BRAKES

CONTENTS

GENERAL INFORMATION

The new Models are equipped with servo contact, two shoe, internal expanding brakes with application adjusters. The lower ends of the brake shoes are connected by a tubular star wheel adjusting screw, (Fig. 1). Cars with heavy duty brakes are not self-adjusting.

SERVICE BRAKES

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
PEDAL GOES TO FLOOR	(a) Fluid low in reservoir.	(a) Fill and bleed master cylinder.
	(b) Air in hydraulic brake system.	(b) Fill and bleed hydraulic brake system.
	(c) Improperly adjusted brake.	(c) Repair or replace self-adjuster as required.
	(d) Leaking wheel cylinders.	(d) Recondition or replace wheel cylinder and replace both brake shoes.
	(e) Loose or broken brake lines.	(e) Tighten all brake fittings or replace brake line.
	(f) Leaking or worn master cylinder.	(f) Recondition or replace master cylinder and bleed hydraulic system.
	(g) Excessively worn brake lining.	(g) Reline and adjust brakes.
SPONGY BRAKE PEDAL	(a) Air in hydraulic system.	(a) Fill master cylinder and bleed hydraulic system.
	(b) Improper brake fluid (low boiling point).	(b) Drain, flush and refill with brake fluid.
	(c) Excessively worn or cracked brake drums.	(c) Replace all faulty brake drums.
	(d) Broken pedal pivot bushing.	(d) Replace nylon pivot bushing.
BRAKES PULLING	(a) Contaminated lining.	(a) Replace contaminated brake lining.
	(b) Front end out of alignment.	(b) Align front end.
	(c) Incorrect brake adjustment.	(c) Adjust brakes and check fluid.
	(d) Unmatched brake lining.	(d) Match primary, secondary with same type of lining on all wheels.
	(e) Brake drums out of round.	(e) Grind or replace brake drums.
	(f) Brake shoes distorted.	(f) Replace faulty brake shoes.
	(g) Restricted brake hose or line.	(g) Replace plugged hose or brake line.
	(h) Broken rear spring.	(h) Replace broken spring.
SQUEALING BRAKES	(a) Glazed brake lining.	(a) Cam grind or replace brake lining.
	(b) Saturated brake lining.	(b) Replace saturated lining.
	(c) Weak or broken brake shoe retaining spring.	(c) Replace retaining spring.
	(d) Broken or weak brake shoe return spring.	(d) Replace return spring.
	(e) Incorrect brake lining.	(e) Install matched brake lining.
	(f) Distorted brake shoes.	(f) Replace brake shoes.
	(g) Bent support plate.	(g) Replace support plate.
	(h) Dust in brakes or scored brake drums.	(h) Blow out brake assembly with compressed air and grind brake drums.

Condition	Possible Cause	Correction
CHIRPING BRAKES	(a) Out of round drum or eccentric axle flange pilot.	(a) Repair as necessary, and lubricate support plate contact areas (6 places).
DRAGGING BRAKES	(a) Incorrect wheel or parking brake adjustment.	(a) Adjust brakes and check fluid.
	(b) Parking brakes engaged.	(b) Release parking brakes.
	(c) Weak or broken brake shoe return spring.	(c) Replace brake shoe return spring.
	(d) Brake pedal binding.	(d) Free up and lubricate brake pedal and linkage.
	(e) Master cylinder cup sticking.	(e) Recondition master cylinder.
	(f) Obstructed master cylinder relief port.	(f) Use compressed air and blow out relief port.
	(g) Saturated brake lining.	(g) Replace brake lining.
	(h) Bent or out of round brake drum.	(h) Grind or replace faulty brake drum.
HARD PEDAL	(a) Brake booster inoperative.	(a) Replace brake booster.
	(b) Incorrect brake lining.	(b) Install matched brake lining.
	(c) Restricted brake line or hose.	(c) Clean out or replace brake line or hose.
	(d) Frozen brake pedal linkage.	(d) Free up and lubricate brake linkage.
WHEEL LOCKS	(a) Contaminated brake lining.	(a) Reline both front or rear of all four brakes.
	(b) Loose or torn brake lining.	(b) Replace brake lining.
	(c) Wheel cylinder cups sticking.	(c) Recondition or replace wheel cylinder.
	(d) Incorrect wheel bearing adjustment.	(d) Clean, pack and adjust wheel bearings.
BRAKES FADE (HIGH SPEED)	(a) Incorrect lining.	(a) Replace lining.
	(b) Overheated brake drums.	(b) Inspect for dragging brakes.
	(c) Incorrect brake fluid (low boiling temperature).	(c) Drain, flush, refill and bleed hydraulic brake system.
	(d) Saturated brake lining.	(d) Reline both front or rear of all four brakes.
PEDAL PULSATES	(a) Bent or out of round brake drum.	(a) Grind or replace brake drums.
BRAKE CHATTER AND SHOE KNOCK	(a) Out of round brake drum.	(a) Grind or replace brake drum.
	(b) Loose support plate.	(b) Tighten support plate bolts to proper specifications.
	(c) Bent support plate.	(c) Replace support plate.
	(d) Distorted brake shoes.	(d) Replace brake shoes.
	(e) Machine grooves in contact face of brake drum. (Shoe Knock)	(e) Grind or replace brake drum.
	(f) Contaminated brake lining.	(f) Replace either front or rear or all four linings.
BRAKES DO NOT SELF ADJUST	(a) Adjuster screw frozen in thread.	(a) Clean and free-up all thread areas.
	(b) Adjuster screw corroded at thrust washer.	(b) Clean threads and replace thrust washer if necessary.
	(c) Adjuster lever does not engage star wheel.	(c) Repair, free up or replace adjuster as required.
	(d) Adjuster installed on wrong wheel.	(d) Install correct adjuster parts.

SERVICE PROCEDURES

ADJUSTING SERVICE BRAKES

Normally self adjusting brakes will not require manual adjustment but in the event of a brake reline it may be advisable to make the initial adjustment manually to speed up the adjusting time.

(1) Jack up vehicle so all wheels are free to turn.

(2) Remove rear adjusting hole cover from all brake supports of vehicle.

(3) **Be sure parking brake lever is fully released, then back off parking brake cable adjustment so there is slack in cable.**

(4) Insert adjusting Tool C-3784, into star wheel or adjusting screw. Move handle of tool upward until a slight drag is felt when road wheel is rotated.

(5) Insert a thin screwdriver into brake adjusting hole and push adjusting lever out of engagement with star wheel. **(Care should be taken not to bend**

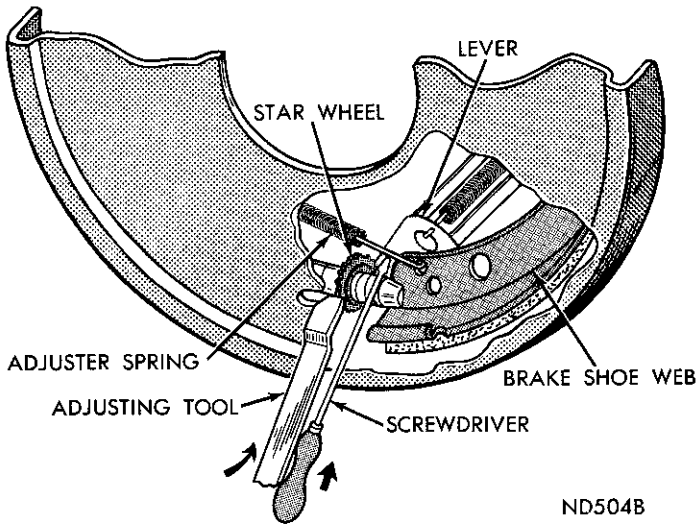

Fig. 1—Adjusting Brakes

adjusting lever (Fig. 1). While holding adjusting lever out of engagement, back off star wheel to insure a free wheel with no brake shoe drag.

(6) Repeat above adjustment at each wheel. The adjustment must be equal at all wheels. Install adjusting hole covers in brake supports.

(7) Adjust parking brake **after** wheel brake adjustment.

It is important to follow the above sequence to avoid the possibility of the parking brake system causing brake drag as may occur if the parking brakes are adjusted before the service brakes.

TESTING APPLICATION ADJUSTER OPERATION

Place the vehicle on a hoist, with a helper in the driver's seat to apply the brakes. Remove the plug from the rear adjustment slot in each brake support plate to observe the adjuster star wheel. Then, to exclude the possibility of maximum adjustment, that is, the adjuster refuses to operate because the closest possible adjustment has been reached, the star wheel should be backed off approximately 30 notches. It will be necessary to hold the adjuster lever away from the star wheel to allow backing off of the adjustment.

Spin the wheel and brake drum in the reverse direction and apply the brakes vigorously. This will provide the necessary inertia to cause the secondary brake shoe to leave the anchor. The wrap up effect will move the secondary shoe, and the cable will pull the adjuster lever up. Upon application of the brake pedal, the lever should move upward, turning the star wheel. Thus, a definite rotation of the adjuster star wheel can be observed if the automatic adjuster is working properly. If by the described procedure one or more adjusters do not function properly, the respective drum must be removed for adjuster servicing.

BLEEDING BRAKE SYSTEM

Clean all dirt and foreign material from the cover of the master cylinder to prevent any dirt from falling into the master cylinder reservoir when the cover is removed.

Using the one man bleeder tank C-3496B (with adaptor) provides a convenient means of keeping the master cylinder full while pressurizing the hydraulic system for bleeding. (Complete bleeding of the dual master cylinder is important! See Bleeding the Master Cylinder of this section.) **Manual bleeding is not recommended, because of reduced fluid flow.**

Tighten the brakes of each wheel until the brakes are locked. (This reduces the movement of the wheel cylinder cups and assists in bleeding.)

Starting with the right rear wheel clean all dirt from the bleeder valve. Place bleeder hose C-650 on the bleeder valve and insert the other end of the bleeder hose into a clean jar half filled with clean brake fluid. (This will permit the observation of air bubbles as they are being expelled from the hydraulic system and also prevent air from being drawn back in to the system. (Follow the manufacturers instructions in the use of the bleeder tools.)

Continue this bleeding operation on the other wheels, starting with the left rear wheel, then the right front and finishing with the left front wheel.

If necessary, repeat this bleeding operation if there is any indication (a low, soft or spongy brake pedal) of air remaining in the hydraulic system. Readjust the brakes as described previously.

TEST FOR FLUID CONTAMINATION

To determine if contamination exists in the brake fluid (as indicated by swollen or deteriorated rubber cups), the following test can be made.

Place a small amount of the drained brake fluid into a small clear glass bottle. Separation of the fluid into distinct layers will indicate mineral oil content. **If there is any question of mineral oil content, as indicated by swollen or deteriorated rubber parts, drain and flush thoroughly and replace all rubber parts.**

WHEEL STUD NUT TIGHTENING

The tightening sequence and tightening of the wheel stud nuts is of great importance to insure efficient brake operation. The use of an impact or long handled wrench may distort the drum.

A criss-cross tightening sequence should be used (Fig. 2). Tighten all the stud nuts to one-half the specified tightening first (30 ft. lbs.) and then repeat the sequence tightening to the specified 65 foot pounds.

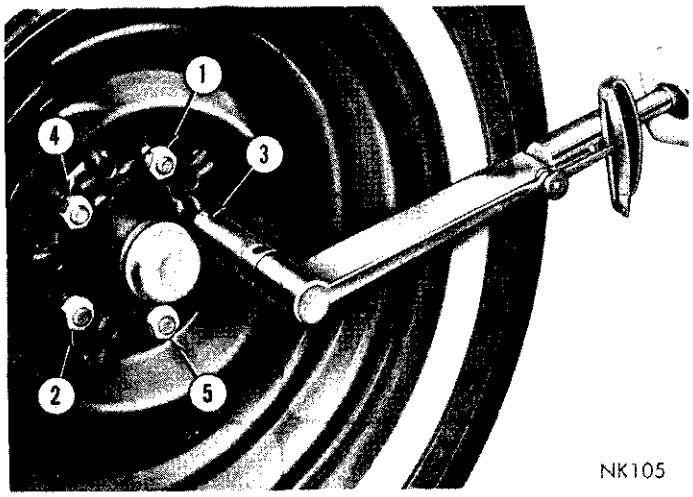

Fig. 2—Wheel Stud Nut Tightening Sequence

BRAKE HOSE AND TUBING

The flexible hydraulic brake hose should always be installed in the vehicle by first tightening the male end of the hose in the wheel cylinder or rear axle housing tee. The hose is then clipped to the hose bracket in a manner to give minimum twist. **Excessive twist can result in hose interference problems with possible hydraulic system failure.**

Inspection of brake hose and tubing should be included in all brake service operations. The hoses should be checked for:

(1) Correct length, severe surface cracking, pulling, scuffing or worn spots. **(Should the cotton fabric casing of the hose be exposed by cracks or abrasions in the rubber hose cover, the hose should be replaced.** Eventual deterioration of the hose can take place with possible burst failure).

