SECTION IV
BRAKES

Description

SERVICE BRAKES—The Packard service brakes (see Fig. 1) are of the servo or self-energizing type and are hydraulically operated. The principle of hydraulic brake operation is based upon Pascal's law of physics which states that: "Pressure applied to a confined body of liquid is transmitted equally and undiminished in all directions throughout the liquid." Therefore, foot pressure applied to the brake pedal is transmitted to each wheel equally, and all four brakes are applied with equal force.

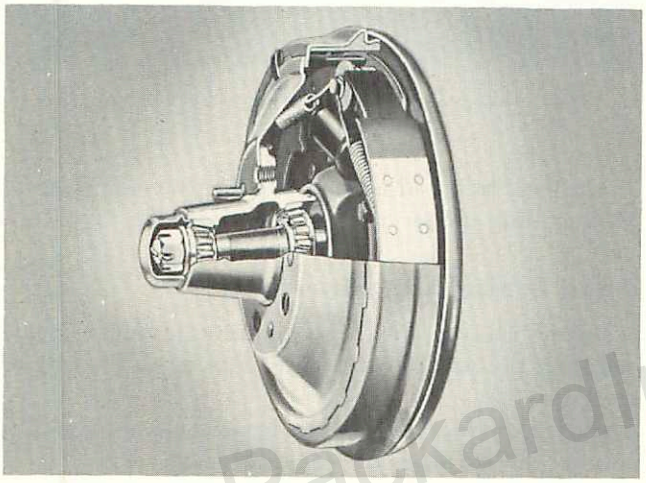

Figure 1—Cutaway View of the Packard Service Brake

Foot pressure applied to the brake pedal forces fluid from the master cylinder through the lines to each wheel assembly. The fluid displaces the pistons in the wheel cylinder which in turn move the brake shoes out in contact with the drum. When the brake shoes come in contact with the drum, the turning of the drum tends to rotate the shoes in the same direction. In the self-energizing type brake (see Fig. 2), the shoes float free and the force of friction between the shoes and the drum moves the entire assembly in the direction of wheel rotation. On brake application with the wheel rotating forward, the primary or front shoe moves downward and the secondary or rear shoe moves upward. When the upper end of the secondary shoe butts against the stationary anchor pin, the secondary shoe pivots at the pin and moves out toward the drum. The primary shoe tends to turn about the adjusting link which is now held stationary by the secondary shoe. The frictional force, set up by the drum, which is applied to the primary shoe, is transmitted to the secondary shoe. This wrapping action of the shoes uniformly increases the pressure at every point around the braking surface. This increases the stopping ability, with less physical effort required by the driver. On brake application with the wheel rotating rearward, the action of the shoe is reversed.

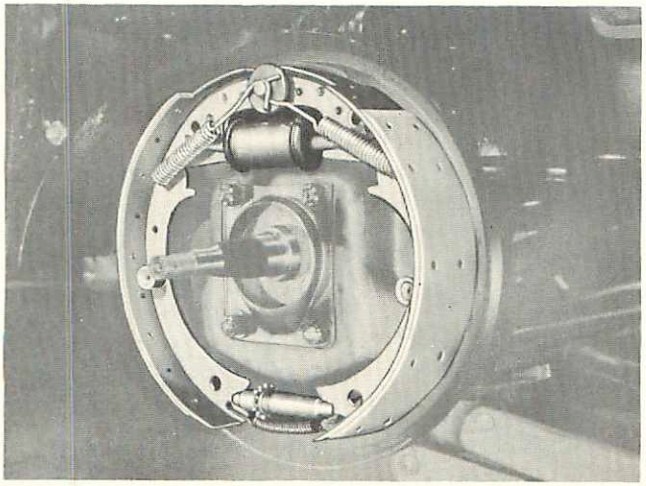

Figure 2—Front Wheel Brake With Drum Removed

HAND BRAKE—The hand brake is a mechanical device (see Fig. 3) that operates the shoes of the rear wheel brakes. The force is applied by a "T" type handle, which is pulled out to lock the rear wheels and is released by turning slightly counterclockwise. The hand brake lever is connected by the front steel cable to one end of the equalizer lever. The fulcrum end of the lever operates in a slot in the frame "X" member. A single steel cable passes through an equalizer which is connected to the equalizer lever by a link. The ends of the rear cable are connected to a strut lever in each rear wheel brake.

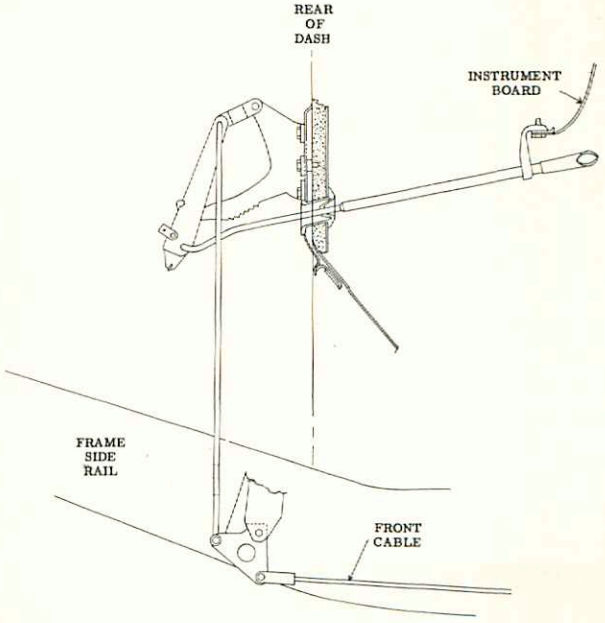

Figure 3—The Hand Brake is a Mechanical Device

SERVICING THE BRAKES

Brake Pedal Free Play

It is important that the brake pedal be properly adjusted to make sure that the compensating port of the master cylinder is uncovered, so that the excess fluid can return from the lines to the master cylinder reservoir. There should be ¼" brake pedal free play before the pressure stroke starts. A greater amount of free play will reduce the effective stroke of the master cylinder and in turn reduce the effectiveness of the brakes.

Adjustment

To adjust the brake pedal free play, loosen the lock nut on the master cylinder rod. Turn the large hexagon nut "in" to decrease the free play and turn it "out" to increase the free play. After the push rod is properly adjusted, tighten the lock nut. Do not permit the master cylinder boot to twist while adjusting the pedal free play.

Service Brake Adjustment

Before making a brake adjustment, first check the fluid level in the master cylinder reservoir. Then check the brake pedal free play and adjust if necessary.

Check the wheel bearing adjustment. Brakes cannot be properly adjusted when the wheel bearings are loose since the shoes will not remain centralized in the drum.

If a satisfactory adjustment cannot be obtained, remove the wheels and check the condition of the lining. If the lining is loose on the shoe, grease soaked, or badly worn, the brakes should be relined. Linings are considered worn if the heads of the rivets are within 1/32" from the lining surface. Always reline with Packard Precision Replacement Brake Lining Sets.

Front or Rear Adjustment

Only one adjustment is required on the 55th Series cars. This adjustment is made at the star wheel adjusting screw.

Raise the car on a hoist or by a jack until the four wheels are off the floor. Disconnect the hand brake front cable at the equalizer lever. Remove the adjusting hole cover from the backing plate. Using a screw driver or a suitable adjusting tool to turn the adjusting screw, engage the end of the tool with the teeth on the screw; use the slot edge as a fulcrum and move the outer end of the tool upward (see Fig. 4). Turn the adjusting screw until the wheel can just be turned by hand. Then back off the adjusting screw at least seven notches or as required to free the drum so that the wheel turns freely. Each notch can be felt as the tooth slips past the adjusting screw spring.

Install the adjusting hole cover in the backing plate.

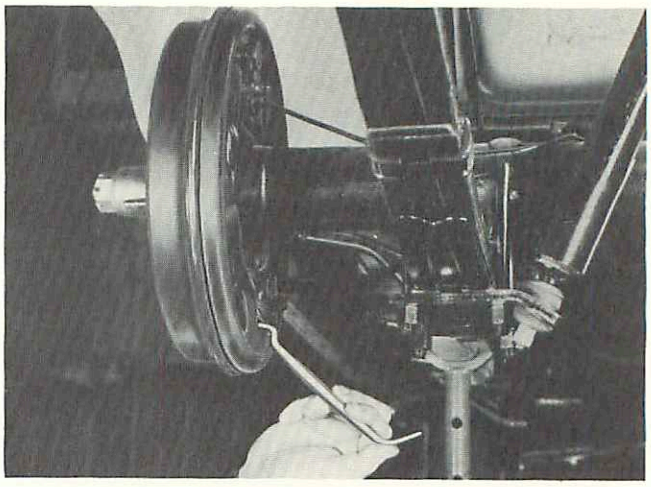

Figure 4—Adjusting the Brakes by Turning the Star Wheel

The hand brake adjustment should always be checked after making the service brake adjustment.

Hand Brake Adjustment

Before making the hand brake adjustment, make sure that the service brakes are adjusted to the proper clearance.

Loosen the lock nut on the front cable rod and disconnect the rod from the equalizer lever.

Loosen the lock nut at the equalizer and adjust the rear cable so that all slack is removed and the equalizer lever is against the end of the slot in the "X" member. Tighten the lock nut. Check to make sure that the proper notch in the equalizer is used. The notch nearest the end of the equalizer is used on the 5560 and 5580 models, while the other notch is used on the 5540 models.

Then hook up the front cable rod and, by means of the adjusting nut, adjust the front cable to give a minimum of 1/16" clearance between the equalizer lever and the back of the slot in the "X" member (see Fig. 5).

