

## POWER BRAKES—BENDIX

### GENERAL DESCRIPTION

The Bendix power brake unit can be identified by the die-cast hydraulic cylinder and pressed steel filler cap (Fig. 5-17). The Moraine power brake unit can be identified by the cast iron master cylinder and cast iron filler cap (Fig. 5-40) and the thin "dipped" rubber boot.

The Bendix power brake is a combined vacuum and hydraulic unit for power braking, utilizing engine intake manifold vacuum, and atmospheric pressure for its operation (Fig. 5-12). It is a self-contained unit requiring no external rods or levers exposed to dirt or moisture. Other parts of the brake system are the same as with standard brakes. Two external line connections to the power brake are necessary. One is a vacuum connection to the carburetor (and vacuum reservoir). The other is a hydraulic connection into the hydraulic brake system.

The power brake system provides reduced pedal travel compared to the conventional brake system. The reduced pedal travel lowers the height of the pedal down to approximately that of the accelerator pedal, permitting the driver to shift his toe from one pedal to the other without lifting his heel from the floor. Lighter pedal pressures are also obtained for normal stops.

Design of the power brake is such that, in case of engine failure and consequent loss of engine vacuum, several applications of the brakes can be made utilizing vacuum supply in the vacuum reservoir. In case of complete loss of vacuum, the brakes can be applied manually in the conventional manner. More effort for manual application is required, however, due to the lack of power assist.

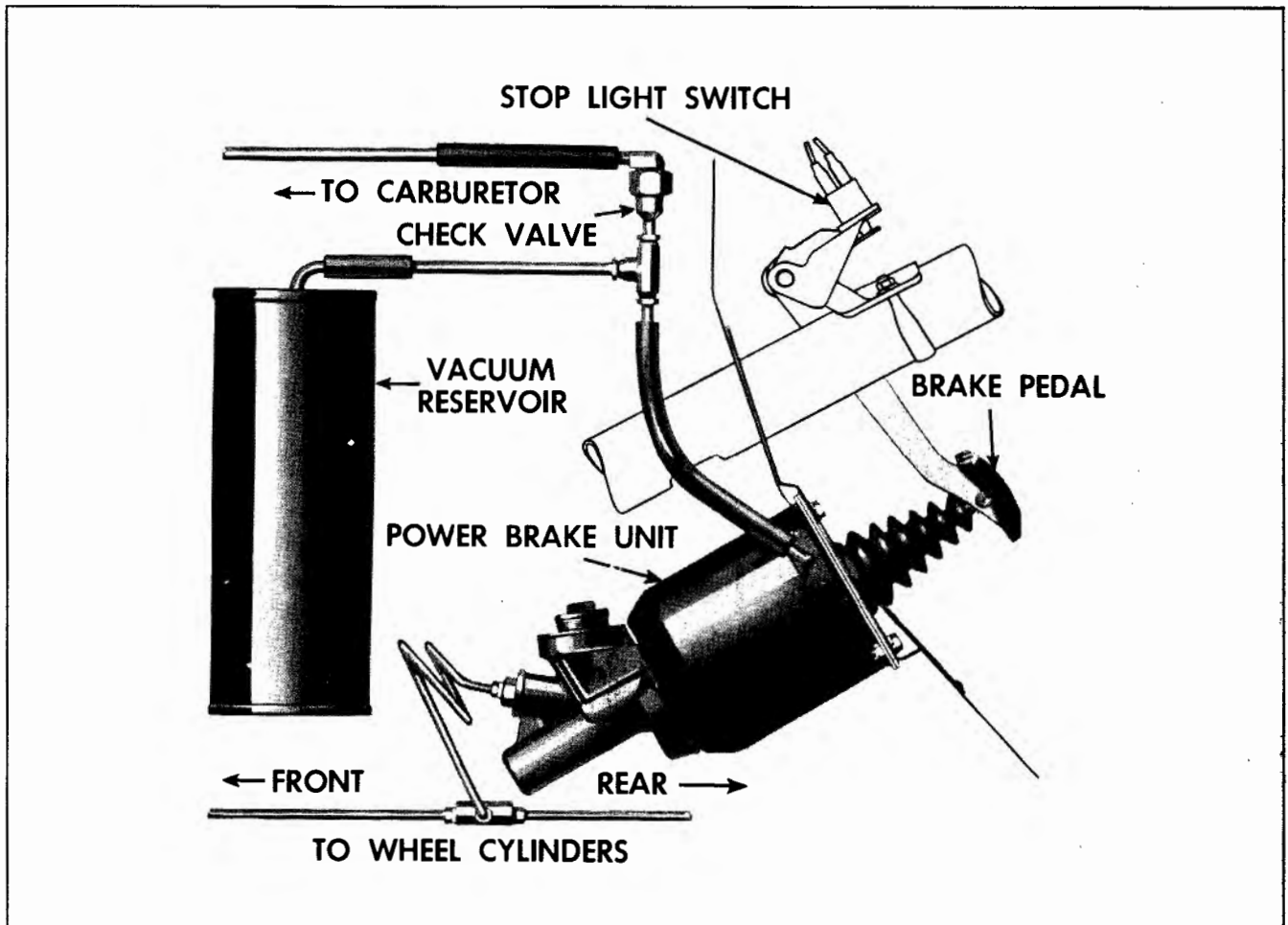
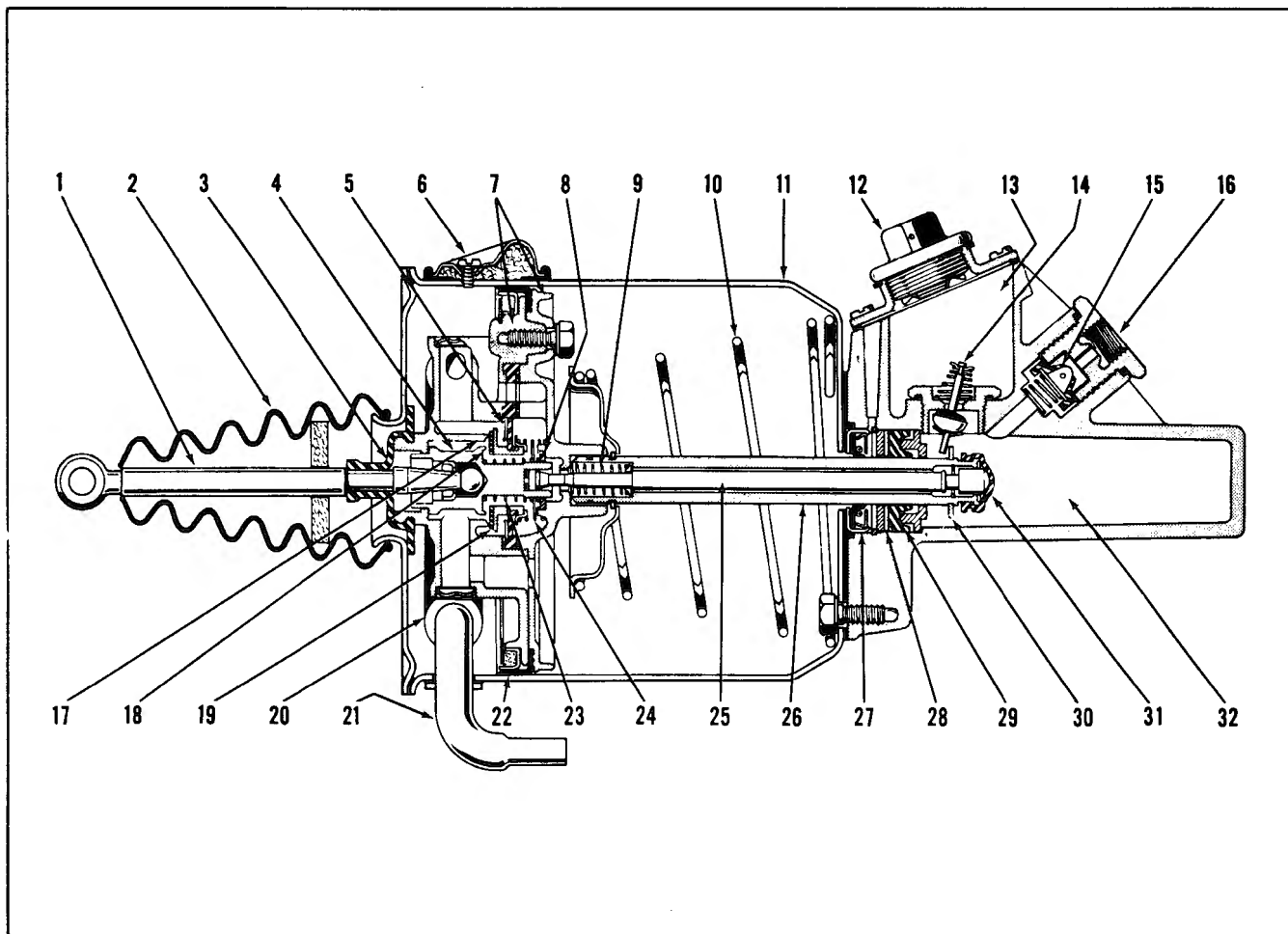