(2) Faulty installation to cause twisting, wheel, tire or chassis interference.

Always use factory recommended hose to insure quality, correct length and superior fatigue life. Care should be taken to make sure that the tube and hose mating surfaces are clean and free from nicks and burrs. New copper seal washers should be used and the tube nuts and connections should be properly made and tightened. Double wall steel tubing should always be used to insure superior fatigue life. Care should be taken when replacing brake tubing, to use the proper bending and flaring tools and to avoid routing the tubes against sharp edges, moving components or in hot areas. All tubes should be properly attached with recommended retaining clips.

Steel tubing is used to conduct hydraulic pressure to the front and rear brakes. Flexible rubber hose is used at both front brakes and at a rear axle junction block. Steel tubing is used from the junction block to both rear wheel cylinders. All fittings, tubing and hoses should be inspected for rusted, damaged or

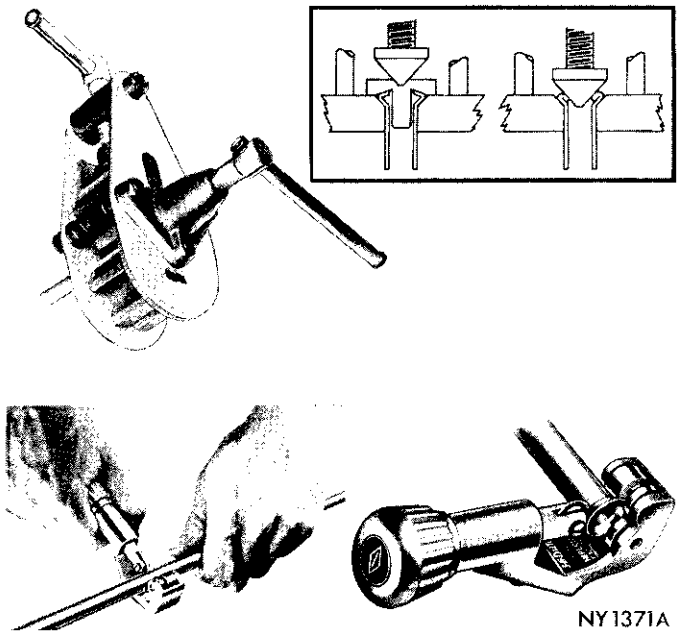

Fig. 3—Cutting and Flaring Steel Tubing

faulty flaring seats. The steel tubing is equipped with a double flare or inverted seat to insure more positive seating in the fitting. To repair or reflare tubing proceed as follows:

(1) Using Tool C-3478, cut off damaged seat or damaged tubing (Fig. 3).

(2) Ream out any burred or rough edges showing on inside edges of tubing. This will make ends of tubing square and insure better seating of flared end of tubing. **Place compression nut on tubing prior to flaring tubing.**

(3) To flare tubing, open handles of flaring Tool C-3838 and rotate jaws of tool until mating jaws of tubing size are centered in area between vertical posts.

(4) Slowly close handles with tubing inserted in jaws but do not apply heavy pressure to handle as this will lock tubing in place.

(5) Place gauge "Form A" on edge over end of tubing and push tubing through jaws until end of tubing contacts recessed notch of gauge matching size of tubing (Fig. 3).

(6) Squeeze handles of flaring tool and lock tubing in place.

(7) Place proper sized plug of gauge "A" down in end of tubing. Swing compression disc over gauge and center tapered flaring screw in recess of disc.

(8) Lubricate taper of flaring screw and screw in until plug gauge has seated on jaws of flaring tool. This action has started to invert extended end of tubing.

(9) Remove gauge and apply lubricant to tapered end of flaring screw and continue to screw down until

tool is firmly seated in tubing.

(10) Remove tubing from flaring tool and inspect seat.

(11) Clean seat and tube of any lubricant before connecting to hydraulic system.

SERVICE BRAKES

INDEX

SERVICE PROCEDURES

Illustrations of the various service procedures will not always show any one specific brake.

BRAKE DRUM REMOVAL

Removing Front Brake Drums

To aid in brake drum removal loosen brake star adjusting wheel.

(1) Remove rear plug from brake adjusting access hole.

(2) Insert a thin screw driver into brake adjusting hole and push adjusting lever away from star adjusting wheel. **Care should be taken not to bend adjusting lever.**

(3) Insert Tool C-3784 into brake adjusting hole and engage notches of brake adjusting star wheel. Release brake adjustment by prying down with adjusting tool.

(4) Remove wheel cover, grease cap, cotter pin, lock, adjusting nut, outer wheel bearing and remove wheel and drum assembly from spindle to expose brake linings (Fig. 1).

(5) Inspect brake lining for wear, shoe alignment, or contamination from grease or brake fluid.

Removing Rear Brake Drums

(1) Remove rear plug from brake adjusting access hole.

(2) Insert a thin screw driver into brake adjusting hole and hold adjusting lever away from notches of adjusting screw.

(3) Insert Tool C-3784 into brake adjusting hole and engage notches of brake adjusting screw. Release

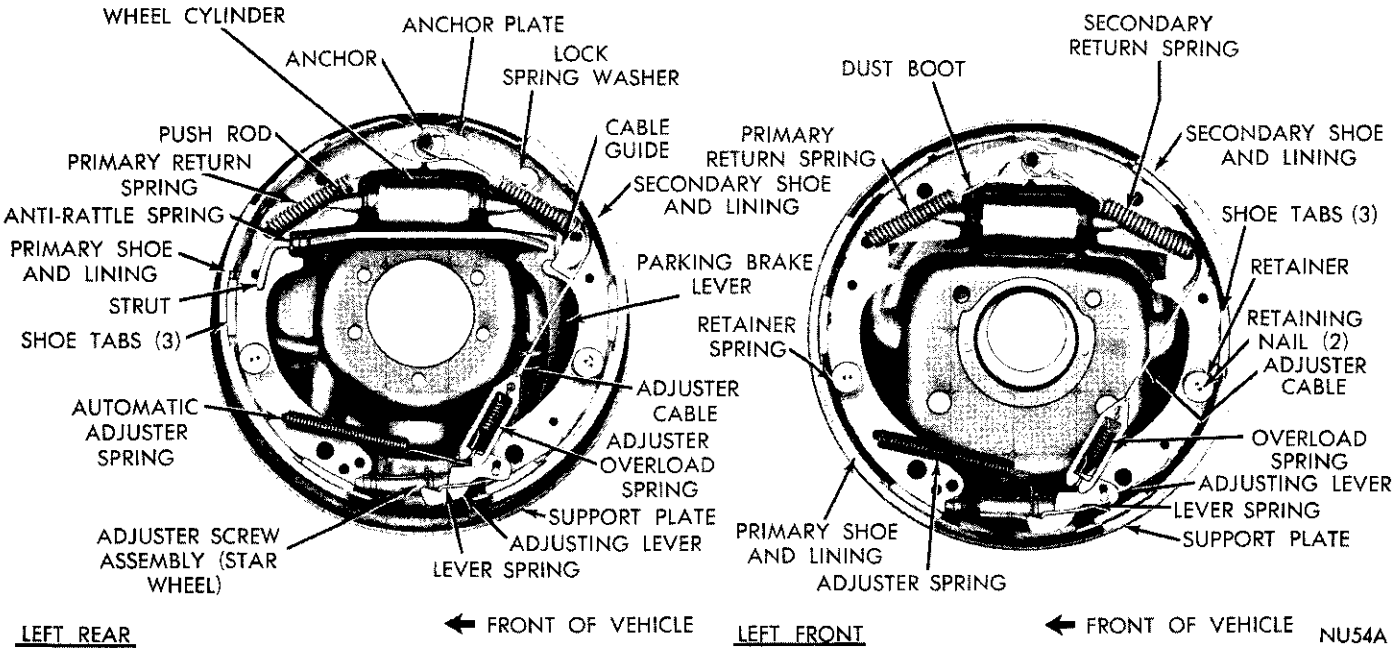

Fig. 1—Brake Assemblies

brake by prying down with adjusting tool.

(4) Remove rear wheel and clips from wheel studs that hold drum on axle. Discard clips. Remove drum.

(5) Inspect brake lining for wear, shoe alignment or contamination from grease or brake fluid. (Fig. 1).

BRAKE SHOE REMOVAL

Removing Front Brake Shoes

(1) Using Tool C-3785 remove brake shoe return springs (Fig. 2). (Note how secondary spring overlaps primary spring). (Fig. 1).

(2) Slide eye of automatic adjuster cable off anchor and unhook from adjusting lever. Remove cable, overload spring, cable guide and anchor plate.

(3) Disengage adjusting lever from spring by sliding forward to clear pivot, then working out from under spring. Remove spring from pivot. Remove automatic adjuster spring from secondary shoe web and disengage from primary shoe web. Remove spring.

(4) Remove brake shoe retainers, springs and nails, using Tool C-4070, (Fig. 3).

(5) Disengage primary and secondary shoes from push rods and remove from support. Remove adjusting star wheel assembly from shoes.

Removing Rear Brake Shoes

(1) Using Tool C-3785, remove brake shoe return springs (Fig. 4). (Note how secondary spring overlaps primary spring). (Fig. 1).

(2) Slide eye of automatic adjuster cable off anchor and then unhook from adjusting lever. Remove cable, overload spring, cable guide and anchor plate.

(3) Disengage adjusting lever from spring by sliding forward to clear pivot, then working out from under spring. Remove spring from pivot. Remove automatic adjuster spring from secondary shoe web and disengage from primary shoe web. Remove spring.

(4) Remove brake shoe retainers, springs and nails

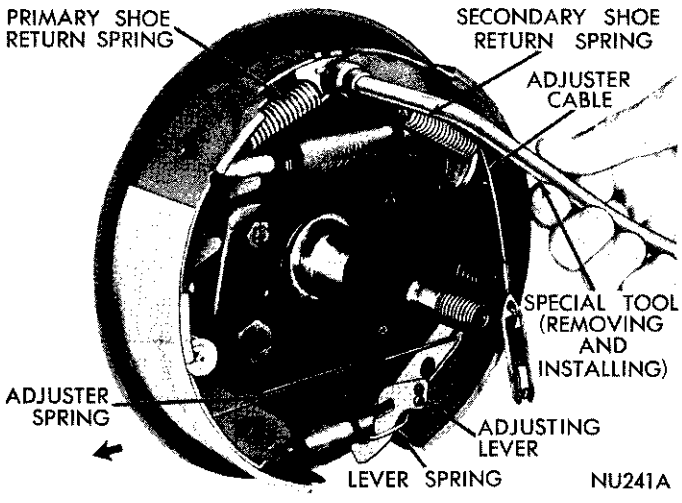

Fig. 2—Removing or Installing Shoe Return Springs (Left Front)

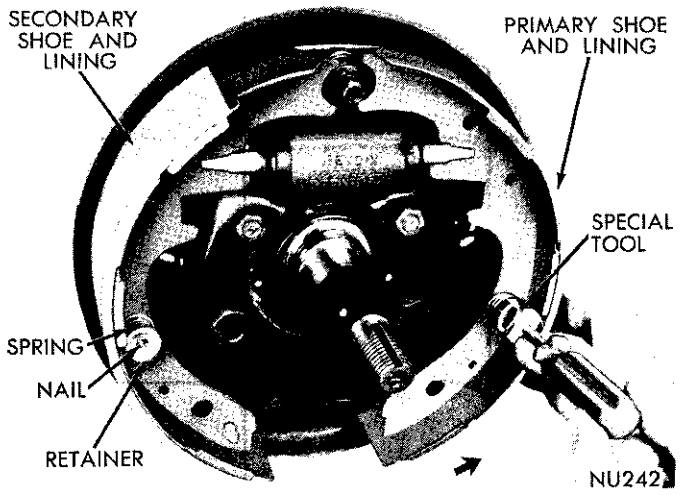

Fig. 3—Removing or Installing Shoe Retainers, Springs and Nails (Right Front)

using Tool C-4070, (Fig. 5).

(5) Spread anchor ends of primary and secondary shoes and remove parking brake lever strut and anti-rattle spring (Fig. 6).

(6) Disengage parking brake cable from parking brake lever.

(7) Disengage primary and secondary shoes from push rods and remove from support. Remove adjusting star wheel assembly from shoes.

CLEANING AND INSPECTION

Wipe or brush clean (dry) the metal portions of the brake shoes. Examine the lining contact pattern to determine if the shoes are bent. The lining should show contact across the entire width, extending from heel to toe. Shoes showing contact only on one side should be replaced. Shoes having sufficient lining but lack of contact at toe and heel should be measured for proper grind.

