two round retainers at each yoke as shown in figure 31. Using a soft, flat faced drift of slightly smaller diameter than the bearing retainer, tap the upper retainer until the lower retainer is forced out of the yoke. Turn the shaft so that the remaining retainer is at the bottom and tap on the exposed end of the journal cross until this retainer is forced out of the yoke. Now cut the retaining wire, slip off the wing type retainers (always from the bottom) and lift out each journal cross as shown in figure 32.

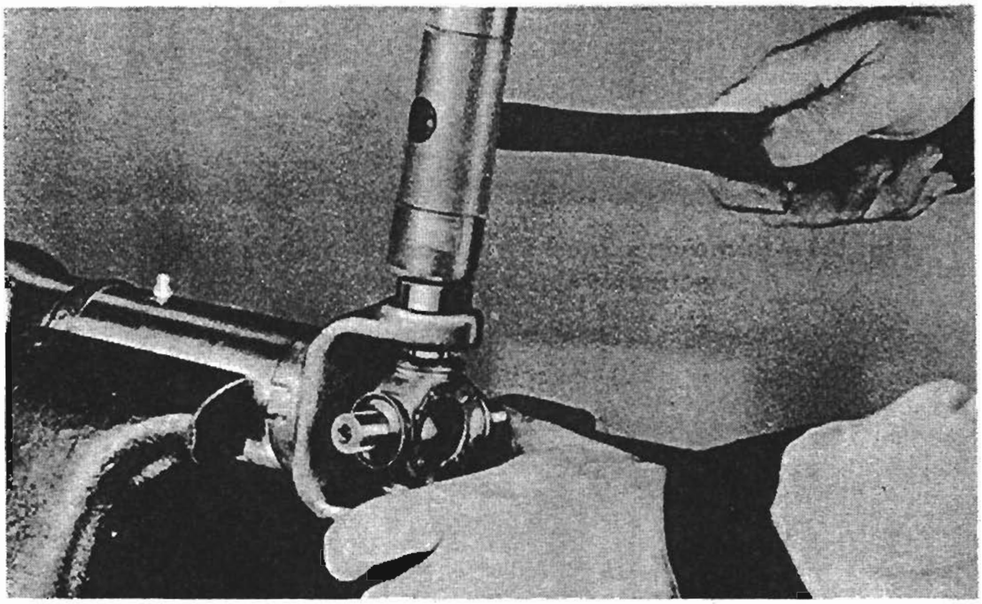


Fig. 33—Forcing the Round Type Bearing Retainers Into Position with a Soft Hammer.

ASSEMBLY

For the Mechanics universal joint, repack the needle bearing retainers with regular chassis pressure gun grease. (Spicer assemblies are provided with a fitting at the journal cross for lubrication.)

After inserting each journal cross in its yoke by reversing the disassembly procedure, force the round type retainers into position with a soft hammer (figure 33) or press in position with an arbor press. If the bearing will not force on fairly easily, check to see if a needle has dropped out of position, jamming at the cross journal. Install the snap rings and, if assembling a Mechanics type joint, slip on the wing type bearings and wire them in position as shown in figure 30. Now bolt the joint and shaft assembly to its mating flanges to complete the installation.

CAUTION

When assembling the slip yoke to the shaft it is necessary that the arrow on the slip yoke aligns with the arrow on the

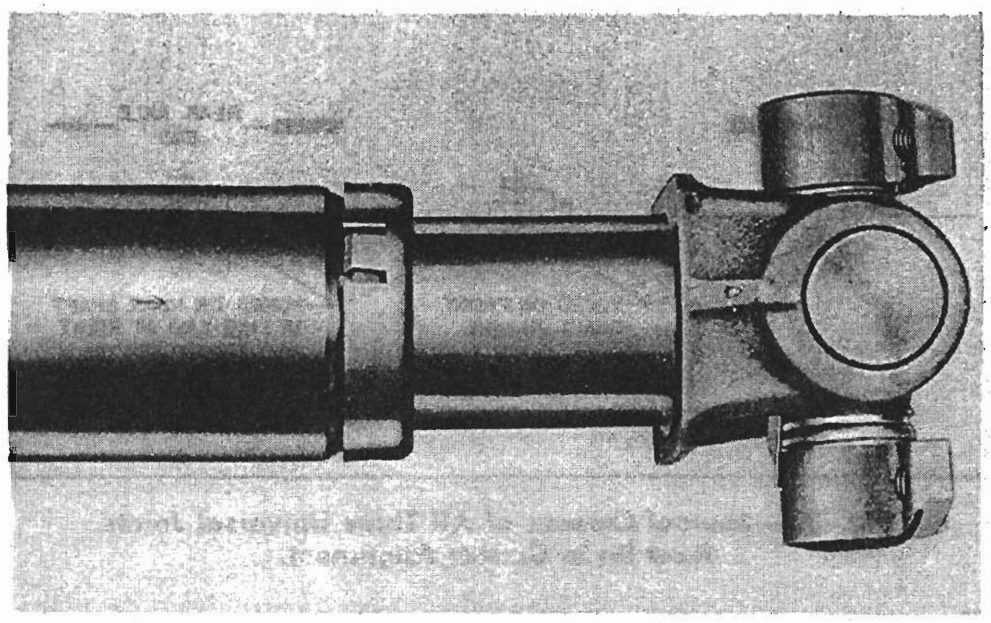


Fig. 34—Be Sure that the Arrow on the Slip Yoke Aligns with the Arrow on the Shaft.

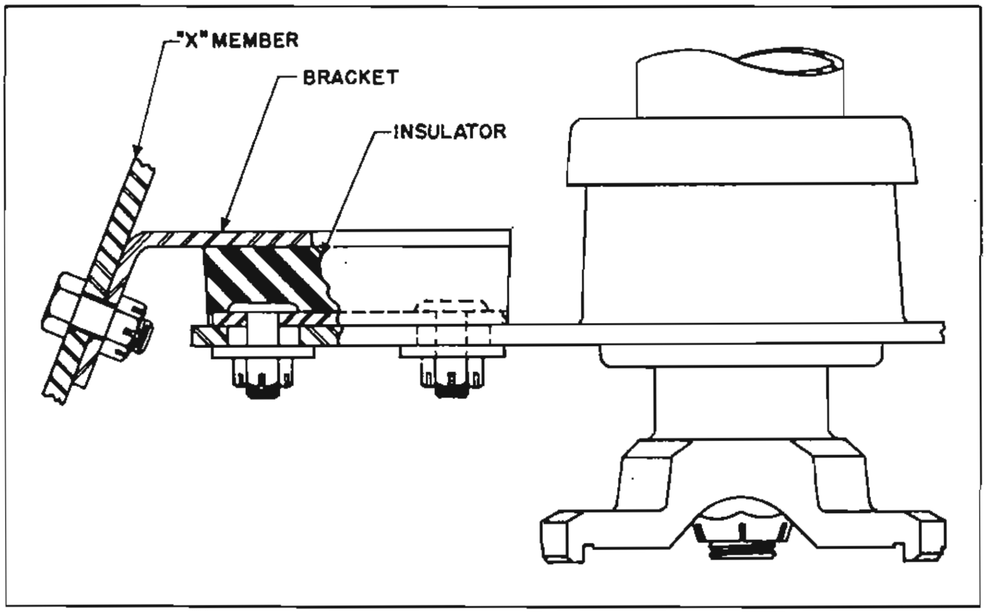


Fig. 35—Intermediate Bearing and Bracket Assembly Used in 21st Series Long Wheelbase Models.

shaft. See figure 34. When this is done the trunnions will be lined up properly and excessive vibration and malfunctioning of the assembly will be prevented.