Fig. 5-12 Power Brake Schematic



- |                                    |  |                                    |
|------------------------------------|--|------------------------------------|
| 1. Valve Operating Rod             | 12. Fluid Reservoir Filler Port        | 22. Piston Packing                 |
| 2. Rod Dust Guard                  | 13. Hydraulic Fluid Reservoir          | 23. Valve Return Spring            |
| 3. Valve Plunger Seal              | 14. Hydraulic Fluid Compensating Valve | 24. Poppet Return Spring           |
| 4. Valve Plunger                   | 15. Residual Pressure Check Valve      | 25. Reaction Rod                   |
| 5. Diaphragm Plate                 | 16. Hydraulic Port to Wheel Cylinder   | 26. Hydraulic Plunger              |
| 6. Air Cleaner and Atmosphere Port | 17. Vacuum Port                        | 27. Hydraulic Plunger Wiper Seal   |
| 7. Power Piston                    | 18. Atmosphere Port                    | 28. Hydraulic Plunger Guide Washer |
| 8. Valve Plunger Guide Washer      | 19. Poppet and Diaphragm Assembly      | 29. Hydraulic Plunger Cup          |
| 9. Counter-Reaction Spring         | 20. Internal Vacuum Hose               | 30. Hydraulic Plunger Washer       |
| 10. Piston Return Spring           | 21. Vacuum Inlet Tube                  | 31. Reaction Rod Membrane          |
| 11. Vacuum Cylinder                |  | 32. Hydraulic Cylinder             |

Fig. 5-13 Cross Section of Power Brake

### CONSTRUCTION

The Bendix Hydraulic Reaction unit consists of several basic sections combined into a single assembly (Fig. 5-13). These are: vacuum power cylinder,

power piston, valve and operating rod assembly, hydraulic plunger and reaction rod, and hydraulic cylinder and reservoir assembly.

The vacuum power cylinder consists of a cylinder, a vacuum power piston and a piston return spring.

The power piston and the components which make up the valve assembly are connected to the brake pedal through the valve operating rod. The valve operating rod is connected to the valve plunger which operates within the power piston. The valve return spring is incorporated to return the valve plunger, and valve operating rod to the released position when the pedal is released.

The valve portion of the unit consists of a poppet valve, and atmospheric port and a vacuum port. The atmospheric port seat is located on the valve plunger while the vacuum port seat is located on the left piston plate.

The valve poppet is assembled into a flexible diaphragm in the power piston. A plate is used in conjunction with the diaphragm to limit the effective area of the diaphragm. When the power unit is in the released position, the poppet return spring overcomes the force on the poppet as a result of the atmospheric pressure on the left side of the poppet and the vacuum on the right side of the poppet so that the poppet return spring holds the poppet on the vacuum poppet seat. A boot type seal is used to seal the opening between the piston plate and the valve operating rod.

When pressure is applied to the power piston, the hydraulic plunger assembly transmits the force of the piston to the hydraulic cylinder. A reaction rod which is a part of the hydraulic plunger assembly operates within the hydraulic plunger to transmit a "reaction force" back through the rod against the valve plunger. A counter reaction spring located between the power piston and reaction rod permits initial application of power before sufficient hydraulic pressure is developed within the master cylinder to react through the membrane at the end of the hydraulic plunger and the reaction rod.

The hydraulic cylinder with the fluid reservoir is attached to the end of the vacuum cylinder. The hydraulic cylinder is sealed off from the vacuum cylinder at the hydraulic plunger by a wiper leather seal and a rubber cup type seal. A hydraulic compensating valve is placed between the hydraulic cylinder and the fluid reservoir. This valve is of the tilting type and is closed at all times except when the unit is in its fully released position. A residual check valve located at the output end of the hydraulic cylinder maintains a slight pressure in the hydraulic

lines and wheel cylinders when the brakes are released as in the conventional brake system. This prevents the entrance of air into the hydraulic lines upon release of the brakes.

#### PRINCIPLES OF OPERATION

##### RELEASED POSITION (Fig. 5-14).

When the engine is running and the brakes are released, vacuum from the engine intake manifold is transmitted through the vacuum check valve to the power brake vacuum tube and to the vacuum reservoir. From the vacuum tube, vacuum is transmitted into the unit through a flexible hose which is attached to the power piston at the left side.

In the released position (Fig. 5-14) the driver's foot pressure is removed from the valve operating rod. This allows the valve operating rod and valve plunger to be held to the left in the power piston by the valve return spring, opening the atmospheric port while the vacuum port is closed. With atmosphere present on both sides of the power piston, the unit is in the released position. The power piston return spring is attached to the hydraulic plunger and holds the hydraulic plunger and vacuum piston in the released position.

When the power piston and valve operating rod are in their released positions, the various parts of the hydraulic portion of the unit are also in their released positions. The compensating valve is tilted by the washer at the end of the hydraulic plunger permitting fluid flow from the reservoir to the hydraulic cylinder. The residual pressure check valve maintains fluid under slight pressure in the lines to the wheel cylinders to prevent the entrance of air into the hydraulic system.

##### RELEASING (Fig. 5-14).

When the driver releases the pressure applied to the valve operating rod, the valve plunger returns to its released position. The vacuum port is then closed and the atmospheric port reopened to admit atmosphere to the right side of the power piston to balance the piston in atmosphere. The power piston return spring returns the power piston and hydraulic plunger to the released position. As the hydraulic plunger approaches the released end of the stroke, the washer on the hydraulic plunger again contacts the compensating valve stem and opens the valve port to allow the release of excessive fluid in the hydraulic cylinder to return to the fluid reservoir or to permit makeup fluid to flow by gravity from the fluid reservoir to the plunger chamber.