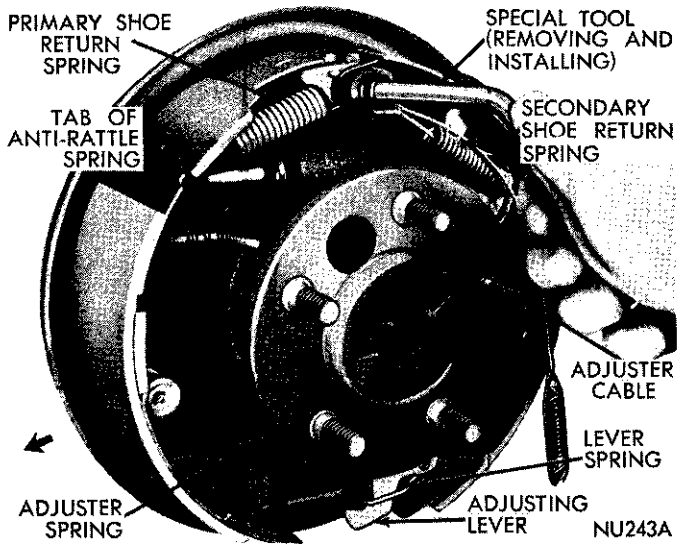

Fig. 4—Removing or Installing Shoe Return Springs (Left Rear)

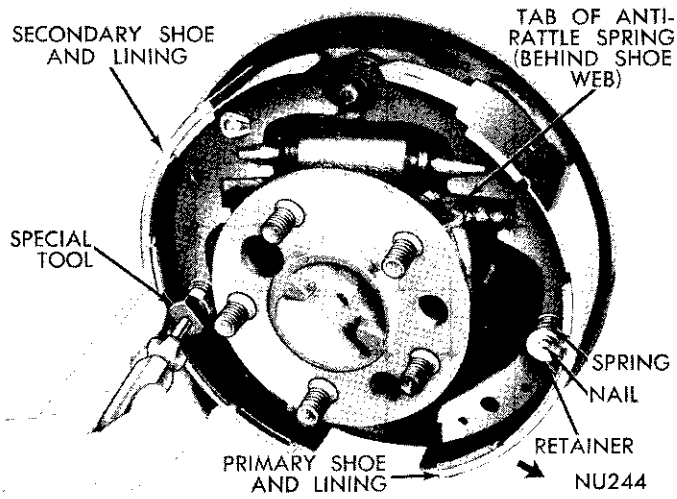

Fig. 5—Removing or Installing Shoe Retainers, Springs and Nails (Right Rear)

Clean the support, using a suitable solvent, then inspect for burrs. Remove if necessary. Clean and inspect the adjusting screws for pulled or stripped threads, then apply a thin film of lubricant to the threads.

New brake shoe return springs and hold down springs should be installed where the old springs have been subjected to overheating or if their strength is questionable. Spring paint discoloration or distorted end coils would indicate an overheated spring.

GRINDING RECOMMENDATIONS

Brake Shoe Lining—New lining should be measured and ground .060″ to .080″ (maximum under the drum diameter). When replacing brake shoe and lining assemblies, always check them in the drum they are to be used with to insure that they have the recommended radius grind. This grind, which should provide at least .004 inch heel and toe clearance, is necessary for proper lining to drum contact during brake application.

Drum Refacing—Measure the drum runout with an accurate gauge. Drum runout should not exceed .006 inch out of round. If the drum runout is in excess of .006 inch, (total indicator run-out) the drum should be refaced. Remove only as much material as is necessary to clean up the drum. It is recommended the front drums be refaced with the wheel and tire mounted. **Do not reface more than .060 inch over the standard drum diameter.**

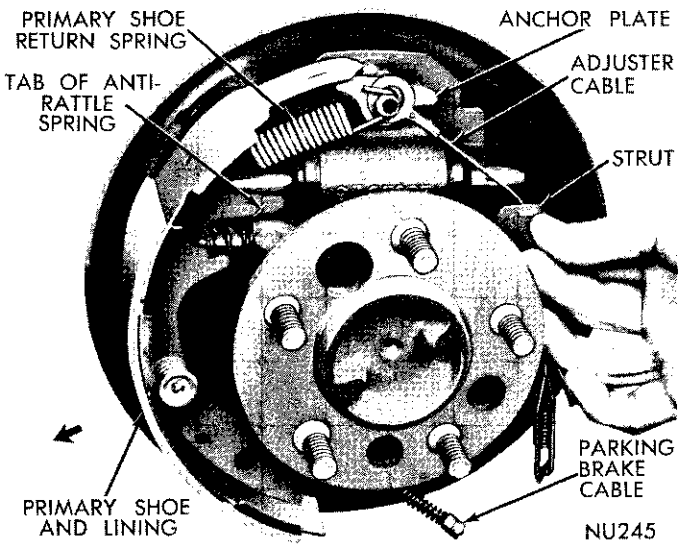

Fig. 6—Removing or Installing Parking Brake Strut and Spring (Left Rear)

BRAKE SHOE INSTALLATION

Installing Front Brake Shoes

Lubricate with a thin film the shoe tab contact area (6 places) on support plate with Chrysler support plate lubricant, Part number 2932524 or equivalent (Fig. 9).

(1) Match a primary with a secondary brake shoe and place them in their relative position on a work bench.

(2) Install adjusting star wheel assembly between primary and secondary shoes, with a star wheel next to secondary shoe (Fig. 1). (The left star wheel adjusting stud end is stamped "L" which indicates its position on vehicle). The left side star wheel is cadmium plated. The right is black, and the adjusting stud end is **not** stamped.

(3) Install adjuster spring in primary shoe and hook other end in web of secondary. Install adjusting lever spring over pivot pin on shoe web. Install adjusting lever under spring and over pivot pin. Slide lever slightly rearward to lock in position (Fig. 1).

(4) Spread anchor ends of brake shoes to hold star adjusting wheel assembly in position.

(5) Holding brake shoes firmly, place assembly on support plate, and at the same time engage shoe webs with push rods. (Fig. 7).

(6) Using Tool C-4070, install shoe retaining nails, springs and retainers.

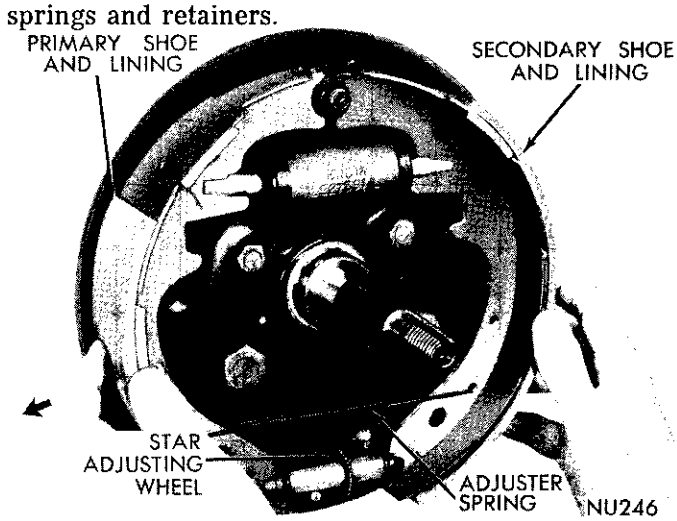

Fig. 7—Installing Brake Shoes (Left Front)

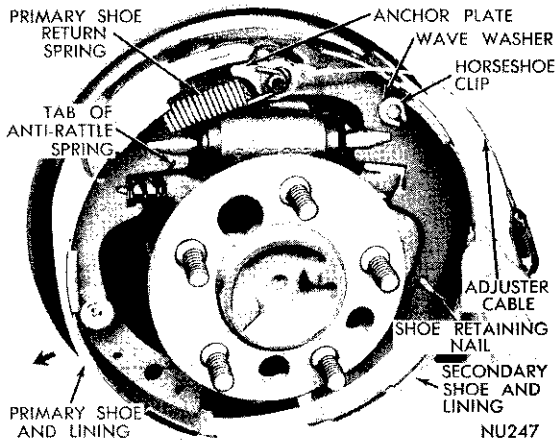

Fig. 8—Installing Brake Shoes (Left Rear)

(7) Install anchor plate over anchor.

(8) Slide "eye" of adjusting cable over anchor and against anchor plate. Engage end of primary shoe return spring in shoe web and install other end over anchor, using Tool C-3785.

(9) Install cable guide in secondary shoe web. Holding in position, engage secondary shoe return spring through guide and into web. Install other end over anchor, using Tool C-3785. (Be sure cable guide remains flat against shoe web, and that secondary spring overlaps primary). (Fig. 1). Using pliers, squeeze ends of spring loops (around anchor) until parallel.

(10) Thread adjuster cable over guide and hook end of overload spring in lever (Fig. 1). (Be sure "eye" of cable is pulled tight against anchor and in a straight line with guide).

Installing Rear Brake Shoes

Lubricate with a thin film the shoe tab contact area (6 places) on support plate with Chrysler support plate lubricant, Part number 2932524 or equivalent (Fig. 9).

(1) Install parking brake lever on inner side of secondary shoe web after lubricating pivot with support plate lubricant. Secure with wave washer and horseshoe clip.

(2) Engage parking brake lever with cable, then slide secondary shoe against support plate, and at the same time engage shoe web with push rod, and against anchor.

(3) Slide parking brake strut behind hub and into slot in parking brake lever. Slide anti-rattle spring over free end of strut. On eleven inch brakes, be sure spring tab is pointing forward and down on outside of shoe web (Left Brake), and pointing frontward and down behind shoe web (Right Brake) (Fig. 1).

(4) Slide primary shoe into position and engage with push rod and free end of strut. Install anchor plate over anchor, then install eye of adjuster cable over anchor.

(5) Engage primary shoe return spring in web of

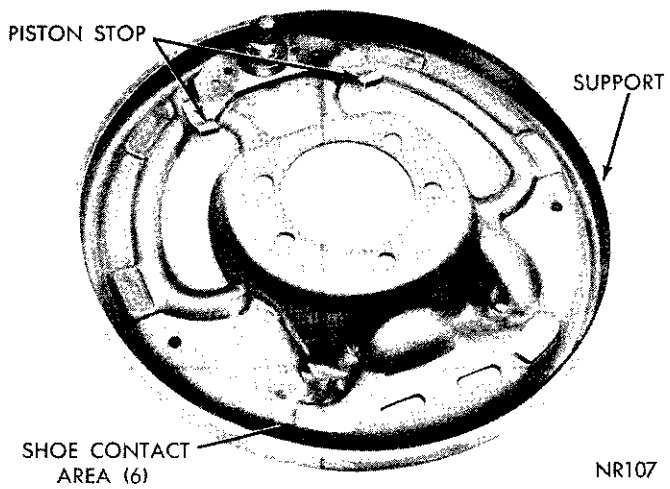

Fig. 9—Shoe Contact Area on Support

shoe and install free end over anchor, using Tool C-3785.

(6) Install cable guide in secondary shoe web. Holding in position, engage secondary shoe return spring through guide and into web. Install other end over anchor, using Tool C-3785. (Be sure cable guide remains flat against shoe web and that secondary spring overlaps primary). (Fig. 1). Using pliers, squeeze ends of spring loops (around anchor) until parallel.

(7) Install adjusting star wheel assembly between primary and secondary shoes, with star wheel next to secondary shoe. (Fig. 1). The left star wheel adjusting stud end is stamped "L" which indicates its position on vehicle. The left side star wheel is cadmium plated. The right is black, and the adjusting stud end is **not** stamped. Install adjuster spring between shoes (Fig. 1). (Engage primary shoe first).

(8) Install adjusting lever spring over pivot pin on shoe web. Install adjusting lever under spring and over pivot pin. Slide lever slightly rearward to lock in position.

(9) Using Tool C-4070, install shoe retaining nails retainers and springs.

(10) Thread adjuster cable over guide and hook end of overload spring in lever. (Fig. 1). (Be sure eye of cable is pulled tight against anchor and in a straight line with guide).

Installing Front Brake Drums

(1) Lubricate wheel bearings and install brake drum and adjust wheel bearing to proper preload.

(2) Adjust brakes as described under "Service Procedures" at front of this Section.

Installing Rear Brake Drums

(1) Install brake drum, reinstallation of retaining clips is not necessary. Install wheel and tire assembly.

(2) Adjust brakes as described under "Service Procedures" at front of this Section.

MASTER CYLINDER

(Drum Brakes)

INDEX

GENERAL INFORMATION

The tandem master cylinder (Fig. 1) is of the compensating type with the reservoirs cast integrally. The master cylinder consists of a front and rear piston (in tandem) two outlets, each contain a residual pressure valve and spring (Fig. 4).

The **front** outlet tube from the master cylinder is connected to the hydraulic system safety switch (Figs. 8 and 9) and thence to the **rear** brakes. The **rear** outlet tube from the master cylinder is also connected to the safety switch and the **front** brakes.

The master cylinder used on vehicles not equipped with power brake unit is serviced in the same manner as the master cylinder with power brakes, with one exception, the master cylinder for power brakes does not include the push rod.

The disc brake master cylinder is different than the standard drum brake master cylinder and is covered in the disc brake section of the brake group.