INTERMEDIATE BEARING

Figure 35 shows the intermediate bearing and bracket assembly used on the 22nd Series seven-passenger sedan, limousine, hearse and ambulance.

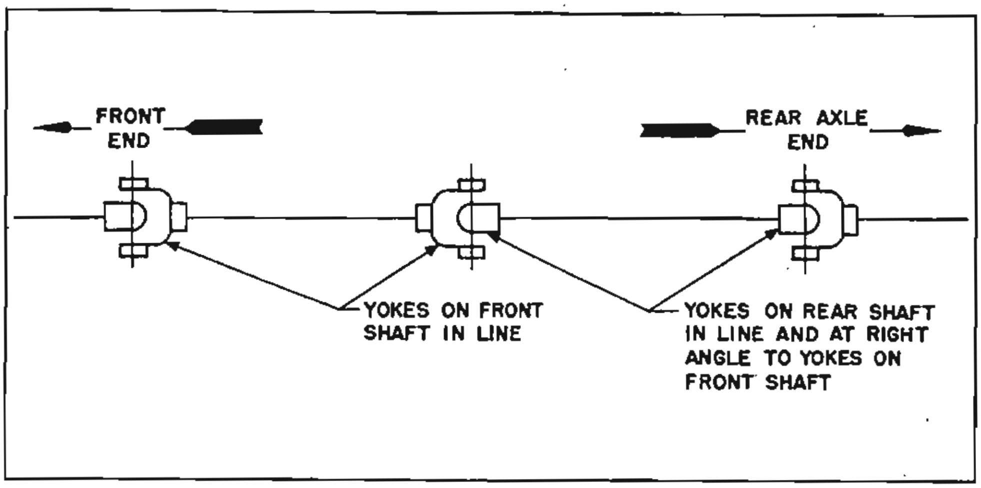


Fig. 36—Journal Crosses of All Three Universal Joints Must Be in Correct Alignment.

To replace the intermediate bearing in these long wheelbase models, remove the rear axle universal joint flange cap screws, those for the transmission universal joint flange, and the intermediate bearing bracket bolts. After this has been done, remove both front and rear propeller shafts and the intermediate bearing bracket from the car as an assembly.

Remove the intermediate universal joint. Take off the universal joint flange retaining nut at the rear of the forward shaft, slip off the flange and dust shield, and slide the intermediate bearing and bracket off the end of the shaft. Now press the bearing and its rubber retainer from the sleeve in the bracket and discard them. Inspect the condition of the rubber pads bonded to the rear of the bracket. If the bond has let go or if the pads have deteriorated badly discard the bracket and replace it with a new one.

To assemble the bearing, first lubricate the outside of the race or the inside of the retainer with brake fluid, then pull the synthetic rubber retainer over the race. Lubricate the outside of the retainer or the inside of the bracket sleeve with brake fluid and push the bearing and retainer into the sleeve of the bracket.

Slide the assembled bearing and bracket over the shaft splines into position, making sure that the race butts securely against the forward dust shield flange. Apply a thin but thorough coating of Lubriplate to the shaft splines and slip the flange on the shaft, using extreme care to line up the journal cross bearings with those in the forward universal joint.

Install the universal joints, the propeller shafts, and the intermediate bearing and bracket in the car, making sure that all three universal joints are in correct alignment. See figure 36. Be sure also that the intermediate bearing bracket is installed with the bearing above center, since spacing of the bolt holes is such that the bracket could

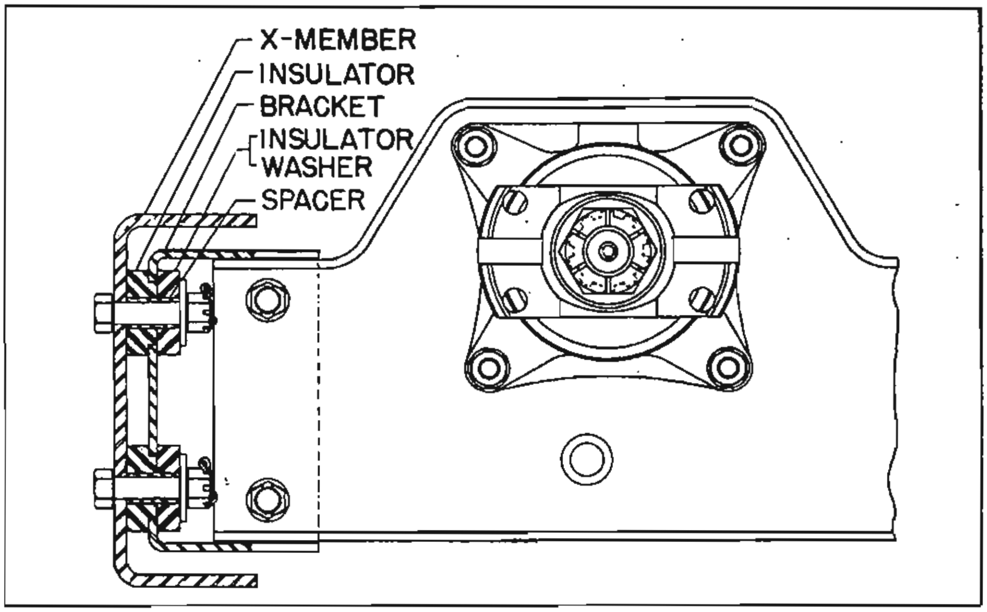


Fig. 37—Intermediate Bearing and Bracket Assembly Used in 22nd Series Long Wheelbase Models.

be installed upside down. Tighten all universal joint flange cap screws and take up snugly on the intermediate bracket bolts.

Raise the rear wheels off the floor and run the car in gear to check for shaft alignment. Adjust the bracket if necessary and when the shaft alignment is satisfactory, tighten the bracket bolts to the recommended torque. (See the torque chart at the back of this manual.)

With the exception of the bearing-bracket installation, disassembly, assembly, and installation procedures for 21st Series seven-passenger sedan, limousine, hearse and ambulance are similar to those previously outlined for 22nd Series long wheelbase models.

When installing the bearing and bracket assembly, first make sure that the rubber insulators and washers are centered around the spacers—then tighten the retaining nuts just enough to hold the metal flat washers securely against the inner end of the spacers. See figure 37. Overtightening the nuts will buckle the spacers and cause distortion of the rubber insulators. If the cotter pin openings in the bolt and nut do not line up after the nuts are properly set, either file down the seating face of the nut or try different nuts of the same size until the openings will take the cotter pin.

When the bracket is properly installed, the rubber insulators and rubber washers will be only slightly compressed and it should be possible to move the bracket up and down or sideways by hand. If any of the metal spacers are buckled, the rubber parts will be distorted thus destroying the "floating" principle and tending to set up a roughness or disturbance in the functioning of the propeller shaft assembly.