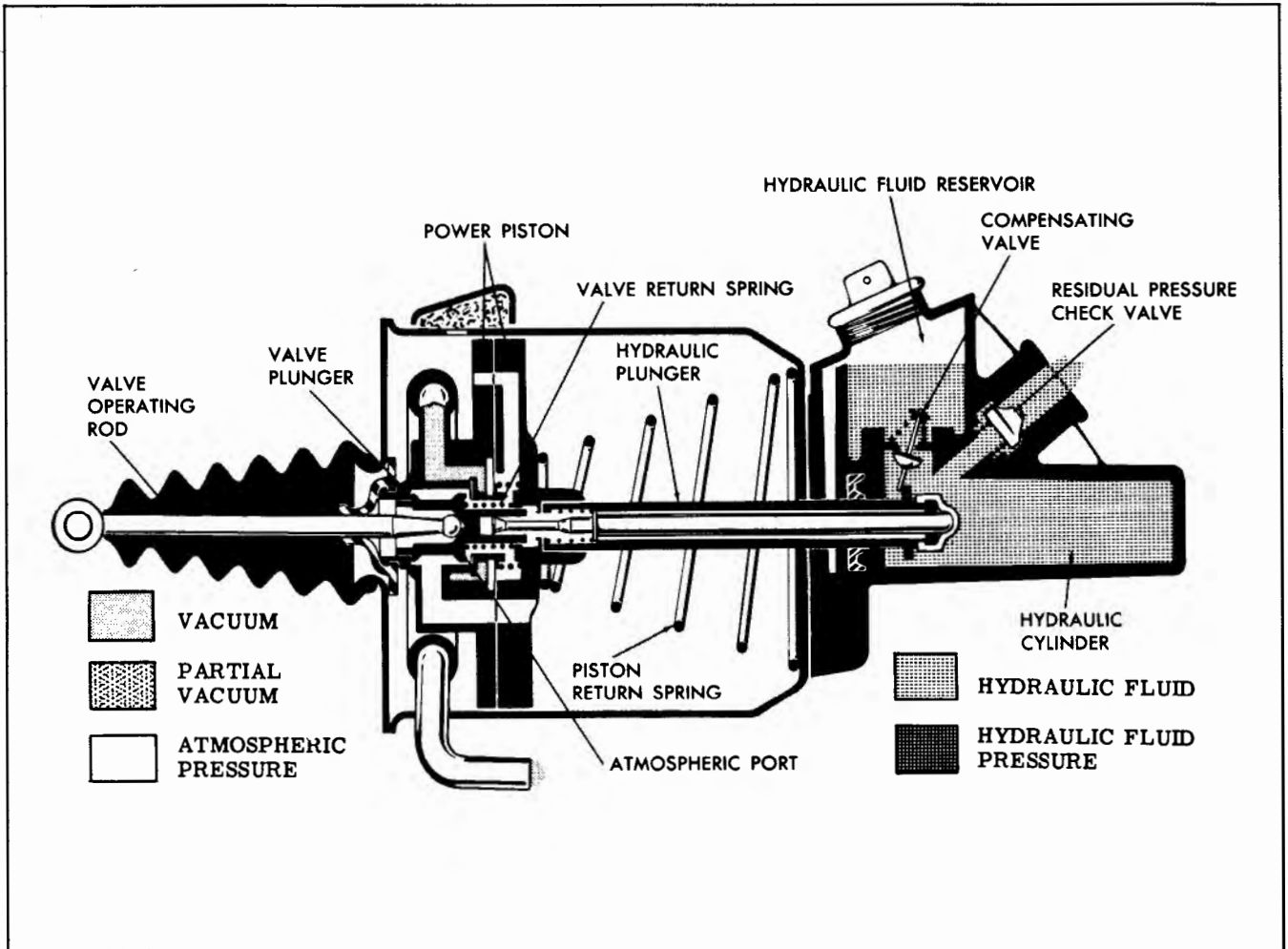


Fig. 5-14 Power Brake in Released Position

#### APPLYING (Fig. 5-15).

As the brake pedal is applied by the driver, the push rod moves the valve plunger and closes the atmospheric port, see (Fig. 5-15). After the atmospheric port is closed against the poppet, further movement of the valve push rod and plunger compresses the poppet return spring and opens the vacuum port. When the vacuum port is opened, vacuum is admitted through the piston passages to the right side of the power piston. With partial vacuum on the right side of the power piston and atmosphere on the left side of the piston, the differential in pressure creates a force which moves the power piston to the right, moving the hydraulic plunger with it. Initial movement of the plunger allows the compensating valve to seat and trap fluid in the hydraulic cylinder. Hydraulic fluid pressure is then forced through the residual pressure check valve and brake lines to the wheel cylinder.

Hydraulic pressure against the membrane at the end of the hydraulic plunger transmits a pressure to the reaction rod. This pressure acts back to the left through the reaction rod and counter reaction spring against the valve plunger and valve operating rod which tends to close the vacuum port and re-open the atmospheric port. Since the reaction force is in proportion to the hydraulic pressure developed within the hydraulic cylinder and the wheel cylinders, it gives the driver a "feel" of the amount of braking.

#### HOLDING POSITION (Fig. 5-16)

When pressure applied by the driver remains constant, the valve is allowed to remain in its holding position. In the holding position both the vacuum and the atmospheric ports of the poppet valve are closed. No further movement of the power piston can occur unless the pressure on the pedal is increased or decreased.

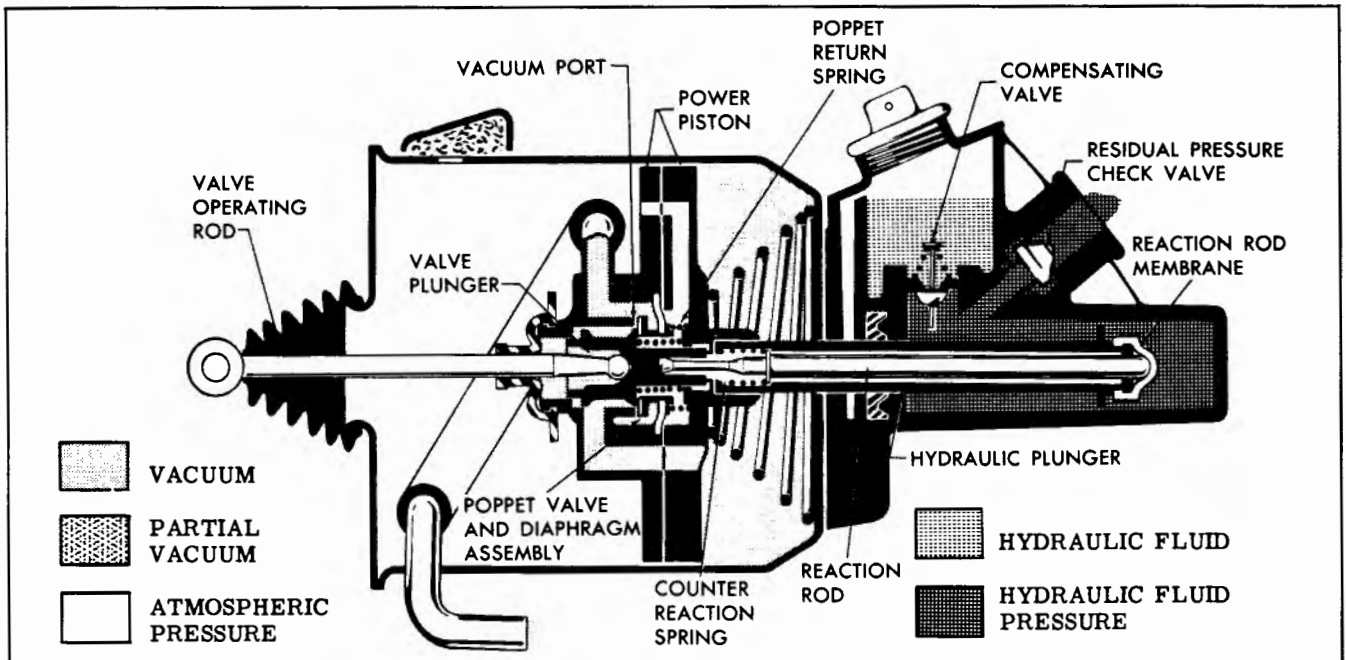


Fig. 5-15 Power Brake in Applying Position

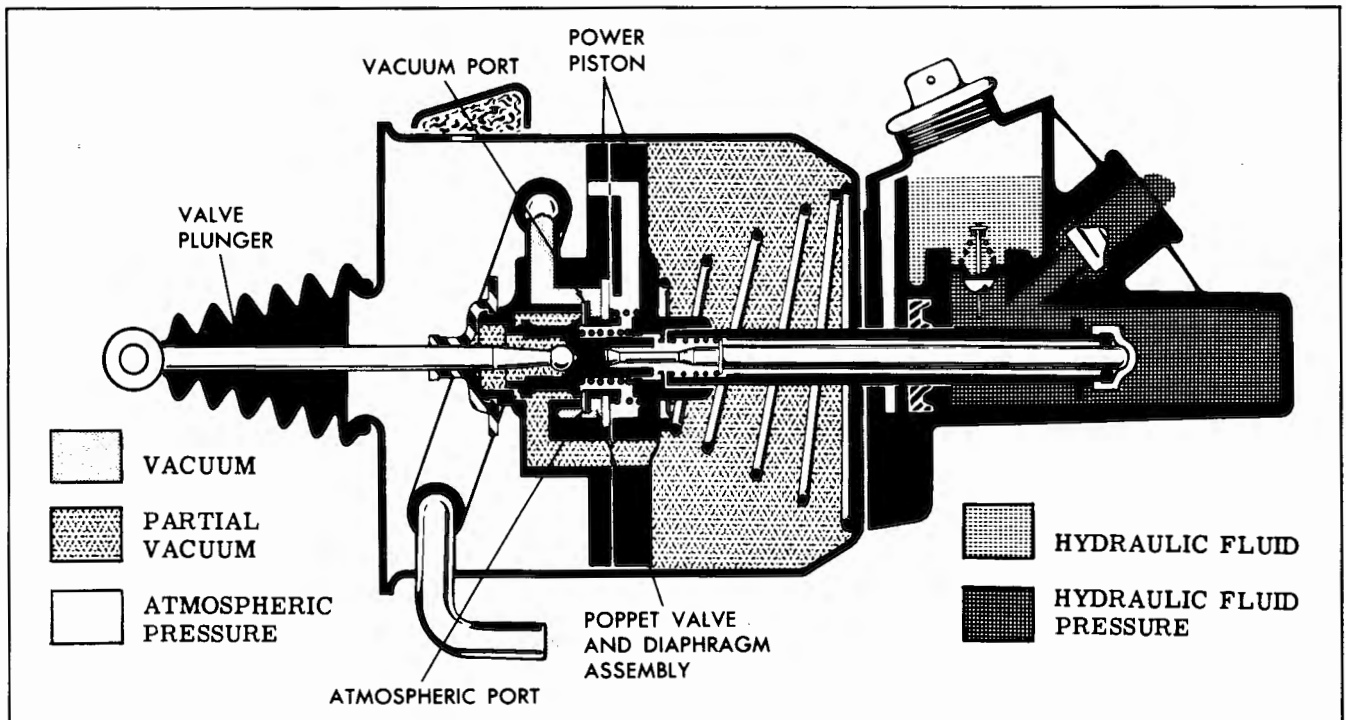


Fig. 5-16 Power Brake in Holding Position

### 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 remaining in the system, the brakes can still be applied manually; however, for a given

amount of vehicle braking more physical effort must be exerted by the driver than when there is vacuum present in the system. In the case of "no power" the force supplied by the driver against the end of the valve operating rod will be transmitted directly to the hydraulic plunger and to the wheel cylinders.