SERVICE PROCEDURES

MASTER CYLINDER REMOVAL

(1) Disconnect the front and rear brake tubes from master cylinder (the residual pressure valves will keep cylinder from draining).

(2) Remove nuts that attach master cylinder to cowl panel and/or power brake unit (if so equipped).

(3) Disconnect pedal push rod (manual brakes) from brake pedal.

(4) Slide master cylinder straight out from cowl panel and/or power brake unit (if so equipped).

DISASSEMBLING MASTER CYLINDER

To disassemble the master cylinder, (Figs. 1 and 4) clean outside of master cylinder thoroughly.

(1) Remove cover retaining bolt, and clamp, then remove cover and gasket. Empty brake fluid from reservoirs.

(2) Loosen piston retainer screw then press in on rear piston and flip retainer down to release rear piston assembly. Slide rear piston assembly out of cylinder bore.

(3) Remove screw and gasket that retains front piston; then, upending master cylinder, tamp (open end down) on bench to remove front piston. **If front piston sticks in bore of cylinder, use air pressure to force piston out of cylinder. New cups must be installed at reassembly if air pressure is used.**

(4) Remove front piston compression spring from bore.

(5) Remove rubber cups from pistons, after noting position of cup lips.

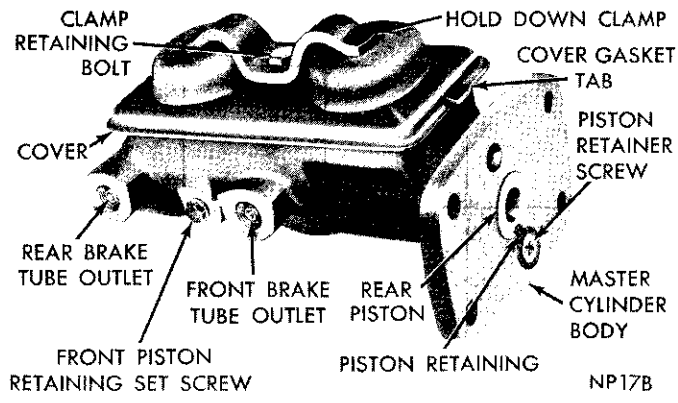

Fig. 1—Tandem Master Cylinder Assembly

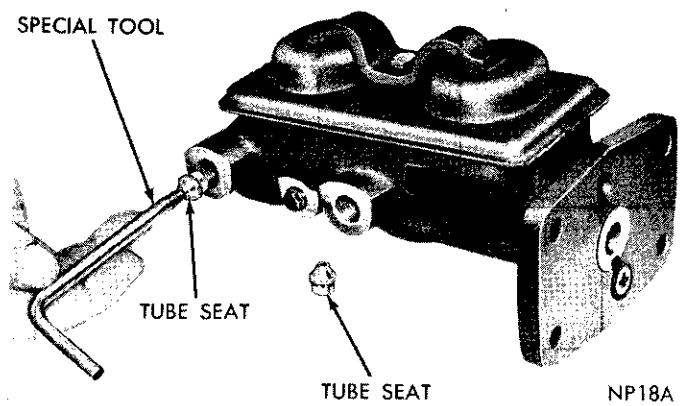

Fig. 2—Removing Tube Seats

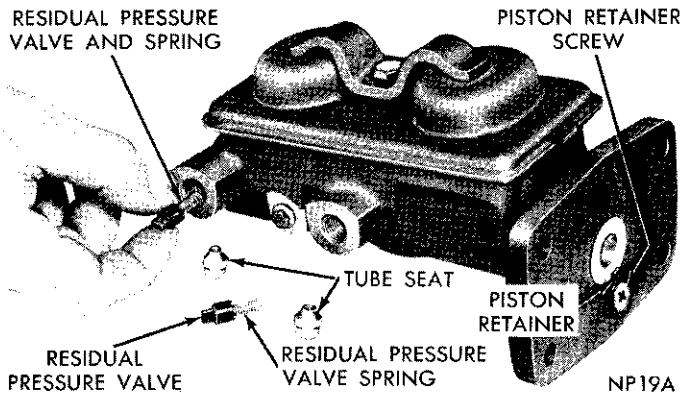

Fig. 3—Removing or Installing Residual Pressure Valves and Springs

Do not remove the primary cup of the rear piston. If cup is damaged or worn, install a new rear piston assembly.

(6) Using Tool T-109-178 (or an easy out) remove tube seats by threading tool firmly into seat, tap tool and seat out of cylinder body, (Fig. 2). Discard seats.

(7) Remove two residual pressure valves and springs (Fig. 3).

CLEANING AND INSPECTION

Clean master cylinder thoroughly, using a suitable solvent and dry with compressed air. Wash the cylinder bore with clean brake fluid and inspect for scoring or pitting. Master cylinder bore walls that have light scratches or show signs of corrosion, can usually be cleaned with crocus cloth. However, cylinder bores that have deep scratches or scoring may be honed, providing the diameter of the bore is not increased more than .002 inch. If master cylinder bore does not clean up at .002 inch when honed, the master cylinder should be discarded and a new master cylinder installed.

If master cylinder pistons are badly scored or corroded, replace them with new ones. The piston cups and seals should be replaced when reconditioning a master cylinder.

When overhauling a master cylinder, use all parts furnished in repair kit. **Discard all used rubber parts.**

REASSEMBLING MASTER CYLINDER

Front Piston

Before assembling the master cylinder, dip all component parts in clean brake fluid and place on a clean shop towel or paper (assembling seals dry can ruin them).

(1) Install thin washer on piston front end then, carefully work primary cup on front end of front piston with the lip away from piston (Fig. 4).

(2) Slide "O" ring over the rear end of front piston and into correct land.

(3) Carefully work front piston secondary cup (Fig. 4) into rear land, with the cup lip away from piston.

(4) Slide cup retainer over front end of piston, followed by piston spring (Fig. 4).

(5) Install piston spring, piston cup retainer, piston and cups into bore of master cylinder (Fig. 5).

Be sure the lip of cups enter bore evenly in order not to damage sealing qualities of cups. (Keep well lubricated with brake fluid.)

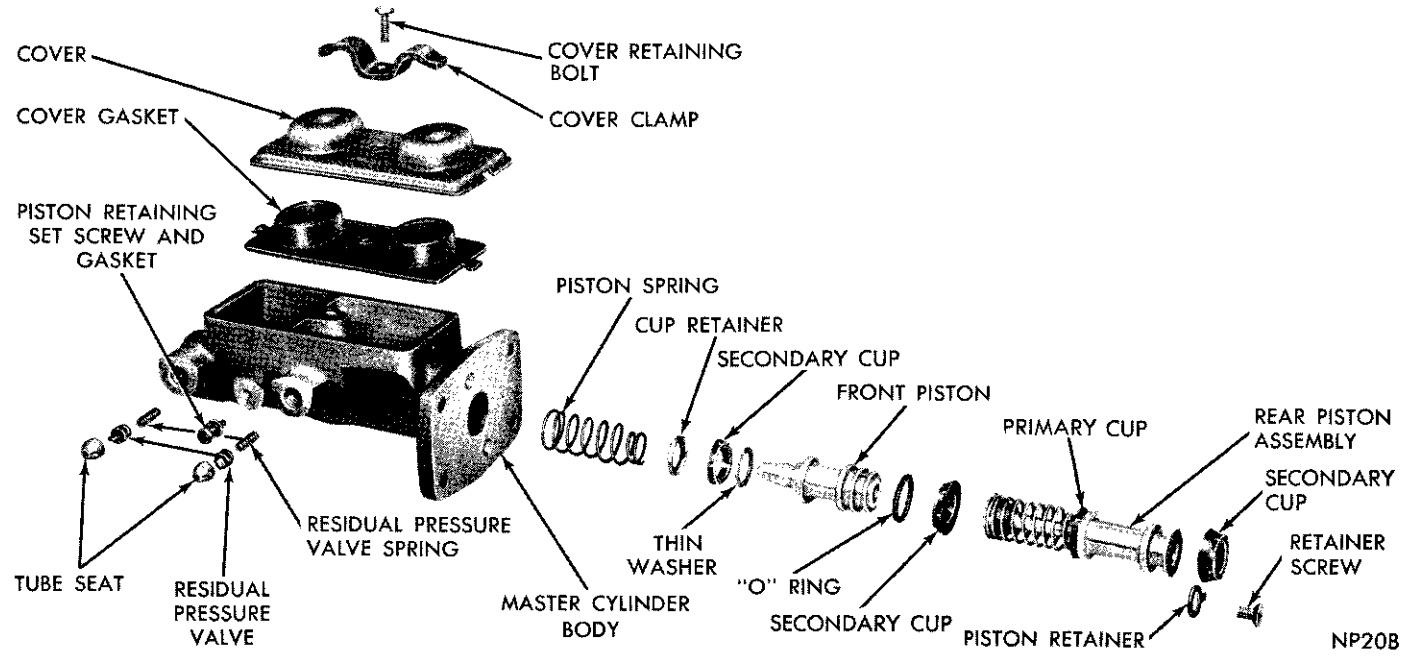

Fig. 4—Tandem Master Cylinder (Exploded View)

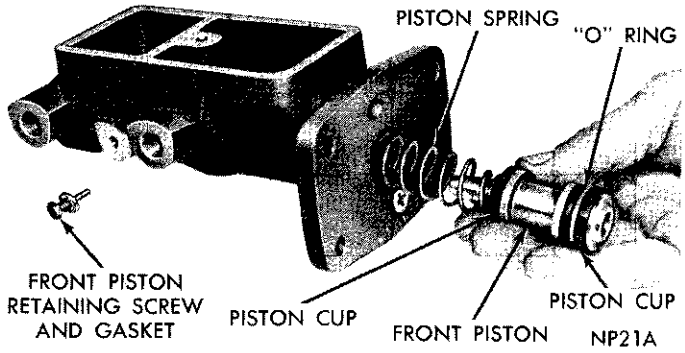

Fig. 5—Installing Front Piston and Spring

Rear Piston

(1) Carefully work secondary cup over rear end of rear piston with lip of cup toward piston (Fig. 4).

(2) Center spring retainer of rear piston assembly over shoulder of front piston. Push piston assemblies into bore up to center piston cup. Carefully work cup into bore then push piston **in** up to rear cup. Carefully work lip of rear cup into bore, then push in on piston until seated (Fig. 6).

(3) Holding piston in seated position, move piston retainer over piston and tighten screw securely.

(4) Install front piston retaining set screw and gasket in cylinder body and tighten securely (Fig. 1).

(5) Install residual pressure valves and springs in outlet ports and install tube seats, firmly. (When the bleeding tubes are attached, the tube seats will be positioned correctly.)

BLEEDING MASTER CYLINDER

Before installing the master cylinder on vehicle, it must be bled on the bench as follows:

(1) Clamp master cylinder in a vise and attach bleeding tubes Tool C-4029 (Fig. 7).

(2) Fill both reservoirs with approved brake fluid.

(3) Using a wooden stick or dowel (power brake equipped vehicles) depress push rod slowly and allow the pistons to return under pressure of springs. Do this several times until all air bubbles are expelled. (Fig. 7).

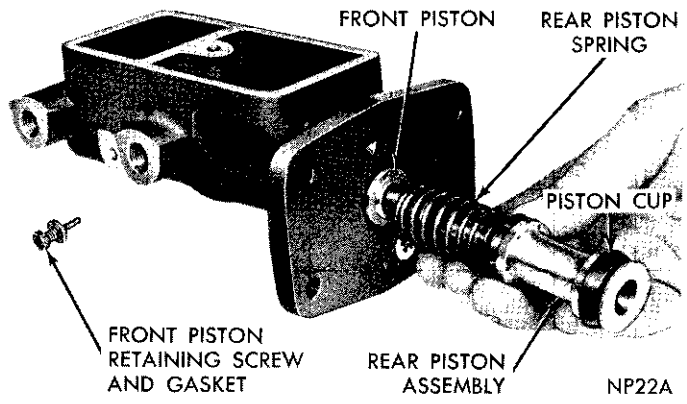

Fig. 6—Installing Rear Piston Assembly

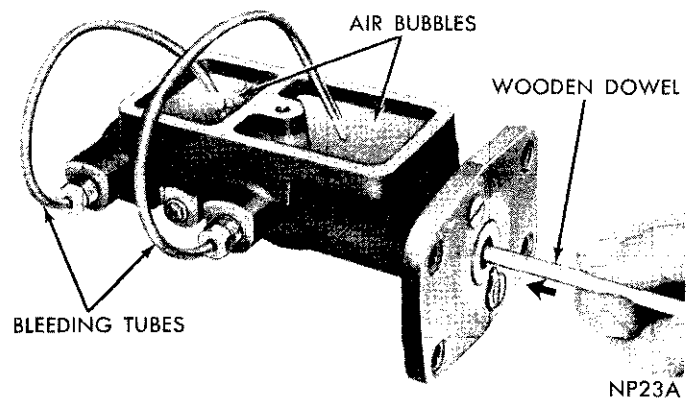

Fig. 7—Bleeding Master Cylinder

(4) Remove bleeding tubes from cylinder and install cover and gasket. (As tubes are removed, fluid remaining in tubes will syphon out.)