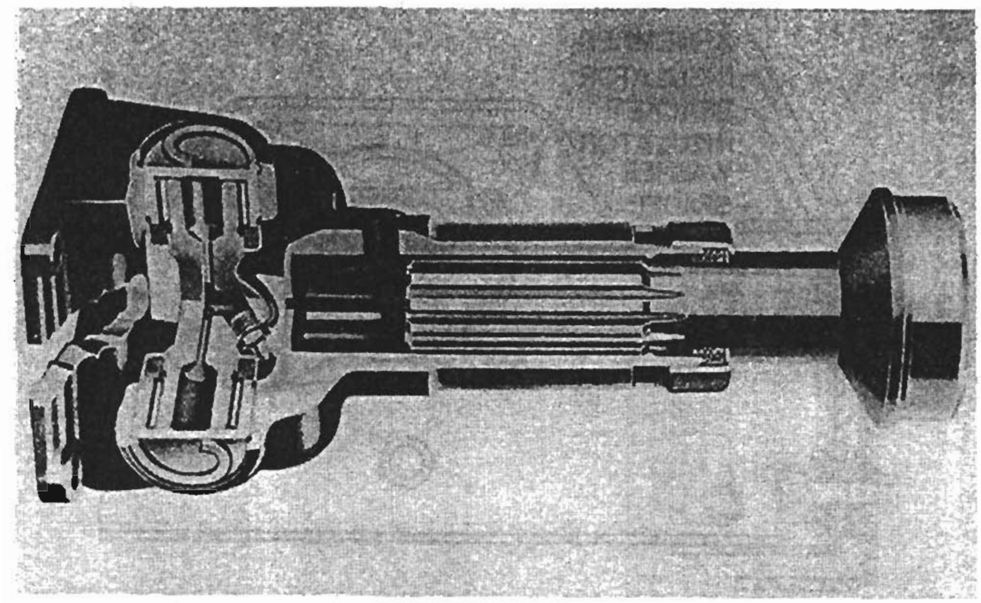


Fig. 38—Cutaway View of Spicer Universal Joint. Note Oil Reservoirs in Journal Cross.

TROUBLE SHOOTING

All universal joint and propeller shaft assemblies are inspected to a reasonable, specified static and dynamic out of balance tolerance before acceptance by the Factory. For this reason, if severe vibration is encountered, it is probably caused either by a damaged propeller shaft, worn needles, or worn or brinneled bearing surfaces. The latter failure usually results from lack of bearing lubricant.

To check for worn universal bearings, rock the propeller shaft by hand. Excessive bearing wear will show up readily by this method since only a few thousandths of an inch of backlash should be apparent if the bearings are in good condition.

LUBRICATION

It is recommended that Mechanics type universal joints be disassembled, inspected, and the bearings packed with regular chassis gun grease at intervals of 30,000 miles.

The Spicer universal joint bearing assemblies should be lubricated at 1000-mile intervals or whenever the chassis is lubricated. These assemblies are held in position by snap rings, and unlike the Mechanics universals, may be lubricated by means of an external fitting provided for this purpose. S.A.E. 140 oil is forced into the cross journal reservoirs through the fitting and oil channels (figure 38) at the time of chassis lubrication. These reservoirs feed their supply of oil to the needle bearings by means of centrifugal force.

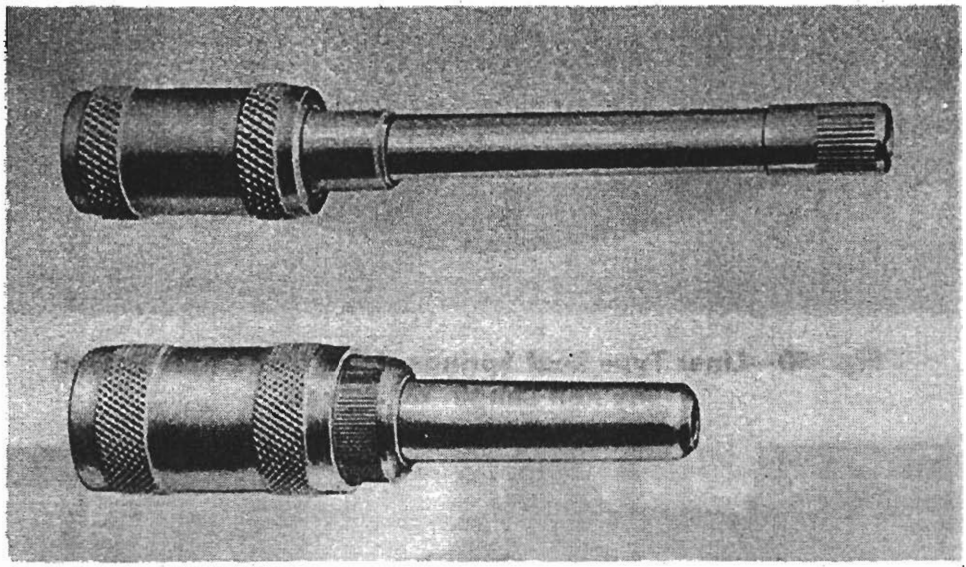


Fig. 39—Slender Nozzled Adaptors Are Required to Reach the Fitting in the Spicer Journal Cross.

CAUTION

> Chassis grease should never be used for lubrication of Spicer cross bearings. The high viscosity of this material would seriously hamper the centrifugal force feeding method used to lubricate the needle bearing assemblies and might result in their failure.

An adapter with a slender nozzle, similar to those shown in figure 39, is required to reach the fitting in the Spicer journal cross.

SPRINGS

LOAD AND RATE

The capacity or load of a helical or coil compression spring is the maximum static load it will support and still not deflect below the designed riding height. The *rate* of a helical or coil compression spring is the load necessary to compress it one inch. A coil spring has a constant rate, that is: if the rate happened to be 100 pounds per inch, 200 pounds would compress it two inches, 300 pounds, 3 inches, and so on.

In the Packard front suspension the spring rate is taken from the wheel and not directly from the spring itself. The difference in the distance from the wheel to the pivot and from the pivot to the springs sets up a mechanical advantage or leverage which multiplies the actual spring rate. The front spring rates in the parts list are therefore considerably lower than the true rates of the coil springs; however, the rates appearing in the parts list are the ones to consider when ordering replacement springs.

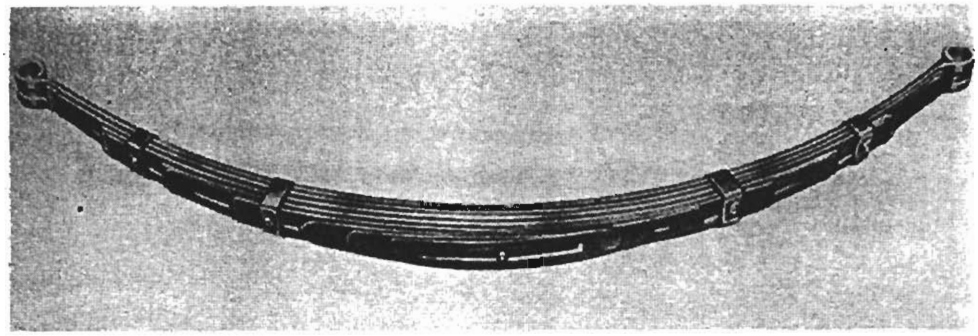


Fig. 40—Liner Type Leaf Springs. Note that Liners Extend the Full Length of Leaves.