## PERIODIC SERVICE

Each time the car is in the service department the brake pedal height should be observed. Brakes should be adjusted any time the pedal pad to floor clearance is less than 1" with brakes applied and engine running.

The power brake piston packing is lubricated at the time of original assembly and needs no further lubrication. **CAUTION:** Do not lubricate push rod and valve plunger.

## ADJUSTMENTS ON CAR

There are no special brake adjustments required on Pontiac cars equipped with power brakes. Any time the brake pedal goes to within 1" from floor (floor mat to underside of pedal pad) brakes should be adjusted as outlined under "Adjustments on Car", page 5-3.

The following inspections must be made on cars with power brakes at the time the brakes are adjusted.

1. Check for possible vacuum leaks at carburetor, vacuum check valve, vacuum reservoir, and vacuum power cylinder.
2. Check fluid level in hydraulic cylinder reservoir. Fluid level should be  $\frac{1}{2}$ " from the top of filler plug opening.
3. Check condition of air cleaner hair and insert clean hair if necessary.
4. Check steering column pedal pivot bracket for loose screws. Check for free operation of brake pedal. If binding exists check for misalignment between pedal and vacuum cylinder push rod.
5. Check stop light switch for proper operation.

## MINOR REPAIRS

### BLEEDING BRAKES

Brakes should be bled in the same manner as standard brakes following the procedure on page 5-5.

## STOP LIGHT SWITCH—REMOVE AND REPLACE

### REMOVE

1. Disconnect wires from switch.
2. Remove cap screw which retains switch to left side of brake pedal pivot bracket.
3. Remove switch from end of pivot bracket shaft.

### REPLACE

1. Position switch on end of pivot bracket shaft and loosely install cap screw.
2. Ensure that brake pedal is retracted (out) to its normal position, and position switch so that the distance between the striker plate and base of switch is not less than  $11/32$ ". **NOTE:** A size "S" drill can be used as a gauge.
3. Connect wires to stop light switch.
4. Start engine and check for proper operation of switch. Switch operation is satisfactory if stop lights go "on" when pedal has traveled approximately  $\frac{1}{2}$ " from normal position.

## REMOVAL OF POWER BRAKE UNIT

1. Disconnect vacuum hose from vacuum pipe leading to vacuum tee connector.
2. Raise car and remove engine side apron from left side.
3. Remove coiled hydraulic pipe from outlet fitting on hydraulic cylinder and from tee connector.
4. Disconnect push rod from pedal.
5. Disconnect wires from stop light switch.
6. Remove nuts from U-bolt which retains pedal pivot bracket to steering column; remove pedal and pivot bracket (with stop light switch assembly attached).
7. Remove accelerator pedal.
8. Push rubber grommet up on steering column and move floor mat out of way.
9. Remove clutch pedal seal retainer (Synchro-Mesh equipped cars) and steering column seal retainer and remove seals.
10. On Hydra-Matic equipped cars, remove screws which retain mounting plate to floor pan and remove mounting plate with power brake unit attached. On Synchro-Mesh equipped cars, proceed as follows:



a. Remove screws which retain power brake unit to mounting plate. (Brake unit will rest on frame.)

b. Remove screws which retain mounting plate to floor pan and remove mounting plate, "jockeying" as necessary to clear clutch pedal.

c. Remove power brake unit. **CAUTION:** Do not support or carry brake unit by push rod since push rod may be pulled out of plunger.

11. Remove mounting plate from brake unit, if not previously removed, and remove vacuum hose from vacuum cylinder inlet tube.

## DISASSEMBLY OF BENDIX POWER BRAKE UNIT

**NOTE:** Use extreme care in handling the natural rubber parts to prevent their coming into contact with mineral oil, grease, gasoline, or cleaning solvent.

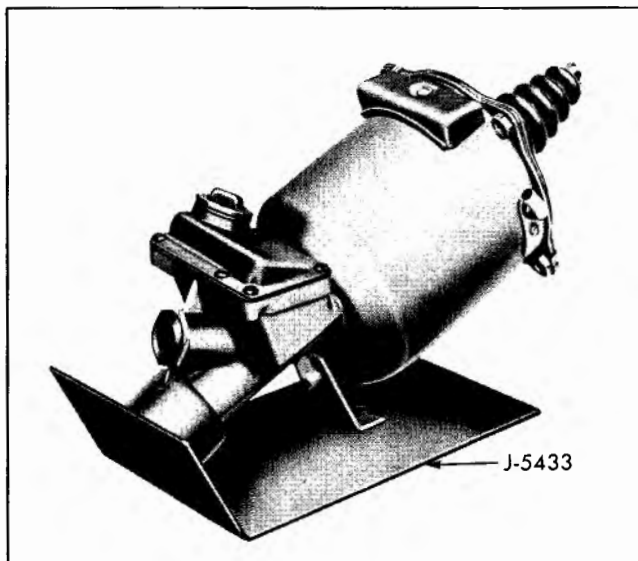


Fig. 5-17 Power Brake Unit in Holding Fixture

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

2. Mount unit in holding fixture J-5433 (Fig. 5-17). If holding fixture is not available, clamp hydraulic cylinder in vise.

### REMOVAL OF END PLATE AND AIR CLEANER (Fig. 5-18)

With unit in holding fixture J-5433 remove rubber dust guard (1) and felt (2) from valve push rod. **NOTE:** A drop of brake fluid on end of push rod eye will permit removal of dust guard without damage. Bend out tabs (3) on end plate and remove end plate (4) and gasket (5). Slide vacuum hose (6) off vacuum tube attached to vacuum cylinder (7). Remove air cleaner attaching screw (12) and separate gasket (11), remove shell (10), hair (9) and rubber seal (8).

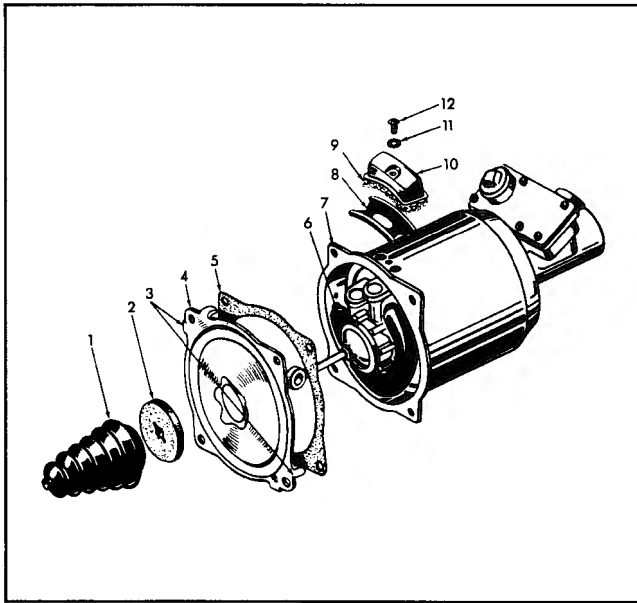


Fig. 5-18 Removal of End Plate and Air Cleaner

### REMOVAL OF VACUUM PISTON AND VALVES (Fig. 5-19)

Remove tube and plate attaching screws (7), tube and plate (8) and gasket (9). Remove burrs from inside of vacuum cylinder at air cleaner and vacuum tube attaching screw holes (10). Pull out vacuum piston and valve assembly (6) from vacuum cylinder (1). Remove counter reaction spring (5) and washer (4) from end of hydraulic plunger (2). Then remove "O" ring seal (3) from groove in hydraulic plunger.

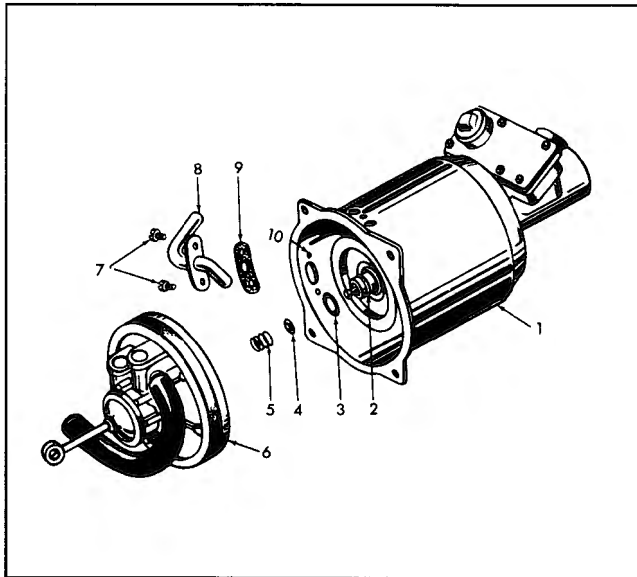


Fig. 5-19 Removal of Vacuum Piston and Valves

### REMOVAL OF PISTON RETURN SPRING (Fig. 5-20)

Push in on spring retainer plate (2) sufficient to release "C" washer (1). While holding spring compressed, slide "C" washer out of groove in hydraulic plunger (4). Remove retainer plate (2) and vacuum piston return spring (3).