(5) Install cover retaining clamp and clamp screw.

(6) Remove from vise and install master cylinder on vehicle as follows:

INSTALLING MASTER CYLINDER

(1) Install master cylinder on vehicle, aligning push rod with cowl panel opening (manual brakes) or power brake push rod with cylinder piston.

(2) Slide over mounting studs. Install attaching nuts and tighten to 9 foot-pounds. Connect push rod to brake pedal.

(3) Connect front and rear brake tubes and tighten to 150 inch-pounds.

(4) Bleed brakes at wheel cylinders using regular procedure, being sure fluid level is maintained. (See Bleeding the Brake System.)

TESTING MASTER CYLINDER

Be sure that the master cylinder compensates at both ports. This can be done by applying the pedal lightly with the engine running (power brakes) and observing for a gyser of fluid squirting up in the reservoirs. This may only occur in the front chamber and so to determine if the rear compensating port is open, it will be necessary to pump up the brakes rapidly and, then, hold the pedal down. Have an observer watch the fluid in the rear reservoir while the pedal is raised. A disturbance in the fluid indicates that the compensating port is open.

HYDRAULIC SYSTEM SAFETY SWITCH

The hydraulic system safety switch (Figs. 8 and 9) is used to warn the vehicle operator that one of the hydraulic systems has failed. A failure in one part of the brake system does not result in failure of the entire hydraulic brake system. As an example, failure

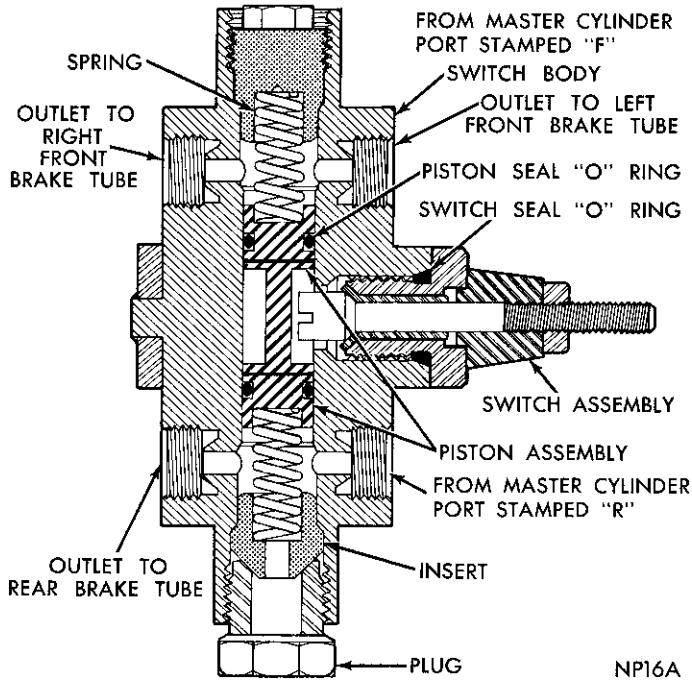

Fig. 8—Hydraulic System Safety Switch (Sectional)

of the rear brake system will leave the front brake system still operative.

As pressure falls in one system, the other system's normal pressure forces the piston to the inoperative side contacting the switch terminal, causing a red warning light to come on in the instrument panel, thus, warning the operator of the vehicle that one of the systems has failed and should be repaired.

The safety switch is mounted on the frame in a vertical position, with the brake tubes connected. (Fig. 8).

If a malfunction occurs within the switch, disconnect tubes from body assembly and install a new assembly. **The component parts of the switch body are not serviced.** However, the terminal unit can be removed if a malfunction occurs and a new terminal unit installed.

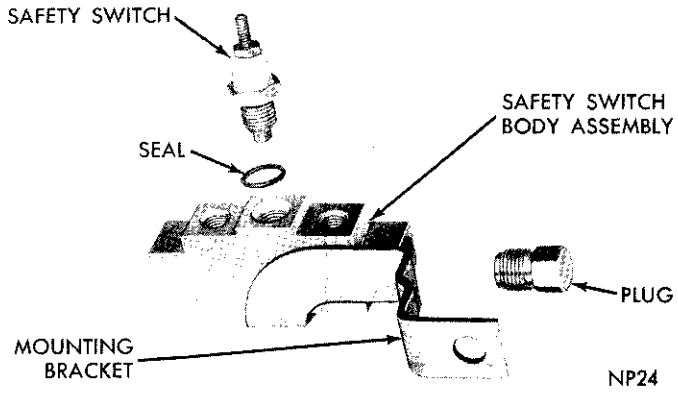

Fig. 9—Hydraulic System Safety Switch (Exploded View)

If a new body is installed, bleed the brake system

TESTING HYDRAULIC SYSTEM SAFETY SWITCH

The brake warning light flashes only when the parking brake is applied with the ignition key turned "ON". The same light will also illuminate should one of the two service brake systems fail when the brake pedal is applied. To test the system turn the ignition key "ON", and apply the parking brake. If the light fails to light, inspect for a burned out bulb, disconnected socket, a broken or disconnected wire at the switch.

To test the service brake warning system, raise the car on a hoist and open a wheel cylinder bleeder while a helper depresses the brake pedal and observes the warning light. If the light fails to light, inspect for a burned out bulb, disconnected socket, a broken or disconnected wire at the switch. If the bulb is not burned out and the wire continuity is proven, replace the brake warning switch in the brake line Tee fitting mounted on the frame rail in the engine compartment below the master cylinder.

WHEEL CYLINDERS

INDEX

GENERAL INFORMATION

A piston stop (Fig. 3) is welded to the support plates to prevent the pistons from moving out far enough to lose brake fluid. The piston boots are of the press-on type and prevents moisture from entering the wheel cylinder.

To perform service operations or inspections of the wheel cylinders, it will be necessary to remove the cylinders from the support plate and disassemble on the bench.

REMOVING WHEEL CYLINDERS

Front or Rear

With all the brake drums removed, inspect the wheel cylinder boots for evidence of a brake fluid leak. Visually check the boots for cuts, tears, or heat cracks, and if any of these conditions exist, the wheel cylinders should be completely cleaned, inspected and new parts installed. (A slight amount of fluid on the boot may not be a leak, but may be preservative fluid used at assembly.

(1) In case of a leak, remove brake shoes, (replace if soaked with grease or brake fluid.)

(2) Disconnect brake hose from brake tube at frame bracket (front wheels) or disconnect brake tube from wheel cylinder (rear wheels).

(3) Disconnect brake hose from wheel cylinder (front). Remove wheel cylinder attaching bolts (front or rear), then slide wheel cylinder assembly out of support.

DISASSEMBLING WHEEL CYLINDERS

Front or Rear (Fig. 1)

(1) Using a suitable tool, pry boots away from cylinders and remove. Remove push rods.

(2) Press **in** on one piston and force out piston, cup, spring cup and piston.

(3) Wash wheel cylinder, pistons, and spring in clean brake fluid or alcohol; clean thoroughly and blow dry with compressed air. Inspect cylinder bore and piston for scoring and pitting. (Do not use a rag as lint from the rag will adhere to bore surfaces.)

Wheel cylinder bores and pistons that are badly scored or pitted should be replaced. Cylinder walls that have light scratches, or show signs of corrosion, can usually be cleaned with crocus cloth, using a circular motion. Black stains on the cylinder walls are caused by piston cups and will not impair operation of cylinder.

ASSEMBLING WHEEL CYLINDERS

Front or Rear (Fig. 1)

Before assembling the pistons and new cups in the wheel cylinders, dip them in clean brake fluid. If the boots are deteriorated, cracked or do not fit tightly on the push rods or the cylinder casting, new boots must be installed.

(1) Wash wheel cylinder with alcohol and blow dry with compressed air. Coat cylinder bore with clean brake fluid.

(2) Install expansion spring in cylinder. Install cups in each end of cylinder with open end of cups facing each other.

(3) Install pistons in each end of cylinder with recessed end of pistons facing open ends of cylinder.

(4) Install boots with push rods over ends of cylinder and press over ends until boot is seated against cylinder shoulder. **Use care not to damage boot.**

INSTALLING WHEEL CYLINDERS

Front or Rear

(1) Slide wheel cylinder into position on support (front or rear). Install mounting screws and torque to 220 inch-pounds.

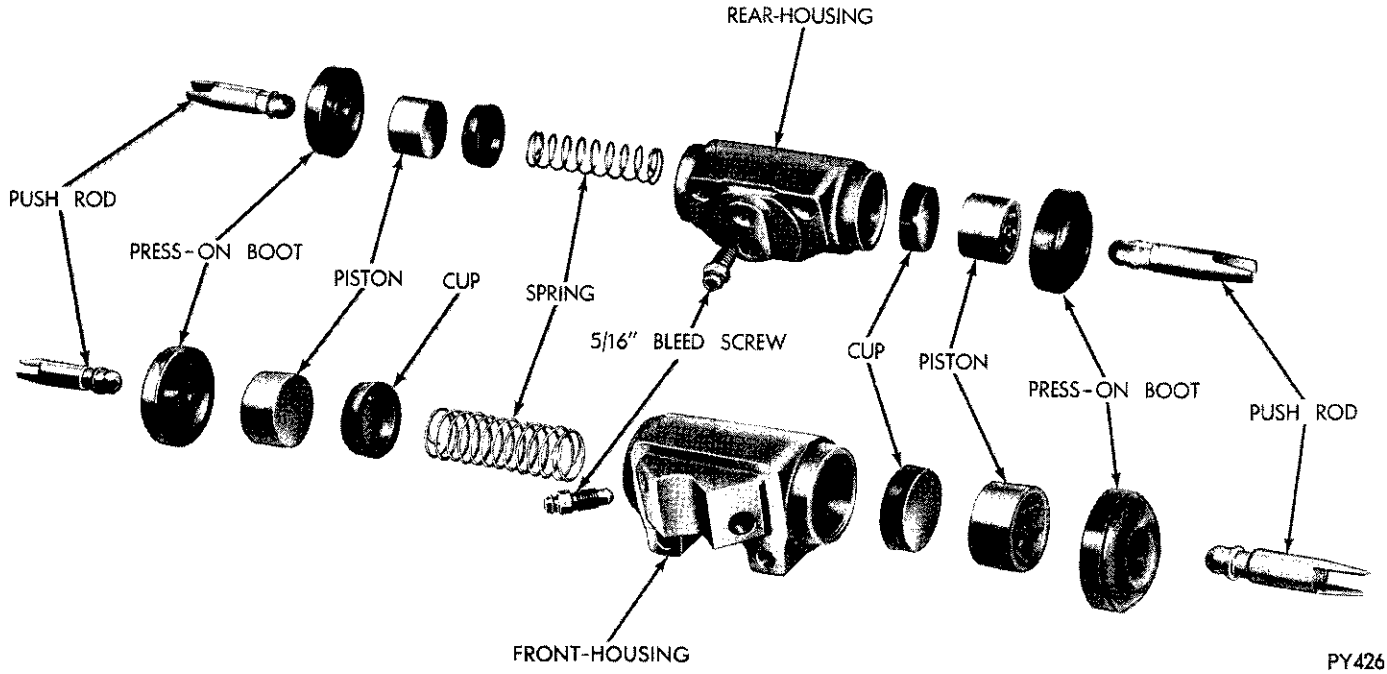

Fig. 1—Wheel Cylinders (Front and Rear)

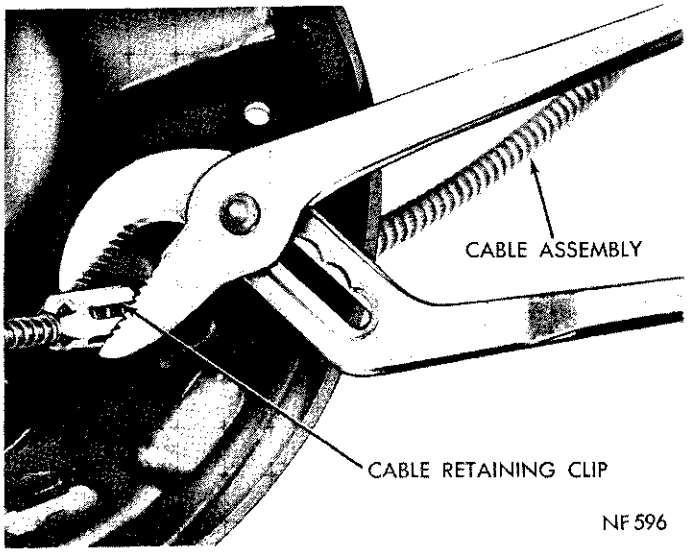

Fig. 2—Removing Brake Cable from Support

(2) Connect brake tube to rear wheel cylinder and torque to 115 inch pounds. Connect brake hose to front wheel cylinder, using a new gasket. Torque to 25 foot pounds, before attaching brake hose to frame bracket. **Should hose be connected to wheel cylinder last, tightening of the hose into wheel cylinder will twist hose, and can result in suspension or tire interference.**

(3) Connect brake line to brake hose and torque to 115 inch-pounds.