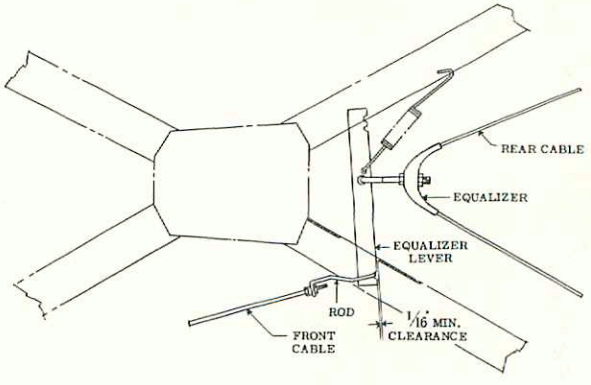

Figure 5—Schematic of Hand Brake Cables

Brake Shoe

REMOVAL—Raise the car on a hoist or by a jack until the wheels are off the floor. Remove the wheel, and hub and drum assembly.

Block the brake pedal in the released position to prevent application while the brake drums are off.

Remove the brake shoe hold-down springs and cups. Remove the brake shoe return springs, using Tool KMO-526 (see Fig. 6).

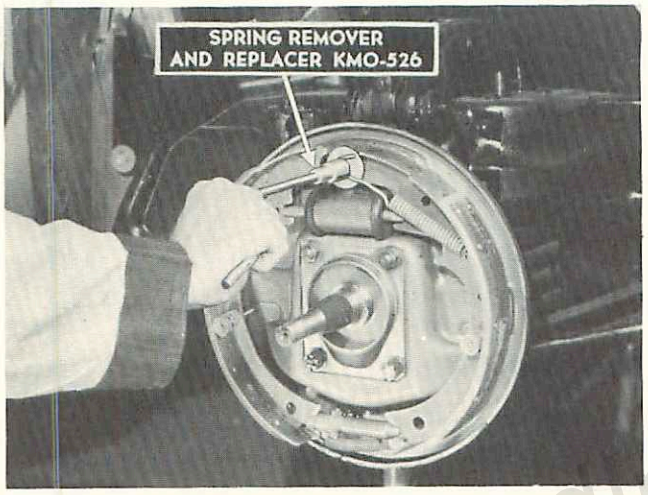

Figure 6—Removing the Brake Shoe Return Springs

Spread the shoes to release them from the brake shoe actuating spring and lift off both shoes. Unhook the adjustment screw spring and remove the adjusting screw.

Install the Brake Cylinder Clamp KMO-145 on the wheel cylinder to prevent the spring from forcing the cups and boots from the cylinder (see Fig. 7).

RELINING—Be sure to install the linings as they are marked. A lining marked as secondary may only be installed on a secondary shoe. This is important since the coefficient of friction of the primary and secondary linings is different.

When installing the lining, it is important that the linings are tight on the shoes. Linings which are loose place the braking load on the rivets, causing them to wear and eventually shear.

Only rivets which insure a close fit between the rivet shank and the drilled hole in the lining and the shoe should be used. Rivets with small shanks permit the lining to shift on the shoe when under load, resulting in unsatisfactory braking action and premature failure. The rivets should be long enough to properly upset the end and securely attach the lining. Should the rivet be too long, the upset end will split, weakening the rivet.

INSTALLATION—Be sure all backing plate ledges are lubricated with Lubriplate. Lubricate the adjusting screw nut and socket. Lubricate the outer end of the actuating pins and hold-down spring cups. On rear wheels, lubricate the hand brake strut and lever.

Do not permit lubricant or brake fluid to come in contact with the linings.

With the adjusting screw turned into the nut, install the adjusting assembly between the lower ends of the shoes. On the left wheel brakes, the adjusting screw nut is toward the secondary shoe. On the right wheel brakes, the adjusting screw nut is toward the primary shoe.

Connect the adjusting screw spring. Position the shoes on the backing plate, spread the upper ends of the shoes, and slip them in place into the actuating pin slots (see Fig. 8). Connect the shoe return springs, using Tool KMO-526-A. On the 5580 models, be sure that the springs are in their correct positions. The orange spring is used on the primary shoe and the yellow spring is used on the secondary shoe. On the 5540 and 5560 models, all springs are blue and can be installed on either shoe. Remove the wheel cylinder clamp.

Install the shoe hold-down springs and cups.

On the front wheels, clean and repack the wheel bearings. Install new oil seals if necessary.

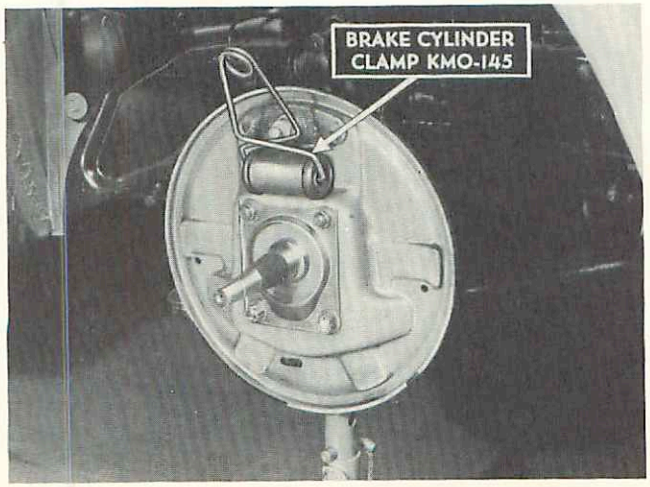

Figure 7—Brake Cylinder Clamp Installed

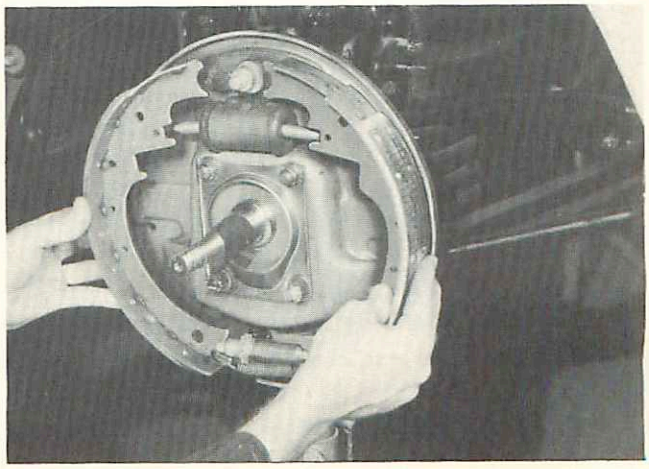

Figure 8—Installing the Brake Shoes

Install the hub and drum assemblies and wheels.

Bleed the brake lines as outlined under Bleeding the Hydraulic System.

Adjust the brakes as described under Service Brake Adjustment.

Master Cylinder

REMOVAL — Disconnect the brake lines from the master cylinder. Disconnect the push rod at the pedal. Remove the mounting bolts and remove the master cylinder.

DISASSEMBLY — Remove the push rod link and boot.

Remove the piston stop snap ring and piston stop. Then slip the piston and secondary cup assembly, primary cup, return spring, check valve, and valve seat out of the cylinder bore. Fig. 9 illustrates the parts of the master cylinder assembly.

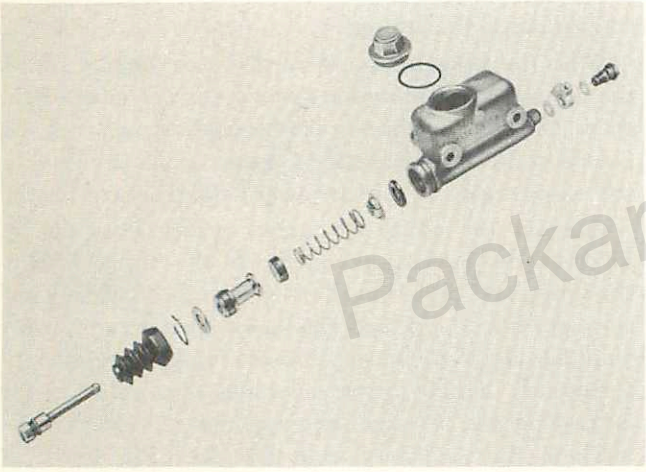

Figure 9—Exploded View of the Master Cylinder

CLEANING AND INSPECTION—Clean all brake parts in alcohol. Do not wash or soak them in gasoline or other cleaning solvents.

Inspect the piston for wear, scoring, or pitting.

Inspect the cups for wear or swelling.

Inspect the cylinder bore for wear, scoring, or pitting, especially near the fluid inlet port. If the cylinder is scored or pitted, install a new cylinder. Do not attempt to hone the cylinder, since honing the surface will increase cup and piston wear, and oversize pistons are not available.

ASSEMBLY — Dip all master cylinder parts in Packard Brake Fluid. Be sure the parts are kept clean.

Install the valve seat, check valve, and piston return spring.

Install a new primary cup, piston and secondary cup. Wet the cups with brake fluid, and carefully slip the cups into the bore to prevent damage to the cup lips.

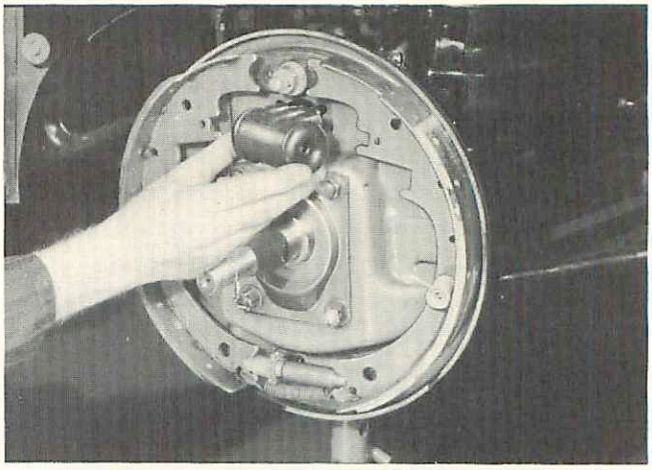

Figure 10—Removing the Wheel Cylinder

Install the piston stop and stop ring. Install the push rod and boot.

Install the cylinder and bleed the lines as described under Bleeding the Hydraulic System.