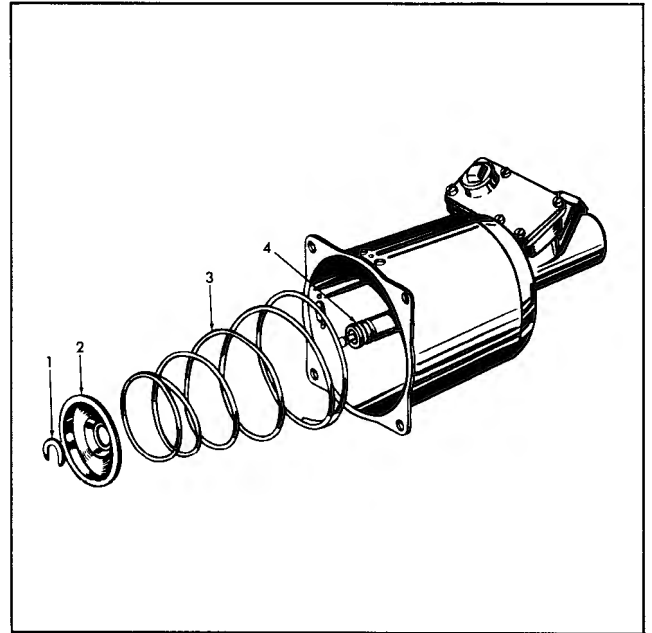


Fig. 5-20 Removal of Piston Return Spring

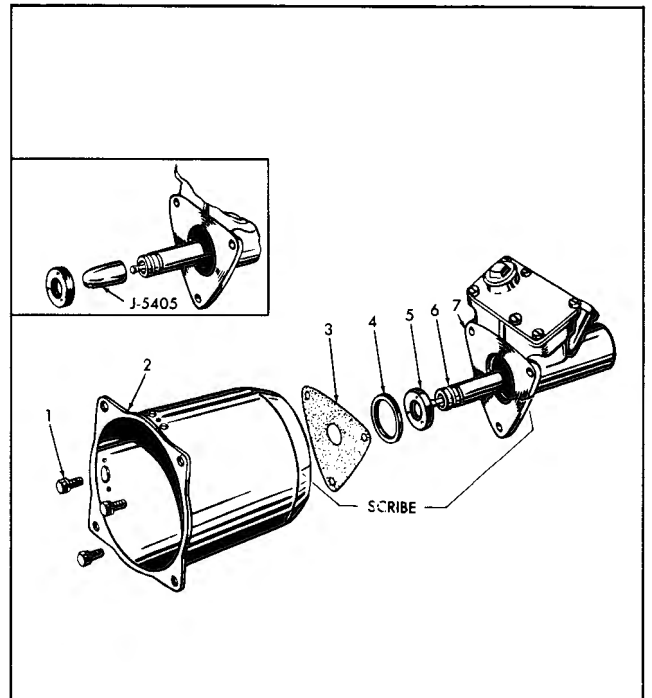


Fig. 5-21 Removal of Vacuum and Hydraulic Cylinder



### REMOVAL OF VACUUM AND HYDRAULIC CYLINDER (Fig. 5-21)

Scribe across vacuum cylinder (2) and hydraulic master cylinder (7). With power brake cylinder mounted in holding fixture J-5433, remove three vacuum cylinder attaching screws and lockwashers (1) (use 7/16" socket with extension). Lift off vacuum cylinder, remove Vellumoid gasket (3) and rubber ring gasket (4). Push hydraulic plunger (6) into hydraulic master cylinder and remove leather seal (5) from master cylinder (7).

### REMOVAL OF PLUNGER SEAL, PLATE AND VALVE COVER (Fig. 5-22)

Scribe across master cylinder (6) and cover (3); remove filler cap (2), remove six cover attaching screws (1), cover (3) and gasket (4). Remove compensating valve (5) (use 1-1/8" thin wall socket). Loosen outlet fitting (6) with 1-1/4" wrench. **DO NOT REMOVE OUTLET FITTING AT THIS TIME.** Remove retainer ring (7). When retainer ring is of the Truarc type, use tool J-4480. When retainer ring is of Spirolex type, use sharp pointed instrument to pry ring out of groove. Pull hydraulic plunger (12) out of hydraulic master cylinder and remove steel washer (8), fibre guide washer (9), rubber cup (10) and cup retainer (11) from hydraulic plunger. Re-

move membrane seal (15) nylon gasket (14) from hydraulic plunger (13), see inset upper left.

### REMOVAL OF RESIDUAL CHECK VALVE (Fig. 5-23)

Remove hydraulic master cylinder from holding fixture and then remove outlet fitting (1), residual check valve spring (4), valve cup and retainer (3) from master cylinder (5). Remove gasket (2) from fitting (1).

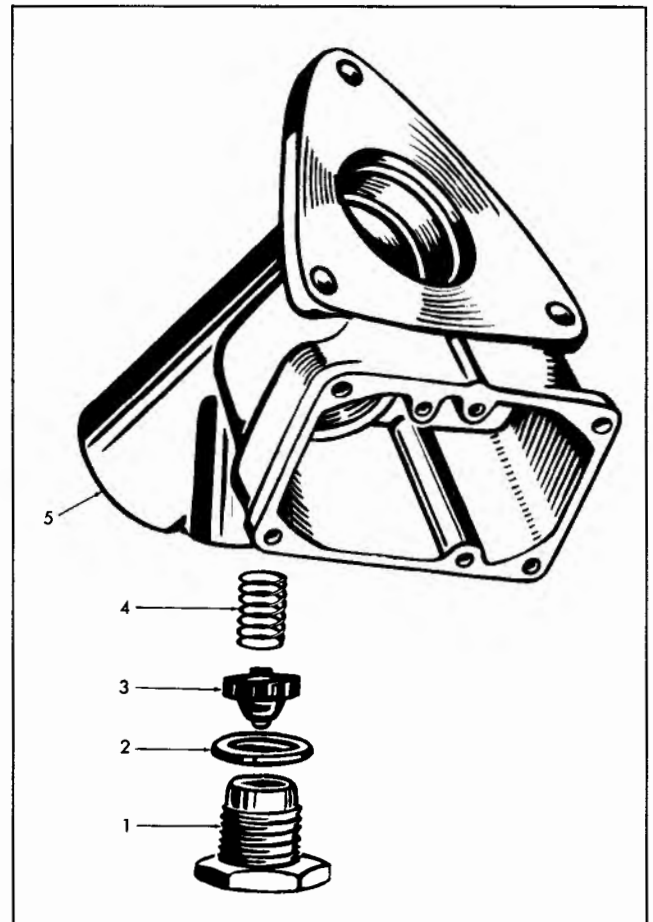


Fig. 5-23 Removal of Residual Check Valve

### DISASSEMBLY OF COMPENSATING VALVE (Fig. 5-24)

Clamp compensating valve fitting (3) in vise; spread and remove spring retainer (1), then remove spring (2), valve stem and poppet (5) and fitting gasket (4) from compensating valve fitting.