REMOVING BRAKE SUPPORT

(Front)

(1) Disconnect brake line from brake hose at frame bracket.

(2) With wheel and brake drum removed, remove four support attaching nuts and washers.

(3) Remove support and brake assembly from spindle.

(Rear)

(1) With wheel and brake drum removed, remove support attaching nuts and washers.

(2) Remove rear axle shaft and retainer.

(3) Disconnect hydraulic brake line from wheel cylinder.

(4) Disengage brake cable from parking brake lever.

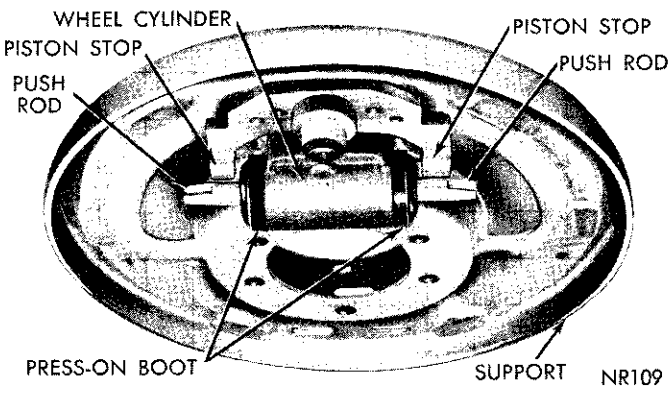

Fig. 3—Wheel Cylinder Piston Stops

(5) Using a suitable tool compress three flared legs of cable retainer and pull brake cable out of support (Fig. 2).

(6) Remove brake support from rear axle housing.

INSTALLING BRAKE SUPPORT

(Front)

(1) Place support plate on spindle and install attaching bolts, nuts, and washers. Tighten bolts that mount through support plate knuckle to 55 foot-pounds. The bolts that go through the support plate, knuckle, and steering arm must be torqued to 120 foot-pounds.

(2) Connect brake hose to wheel cylinder, tighten to 25 foot-pounds, before connecting brake hose to frame bracket. **Should hose be connected to wheel cylinder last, tightening of hose into wheel cylinder will twist the hose, which can result in suspension or tire interference problems.**

(3) Connect brake line to brake hose and torque to 115 inch-pounds.

(Rear)

(1) Install support onto rear axle housing.

(2) Insert rear axle shaft and retainer into housing and install axle retainer nuts and washers. Torque retainer nuts to 35 foot-pounds.

(3) Attach brake line to wheel cylinder and torque to 115 inch-pounds.

(4) Insert parking brake cable into support plate and attach cable to parking brake lever.

PARKING BRAKES

INDEX

GENERAL INFORMATION

The rear wheel service brakes also act as parking brakes. The brake shoes are mechanically operated by a lever and strut connected to a flexible steel cable. The wheel brake cables are joined together by a forward brake cable and equalizer extending to the parking brake pedal or release handle (Figs. 1 and 2).

The parking brake pedal assembly used (Fig. 4) on Imperial models is pedal applied but is released by a vacuum valve. When the engine is started and vacuum is developed, energy is then available to release the parking brake. This is controlled by the transmission shift lever. When the transmission is in neutral or "Park" position, the lever attached to the gearshift tube slide, closes the valve which is mounted on the steering column, (passenger compartment). This stops the vacuum to the vacuum release cannister and allows the parking brake to be applied.

When the shift lever is moved (forward or reverse) the valve is opened to actuate the vacuum release. In the event of engine failure and no vacuum, the brake may be released by a manual release lever mounted on the left side of the parking brake pedal assembly. This system prevents the vehicle from being driven with the parking brake in the applied position (Fig. 4).

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
DRAGGING BRAKE	(a) Improper cable or brake shoe adjustment.	(a) Properly adjust service brakes then adjust parking brake cable.
	(b) Broken brake shoe return spring.	(b) Replace any broken return spring.
	(c) Broken brake shoe retainer spring.	(c) Replace broken retainer spring.
	(d) Grease or brake fluid soaked lining.	(d) Replace grease seal or recondition wheel cylinders and replace both brake shoes.
	(e) Sticking or frozen brake cable.	(e) Replace cables.
	(f) Broken rear spring.	(f) Replace broken rear spring.
	(g) Bent or rusted cable equalizer.	(g) Straighten, or replace and lubricate equalizer.
	(h) Improper vacuum release valve adjustment (Imperial).	(h) Adjust vacuum release valve.
	(i) Heat Set, parking brake cable springs.	(i) Replace parking brake cable.
BRAKE WILL NOT HOLD	(a) Broken or rusted brake cable.	(a) Replace or clean and lubricate brake cable.
	(b) Improperly adjusted brake or cable.	(b) Adjust brakes and cable as necessary.
	(c) Soaked brake lining.	(c) Replace brake lining.
	(d) Ratchet or pedal mechanism worn.	(d) Replace pedal assembly.

SERVICE PROCEDURES

ADJUSTING PARKING BRAKES

The service brakes must be properly adjusted before adjusting the parking brake.

(1) Release parking brake lever and loosen cable adjusting nut to insure cable is slack, (Fig. 1). Before loosening cable adjusting nut, clean threads with wire brush and lubricate with grease.

(2) Tighten cable adjusting nut until a slight drag is felt while rotating wheel, loosen cable adjusting nut until both rear wheels can be rotated freely, then back off cable adjusting nut two full turns.

(3) Apply parking brake several times, then release and test to see that rear wheels rotate freely without dragging.

The independent rear brake cables are attached to an equalizer (Fig. 1). The front cable is adjusted at equalizer.

REMOVING REAR PARKING BRAKE CABLE

Should it become necessary to remove the parking brake cable (rear) for installation of a new cable, (Fig. 2), under "Wheel Cylinders."

(1) With vehicle jacked up or on a suitable hoist, remove rear wheels.

(2) Disconnect brake cable from equalizer.

(3) Remove retaining clip from brake cable bracket.

(4) Remove brake drum from rear axle.

(5) Remove brake shoe return springs.

(6) Remove brake shoe retaining springs.

(7) Remove brake shoe strut and spring from brake support plate and disconnect brake cable from operating arm.

(8) Compress retainers on end of brake cable

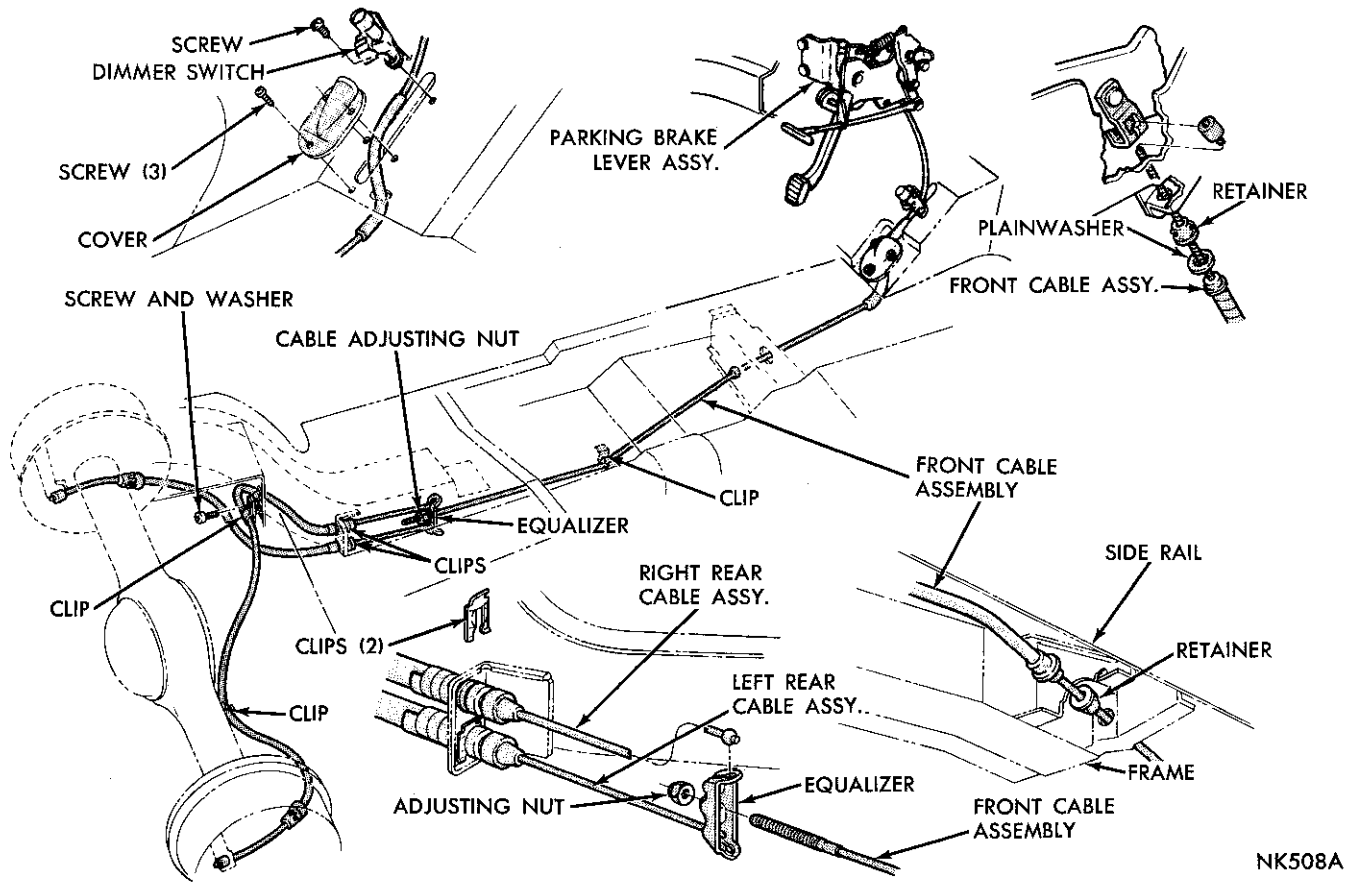

Fig. 1—Parking Brake Cable Routing

housing and remove cable from brake support. (Fig. 2), under "Wheel Cylinders."

INSTALLING REAR PARKING BRAKE CABLE

When installing a new brake cable, lubricate the cable with short fibre grease at the contact points.

(1) Insert brake cable and housing into brake support plate making certain that housing retainers lock housing firmly into place.

(2) Holding brake shoes in place on support plate, engage brake cable into brake shoe operating lever.

(3) Install brake shoe retaining springs, and brake shoe return springs.

(4) Install brake drum and wheel.

(5) Insert brake cable and housing into cable bracket and install retaining clip.

(6) Insert brake cable into equalizer. Note different size slot for corresponding cable end fitting.

REMOVING FRONT PARKING BRAKE CABLE

(1) Disengage front cable from equalizer and using a screwdriver force cable housing and retaining clip out of frame crossmember.

(2) Disengage cable housing from underbody mounting bracket.

(3) Raise floor mat or carpet and remove rubber grommet holding cable housing into floor pan.

(4) Depress parking brake pedal, pulling cable through housing so that when pedal is released, cable may be disengaged from clevis.