Wheel Cylinder

REMOVAL—Remove the wheel, and hub and drum assembly. Disconnect the brake line from the cylinder. Disconnect the brake shoe return springs, using Tool KMO-526, and spread the shoes. Remove the retaining cap screws and lift the cylinder off the backing plate (see Fig. 10).

Do not permit the brake fluid to spill on the shoe linings.

DISASSEMBLY — Remove the actuating pins. Slip the boots off the cylinder and remove the cups, pistons, and return spring (see Fig. 11).

CLEANING AND INSPECTION—Clean all wheel cylinder parts with alcohol. Do not wash or soak them in gasoline or cleaning solvent.

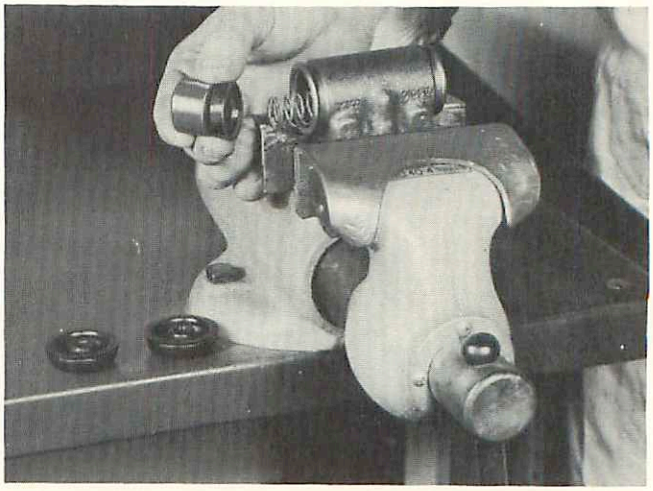

Figure 11—Removing a Wheel Cylinder Piston and Cup

Inspect the pistons for wear, scores, or pits.

Inspect the cups for wear or swelling.

Inspect the cylinder bore for wear, scores, or pits.

ASSEMBLY—Dip all wheel cylinder parts in Packard Brake Fluid. Be sure the parts are clean.

Install the spring, new cups and pistons. Be careful that the cups are not damaged in the installation. Install the boots and actuating pins.

INSTALLATION — If installing a new cylinder, make sure that it is the correct size for the particular model. The front cylinders are the same size (1⅛" dia.) on all 55th Series models. The rear cylinders on the 5540 and 5560 models have a bore of 1 1/16" while the rear cylinders on the 5580 models have a 1" bore.

Install the wheel cylinder on the backing plate and attach it with the two cap screws.

Engage the brake shoes in the actuating pins and connect the brake shoe return springs. Connect the brake lines and bleed the lines as outlined under Bleeding the Hydraulic System.

Bleeding the Hydraulic System

Since the efficient operation of the hydraulic brakes requires a solid column of fluid in the system, the presence of air in the system will give faulty brake operation. The brake pedal will feel spongy.

At any time a unit, line, or connection of the hydraulic system is removed or disconnected, it is possible for air to enter the system. Another cause for air in the system is the failure to maintain the proper fluid level in the master cylinder reservoir. Whenever the fluid in the system is to be replaced with new fluid, the brakes must be bled.

Remove the master cylinder filler plug and insert the Master Cylinder Filler J-713 with the jar filled with brake fluid. If the filler is not used, care must be taken to make sure that the master cylinder is not pumped dry, as this would admit air into the system.

Connect a rubber tube to the bleeder valve and allow the other end to hang into a clean container (see Fig. 12). Open the bleeder valve three-fourths of a turn.

Depress the brake pedal slowly by hand. Allow the pedal to return slowly. Continue this operation until the bubbles cease to appear from the end of the hose. Then, depress the pedal and close the bleeder valve.

Remove the bleeder hose.

Repeat this operation at the other three wheels.

If the master cylinder filler is not used, check the fluid level after bleeding each wheel and refill.

Pressure bleeding may be accomplished by using a pressure bleeder attached to the master cylinder filler. The pressure bleeder admits fluid into the cylinder under pressure and it is not necessary to operate the brake pedal.

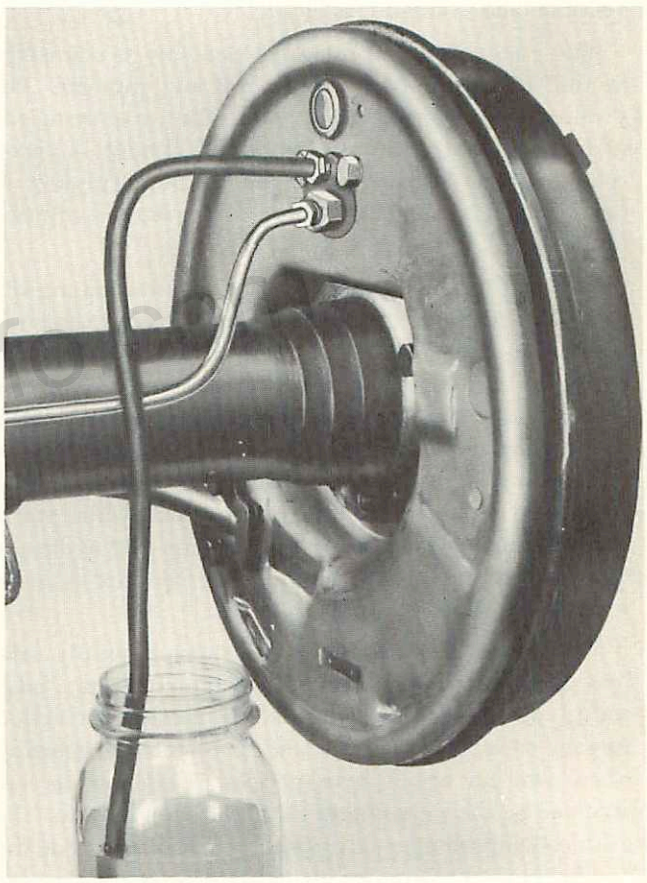

Figure 12—Bleeding the Brake Hydraulic System

EASAMATIC POWER BRAKES

Description

Easamatic Power Brakes provide positive power assisted brake action for the driver the instant the brake foot pedal is depressed.

The unit is a self-contained vacuum and hydraulic unit for power braking, utilizing engine intake manifold vacuum and atmospheric pressure for its power.

The power brake replaces the conventional brake master cylinder and requires no external rods or levers exposed to dirt and moisture. The assembly is attached rigidly to the floor pan and operates from a suspended pedal which is connected directly to the power brake push rod. The location of the pedal provides more foot room for the driver. Because of the reduced pedal travel required by power brakes as compared to the conventional braking system, the pedal height is approximately three inches lower. This brings the pedal

down to the approximate height of the accelerator pedal which permits the driver to shift his toe from one pedal to the other without lifting his heel from the floor. Lighter pedal pressures are required for brake applications.

Should failure occur in the vacuum system, several applications of the brakes can be made before the vacuum supply is depleted. After this, application can be made manually as in a conventional system. However, more effort is required because of the lack of power assist.

The power brake consists of three basic sections combined into a single unit—a vacuum power cylinder, a piston and control valve assembly, and a hydraulic cylinder and reservoir assembly.

The piston and control valve assembly is connected to the brake pedal by a push rod and plunger. The piston operates inside the vacuum cylinder, moving the hydraulic plunger into the hydraulic cylinder. A piston return spring is provided in the vacuum cylinder to return the piston and hydraulic plunger to their released positions.

The end of the vacuum cylinder is attached rigidly by screws to the hydraulic cylinder and fluid reservoir casting. On the outside of the vacuum cylinder is a vacuum supply tube and an air cleaner and atmospheric port. Attached to the hydraulic cylinder assembly is a fluid reservoir cover and a hydraulic port fitting incorporating a residual pressure check valve. A fluid compensating valve is located between the fluid reservoir and the hydraulic cylinder. Vacuum and hydraulic seals are provided in the bore of the hydraulic cylinder to seal around the hydraulic plunger.

The piston is connected to the vacuum supply tube by a flexible vacuum hose. The piston contains a push rod plunger, a diaphragm assembly, a counter-reaction spring, a vacuum poppet and poppet compensating stem, and an atmosphere poppet. The poppets are actuated by the rod plunger through the pivot arm. The push rod and plunger return spring is located inside the diaphragm assembly. The spring returns the rod plunger to its released position in the piston. A leather packing is located at the outside diameter of the piston to provide a seal between the piston and the vacuum cylinder.

Operation

RELEASED POSITION—When the engine is running and brakes are released, vacuum from the engine intake manifold is transmitted through the system vacuum check valve to the power brake vacuum tube and to a vacuum reservoir (see Fig. 13). From the vacuum tube, vacuum is transmitted into the unit through a flexible hose which is attached to the power piston at the left of the vacuum poppet.

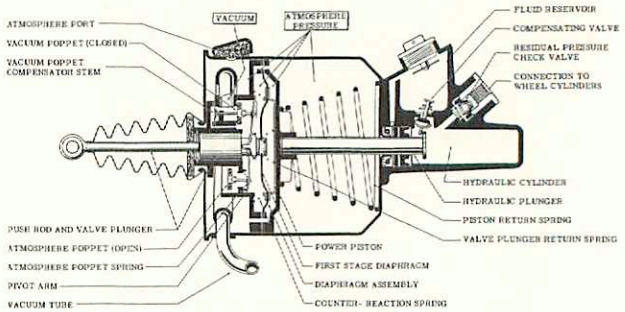

Figure 13—Easamatic Power Brake in Released Position

As shown in Figure 13, atmosphere, after passing through the air cleaner and atmosphere port, enters the power brake cylinder chamber at the left side of the power piston. From the left side of the piston, atmospheric pressure is admitted through the open atmospheric poppet to the left side of the diaphragm assembly and through the passage shown at the top of the diaphragm to the cylinder chamber at the right of the piston. A small passage in the piston admits atmosphere from the left side of the diaphragm assembly to the left side of the diaphragm of the vacuum poppet compensator stem. Because there is a vacuum on the right side of the compensator stem diaphragm, a slight force is exerted on the vacuum poppet, partially balancing the force of differential pressure against the vacuum poppet. Atmospheric pressure also enters the passage shown at the bottom of the piston and is admitted to the right side of the diaphragm assembly. A small opening in the diaphragm plate admits air to the inner (first stage) diaphragm.