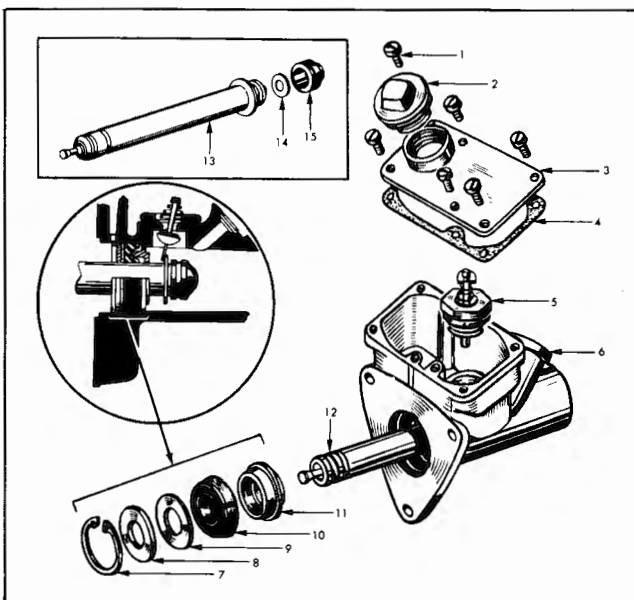


Fig. 5-22 Removal of Plunger Seal, Plate and Valve Cover

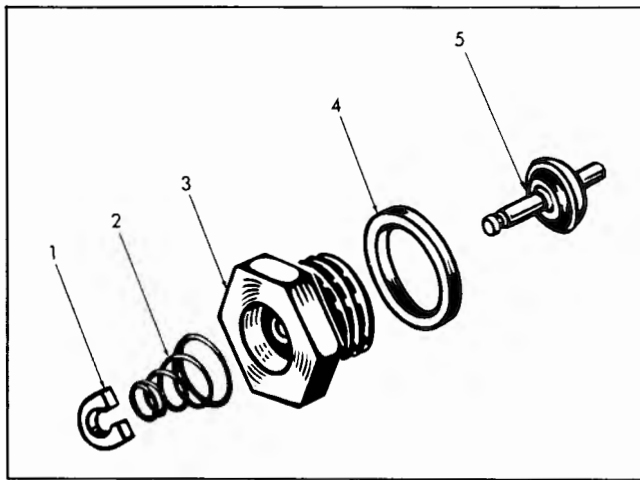


Fig. 5-24 Disassembly of Compensating Valve

### REMOVAL OF PISTON (Fig. 5-25)

Remove valve rod seal and stop (16) from piston (20) and piston rod (15). Remove vacuum hose (21) from piston assembly. Remove retainer plate (17) felt (18) and expander spring (19). Hold rear piston plate (14) in vise and remove four cap screws (1),

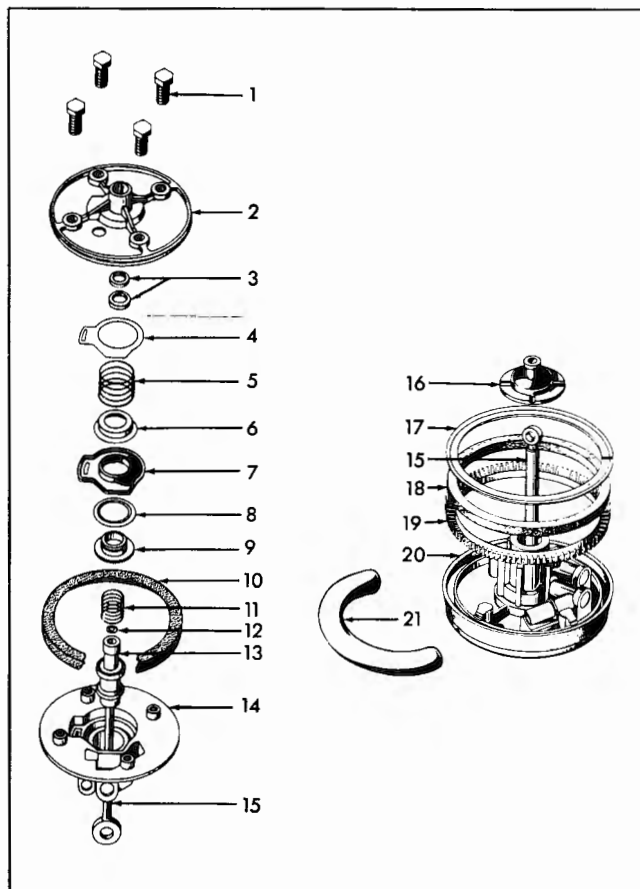


Fig. 5-25 Removal of Piston

front piston plate (2), diaphragm plate (4) and poppet return spring (5). Remove diaphragm parts (group 6 through 9) as an assembly and then separate these parts. Lift off leather piston packing (10) and valve return spring (11). Remove rubber bumper (12) using sharp pointed instrument from end of valve plunger (13), seal and fibre washer (3) from piston plate (2). Remove valve operating rod (15) and valve plunger (13) from piston. **NOTE:** If valve operating rod or valve plunger are to be replaced, inject alcohol in valve plunger opening around the valve operating rod to enable easy removal of rubber lock. Hold valve operating rod in vise and drive valve plunger off operating rod using 3/4" open end wrench or similar tool against valve plunger.

## CLEANING AND INSPECTION

### CLEANING

Thoroughly wash all parts in alcohol or a commercial cleaning fluid. *Use only alcohol* on rubber parts or parts containing rubber. Use air hose to blow dirt and cleaning fluid out of recesses and internal passages. Remove rust or corrosion from bore of vacuum cylinder shell with fine emery cloth.

It is *important* that all cleaned parts be placed on clean paper or cloth to prevent the possibility of dirt being assembled into the power brake.

### INSPECTION

Inspect all parts for wear or damage and replace as necessary. Particular attention should be given to the following items.

#### VACUUM CYLINDER SHELL

Inspect shell for scores, pits, dents or nicks, or damaged threads in nuts or in mounting flanges.

#### HYDRAULIC CYLINDER CASTING

Examine the bore down one inch from the open end. For the hydraulic cup to seal properly, this

portion of the bore must be free from scores, deep scratches and corrosion. The sealing surfaces at the reservoir cover, compensating port, and hydraulic outlet port must be free of scoring, pitting, dents and nicked edges. Also check casting for cracks and damaged threads.

#### HYDRAULIC PORT FITTING

The surface at the small end of the fitting must be free of scoring or corrosion which might prevent sealing with the rubber cup of the residual check valve.

#### COMPENSATING PORT FITTING

Inspect surface around port opening, inside threaded end of fitting, for scoring or corrosion which might prevent proper seating of the compensating valve.

#### VALVE SUPPLY TUBE

Make sure the tube braze is secure and the tube plate is not distorted.

#### PISTON PLATES

Examine plates for cracks and damaged threads. Inspect plunger bore in the rear piston plate and poppet seats for scratches and nicks. *Do not* attempt to refinish bore. Replace with new plate if necessary.

#### HYDRAULIC PLUNGER AND WASHER ASSEMBLY

Inspect polished surface for scores, pits, or dents. *Do not* attempt to refinish plunger surface; replace with new assembly if necessary.

#### PUSH ROD AND PLUNGER ASSEMBLY

Rod must pivot freely in plunger without any noticeable end play. Inspect plunger for scores, pits, or dents on outside diameter of polished surfaces. *Do not* attempt to refinish plunger surface; replace with new assembly if necessary.

#### VACUUM CYLINDER END PLATE

Examine end plate for distortion.

#### ASSEMBLY OF BENDIX POWER BRAKE UNIT

**NOTE:** Before assembly dip all hydraulic system parts in clean alcohol and place in a clean pan or on a clean paper.

#### REPLACEMENT OF RESIDUAL CHECK VALVE (Fig. 5-26)

Assemble new gasket (2) over threads of hydraulic outlet fitting (1). Hold outlet fitting in vertical position and insert cone end of cup and retainer (3) in fitting. Place check valve spring (4) in recess of retainer. Hold hydraulic master cylinder (5) upside down and thread outlet fitting into hydraulic master cylinder hand tight.

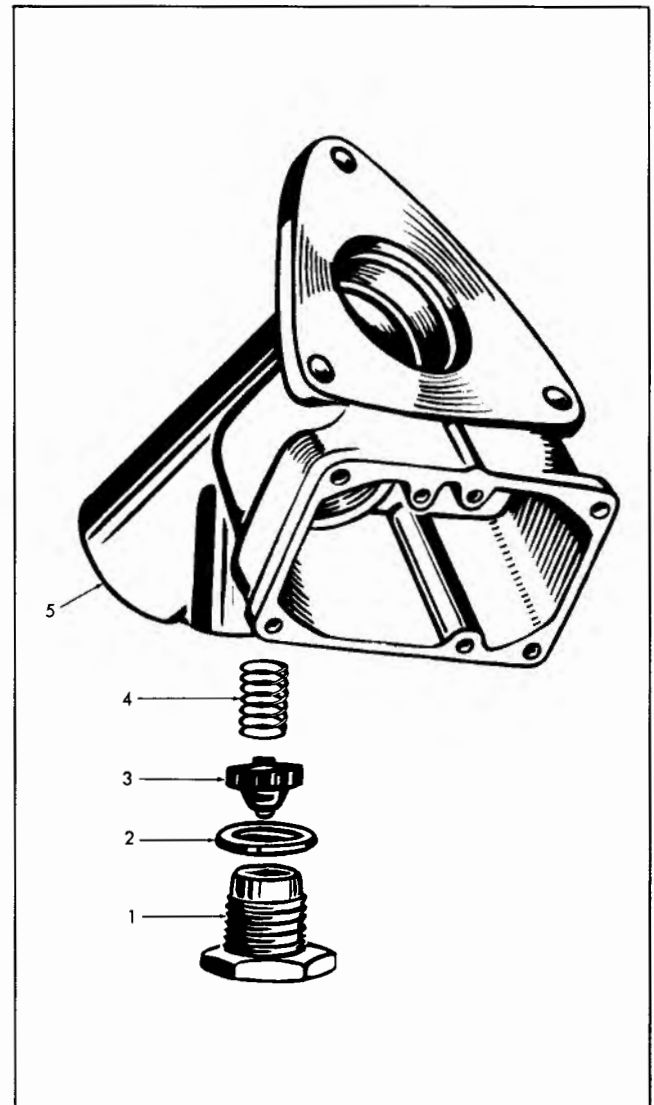


Fig. 5-26 Replacement of Residual Check Valve



### ASSEMBLY OF COMPENSATING VALVE (Fig. 5-27)

Insert grooved end of valve poppet and stem (5) through hole in fitting (3) from threaded end. Assemble large diameter end of spring (2) over stem, hold valve poppet on seat, compress spring and assemble retainer washer (1) in groove of valve stem. Squeeze ends of washer together with pliers. Assemble new gasket (4) over threads of compensating valve fitting.