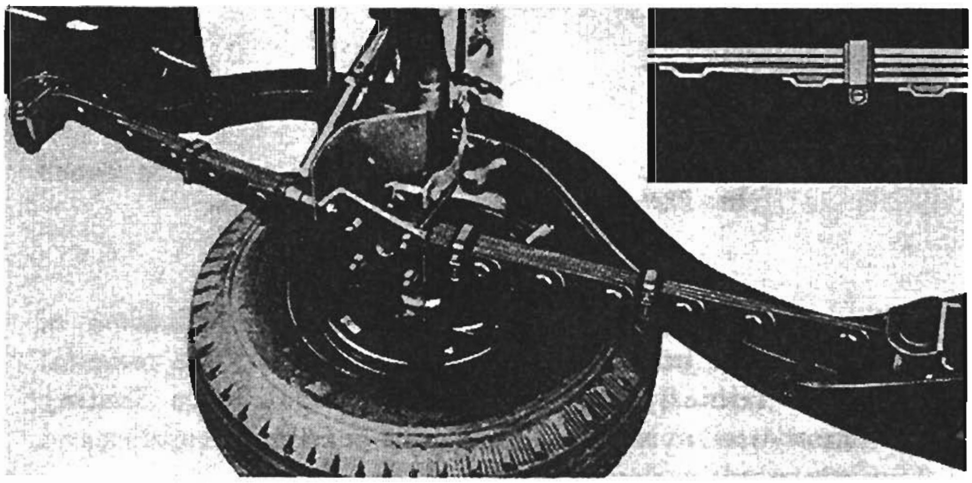


Fig. 41—Insert Type Leaf Springs. Note that Button Inserts Are Positioned at Ends of Leaves Only.

The load of a leaf spring is, like the coil spring, the maximum load it will support and still not deflect below the designed riding height.

The rate of an elliptical leaf spring, however, unlike the coil spring, is not constant. It builds up as the spring is depressed, so the rate of a leaf spring is defined as the load necessary to depress it the first inch below the designed riding height.

REAR SPRINGS

GENERAL

Packard rear springs are made of a manganese steel alloy and are of the semi-elliptical type. Spring steel brackets riveted to the frame and a rubber bushing and link arrangement combine to shackle the springs in position. U-bolts hold the rear axle tightly to the rear springs, the thrust and braking forces from the wheels being transmitted to the frame through the rear axle, springs, shackles, and the spring mounting brackets.

Two types of leaf separators are in service—the liner type and the button or insert type.

Figure 40 shows leaf springs with liner type separators installed. The liners are made of a paper board core wrapped in cloth and impregnated with wax.

Rubber, silenite, and antimony-lead alloy inserts separate the leaves in the button type leaf spring. See figure 41. The long upper leaves incorporate the rubber inserts, and operate with the lowest friction for light loads, while progressively heavier loads bring the shorter leaves and higher friction separators into operation.

LINER TYPE SPRINGS

The two upper liner tips will normally wear before the rest since the end travel distance is greater and the movement of the upper leaves is repeated more times than that of the other leaves. Rear spring liner insert kit, part number 410462, supplies liner inserts designed to replace the liner ends in the two upper spring leaves. The procedure recommended for this repair follows:

1. The following equipment is required.

   A liner kit (410462)

   A hardwood wedge

   A hacksaw blade

Make the hardwood wedge from a block 5 inches long, 1½ inch wide, and ¾ inch thick, then taper the end from ¾ inch to ⅛ inch along a length of about 2 inches. Grind down the back of the hacksaw blade at the forward end until it is about ¼ inch wide for a length of four inches.

2. Remove the spring clips.
3. Raise the rear end of the car until no load is on the springs.
4. Mark off the length of the liner tip on the top spring leaf, allowing the end to extend ½ inch beyond the end of the second leaf.
5. Spread the ends of the springs and, after placing a piece of sheet metal over the liner for its protection, pry the leaves apart where the replacement part is needed. Insert the wedge under the liner just beyond the point where the old liner is to be cut off. See figure 42.
6. With the hacksaw tool, saw off the worn section of the liner previously marked.
7. Place the new liner insert between the spring leaves with the tongue upward and with the metal tipped end extending beyond the end of the lower spring about ½ inch. Be sure that

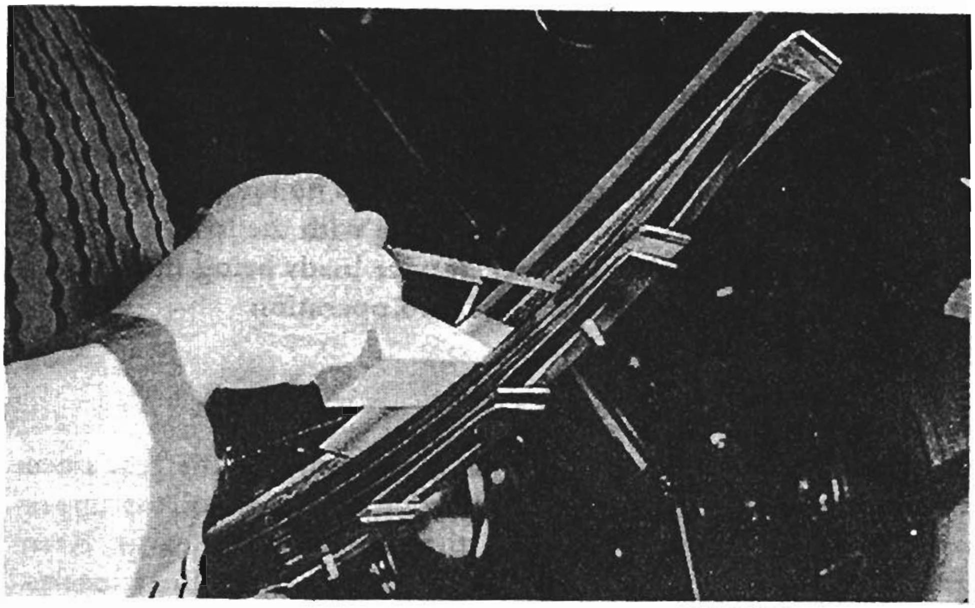


Fig. 42—Showing Wedging of Spring Leaves Just Prior to Sawing Off Worn Liner Tip.

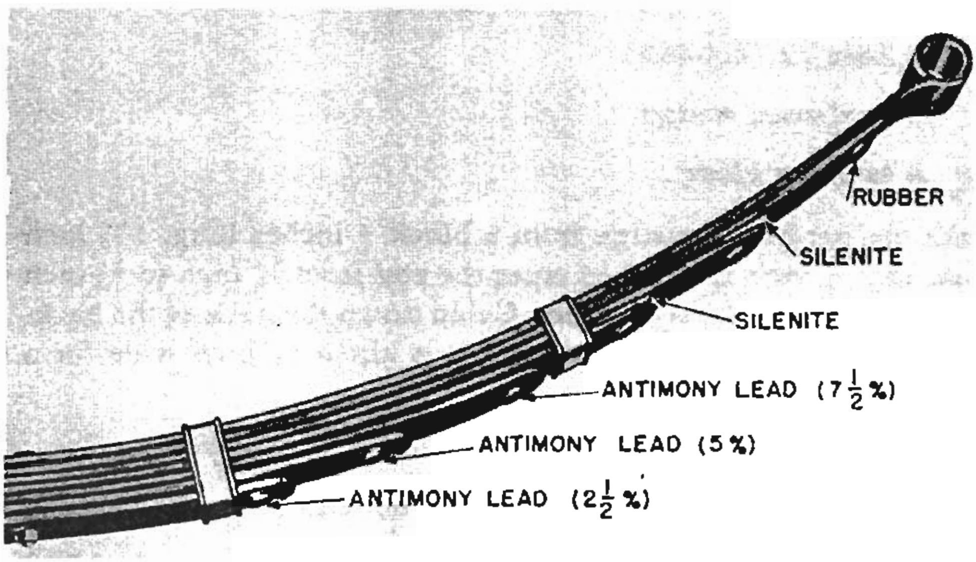


Fig. 43—Correct Placement of Button Inserts in Insert Type Leaf Spring.

the tongue and rubber button on the insert fit into the groove in the upper leaf, then remove the wedge and sheet metal carefully so that the new liner tip will remain in position.