In the released position, as shown in Figure 13, both the power piston and the diaphragm assembly are balanced in atmospheric pressure. The piston is held to the left in its released position by the piston return spring and the push rod and plunger assembly is held in position in the piston by the push rod return spring.

The compensating valve is tilted by the washer at the end of the hydraulic plunger to permit fluid to flow from the fluid reservoir to the hydraulic cylinder.

The residual pressure check valve maintains fluid under slight pressure in the lines to the wheel cylinders to prevent drain down of the fluid in the hydraulic system.

APPLYING—As the brake pedal is applied, the push rod and plunger move to the right in the power piston, allowing the pivot arm and atmospheric poppet spring to close the atmosphere poppet (see Fig. 14). After the atmosphere poppet closes, the pivot arm, which pivots freely on the push rod plunger, opens the vacuum poppet.

The preloading of the vacuum poppet by the vacuum poppet compensator stem reduces the force required to

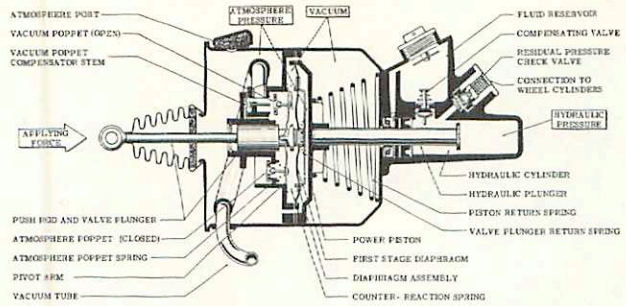

Figure 14—Easamatic Power Brake in Applying Position

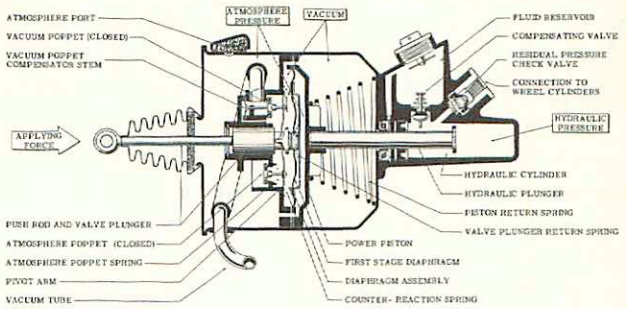

Figure 15—Easamatic Power Brake in Holding Position

lift the poppet from its seat. Smoothness in the initial application of the power brake is thereby obtained.

With the vacuum poppet open, vacuum is present on the left side of the diaphram assembly on the right side of the power piston. With vacuum on the right side of the piston and atmospheric pressure on the left side, a force is obtained which moves the piston to the right, compressing the return spring. With vacuum on the left side of the diaphragm assembly and atmospheric pressure on the right side, a reaction force on the diaphragm is obtained which pushes the diaphragm back against the push rod and plunger. The reaction force is in proportion to the force acting to the right on the power piston, thus giving the driver a sense of "feel" of the degree of braking. A lighter degree of reaction is obtained against the push rod and plunger during initial application by use of the inner (first stage) diaphragm. After initial application, the force of the counter-reaction spring is overcome and additional reaction force from the diaphragm assembly is obtained against the push rod and plunger.

As the power piston moves to the right, the hydraulic plunger moves to the right in the hydraulic cylinder. Initial movement of the plunger allows the compensating valve to seat, trapping fluid in the hydraulic cylinder. Fluid under pressure is forced past the residual pressure check valve and through the lines to the wheel cylinders.

HOLDING POSITION—After the degree of braking desired is obtained, no increase in force is exerted against the push rod and plunger, and the rod and plunger stop moving to the right. The reaction force to the left balances the force on the push rod, and the power piston and rod plunger reach a holding or lap position. In this position, both the vacuum and atmosphere poppets are seated (see Fig. 15). The degree of vacuum at the right side of the piston and at the left side of the diaphragm assembly is sufficient to give the required degree of hydraulic pressure and corresponding reaction force. An increase in the applying force on the push rod will move the rod and plunger to the right in the piston and open the vacuum poppet, causing an increase in hydraulic pressure. A decrease in force on the rod will let the plunger move to the left and open the atmosphere poppet, causing a decrease in hydraulic pressure.

FULLY APPLIED POSITION — When the power brake is fully applied, the vacuum poppet is held completely open by the push rod plunger. Full manifold vacuum is transmitted to the right side of the power piston allowing maximum possible atmospheric force on the left side of the piston. Any additional hydraulic output pressure is obtained from the addition of force on the brake pedal by the driver without any additional power assist from the power unit.

RELEASING — To release the brakes, the driver releases the brake pedal force on the push rod and plunger which permits the reaction force to move the plunger back. This allows the vacuum poppet to close and causes the plunger pivot arm to open the atmosphere poppet completely. Atmospheric pressure is again admitted to the left side of the diaphragm assembly and to the right side of the power piston. The piston and diaphragm assembly are again balanced in atmosphere, allowing the return spring and fluid pressure in the hydraulic cylinder to return the piston to its released position. Fluid in the lines returns past the residual pressure check valve to the hydraulic cylinder. When the piston reaches the released position, the washer on the hydraulic plunger tilts the compensating valve, opening the hydraulic cylinder to the fluid reservoir.

NO POWER CONDITION—If it should be necessary to use the brakes at a time when the engine is not running and there is no reserve vacuum left in the system, the brakes can be applied in the same manner as in the conventional system. However, as there will be no power assist from the unit, more physical effort will be required. When applying the brakes without the assistance of the brake unit, the push rod and plunger move to the right in the power piston until solid contact is made with the right piston plate. The return spring is then compressed; the piston and hydraulic plunger are moved to the right and the plunger displaces the fluid in the hydraulic cylinder in the same manner as during power application.

SERVICING

Some repair work may be performed with partial disassembly of the unit in its installed position by removing the toe board plate. This includes replacement of the vacuum hose reaction diaphragm, counter-reaction spring, piston return spring, etc.

It is recommended, however, that the complete disassembly procedure be studied before minor repair work is attempted on the unit in its installed position.

Use extreme care in handling the rubber parts to prevent their coming in contact with mineral oil or grease.

Removal

Disconnect the vacuum lines, hydraulic lines, and stop light switch wires from the power unit.

Remove the cotter pin and clevis pin connecting the pedal to the push rod. Disconnect the accelerator pedal.

Remove the screws which hold the steering column grommet and slide the grommet up out of the way. Remove floor mat screws and fold back the floor mat.

Remove the toe board plate retaining screws. Lift the power unit and plate as an assembly from the car. (see Fig. 16.) Remove the plate from the unit.

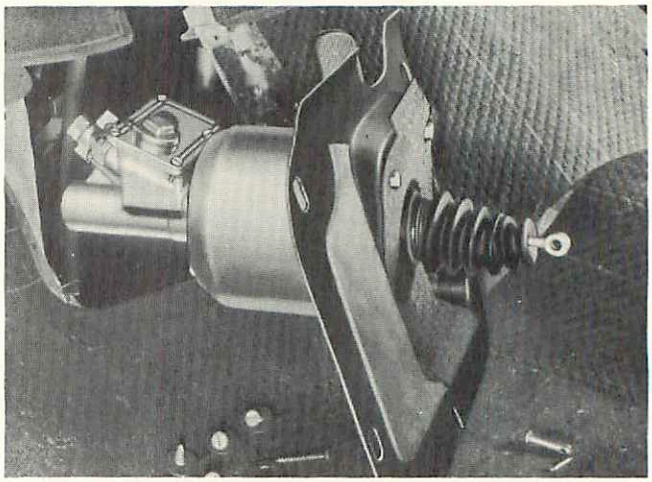

Figure 16—Power Unit and Toe Board Plate Removed

DISASSEMBLY

Clean all dirt from the outside of the unit using care not to allow any of the solvent to enter the unit.

Remove the hydraulic fluid reservoir filler cap and gasket and pour the fluid out of the reservoir.

Scratch alignment marks on the vacuum cylinder and the cylinder end plate, on the cylinder and the hydraulic cylinder casting, and on the reservoir cover and the hydraulic cylinder casting. Scratch alignment marks between the tube fitting and the hydraulic cylinder casting (see Fig. 17).

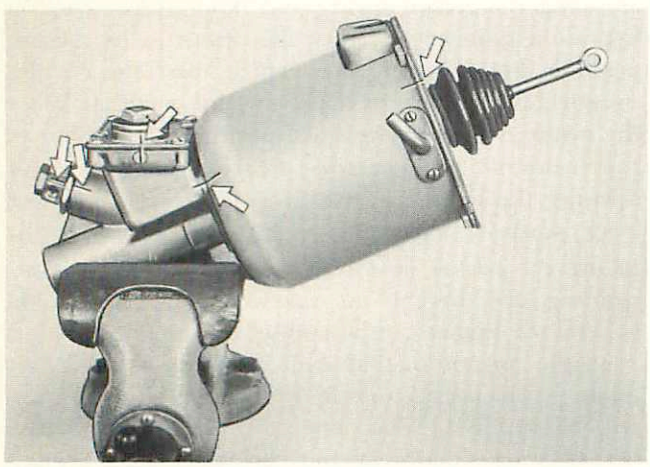

Figure 17—Arrows Indicate Alignment Marks

Place the reservoir casting in a vise, equipped with lead jaws, so that the unit is at its normal mounting angle. Remove the reservoir cover screws, the cover, and the gasket.

Unscrew the compensator port and valve assembly using a 1⅛" thin-wall socket wrench (see Fig. 18).