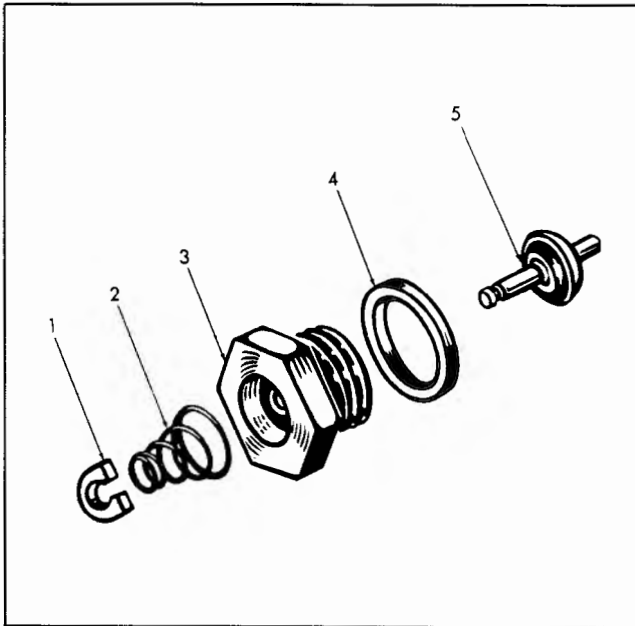


Fig. 5-27 Assembly of Compensating Valve

### ASSEMBLY OF PLUNGER SEAL, PLATE AND VALVE COVER (Fig. 5-28)

With master cylinder in vise, assemble nylon washer (14) and rubber membrane (15) at end of hydraulic plunger (13) see inset upper left. Insert membrane end of plunger (12) in cylinder and assemble seal parts with seal installer J-5405 (inset of Fig. 5-17) over end of plunger as follows: cup retainer (11), with counterbored side away from washer on plunger; cup (10), fibre washer (9), and steel washer (8). Slide seal parts into recess of cylinder, push plunger in to end of its stroke and assemble retainer ring (7) in ring groove. Assemble compensating valve (5) in threaded hole of cylinder and securely tighten (use

$1\frac{1}{8}$ " thin wall socket). Place new gasket (4) on master cylinder, align cover (3) to scribe marks, replace and securely tighten cover screws (1), loosely assemble filler cap (2). Tighten outlet fitting securely (6).

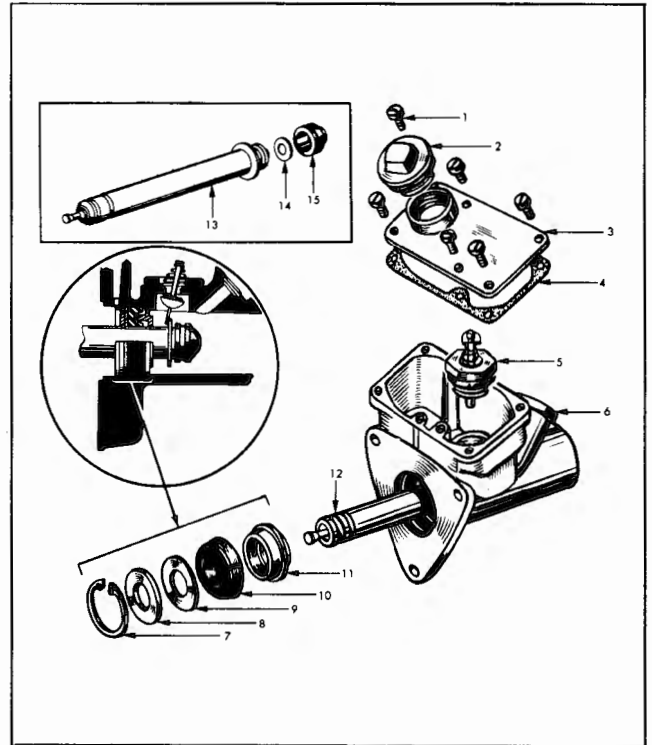


Fig. 5-28 Assembly of Plunger Seal, Plate and Valve Cover

### ASSEMBLY OF VACUUM AND HYDRAULIC CYLINDER (Fig. 5-29)

Pull out hydraulic plunger (6) with seal installer J-5405 placed over end of plunger, assemble leather seal (5) over seal installer with lip of leather toward hydraulic master cylinder, see inset upper left. Press seal into recess of hydraulic master cylinder and then remove seal installer J-5405. Place "O" ring (4) in recess of master cylinder. Insert three cap screws through holes in end of vacuum cylinder (1) and holes in gasket (3). Align vacuum cylinder, gasket and hydraulic master cylinder to scribe marks, assemble three cap screws and tighten securely. Wipe out inside of vacuum cylinder and then pull out hydraulic plunger to end of its stroke.



Place assembly ring J-5406 over piston leather and turn piston assembly upside down. Assemble expander spring (19) against inside lip of leather packing as shown. Dip felt (18) in Bendix Vacuum Cylinder Oil and assemble on expander spring. Assemble retainer plate (17) as shown making certain plate is securely anchored in grooves of four projections of piston assembly. Tighten four attaching cap screws securely and remove assembly ring, J-5406. Assemble vacuum hose (21) on piston. Dip valve push rod seal and bumper (16) in brake fluid and assemble over end of valve push rod (15) making certain seal is seated in groove of piston assembly.

### ASSEMBLY OF VACUUM PISTON IN CYLINDER (Fig. 5-32)

Apply thin film of vacuum cylinder oil to inside of cylinder (1). Assemble "O" ring seal (3) in groove of hydraulic plunger. Then assemble counter reaction spring (5) and washer (4) in recess at end of plunger. Insert piston (6) in cylinder. When end of hose lines up with elongated hole, assemble new gasket (9), tube and plate (8) and attach with screws (7). Slide end of hose on vacuum tube approximately  $\frac{5}{8}$ ". Operate piston through its full stroke several times to make certain that vacuum hose does not rub against cylinder or piston.

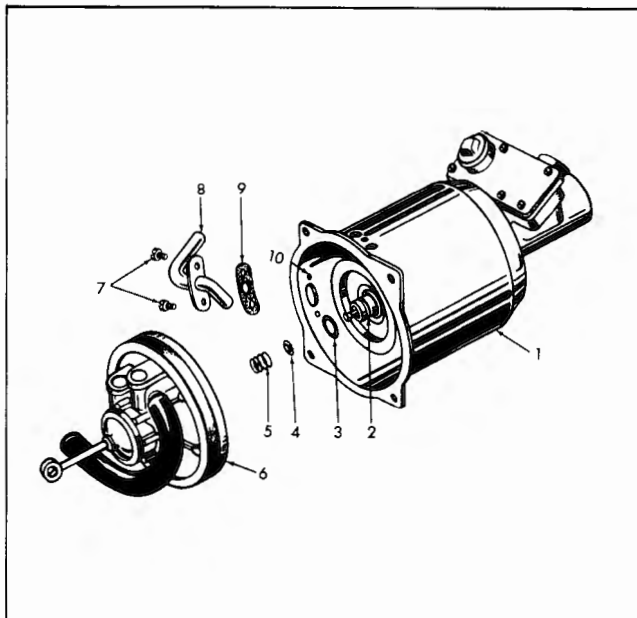


Fig. 5-32 Assembly of Vacuum Piston in Cylinder

### ASSEMBLY OF END PLATE AND AIR CLEANER (Fig. 5-33)

Assemble rubber seal (8) on edges of air cleaner shell (10). Attach air cleaner to vacuum cylinder using screw (12) and gasket (11). With 6" scale or other similar tool, push hair (9) into open spaces at each end of air cleaner. Align holes on end plate (4) and gasket (5) with holes in flange of cylinder and bend over two tabs of end plate to secure end plate and gasket to cylinder. Assemble push rod felt (2) in second fold of rubber guard (1). Dip small end of guard in brake fluid and assemble guard and felt over push rod. Attach lip of rubber guard over "scallops" at center of end plate.