INSERT TYPE SPRINGS

Figure 43 shows the correct locations of the button inserts in this type of leaf spring. A clearance of from 1/16 to a heavy 1/32 inch between leaf tips is considered satisfactory with the car standing at rest.

If annoying spring squeaks are apparent even though the leaves have adequate clearance, the trouble is probably caused by oxidation of the bearing surface of the antimony-lead inserts.

Fig. 44—Take the Insert Out of the Retainer After Removing the Retainer from Its Seat in the Leaf.

If replacement or clean-up of the inserts is necessary, raise the rear end of the car so that the wheels clear the floor, relieving the springs of the weight of the car. If the rubber and Silenite inserts have worn excessively as determined by the previous inspection, remove the spring clips, wedge the leaves apart for working space, and replace the worn inserts. To recondition the antimony-lead inserts, wedge the leaves apart, one end of each leaf at a time, and remove the insert and its retainer. Take the insert out of the retainer (figure 44) and remove the black oxide from the insert bearing surface with a file. Examine the retainer. If it is distorted or if the rubber seal is damaged, it should be replaced. Now fill the retainer with grease and reinstall the insert in the retainer. After filing the antimony-lead oxide from the bearing surface of the spring above, reinstall the insert and retainer and remove the wedge. Repeat this process until all inserts and spring bearing surfaces have been reconditioned.

REAR SPRING MAINTENANCE

If the main or upper leaf is damaged or broken it may be replaced. However, if any of the shorter leaves have failed it is advisable to install an entirely new spring assembly. The liner type spring may be used on either side in place of the insert type. It is not necessary to replace the rear spring assemblies in pairs as interchanging will not affect the ride.

Never spray the springs when lubricating the car because oil will deteriorate the liners, both rubber and Silenite inserts, and rubber insulated spring clamps.

RIDE

GENERAL

The "flat ride" experienced on Packard cars when the suspension system is functioning properly minimizes pitch, yaw, sway or "roll," and wheel bounce—the four major "ride" factors.

Pitching and bouncing tendencies are held to a minimum by use of the low friction coil springs at the front suspension and high friction leaf springs at the rear suspension. Both springing systems work in conjunction with the shock absorbers at each wheel. The difference in the amount of friction in the actions of the front and rear springs moves the "center of pitch" from the center of gravity (where it would normally be if the rate of oscillation of both springs were the same) back to a theoretical point far beyond the rear springs. Shock absorbers at each spring soften and retard the springing action and complete the wheel suspension.

Sway and yaw tendencies are minimized by a lateral or fifth shock absorber running from a point on the frame to a point on the opposite leaf spring at the rear, and by a roll control bar or stabilizer at the front suspension.

Sometimes a ride complaint is reported by an owner when the trouble may be something entirely different from ride, so it is always a good idea to take the owner along on a road test.

FRICTION LAG

Friction lag of the front and rear suspensions may be checked in the following manner:

Stick a piece of adhesive tape on both the front and the rear bumper and put a pencil reference mark on each piece of tape. Lift the car by the rear bumper by hand as high as is reasonably possible and slowly and gently lower it until it stops. (Try to make it remain as high as possible.) Now measure from the reference mark to the floor and record the measurement. Next, push the bumper down as far as possible and ease off gently. (Try to make it remain as low as possible.) Now measure this distance and subtract it from the first measurement. The difference is friction lag. Repeat this operation two or three times, checking for a consistant measurement, then do the same for the front end.

The ideal friction lag would be zero, but friction lag of about one inch is acceptable.

Before a car has been run approximately 3000 miles, the friction lag of the front suspension will vary because of "new car stiffness," but the rear end should show a low friction lag even at the time of delivery.

NEUTRALIZING THE REAR SUSPENSION

If there is more than one inch friction lag at the rear suspension, the trouble is probably either in the rubber suspension bushings or in the shock absorbers.

Loosen the rear spring shackles, the axle U-bolts, and the front eye bolts. Loosen the shock absorbers at the top and disconnect the bottom ends from the studs. This is a good time to check the front shock absorbers for low fluid level and air bubbles, and both front and rear shocks for smooth action.

NOTE

> Two direct acting airplane type hydraulic shock absorbers are used in the Packard rear suspension. Maintenance of rear shock absorbers consist of replacing leaking or damaged units with new units since their construction is such that they can neither be refilled nor repaired.

Connect the rear shock absorbers loosely and, while all the rubber bushings are loose at both suspensions and the U-bolts are loose, tighten the spring shackles and eye bolts. Draw them up tight so that the bolt shoulders seat on the brackets and make sure the springs are centered.

Next, tighten the U-bolts evenly being careful not to take them up tightly enough to bend the plates and throw the shock studs out of line.

Line up the shock studs by shifting the lower plate and, if necessary, bend the upper stud carefully with a piece of pipe.

Tighten the shock absorber studs being careful not to take them up too tightly since this is liable to put too much pressure on the rubber bushing and set up excessive friction lag.

Now check the friction lag again and, if within the required limits, road test the car as a final check.

TIRES

TIRE PRESSURE

Tires of the low pressure type are designed to function at the higher pressure build-up which will occur in both normal city driving and high speed driving. A pressure greater than that recommended should never be bled off until the tires have cooled to outside temperature.

Tires should be checked to the recommended cold pressure every week and the importance of this should be impressed upon the owner.

TIRE THUMP

Thumping tires are usually the result of one of the following conditions: incorrect tire installation or faulty manufacture. A good procedure to follow for checking for either condition is to inflate all tires to 55 pounds and drive the car on a smooth stretch of highway or street for a reasonable distance (about one city block). Then bleed one tire to recommended pressure and repeat the process, deflating one tire at a time until the thump has been localized.

If no thump is noticeable after all tires have been deflated to recommended pressure, the chances are that one or more tires were improperly installed and the tubes had not had a chance to seat properly.

CAUTION

> When installing tires, always inflate them to 55 pounds cold pressure, then bleed them back to the recommended pressure.

If the thump has been isolated to one or more tires by the above method, it means that a stiff spot has probably been molded in the carcass at manufacture and that it or they should be replaced.