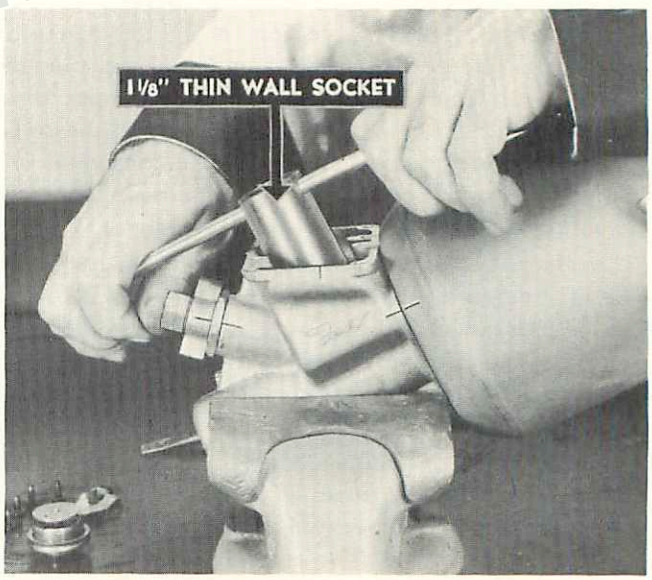

Figure 18—Removing the Compensator Port and Valve

Remove the rubber seal ring from the compensator port fitting. To disassemble, clamp the fitting in a vise; spread open and remove the spring retainer. Then remove the spring and valve stem and poppet.

Unscrew the hydraulic output fitting bolt and fitting. Remove the rubber seal ring from the output fitting. Remove the check valve assembly and check valve

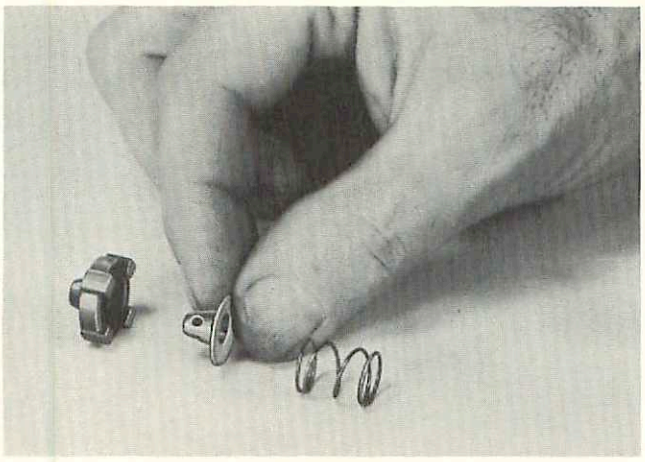

Figure 19—Valve Cap Separated from the Retainer

spring. Separate the check valve rubber cup and cup retainer (see Fig. 19).

Remove the unit from the vise and empty the remaining fluid from the reservoir and hydraulic cylinder. Replace the unit in the vise.

Release the lip of the push rod boot from the cylinder end plate and slip the boot off the end of the valve rod. Remove the felt washer from the valve rod.

Bend the tabs on the end plate and separate the end plate and gasket from the cylinder. Slide the vacuum hose off the tube attached to the vacuum cylinder. Remove the air cleaner screw and separate the screw gasket, shell, hair, and rubber seals (see Fig. 20).

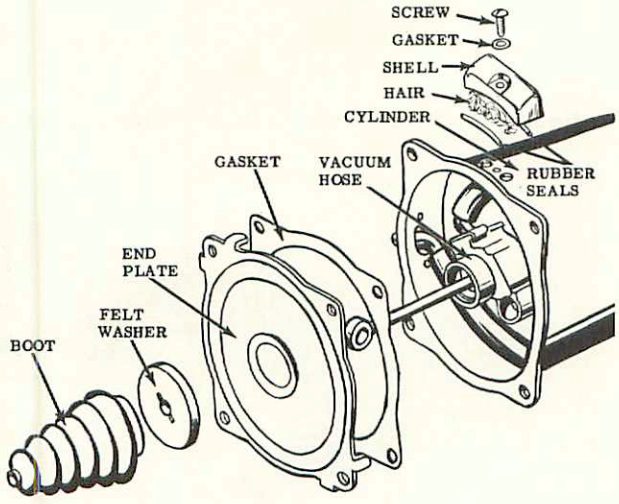

Figure 20—Remove Boot, End Plate, and Air Cleaner

Remove the vacuum tube retaining screws and slip the vacuum tube out of the cylinder and remove the gasket. Then pull the piston assembly out of the cylinder (see Fig. 21).

Remove the vacuum hose from the piston tube. Remove the tube screw and remove the tube and rubber

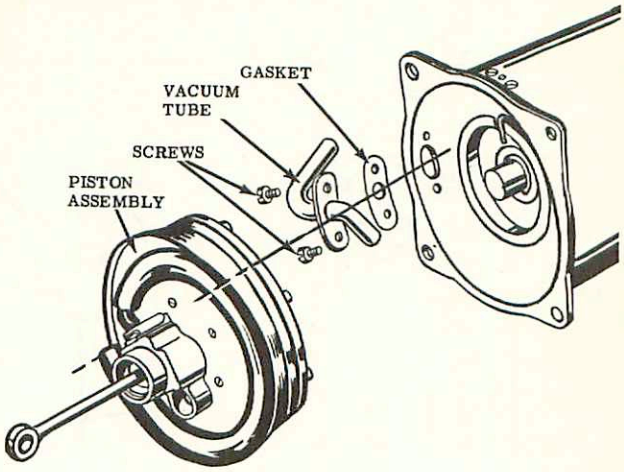

Figure 21—Remove the Vacuum Piston

seal from the piston assembly. Remove the rubber stop from the steel stop washer. (The rubber is cemented to the washer.) Remove the washer screws and remove the steel washer, compensating stem diaphragm, and the stem from the piston assembly (see Fig. 22).

Hold the rear piston plate assembly in a vise, using care not to damage the surface at the vacuum tube port. Loosen the piston plate screws and separate the front

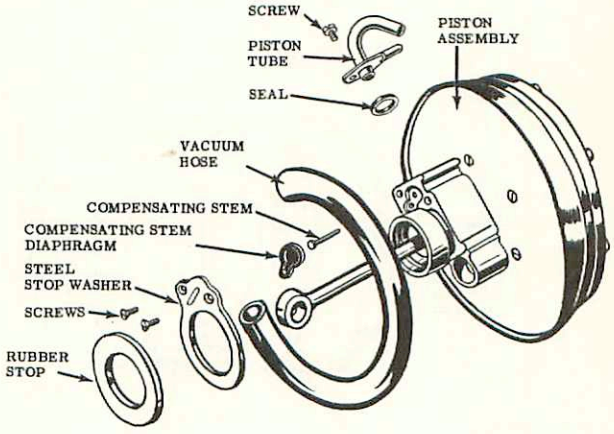

Figure 22—Remove Tubes, Compensating Stem and Diaphragm

piston plate, gasket, diaphragm assembly, and counter-reaction spring from the rear piston plate assembly. (See Fig. 23) Remove the vacuum poppet spring and screw from the plate assembly. Using a pair of pliers, remove the atmosphere poppet retaining clip. Remove the atmosphere poppet spring and atmosphere poppet from the plate. Remove the push rod, plunger, and vacuum poppet assembly. From the groove in the bore of the piston plate, remove the plunger stop ring. Using a sharp tool, remove the lock ring from the groove at the end of the plunger. Then remove the pivot washer and pivot arm from the plunger. Remove

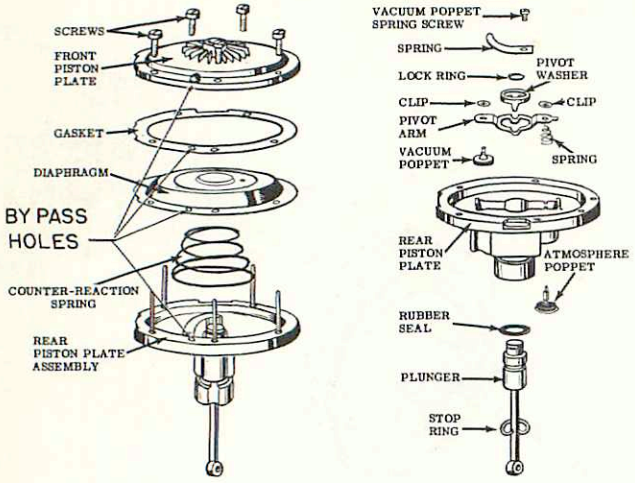

Figure 23—Detail Parts of the Piston

the vacuum poppet clip (break if necessary) and remove the poppet from the pivot arm. Remove the flat rubber seal from the plunger.

Place the rear piston plate on the bench with the packing and plates up. Remove the retaining screws and remove the retainer plate, ring wicking, piston packing plate, and leather piston packing. (See Fig. 24).

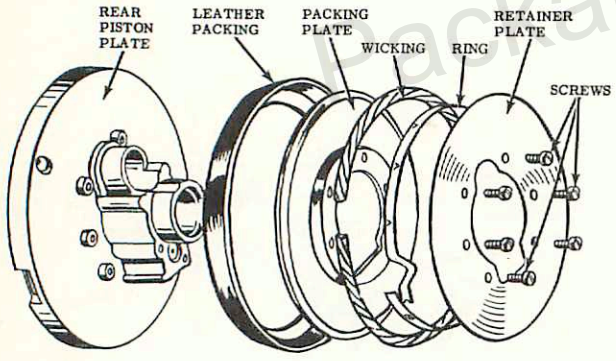

Figure 24—Remove Ring Wicking and Leather Piston Packing

Push in on the vacuum piston return spring retainer sufficiently to release the C washer (see Fig. 25). Then, slide the washer out of the groove of the hydraulic plunger. Remove the retainer plate and vacuum piston return spring.