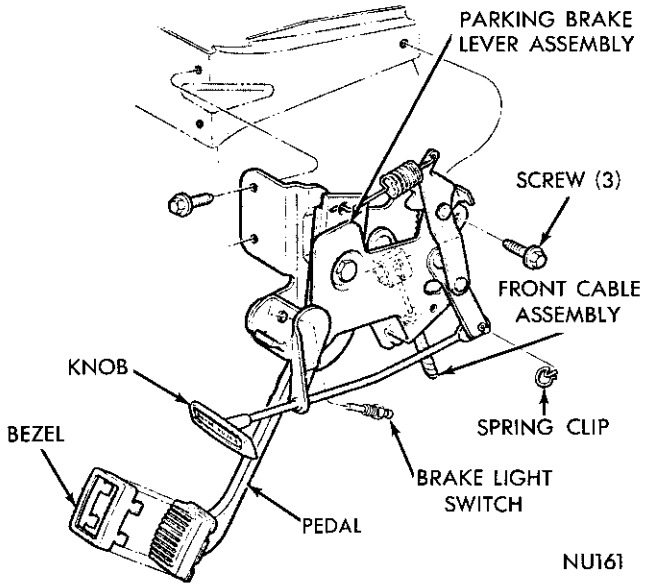

Fig. 2—Parking Brake Pedal

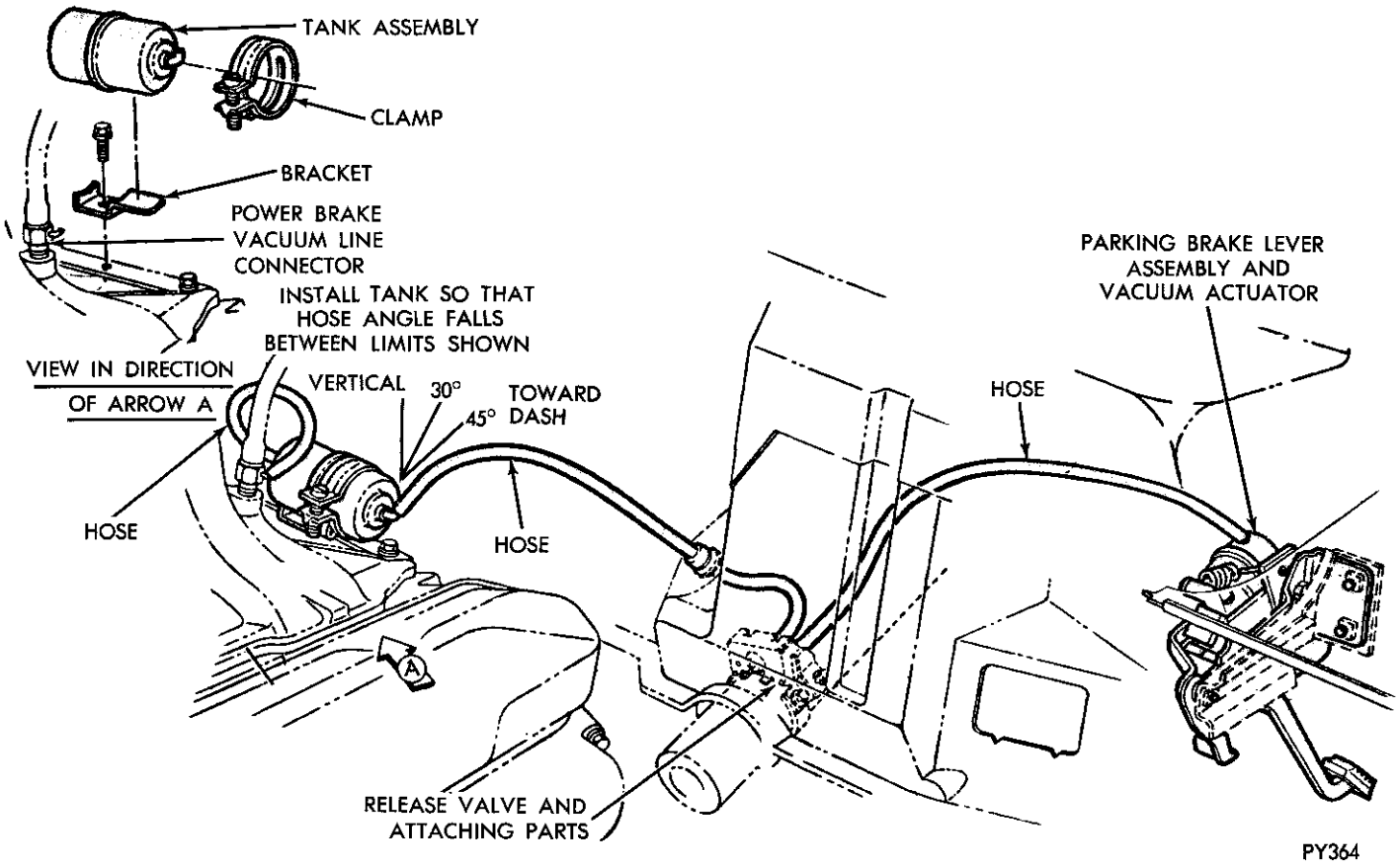

Fig. 3—Parking Brake Vacuum Valve, Actuator and Tank (Imperial)

(5) Using a screwdriver pry housing out of mounting bracket and retaining clip.

(6) Pull parking brake cable and housing up out of floor pan.

INSTALLING FRONT PARKING BRAKE CABLE

(1) Insert parking brake cable down through floor pan.

(2) Install cable housing into underbody mounting bracket.

(3) Insert end fitting of cable into parking brake clevis and force housing and retaining clip into pedal bracket assembly (Fig. 2).

(4) Insert cable through crossmember and force housing and retaining clip into crossmember.

(5) Attach cable to equalizer and adjust parking brake cable.

(6) Apply brakes several times and test for free wheel rotation.

(7) Test operation of vacuum release valve (Imperial only).

PARKING BRAKE VACUUM VALVE (IMPERIAL)

(1) Place transmission shift selector lever in "Drive" (engine off).

(2) Remove vacuum hoses from unit (Fig. 4).

(3) Remove screws that attach vacuum unit to steering column jacket, then remove vacuum valve.

To install vacuum valve unit, (Fig. 4), proceed as follows:

(1) Move actuating arm on valve against spring to extreme position, or until locating holes line up. Install a number 42 drill in hole to properly position valve for installation (Fig. 4).

(2) Move transmission shift selector lever into "Park" position.

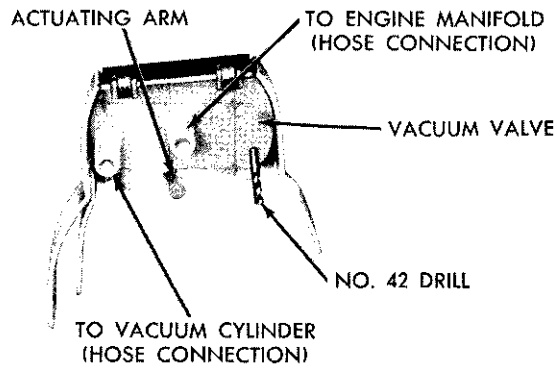

Fig. 4—Parking Brake Vacuum Valve

(3) Place valve in position on steering column jacket and install attaching screws. (Do not tighten.) Rotate valve clockwise (viewed from drivers position) until actuating arm contacts tab inside steering column jacket. Tighten screws securely.

(4) Remove drill from locating hole.

(5) Install vacuum hoses. (Be sure hose from engine manifold is attached to center fitting on valve (Fig. 4).

(6) Start engine and check to see that parking brake can be set in neutral and park position, and will release in reverse and drive positions.

MIDLAND ROSS POWER BRAKE
(Single Diaphragm)

GENERAL INFORMATION

The Midland Ross power brake, (Fig. 1) is located on the engine side of the dash panel. The front cover of the Power Brake Unit supports the master cylinder. The power brake derives its power from the intake manifold vacuum and atmospheric pressure. It does not require a vacuum reservoir.

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
DRAGGING BRAKES (ALL WHEELS)	(a) Brake shoes improperly adjusted.	(a) Adjust brakes.
	(b) Brake pedal linkage binding.	(b) Free up linkage.
	(c) Excessive hydraulic seal friction.	(c) Lubricate seal.
	(d) Compensator port plugged.	(d) Clean out master cylinder.
	(e) Fluid cannot return to master cylinder.	(e) Inspect pedal return and push rod adjustment.
	(f) Parking brake not returning.	(f) Free up as required.
	(g) Metering valve mal-function.	(g) Replace metering valve.
GRABBING BRAKES	(a) Grease or brake fluid on linings.	(a) Inspect for a leak and replace lining as required.
PEDAL GOES TO FLOOR (OR ALMOST TO FLOOR)	(a) Self-adjusters not operating.	(a) Inspect self-adjuster operations.
	(b) Air in hydraulic system.	(b) Bleed brakes.
	(c) Hydraulic leak.	(c) Locate and correct leak.
	(d) Fluid low in master cylinder.	(d) Add brake fluid.
	(e) Shoe hanging up on rough platform.	(e) Smooth and lubricate platforms.

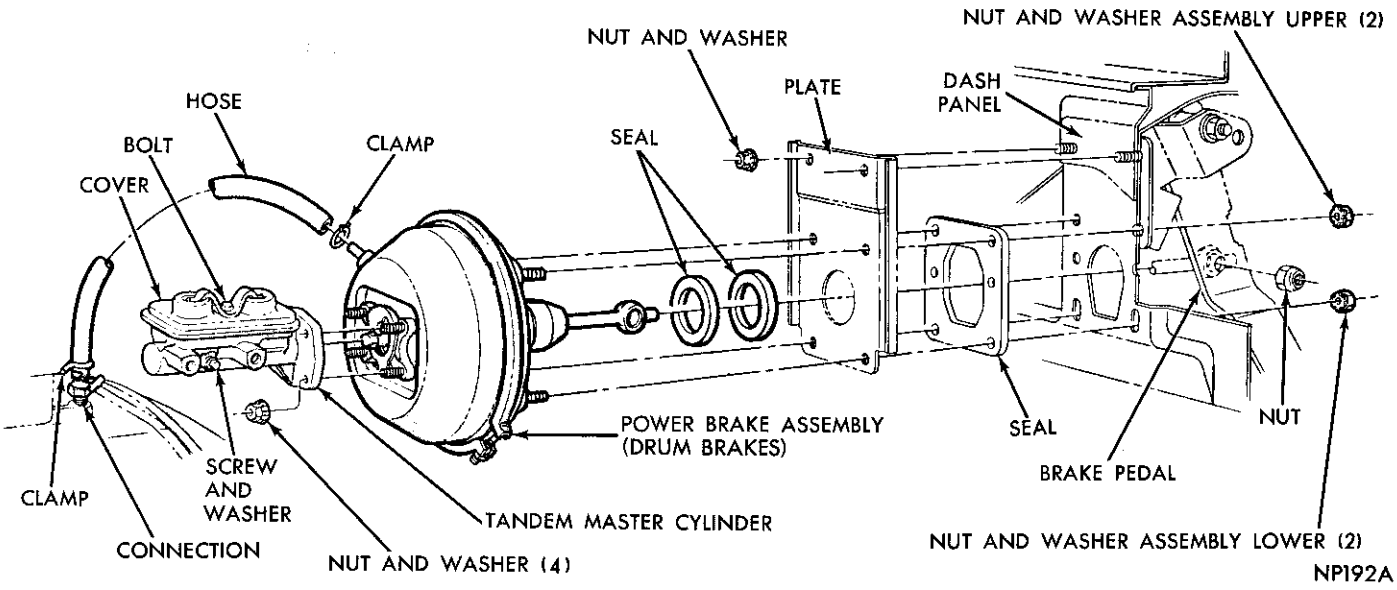

Fig. 1—Power Brake and Master Cylinder

Condition	Possible Cause	Correction
HARD PEDAL (POWER UNIT TROUBLE)	(a) Faulty vacuum check valve.	(a) Replace check valve.
	(b) Collapsed or leaking vacuum hose.	(b) Replace hose.
	(c) Plugged vacuum fittings.	(c) Clean out fittings.
	(d) Leaking vacuum chamber.	(d) Replace unit.
	(e) Diaphragm assembly out of place in housing.	(e) Replace unit.
	(f) Vacuum leak in forward vacuum housing.	(f) Replace unit.

SERVICE PROCEDURES

REMOVING POWER BRAKE (Fig. 1)

(1) Remove nuts attaching master cylinder to brake unit. Remove master cylinder from unit.

(2) Disconnect vacuum hose of power brake.

(3) From under instrument panel, remove nut and attaching bolt from power brake input push rod and brake pedal blade.

(4) Remove four power brake attaching nuts and washers.

(5) Remove power brake from vehicle.

INSTALLING POWER BRAKE

(1) Install power brake assembly into dash and tighten attaching nuts 150 inch-pounds.

(2) Connect brake line and vacuum hose.

(3) Using lubriplate, coat bearing surface of bolt that connects power brake pedal link with brake pedal linkage. Install bolt and nut. Tighten to 30 foot pounds.

CAUTION: Do not attempt to disassemble brake booster as this unit will be serviced by Manufacturer's Service Station.

(4) Install master cylinder on power brake. Tighten mounting nuts to 100 inch-pounds.

With power brake attached to dash panel and vacuum supplied to the unit, the master cylinder should compensate (force jet of fluid up through compensation ports).

(5) Check stop light operation.

POWER BRAKE–BENDIX

(Single Diaphragm)

GENERAL INFORMATION

The single diaphragm type power brake (Fig. 1) is a self contained vacuum hydraulic power braking unit. It is of the vacuum suspended type which utilizes engine intake manifold vacuum and atmospheric pressure for its power. This type of units does not require a vacuum reservoir.

The Bendix Power Brake Unit can be identified by the twist lock method of attaching the housing and cover together.

The basic elements of the vacuum unit are as follows:

A mechanically actuated control valve integral with the vacuum power diaphragms, controls the degree of power brake application or release in accordance with the foot pressure applied to the valve operating rod through the brake pedal linkage.

The control valve is of a single poppet type valve with the atmospheric port and a vacuum port. The vacuum port seat is a part of the valve body attached to the diaphragm assembly. The atmospheric port is a part of the valve plunger which moves within the valve housing and vacuum power diaphragm assembly.