TIGHTENING TORQUE SPECIFICATIONS

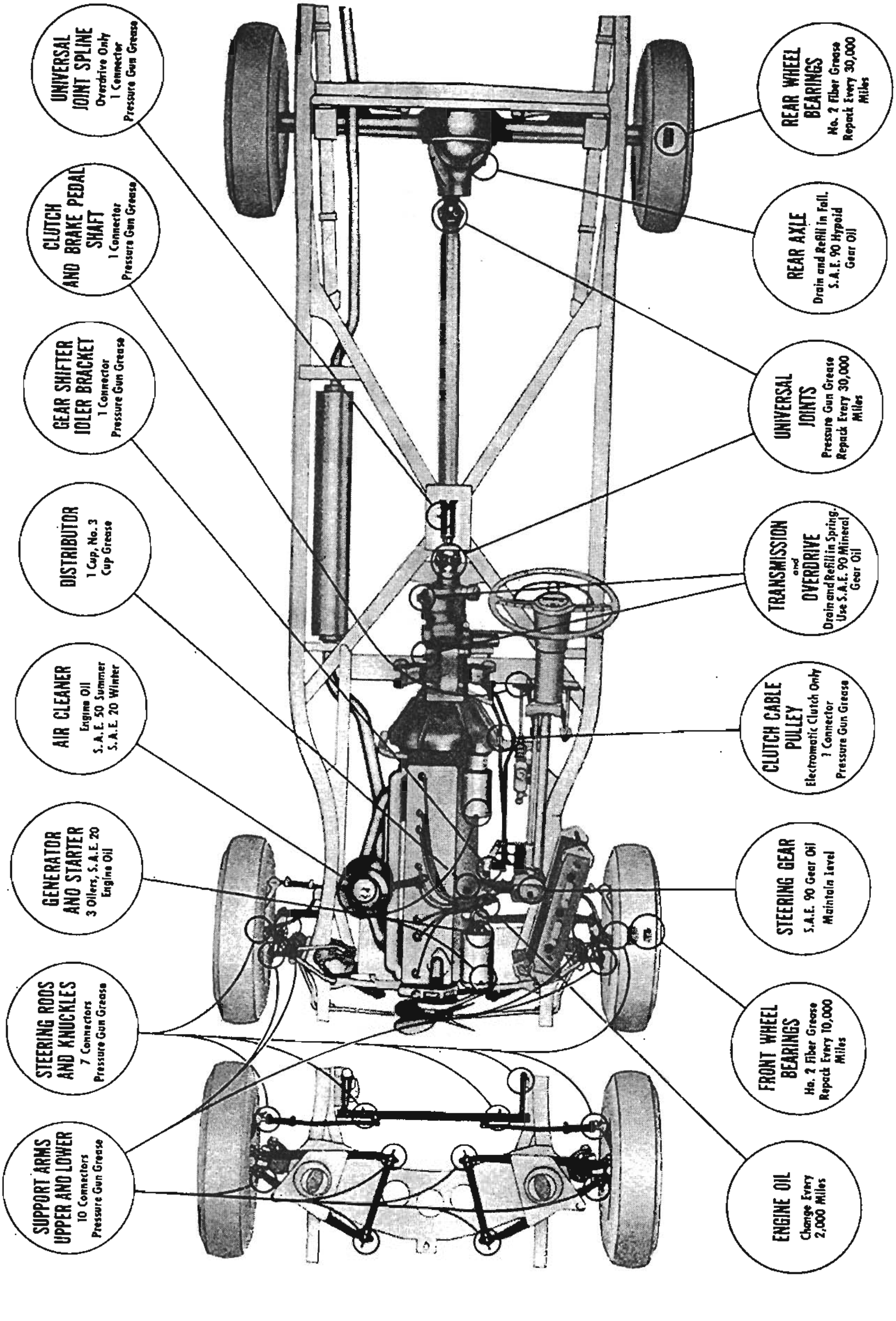
Function	Thread Size	Torque Lbs. Ft. Min.	Torque Lbs. Ft. Max.
BODY			
Body hold down bolt (hard top cars)...	3/8-16	12	15
Body hold down bolt (convertibles)....	3/8-16	20	23
BRAKES			
Cylinder screw........................	5/16-18	15	18
Equalizer lever link nut..............	3/8-24	25	30
Master cylinder screw.................	3/8-16	25	30
	3/8-24	25	30
	7/16-20	55	60
Master cylinder to pedal connecting rod nut................................	7/16-20	25	30
Rear wheel cable to support plate screw.	5/16-24	15	18
Shoe anchor pin nut...................	5/8-18	85	90
Support plate (front) screw nut........	1/2-20	65	75
Support plate (rear) screw nut.........	3/8-24	35	40
BUMPERS			
Assy. to frame bolt nut................	1/2-20	65	75
Guard to impact bar bolt (rear)........	3/8-24	25	30
Guard to impact bar bolt nut...........	1/2-20	65	75
Guard to impact bar screw.............	3/8-16	25	30
Impact bar bracket bolt...............	1/2-20	65	75
Impact bar carriage bolt..............	3/8-24	25	30
Impact bar panel bolt.................	1/4-28	7.5	8.5
Support to impact bar bolt (front)......	1/2-20	65	75
Support to frame bracket bolt (rear)....	3/8-24	25	30
EXHAUST			
Muffler and outlet tube support bolt....	5/16-18	12	15
Muffler outlet tube support assy. bolt nut	5/16-24	12	15
Muffler support "U" bolt...............	5/16-18	12	15
Pipe to manifold screw................	3/8-24	25	30
Pipe to manifold screw................	3/8-16	18	20
Pipe to flywheel housing support bolt...	3/8-16	25	30
Pipe to flywheel housing bracket bolt nut................................	5/16-24	15	18

TIGHTENING TORQUE SPECIFICATIONS

(Continued)

Function	Thread Size	Torque Lbs. Ft. Min.	Torque Lbs. Ft. Max.
REAR SHOCK ABSORBER			
Lock nut and stud nut	½-20	65	75
REAR SPRING			
Bushing bolt and shackle locknut	½-20	65	75
Bushing bolt and shackle locknut	9/16-18	70	75
STABILIZER			
Assy. front to frame bolt	7/16-20	55	60
Tube assy. (lateral) to rear axle nut	½-20	65	70
UNIVERSAL JOINT			
Shaft assembly screw	5/16-24	18	22
Shaft trunnion bearing bracket	¾-16	200	225
Support bolt nut	⅜-24	25	30
Shaft trunnion bearing bracket support bolt nut	5/16-24	15	18
WHEELS			
Wheel bolts	9/16-18	85	95

LUBRICATION DIAGRAM



CHASSIS SPECIFICATIONS

21st SERIES

SIX • EIGHT • SUPER EIGHT

22nd SERIES

EIGHT • SUPER EIGHT • CUSTOM EIGHT

CHASSIS SPECIFICATIONS—21st SERIES

MODELS	SIX 2100	EIGHT 2101-2111	SUPER EIGHT 2103-2106
BRAKES			
Type	Hydraulic—2 Shoe	Hydraulic—2 Shoe	Hydraulic—2 Shoe
Effective Area	165 sq. in.	171.5 sq. in.	208.25 sq. in.
Effective Area Hand Brake	79.25 sq. in.	85.75 sq. in.	98 sq. in.
Drum Diameter—Front	12″ Centrifuse	12″ Centrifuse	12″ Centrifuse
Drum Diameter—Rear	11″ Centrifuse	12″ Centrifuse	12″ Centrifuse
Lining Size and Material			
Primary—Marshall 2201H-8			
Front	1¾″ x $\frac{3}{16}$″ x 11½″	1¾″ x $\frac{3}{16}$″ x 11½″	2¼″ x $\frac{3}{16}$″ x 11½″
Rear	1¾″ x $\frac{3}{16}$″ x 10⅝″	1¾″ x $\frac{3}{16}$″ x 11½″	2″ x $\frac{3}{16}$″ x 11½″
Secondary—Marshall B-50			
Front	1¾″ x $\frac{3}{16}$″ x 13″	1¾″ x $\frac{3}{16}$″ x 13″	2¼″ x $\frac{3}{16}$″ x 13″
Rear	1¾″ x $\frac{3}{16}$″ x 12″	1¾″ x $\frac{3}{16}$″ x 13″	2″ x $\frac{3}{16}$″ x 13″
FRAME			
Type	Taper Pressed Steel Double Drop. Side Rail Box Sectioned at Front and Rear	Taper Pressed Steel Double Drop. Side Rail Box Sectioned at Front and Rear	Taper Pressed Steel Double Drop. Side Rail Box Sectioned at Front and Rear
Thickness	⅛″	⅛″	$\frac{9}{64}$″
Cross Members	Five Channel X-Type in Center	Five Channel X-Type in Center	Five Channel X-Type in Center

CHASSIS SPECIFICATIONS—21st SERIES (Continued)