Hold the hydraulic cylinder and remove the cylinder retaining screws (see Fig. 26). Remove the hydraulic cylinder and remove the gasket and rubber ring seal. Push the hydraulic plunger into the cylinder; then, pull out on the plunger and remove the leather seal.

Using special pliers PK-376, remove the master cylinder piston cup retaining ring (see Fig. 27). (If the ring

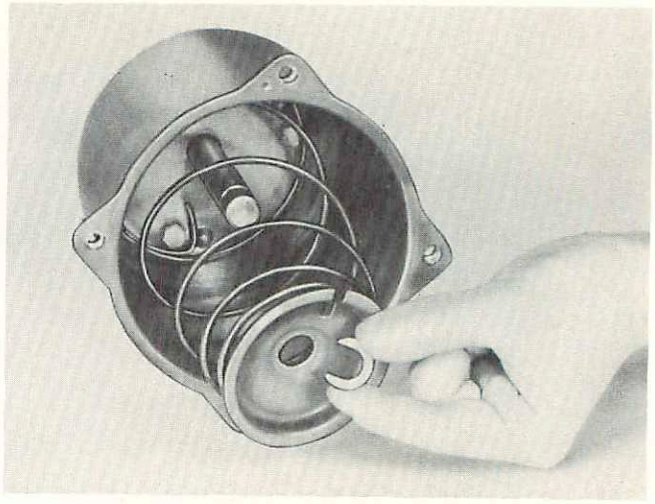

Figure 25—Removing the Vacuum Piston Return Spring

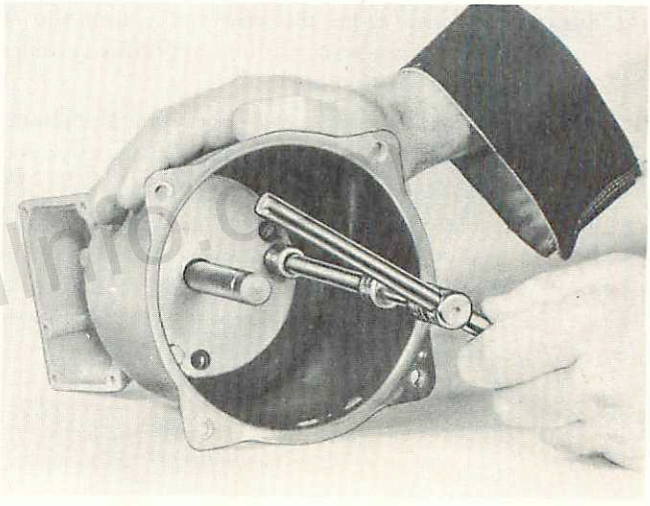

Figure 26—Remove the Cylinder Retaining Screws

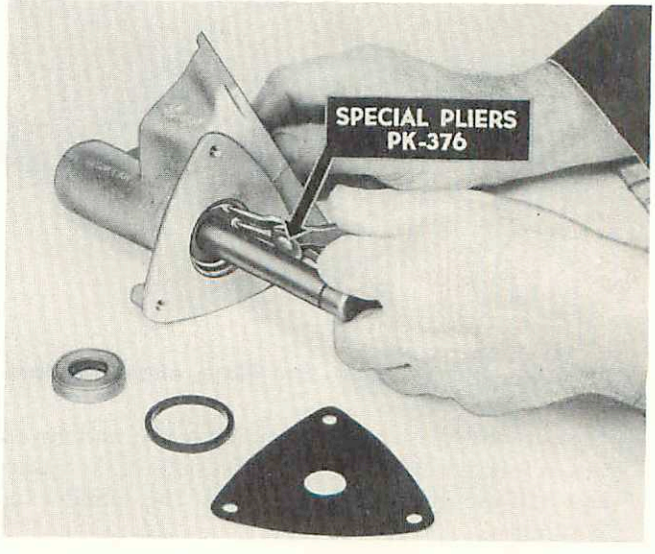

Figure 27—Retaining Ring is Removed With Snap Ring Pliers

is of the Spirolox type, use a sharp pointed tool to pry the end of the ring out of the groove.) Then, pull the master cylinder plunger and seal ports from the cylinder as a unit (see Fig. 28). Remove the steel backup washer, guide washer, master cylinder cup, and cup retainer from the master cylinder plunger.

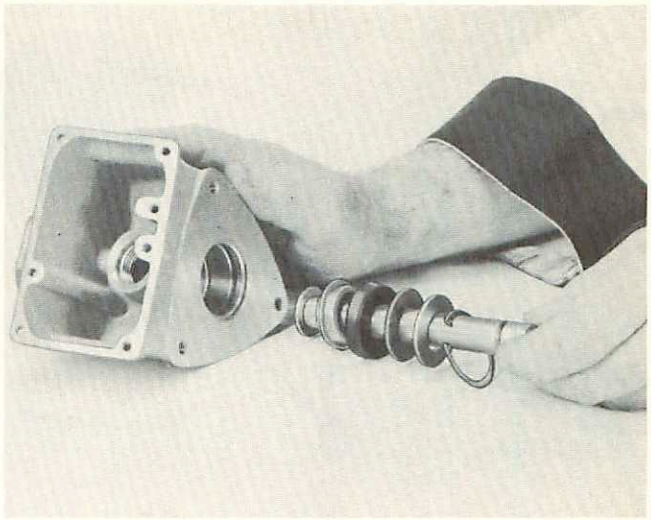

Figure 28—Piston and Details Removed from Hydraulic Cylinder

CLEANING AND INSPECTION

Do not permit the rubber parts to come in contact with mineral oil, solvent, or grease. Wash all parts thoroughly in alcohol and wipe dry. Blow the dirt and cleaning fluid out of the internal passages. If the inside of the vacuum cylinder shell is corroded or rusted, clean the surface with fine emery cloth and finish with crocus cloth.

It is important that the cleaned parts be placed on clean paper or cloth prior to assembly, to prevent the possibility of dirt getting into the power unit.

INSPECTION

In addition to replacement of parts contained in "Power Brake Unit Repair Kit," inspection of parts should be made as follows and parts replaced as necessary.

Inspect the vacuum cylinder shell for scoring, pitting, dents, nicked edges, or damaged threads. Replace if necessary.

Examine the hydraulic cylinder bore 1″ from the open end. The surface must be free from scores, deep scratches, or corrosion, and be satisfactory for sealing with the rubber hydraulic seal. Gasket surfaces at the reservoir cover, the compensator port seat and hydraulic output fitting must be free of scoring, pitting, dents, and nicked edges. Check for cracks and damaged threads. Replace if necessary.

The surface on the face at the small end of the hydraulic output fitting must be free from scores and deep scratches to provide proper sealing surface with the rubber check valve seat. Replace if necessary.

Make sure the braze on the vacuum inlet tube is secure and the tube and mounting plate are not distorted. Replace either part if necessary.

Examine the rear piston plate for cracks or damaged threads. The sleeve must be securely pressed into the piston plate. Replace the assembly if the bore of the sleeve has scores, deep scratches, or corrosion.

Inspect the hydraulic plunger and washer assembly for scoring, pitting, or nicks.

Do not attempt to refinish the plunger surface. Replace the plunger assembly if it is scored or damaged.

The push rod must pivot freely in the plunger without noticeable end play. Inspect the plunger for scoring, pitting, or nicks on the outside diameter polished surface.

Do not attempt to refinish the plunger surface—replace with new assembly if necessary.

Examine the vacuum cylinder end plate for cracks or distortion. Replace any other parts that do not come up to inspection standards.

ASSEMBLY

Dip the hydraulic cylinder plunger and cup in clean brake fluid. Install the cup retainer on the plunger with the end having the small diameter facing the washer on the end of the piston. Slip the Hydraulic Cup

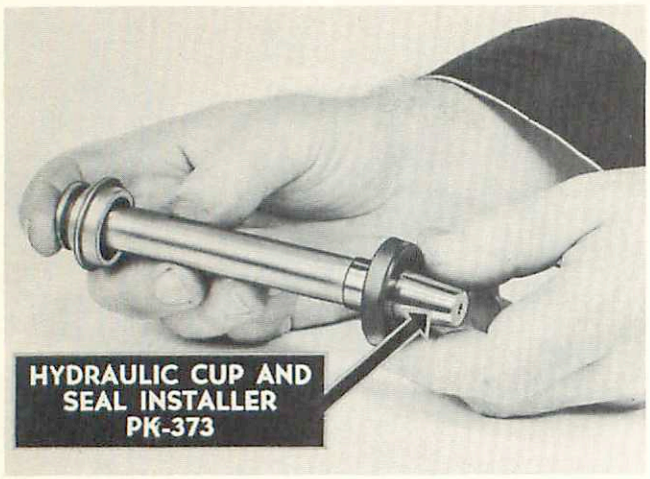

Figure 29—Install the Cup and Seal

and Seal Installer PK-373 over the end of the master cylinder plunger and install the cup with the lip side of the cup on the cup retainer (see Fig. 29).

Place the plunger, retainer, and cup subassembly in the hydraulic cylinder (see Fig. 30). Care should be taken not to damage the cup lip as it enters the cylinder bore.