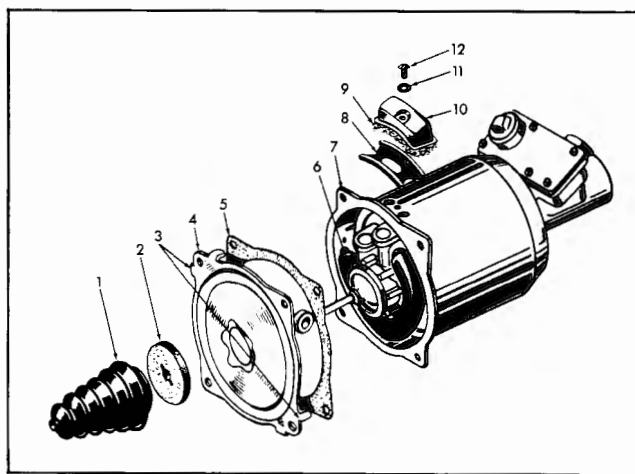


Fig. 5-33 Assembly of End Plate and Air Cleaner

## INSTALLATION OF POWER BRAKE UNIT

**NOTE:** Installation procedure for Hydra-Matic equipped cars differs from that for Synchro-Mesh equipped cars. Each procedure is outlined below.

### PROCEDURE FOR HYDRA-MATIC EQUIPPED CARS

1. Install vacuum hose on tube at side of cylinder and install mounting plate.
2. Place mounting plate, with brake unit attached, in position and install screws which retain mounting plate to floor pan.
3. Replace steering column seal and seal retainer.



4. Replace brake pedal pivot bracket (with pedal and stop light switch attached). **NOTE:** The brake pedal pivot bracket has a tang which must fit in a hole in the steering column.

5. Install push rod in pedal, fastening pin with hairpin retainer. Attach anti-rattle spring around push rod and connect to hole in brake pedal (Fig. 5-34).

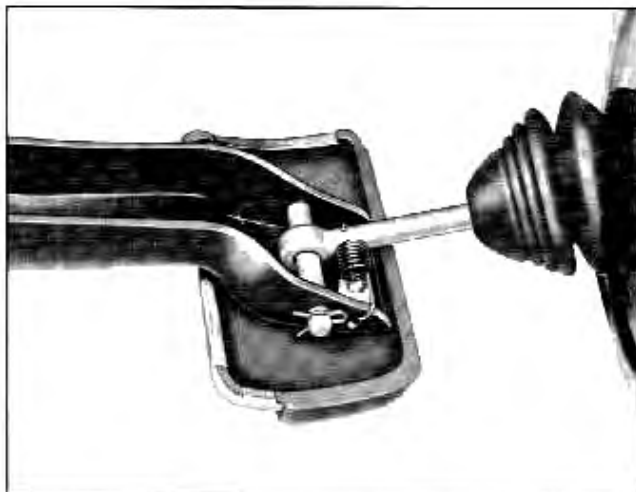


Fig. 5-34 Correct Assembly of Brake Pedal to Push Rod

6. Pull rubber boot back from vacuum cylinder so that push rod can be observed where it enters vacuum cylinder. There should be approximately  $\frac{3}{8}$ " clearance between push rod and bore of plunger at top or 12 o'clock position with brake pedal released (Fig. 5-35). If improper clearance is noted, loosen brake pedal pivot bracket and shift slightly to obtain clearance. **NOTE:** If clearance cannot be obtained, check for bent push rod or bent mounting plate.

7. Connect stop light switch wires and check for proper operation.

8. Connect hydraulic pipe and vacuum hose.

9. Fill hydraulic cylinder with recommended brake fluid (page 5-12) and bleed brakes as outlined on page 5-5. **CAUTION:** Use only recommended brake fluid (page 5-12) to insure satisfactory brake performance.

#### PROCEDURE FOR SYNCHRO-MESH EQUIPPED CARS

1. Install vacuum hose on tube at side of cylinder.

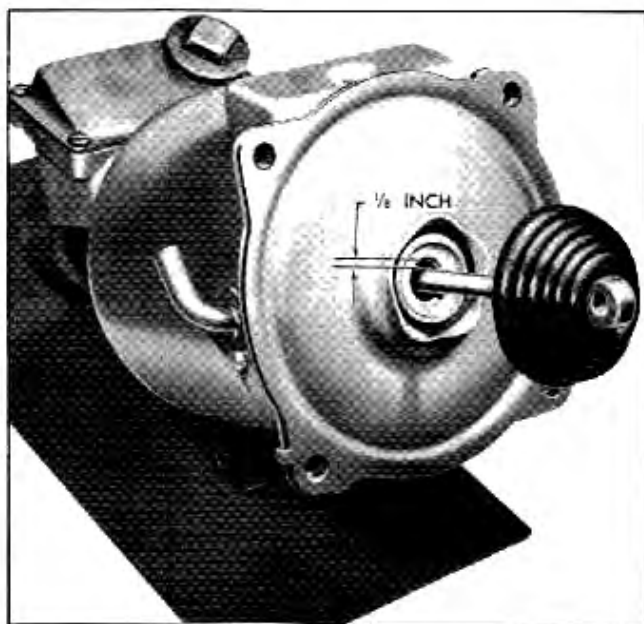


Fig. 5-35 Clearance Between Push Rod and Plunger

2. With aid of an assistant to support and align brake unit from underside of car or under hood, position brake unit in car.

3. Place mounting plate over clutch pedal, position against floor pan, and install retaining screws.

4. Align brake unit with mounting plate and install retaining screws.

5. Replace clutch pedal and steering column seals and seal retainers. Complete installation as outlined in steps 4 through 9 of above procedure.

## DIAGNOSIS AND TESTING—BENDIX POWER BRAKES

### SYSTEM TESTS

Road test brakes by making a brake application at about 20 MPH to determine if vehicle stops evenly and quickly. If pedal has a spongy feel when applying the brakes, air may be present in the hydraulic system. Bleed system as described on page 5-5.

When engine is stopped and transmission is in neutral, apply brakes several times to remove all vacuum in the system. Depress brake pedal, hold

light foot pressure on pedal and start engine. If the vacuum system is operating, pedal will tend to fall away under foot pressure, and less pressure will be required to hold pedal in applied position. If no action is felt, vacuum system is not functioning.

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

If the brake pedal travels to within 1" of the toeboard, brake shoes require adjustment or relining.

### TROUBLE DIAGNOSIS

The same types of brake troubles are encountered with power brakes as with standard brakes. Before checking power brake system for source of trouble refer to trouble diagnosis of standard brakes on page 5-8.

After these possible causes have been eliminated check for cause as outlined below.

### HARD PEDAL

- a. Vacuum failure due to
  1. Faulty vacuum check valve.
  2. Collapsed vacuum hose.
  3. Plugged vacuum hose or fittings.
  4. Leaking vacuum reservoir, or vacuum hose and pipe connections.
- b. Bound up pedal mechanism.
- c. Glazed linings.
- d. Grease, brake fluid, or water on linings.
- e. Power brake unit trouble due to
  1. Vacuum hose on piston loose or restricted.
  2. Vacuum leak in unit between piston plates, past leather piston packing, between vacuum cylinder and hydraulic cylinder, or around hydraulic plunger seal.
  3. Restricted air cleaner.
  4. Jammed push rod and valve plunger.
  5. Broken counter-reaction spring.
  6. Leak past atmosphere poppet valve.
  7. Dented or distorted vacuum cylinder.

- c. Anchor pins loose.
- d. Power brake unit trouble due to
  1. Misaligned pedal bracket or steering column jacket.
  2. Sticking push rod and valve plunger.

### PEDAL GOES TO FLOOR (OR ALMOST TO FLOOR)

- a. Brakes require adjustment.
- b. Air in hydraulic system.
- c. Hydraulic leak in lines or at wheel cylinders.
- d. Fluid in reservoir needs replenishing.
- e. Cracked drums or broken linings.
- f. Power brake hydraulic leakage at
  1. Compensating valve.
  2. Hydraulic plunger seal.
  3. Compensating seals or outlet fitting seals.

### BRAKES FAIL TO RELEASE (OR SLOW RELEASE)

- a. Anchor pins loose.
- b. Bound up brake pedal linkage.
- c. Brakes improperly adjusted.
- d. Power brake unit troubles due to
  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 and valve plunger.
  8. Broken piston return spring.
  9. Dented or distorted vacuum cylinder.
  10. Misaligned pedal bracket.

## TORQUE SPECIFICATIONS BENDIX POWER BRAKE UNIT

### GRABBY OR SEVERE BRAKES

- a. Grease or brake fluid on linings.
- b. Scored drums.

	Lb. Ft.
Vacuum Cylinder to Hydraulic Cylinder Bolt . . . . .	6
Compensating Port Fitting . . . . .	15
Hydraulic Outlet Fitting . . . . .	50