MODELS	SIX 2100	EIGHT 2101-2111	SUPER EIGHT 2103-2106
GASOLINE SYSTEM			
Carburetor—Make and Size	Carter WAI-530-S Downdraft 1¼" Single Barrel	Carter WDO-512-S Downdraft 1¼" Duplex	Carter WDO-531-S Downdraft 1¼" Duplex
Gasoline Feed	Mechanical Pump	Mechanical Pump	Mechanical Pump
Pump Drive	Off Camshaft	Off Camshaft	Off Camshaft
Gasoline Filter	Incorporated in Fuel Pump	Incorporated in Fuel Pump	Incorporated in Fuel Pump
Gasoline Gauge	Electric	Electric	Electric
Gasoline Tank Capacity	17 gal.	17 gal.	20 gal.
Air Cleaner and Silencer	Oil Coated Mesh Std. Oil Bath Special Equipment	Oil Coated Mesh Std. Oil Bath Special Equipment	Oil Bath Standard Equipment
Carburetor Heat Control	Thermostatic	Thermostatic	Thermostatic
Automatic Choke	Thermostatically Controlled	Thermostatically Controlled	Thermostatically Controlled
Carburetor Fuel Level	3/8" Below Top of Bowl	5/32" Below Top of Bowl	5/32" Below Top of Bowl
CHASSIS LUBRICATION			
Every 1000 to 2000 Miles			
Knuckle Pins—Pressure Gun Grease	2 Lub. Connectors	2 Lub. Connectors	2 Lub. Connectors
Steering Connecting Rod—Pressure Gun Grease	2 Lub. Connectors	2 Lub. Connectors	2 Lub. Connectors
Steering Tie Rods—Pressure Gun Grease	2 Lub. Connectors	2 Lub. Connectors	2 Lub. Connectors
Universal Joint Spline Gun Grease—Overdrive Only	1 Lub. Connector	1 Lub. Connector	1 Lub. Connector
Generator—20W	2 Oilers	2 Oilers	2 Oilers

CHASSIS SPECIFICATIONS—21st SERIES (Continued)

MODELS	SIX 2100	EIGHT 2101-2111	SUPER EIGHT 2103-2106
CHASSIS LUBRICATION—Continued			
Starter Motor—20W	1 Oiler	1 Oiler	2 Oilers
Distributor—No. 3 Cup Grease	1 Cup	1 Cup	1 Cup
Clutch and Brake Pedal—Pressure Gun Grease	1 Lub. Connector	1 Lub. Connector	1 Lub. Connector
Gear Shift Idler Levers Bracket—Gun Grease	1 Lub. Connector	1 Lub. Connector	1 Lub. Connector
Steering Idler Lever—Gun Grease	1 Lub. Connector	1 Lub. Connector	1 Lub. Connector
Support Arm Pin, Inner—Gun Grease	4 Lub. Connectors	4 Lub. Connectors	4 Lub. Connectors
Support Arm Pin, Outer—Gun Grease	2 Lub. Connectors	2 Lub. Connectors	2 Lub. Connectors
Wheel Support Pin Upper—Gun Grease	4 Lub. Connectors	4 Lub. Connectors	4 Lub. Connectors
Every 10,000 Miles			
Front Wheel Bearing—Fibre Grease	Repack 2 oz. per Wheel	Repack 2 oz. per Wheel	Repack 2 oz. per Wheel
Every 30,000 Miles			
Rear Wheel Bearing—Fibre Grease	Repack 2 oz. per Wheel	Repack 2 oz. per Wheel	Repack 2 oz. per Wheel
Universal Joints—Gun Grease	Repack	Repack	Repack
SPRINGS			
Front—6 Pass. Sedan	1740 x 76 Coil	1890 x 81 Coil	2030 x 90 Coil
Rear—6 Pass. Sedan	870 x 105 Leaf	870 x 105 Leaf	980 x 110 Leaf
Front Size	5.58 OD, 4¼ ID	5.61 OD, 4¼ ID	5.65 OD, 4¼ ID
Number of Coils—Effective	9.10	9.35	9.33

CHASSIS SPECIFICATIONS—21st SERIES (Continued)

MODELS	SIX 2100	EIGHT 2101-2111	SUPER EIGHT 2103-2106
SPRINGS—Continued			
Rear Length and Width	54⅜" x 2"	54⅜" x 2"	54⅜" x 2"
Shackles	Rubber Mounted	Rubber Mounted	Rubber Mounted
Spring Covers	No	No	No
Shock Absorbers—Front	Hydraulic Two-Way	Hydraulic Two-Way	Hydraulic Two-Way
Shock Absorbers—Rear	Hydraulic Direct Acting	Hydraulic Direct Acting	Hydraulic Direct Acting
Stabilizer—Front	Torsional	Torsional	Torsional
Stabilizer—Rear	Hydraulic Direct Acting	Hydraulic Direct Acting	Hydraulic Direct Acting
Spring Material—Front and Rear	Silico-Manganese	Silico-Manganese	Silico-Manganese
WHEELS			
Type	Demountable Disc	Demountable Disc	Demountable Disc
Size of Tire	15 x 6.50—4 Ply	15 x 6.50—4 Ply	15 x 7.00—4 Ply
Recommended Tire Pressure (Warm)—Front	26 lb.	28 lb.	28 lb.
Recommended Tire Pressure (Warm)—Rear	28 lb.	28 lb.	28 lb.

CAR DIMENSIONS	2100	2101-2111	2103	2123-2126	2106
Wheelbase	120"	120"	127"	148"	127"
Overall Length Bumper to Bumper	208½"	208½"	215½"	236½"	215½"
Overall Height Loaded	63½"	63½"	64"		64"
Overall Width	76⅛"	76⅛"	76⅛"	76⅛"	76⅛"

CHASSIS SPECIFICATIONS—22nd SERIES

MODELS	EIGHT 2201-2211	SUPER EIGHT 2202-2232	CUSTOM EIGHT 2206-2233
BRAKES			
Type	Hydraulic—2 Shoe	Hydraulic—2 Shoe	Hydraulic—2 Shoe
Effective Area	171.5 sq. in.	171.5 sq. in.	208.25 sq. in.
Effective Area Hand Brake	85.75 sq. in.	85.75 sq. in.	98 sq. in.
Drum Diameter—Front	12″ Centrifuse	12″ Centrifuse	12″ Centrifuse
Drum Diameter—Rear	12″ Centrifuse	12″ Centrifuse	12″ Centrifuse
Lining Size and Material			
Primary—Marshall 2201H-8			
Front	$1\frac{3}{4}$″ x $\frac{3}{16}$″ x $11\frac{1}{2}$″	$1\frac{3}{4}$″ x $\frac{3}{16}$″ x $11\frac{1}{2}$″	$2\frac{1}{4}$″ x $\frac{3}{16}$″ x $11\frac{1}{2}$″
Rear	$1\frac{3}{4}$″ x $\frac{3}{16}$″ x $11\frac{1}{2}$″	$1\frac{3}{4}$″ x $\frac{3}{16}$″ x $11\frac{1}{2}$″	2″ x $\frac{3}{16}$″ x $11\frac{1}{2}$″
Secondary—Marshall B-50			
Front	$1\frac{3}{4}$″ x $\frac{3}{16}$″ x 13″	$1\frac{3}{4}$″ x $\frac{3}{16}$″ x 13″	$2\frac{1}{4}$″ x $\frac{3}{16}$″ x 13″
Rear	$1\frac{3}{4}$″ x $\frac{3}{16}$″ x 13″	$1\frac{3}{4}$″ x $\frac{3}{16}$″ x 13″	2″ x $\frac{3}{16}$″ x 13″
Wheel Cylinder Size—Front	$1\frac{1}{16}$″	$1\frac{1}{16}$″	1″
Wheel Cylinder Size—Rear	$\frac{15}{16}$″	$\frac{15}{16}$″	$\frac{15}{16}$″
FRAME			
Type	Taper Pressed Steel Double Drop Side Rail Box Sectioned at Front and Rear	Taper Pressed Steel Double Drop Side Rail Box Sectioned at Front and Rear	Taper Pressed Steel Double Drop Side Rail Box Sectioned at Front and Rear
Thickness	$\frac{1}{8}$″	$\frac{1}{8}$″	$\frac{9}{64}$″