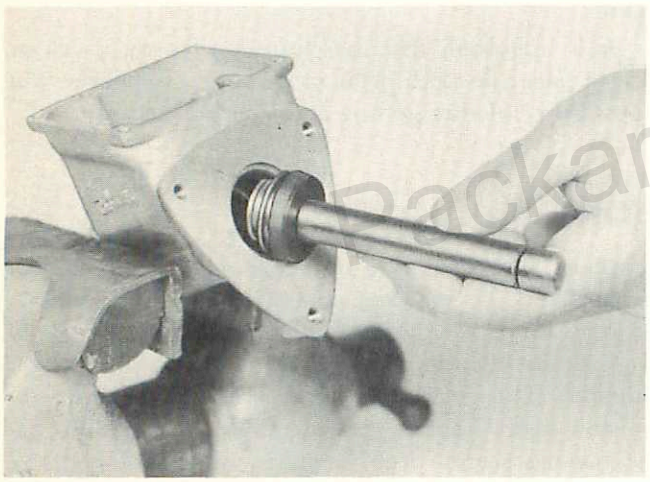

Figure 30—Install Piston, Retainer, and Seal

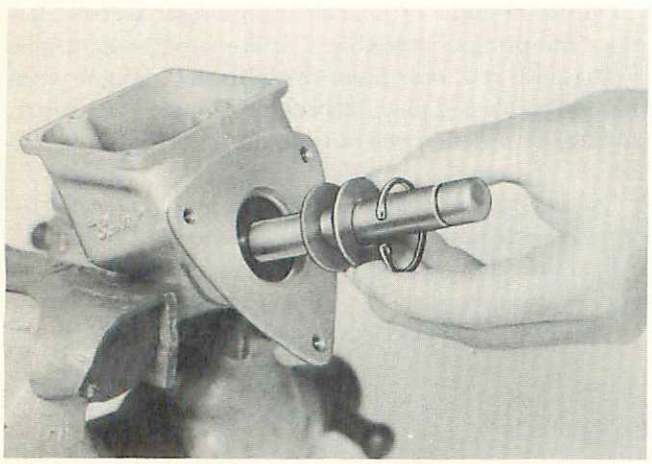

Figure 31—Installing the Washers and Retaining Ring

Slip the guide washer and steel backup washer on the plunger (see Fig. 31). Position the parts against the cup and install the retaining ring.

Holding the hydraulic master cylinder plunger in its outward position, and using the Hydraulic Cup and Seal Installer PK-373, install the leather seal with the lip of the seal toward the cylinder (see Fig. 32).

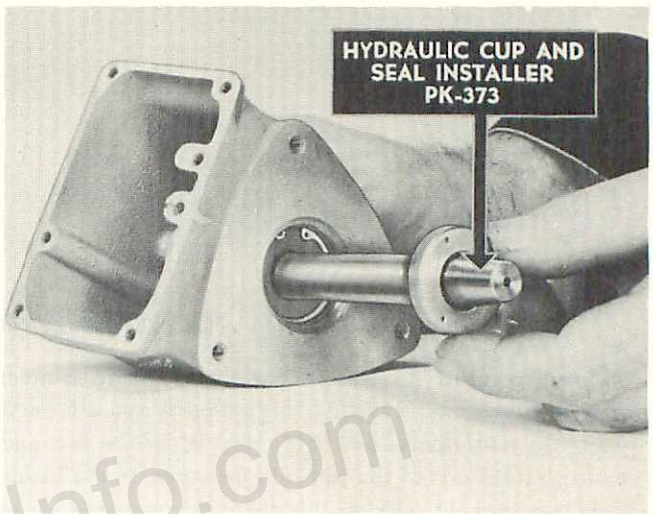

Figure 32—Lip of Seal Must Be Toward Hydraulic Cylinder

Install the master cylinder rubber seal ring and the cylinder gasket. Match the vacuum cylinder and hydraulic cylinder alignment marks and install the mounting screws. Tighten to 4 to 5 pounds torque (see Fig. 33).

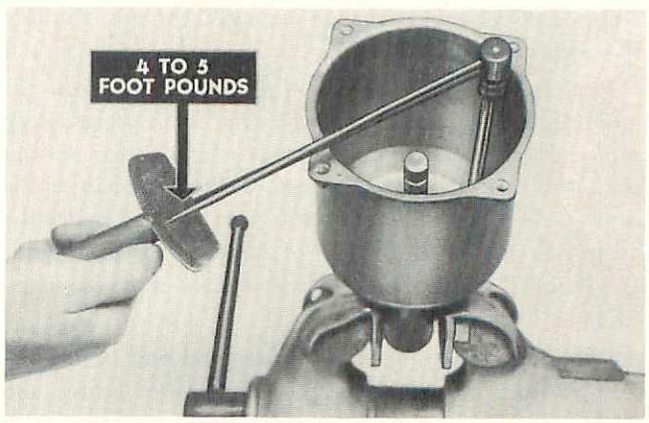

Figure 33—Torque Tightening the Cylinder Shell Cap Screws

Install the piston return spring, engaging the hooked end of the large end of the spring between a mounting screw and a raised projection on the end of the cylinder. Place the spring retainer on the end of the spring and

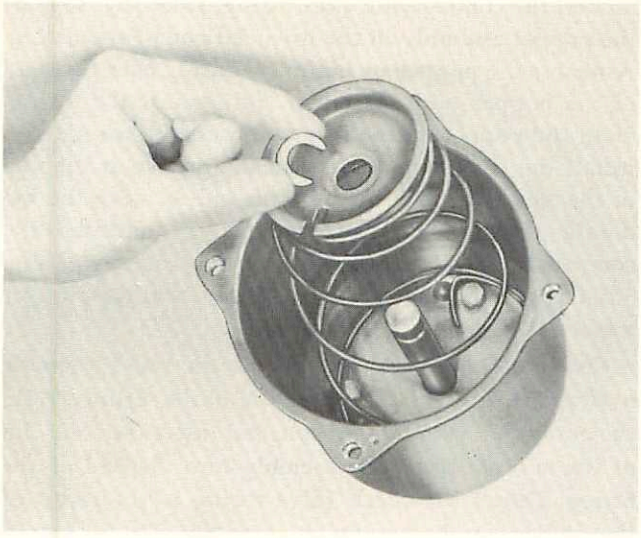

Figure 34—Installing Piston Return Spring

engage the hooked end in the slot of the retainer (see Fig. 34). Compress the spring and, with the retainer plate over the end of the plunger, insert the C washer into the groove of the plunger.

Place the stem of the vacuum poppet in the hole at the rounded end of the pivot arm and install the retaining clip. Assemble the rubber seal in the recess of the push rod plunger with the lip or seal pointing toward the push rod. Coat the end of the plunger with Lubriplate, assemble into the bore of the rear piston plate, and install the stop ring. Place the pivot arm vacuum poppet subassembly over the end of the plunger. Insert the pivot washer and install the lock ring in the groove at the end of the plunger. To install the lock ring, engage the end of the ring in the groove; then "screw" it into place. Place the vacuum poppet spring into the recess of the piston plate and position the spring so that the end of the spring is over the end of the vacuum poppet stem. Then install the spring screw. Place the atmosphere poppet spring between the pivot arm and the piston plate with the large coil of the spring toward the atmosphere port. From the opposite side of the plate, assemble the atmosphere poppet with the stem through the plate, spring, and pivot arm. Place the retainer clip on the stem of the poppet.

Place the rear piston plate assembly flat on the inside of the Vacuum Piston Packing Assembly Ring PK-375 with the push rod of the piston up. Place the leather packing against the piston with the lip up. Place the packing plate inside the packing with the beveled edge of the plate down against the packing and the cutouts and holes of the plate aligned with the piston. Coil the wicking inside the lip of the packing and cut the wick to the required size. Dip the wick in vacuum cylinder oil, let excess oil drip off, and again coil the wicking inside the packing lip. Coil the expander ring inside the wicking with the barbs pointing out and up into the wicking. Engage the notch at the loop end or ring with the hook at the opposite end. Replace and align the wicking retainer plate. Install and tighten the screws securely. Care must be used when installing the screws to apply sufficient pressure on the screw driver to partially compress the packing seal and fully engage the screw threads to prevent stripping the threads.

Install the five Diaphragm Installation Guide Pins PK-375 into the screw holes in the rear plate assembly. Clamp the asembly in a vise. Place the large end of the counter-reaction spring against the rear piston plate. Place the diaphragm over the guide pins with the center "ring" type plate of the diaphragm assembly against the small coil of the spring. Place the diaphragm gasket and front piston plate over the diaphragm assembly, aligning the cutouts of the piston plates, diaphragm, and gasket as well as the by-pass and screw holes. (See Fig. 35.) Compress the counter-reaction spring and remove one guide pin at a time, replacing each pin with a screw. Tighten the screws uniformly to prevent vacuum leakage.

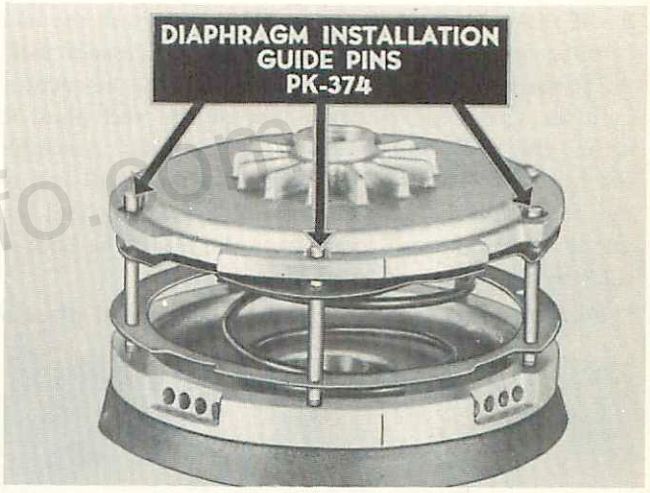

Figure 35—Assembling Diaphragm Side of Piston

Insert the vacuum poppet compensating stem into the hole in the recess of the piston plate. Place the compensating stem diaphragm in the recess with the by-pass slot of the diaphragm out. Place the steel stop washer over the push rod, align the washer to the hub of the piston, and install the retaining screw. Soften the coating of the rubber stop with solvent, and cement the rubber stop to the steel washer. Insert the vacuum tube rubber seal in the recess of the piston, position the tube assembly on the plate, and install the retaining screw. Attach the vacuum hose to the tube, and coil the hose around the hub of the piston.

Apply a thin film of vacuum cylinder oil to the bore of the vacuum cylinder and to the lip of the packing of the piston. Insert the piston into the cylinder so that the free end of the vacuum hose is in line with the

center of the large elongated vacuum tube hole of the cylinder. Push the piston into the cylinder and adjust the position slightly until the hook of the piston return spring falls between two web sections on the front piston plate. Twist the piston assembly 20° to 25° in both directions and stroke the piston against the spring several times by hand to make certain that the piston finds its normal operating position. Check the location of the end of the hose with the hole in the cylinder.

Install the tube assembly and gasket and install the retaining screws. Slip the end of the hose on the tube approximately 5/8". Operate the piston by hand through its full stroke several times to make certain that the hose does not rub against the cylinder or piston. Should interference occur, remove and rotate the piston so that the return spring hook is between a new set of web sections where interference does not occur.

Place the rubber seals on the bottom edges of the air cleaner shell and install the shell on the vacuum cylinder. Using a 6" steel scale or similar tool, push the hair into the open spaces at each end of the air cleaner shell. Align the end plate gasket and end plate on the vacuum cylinder and bend the two tabs of the end plate to secure the plate and gasket to the cylinder. Assemble the felt washer within the boot. Dip the small end of the boot in brake fluid and assemble the boot and felt washer over the push rod. Attach the lip of the boot to the scallops at the center of the end plate.

Dip the rubber seal ring in brake fluid and place it around the compensator port fitting. Insert the stem of the poppet assembly in the threaded end of the fitting. Assemble the poppet spring in the fitting over the stem of the poppet with the large coil against the fitting. Hold the poppet on the seat, compress the spring, and install the C-washer retainer in the groove at the end of the stem. Push in on the push rod to move the hydraulic plunger back approximately ½" and install the compensating valve assembly in the cylinder (see Fig. 36). Operate the push rod to make sure that the plunger washer tilts the compensator valve.

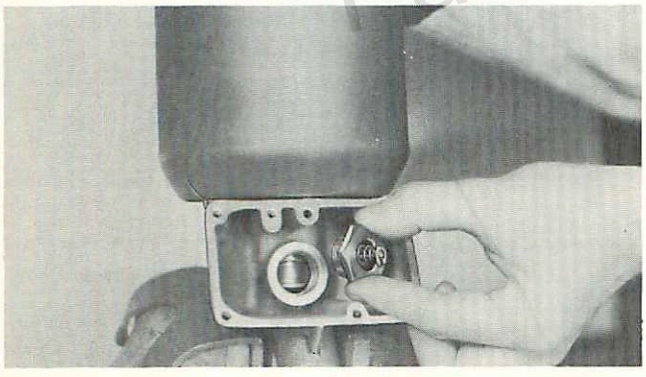

Figure 36—Installing the Compensator Port and Valve

Coat the rubber seal with brake fluid and assemble over the threads of the hydraulic outlet fitting. Hold the outlet in a vertical position, and insert the cone end of the cup and retainer assembly into the end of the fitting. Center the check valve spring in the recess of the rubber cup. Invert the unit (see Fig. 37) and install the fitting, making sure that the parts remain in alignment. Tighten the fitting to 30 to 42 ft-lbs torque. Assemble the copper gasket, hydraulic tube fitting, and another copper gasket over the fitting bolt. Install the bolt, positioning the outlets as indicated by the alignment marks.

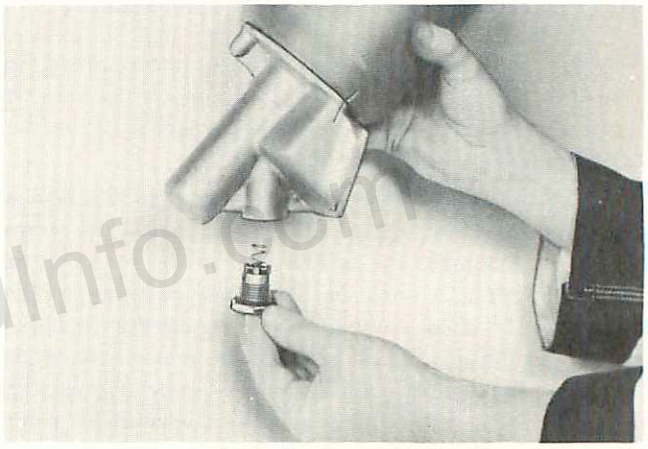

Figure 37—Install the Fitting and Check Valve

Place the cover gasket on the reservoir. Align the cover alignment marks and install the cover screws. Install the filler cap and gasket in the cover.

INSTALLATION

Mount the unit on the toe board plate so that the fluid reservoir filler cap will be upward when installed in the vehicle.

Hold the pedal up to give clearance and install the power unit and plate assembly. Install two of the screws, tightening them only enough to hold the plate in place during alignment. Check the alignment of the end of the push rod with the brake pedal. Shift the plate as required to obtain proper alignment. If additional movement for alignment is necessary, the pedal support bracket on the dash panel can be loosened and repositioned slightly.

Install the clevis pin; then stroke the unit manually through its full stroke a number of times to make sure that a bind does not exist because of misalignment. The plunger must return freely to its fully released position.

If alignment is satisfactory, install the other plate

retaining screws. Remove the clevis pin and install the floor mat. Reinstall the clevis pin and cotter pin. Slide the grommet down on the steering post jacket and install the retaining screws. Connect the accelerator pedal. Connect the vacuum line, hydraulic lines, and stop light switch cables.

Bleeding

Bleeding the system when equipped with power brakes is the same as with conventional brake system. The system may be bled either manually or with a pressure bleeder.

Before bleeding, apply the brakes several times with the engine off to make sure that there is no vacuum reserve present in the cylinder.

Lubrication

The power brake unit is lubricated at the time of assembly and requires no further lubrication.

System Tests

Road test the brakes by making a brake application at about 20 mph to determine if the vehicle stops evenly and quickly. If the pedal has a spongy feel when applying the brakes, air is present in the hydraulic system.

With the engine stopped, hand brake applied, and the transmission in neutral, apply the brakes several times to exhaust all vacuum in the system. Depress the pedal, hold foot pressure on the pedal, and start the engine. If the vacuum system is operating, the pedal will tend to fall away under foot pressure and less pressure will be required to hold the pedal in the applied position. If no action is felt, the vacuum system is not functioning.

Stop the engine and again exhaust all vacuum in the system. Depress the brake pedal and hold foot pressure on the pedal. If the pedal gradually falls away, the hydraulic system is leaking.

If the brake pedal travels to within one inch of the floor pan, the brake shoes require adjustment or relining.

TROUBLE SHOOTING

BRAKE SYSTEM

BRAKE PEDAL GOES TO FLOOR BOARD—BRAKES DO NOT HOLD

Causes

1. Normal wear of lining. Clearance between lining and drum too great.
2. No fluid in the master cylinder reservoir.
3. Leak in hydraulic system will permit brake pedal under pressure to go to floor board gradually.
4. Excessive brake pedal free play will reduce effective stroke of master cylinder.

BRAKES ON ALL WHEELS DRAG

Causes

1. Brake pedal improperly set. Master cylinder rod adjusted too tight, not allowing master cylinder compensating port to be uncovered.
2. Master cylinder primary cup swollen, not allowing compensating port to be uncovered.
3. Faulty master cylinder check valve will cause master cylinder pressure to build up and will not let fluid return to reservoir.
4. Mineral oil in system, swollen cups will cause pressure build-up.
5. Insufficient clearance between drum and lining.

BRAKE ON ONE WHEEL DRAGS

Causes

1. Broken or weak shoe return spring.
2. Brake adjusted too tight.
3. Frozen hand brake cable (rear wheel).
4. Hand brake improperly adjusted (rear wheel).
5. Swollen wheel cylinder cups retard the return action of the shoes.
6. Loose wheel bearings (front wheels).

SPONGY BRAKE PEDAL

Causes

1. Brake shoes improperly adjusted.
2. Air in hydraulic system.

BRAKES

HARD PEDAL

Causes

1. Brake shoes improperly adjusted.
2. Excessively worn lining.
3. Improper lining.
4. Oil or grease on lining.
5. Binding pedal pivot.

SEVERE BRAKES

Causes

1. Oil or grease soaked lining.
2. Brake shoes improperly adjusted.
3. Loose backing plates.
4. Improper brake lining.

CAR SWERVES TO ONE SIDE WHEN BRAKES ARE APPLIED

Causes

1. All causes listed under Severe Brakes.
2. Tires improperly inflated.

POWER UNIT

Before diagnosing the power brake unit, check all causes listed under the particular condition in the system trouble shooting section to make sure that the power unit is at fault.

HARD PEDAL

Causes

1. Faulty vacuum check valve.
2. Collapsed vacuum hose.
3. Plugged vacuum fittings.
4. Leaking vacuum cylinder.
5. Internal vacuum hose loose or restricted.
6. Jammed master cylinder piston.
7. Vacuum leaks in unit between piston plates, past leather piston packing, or at vacuum cylinder-to-hydraulic cylinder mounting face.
8. Broken counter-reaction spring.
9. Leak past atmosphere poppet.
10. Jammed push rod plunger.
11. Restricted air cleaner.

GRABBING BRAKES

Causes

1. Vacuum leakage in reaction diaphragm.
2. Sticking push rod plunger.
3. Faulty pivot arm and vacuum poppet action.
4. Restricted diaphragm passage.

PEDAL GOES TO FLOOR (OR ALMOST TO FLOOR)

Causes

1. Compensating valve leakage.
2. Leak at hydraulic plunger seal.
3. Leak at compensating or outlet fitting seals.

BRAKES FAIL TO RELEASE (OR SLOW RELEASE)

Causes

1. Faulty residual check valve.
2. Excessive hydraulic plunger seal friction.
3. Faulty compensating valve.
4. Excessive piston packing friction.
5. Restricted air passage in piston plate.
6. Restricted air cleaner.
7. Sticky push rod plunger.
8. Broken piston return spring.

FLUTTER FELT AT BRAKE PEDAL ON LIGHT APPLICATION

Causes

1. Restricted air cleaner.