CHASSIS SPECIFICATIONS—22nd SERIES (Continued)

MODELS	EIGHT 2201-2211	SUPER EIGHT 2202-2232	CUSTOM EIGHT 2206-2233
FRAME—(Continued			
Cross Members	Five Channel X-Type in Center	Five Channel X-Type in Center 2232 Specially Reinforced	Five Channel X-Type in Center 2233 Specially Reinforced
GASOLINE SYSTEM			
Carburetor—Make and Type	Carter WDO-644-S Down-draft 1¼" Duplex	Carter WDO-643-S Down-draft 1¼" Duplex	Carter WDO-531-S Down-draft 1¼" Duplex
Gasoline Feed	Mechanical Pump	Mechanical Pump	Mechanical Pump
Pump Drive	Off Camshaft	Off Camshaft	Off Camshaft
Gasoline Filter	Incorporated in Fuel Pump	Incorporated in Fuel Pump	Incorporated in Fuel Pump
Gasoline Gauge	Electric	Electric	Electric
Gasoline Tank Capacity	17 gal.	20 gal.	20 gal.
Air Cleaner and Silencer	Oil Coated Mesh Standard Oil Bath Special Equipment	Oil Coated Mesh Standard Oil Bath Special Equipment	Oil Bath Standard Equipment
Carburetor Heat Control	Thermostatic	Thermostatic	Thermostatic
Automatic Choke	Thermostatically Controlled	Thermostatically Controlled	Thermostatically Controlled
Carburetor Fuel Level	$\frac{5}{32}$" Below Top of Bowl	$\frac{5}{32}$" Below Top of Bowl	$\frac{5}{32}$" Below Top of Bowl
CHASSIS LUBRICATION			
Every 1000 to 2000 Miles			
Knuckle Pins—Pressure Gun Grease	2 Lub. Connectors	2 Lub. Connectors	2 Lub. Connectors
Steering Connecting Rod—Pressure Gun Grease	2 Lub. Connectors	2 Lub. Connectors	2 Lub. Connectors

CHASSIS SPECIFICATIONS—22nd SERIES (Continued)

MODELS	EIGHT 2201-2211	SUPER EIGHT 2202-2232	CUSTOM EIGHT 2206-2233
CHASSIS LUBRICATION—Continued			
Steering Tie Rods—Pressure Gun Grease..	2 Lub. Connectors	2 Lub. Connectors	2 Lub. Connectors
Universal Joint Spline (Overdrive Only) —Gun Grease........................	1 Lub. Connector	1 Lub. Connector	1 Lub. Connector
Generator—20W........................	2 Oilers	2 Oilers	2 Oilers
Starter Motor—20W....................	1 Oiler	1 Oiler	2 Oilers
Distributor—No. 3 Cup Grease...........	1 Cup	1 Cup	1 Cup
Clutch and Brake Pedal—Pressure Gun Grease..............................	1 Lub. Connector	1 Lub. Connector	1 Lub. Connector
Clutch Cable Pulley (Electromatic Only) —Gun Grease........................	1 Lub. Connector	1 Lub. Connector	1 Lub. Connector
Gear Shift Idler Levers Bracket—Gun Grease..............................	1 Lub. Connector	1 Lub. Connector	1 Lub. Connector
Steering Idler Lever—Gun Grease........	1 Lub. Connector	1 Lub. Connector	1 Lub. Connector
Support Arm Pin, Inner—Gun Grease...	4 Lub. Connectors	4 Lub. Connectors	4 Lub. Connectors
Support Arm Pin, Outer—Gun Grease...	2 Lub. Connectors	2 Lub. Connectors	2 Lub. Connectors
Wheel Support Pin Upper—Gun Grease...	4 Lub. Connectors	4 Lub. Connectors	4 Lub. Connectors
Every 10,000 Miles			
Front Wheel Bearing—Fiber Grease......	Repack 2 oz. per Wheel	Repack 2 oz. per Wheel	Repack 2 oz. per Wheel
Every 30,000 Miles			
Rear Wheel Bearing—Fiber Grease.......	Repack 2 oz. per Wheel	Repack 2 oz. per Wheel	Repack 2 oz. per Wheel
Universal Joints—Gun Grease............	Repack	Repack	Repack

CHASSIS SPECIFICATIONS—22nd SERIES (Continued)

MODELS	EIGHT 2201-2211	SUPER EIGHT 2202-2232	CUSTOM EIGHT 2206-2233
SPRINGS			
Front Size	5.65″ OD, 4.25″ ID	5.65″ OD, 4.25″ ID	5.68″ OD, 4.25″ ID
Rear Length and Width	54⅜″ x 2″	54⅜″ x 2″	54⅜″ x 2″
Shackles	Rubber Mounted	Rubber Mounted	Rubber Mounted
Shock Absorbers—Front	Hydraulic Two-Way	Hydraulic Two-Way	Hydraulic Two-Way
Shock Absorbers—Rear	Hydraulic Direct-Acting	Hydraulic Direct-Acting	Hydraulic Direct-Acting
Stabilizer—Front	Torsional	Torsional	Torsional
Stabilizer—Rear	Hydraulic Direct-Acting	Hydraulic Direct-Acting	Hydraulic Direct-Acting
Spring Material—Front and Rear	Silico-Manganese	Silico-Manganese	Silico-Manganese
WHEELS			
Type	Demountable Disc	Demountable Disc	Demountable Disc
Size of Tire	16 x 6.50—4 Ply 15 x 7.00—4 Ply for Station Sedan	15 x 7.00—4 Ply	15 x 7.00—4 Ply 16 x 7.00—4 Ply for 2233
Recommended Tire Pressure (Cold) Front	28 lb. 26 lb. Station Sedan	26 lb.	28 lb. 26 lb. for 2233
Recommended Tire Pressure (Cold) Rear	28 lb. 26 lb. Station Sedan	26 lb.	28 lb. 26 lb. for 2233

CHASSIS SPECIFICATIONS—22nd Series (Continued)

MODELS	EIGHT 2201-2211	SUPER EIGHT 2202-2232	CUSTOM EIGHT 2206-2233
CAR DIMENSIONS			
Wheelbase	120″	120″	127″
Overall Length—Bumper to Bumper	204$\frac{5}{8}$″	204$\frac{5}{8}$″	212$\frac{5}{8}$″
Overall Height Loaded	64$\frac{1}{16}$″—6-Pass. Sedan	64$\frac{1}{16}$″—6-Pass. Sedan	64$\frac{3}{32}$″—6-Pass. Sedan
Overall Height Loaded	64$\frac{5}{16}$″—Club Sedan	64$\frac{5}{16}$″—Club Sedan	64$\frac{11}{32}$″—Club Sedan
Overall Height Loaded	64$\frac{5}{32}$″—Station Sedan	63″—Convertible	63$\frac{1}{2}$″—Convertible
Overall Width	77$\frac{15}{32}$″	77$\frac{15}{32}$″	77$\frac{15}{32}$″