A hydraulic master cylinder which contains all of the elements of the standard brake master cylinder except for the special hydraulic push rod which is a part of the power brake.

SERVICE PROCEDURE

REMOVING POWER BRAKE

(1) Remove four master cylinder attaching nuts and washers and remove master cylinder from power brake.

(2) Disconnect vacuum line from check valve.

(3) From under instrument panel, remove nut and bolt from power brake link and brake pedal.

(4) From under instrument panel remove four brake unit attaching nuts and washers.

(5) Withdraw brake unit assembly from brake support bracket.

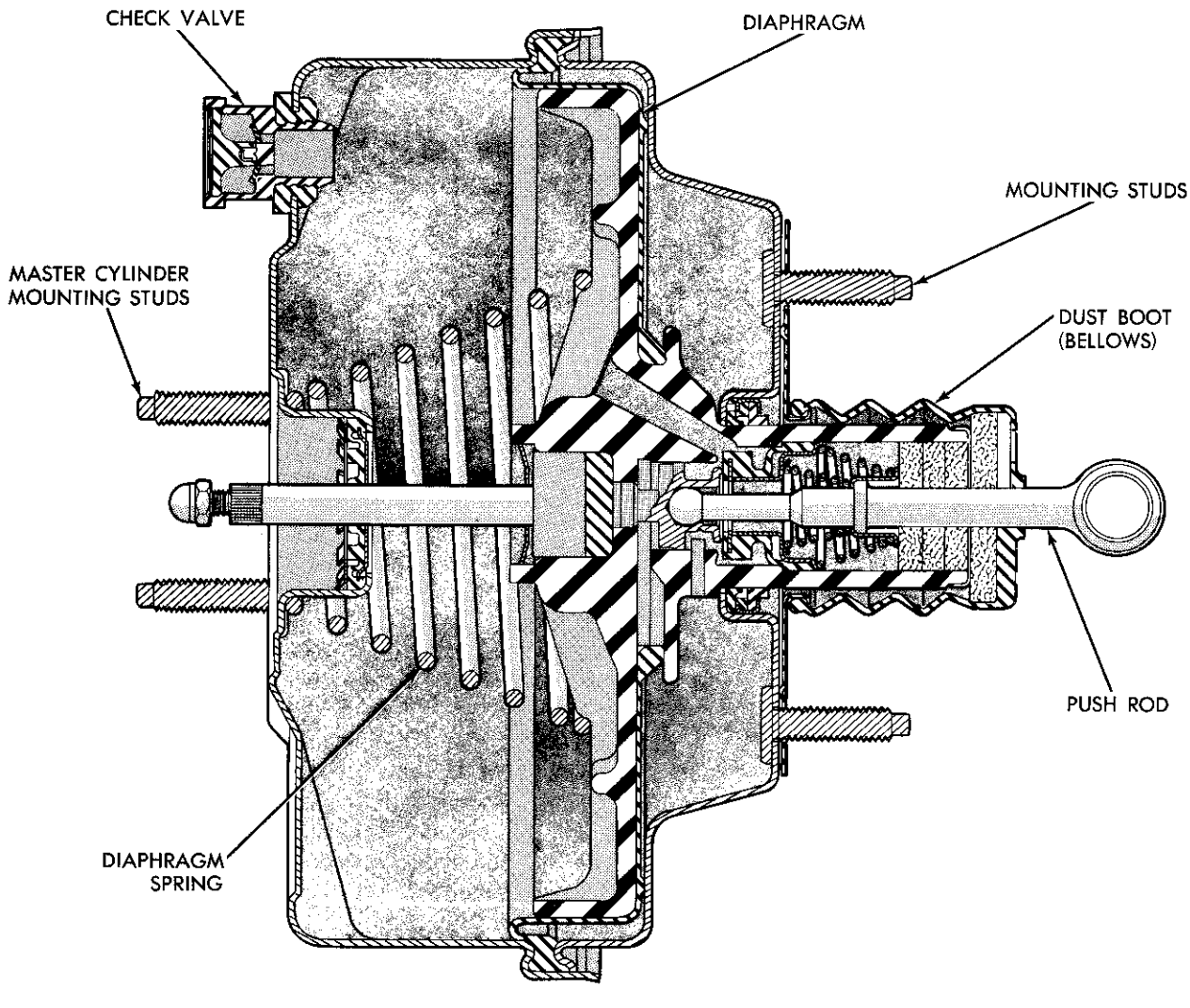

Fig. 1—Power Brake Assembly (Bendix) Drum Brakes

INSTALLING POWER BRAKE

(1) Insert brake link through brake support and install four attaching washers and nuts. Tighten to 150 inch-pounds.

(2) Using lubriplate, coat bearing surface of bolt that connects power brake pedal link with brake pedal. Install bolt and nut. Tighten to 30 foot-pounds.

(3) Attach vacuum hose to check valve.

(4) Install master cylinder on power brake. Tighten mounting nuts to 100 inch-pounds. Be sure power brake output push rod is set to correct length. With power brake attached to dash panel and vacuum supplied to unit, the master cylinder should compensate (force jet of fluid up through front chamber compensation port).

(5) Inspect adjustment of stop light switch.

CAUTION: Do not attempt to disassemble brake booster as this unit will be serviced by Manufacturer's Service Station.

POWER BRAKE—BENDIX

(Tandem Diaphragm)

GENERAL INFORMATION

The tandem diaphragm type power brake (Fig. 1) is a self contained vacuum hydraulic power braking unit. It is of the vacuum suspended type which utilizes engine intake manifold vacuum and atmospheric pressure for its power. This type of unit does not require a vacuum reservoir.

The Bendix Power Brake Unit can be identified by the crimped edge method of attaching the housing and cover together.

The basic elements of the vacuum unit are as follows:

(a) The vacuum power chamber consists of a front

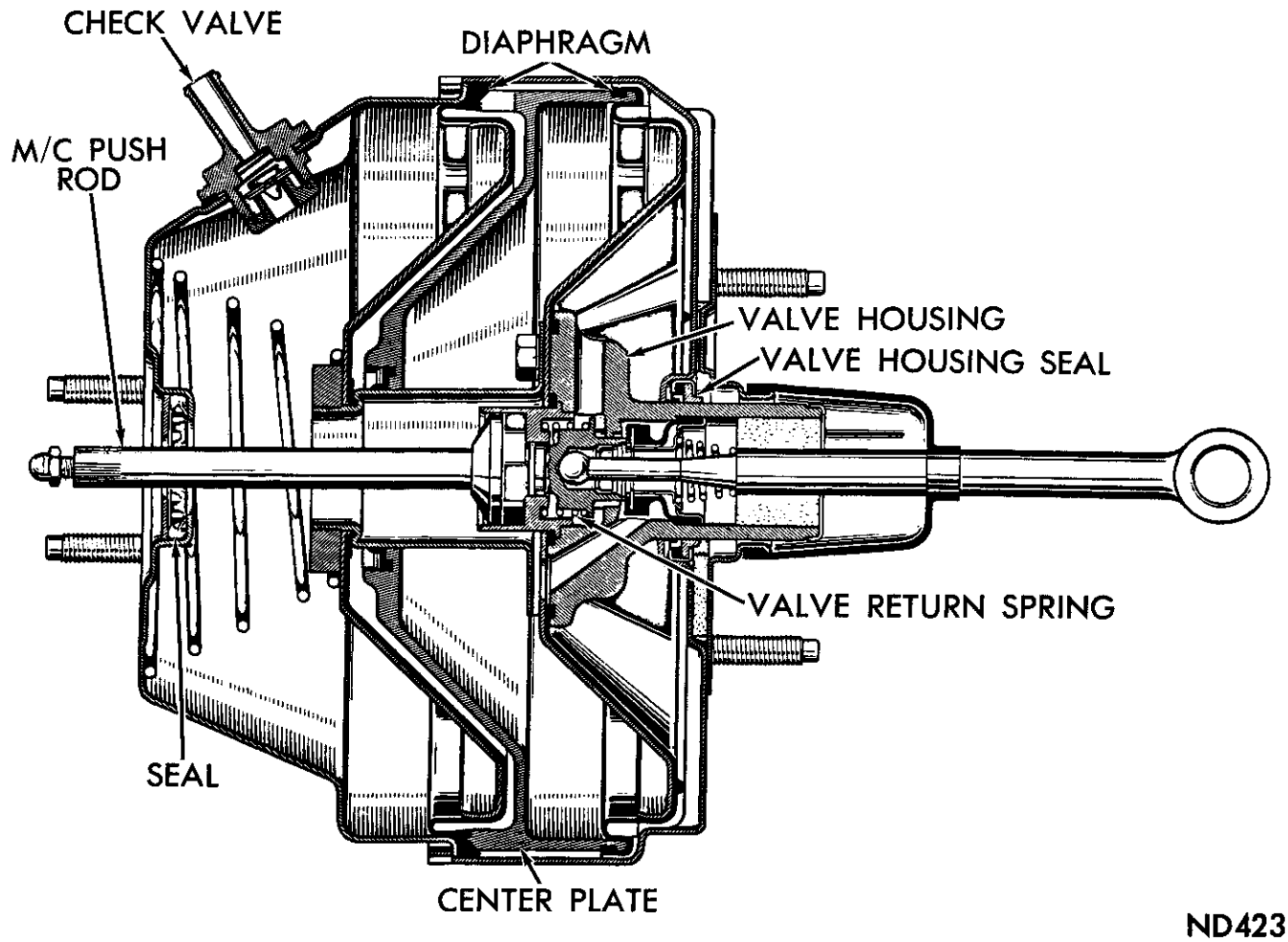

Fig. 1—Power Brake Assembly (Bendix) Disc Brakes

and rear shell, a center plate, front and rear diaphragm, hydraulic push-rod and a vacuum diaphragm return spring (Fig. 1).

(b) A mechanically actuated control valve integral with the vacuum power diaphragms, controls the degree of power brake application or release in accordance with the foot pressure applied to the valve operating rod through the brake pedal linkage.

The control valve is of a single poppet type valve with the atmospheric port and a vacuum port. The vacuum port seat is a part of the valve body attached to the diaphragm assembly. The atmospheric port is a part of the valve plunger which moves within the valve housing and vacuum power diaphragm assembly.

(c) A hydraulic master cylinder which contains all of the elements of the standard brake master cylinder except for the special hydraulic push rod which is a part of the power brake.

SERVICE PROCEDURES

REMOVING POWER BRAKE

(1) Remove four master cylinder attaching nuts and washers and remove master cylinder from power brake.

(2) Disconnect vacuum line from check valve.

(3) From under instrument panel, remove push rod nut and bolt from power brake and brake pedal.

(4) From under instrument panel remove four brake unit attaching nuts and washers.

(5) Withdraw brake unit assembly from brake support bracket.

INSTALLING POWER BRAKE

(1) Insert brake push rod through brake support and install four attaching washers and nuts. Tighten to 150 inch-pounds.

(2) Using lubriplate, coat bearing surface of bolt that connects power brake pedal link with brake

pedal linkage. Install bolt and nut. Tighten to 30 foot pounds.

(3) Attach vacuum hose to check valve.

(4) Install master cylinder on power brake. Tighten mounting nuts to 100 inch-pounds. With power brake attached to dash panel and vacuum supplied to unit, with the brake applied, the master cylinder should compensate (force jet of fluid up through front chamber compensation port).

(5) Inspect adjustment of stop light switch.

CAUTION: Do not attempt to disassemble brake booster as this unit will be serviced by Manufacturer's Service Station.

KELSEY-HAYES DISC BRAKE (FLOATING CALIPER)

INDEX

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
EXCESSIVE PEDAL TRAVEL	(a) Air, leak, or insufficient fluid in system or caliper.	(a) Check system for leaks and bleed.
	(b) Warped or excessively tapered shoe and lining assembly.	(b) Install new shoe and linings.
	(c) Excessive disc runout.	(c) Check disc for runout with dial indicator. Install new disc.
	(d) Rear brake adjustment required.	(d) Check and adjust rear brakes.
	(e) Loose wheel bearing adjustment.	(e) Readjust wheel bearing to specified torque.
	(f) Damaged caliper piston seal.	(f) Install new piston seal.
	(g) Improper brake fluid (boil).	(g) Drain and install correct fluid.
	(h) Power brake malfunction.	(h) Check and correct power unit.
BRAKE ROUGHNESS OR CHATTER (PEDAL PUMPING)	(a) Excessive thickness variation of braking disc.	(a) Check disc for thickness variation using a micrometer.
	(b) Excessive lateral runout of braking disc.	(b) Check disc for lateral runout with dial indicator. Install new disc.
	(c) Rear brake drums out-of-round.	(c) Regrind rear drums and check for out-of-round.
	(d) Excessive front bearing clearance.	(d) Readjust wheel bearings to specified torque.
EXCESSIVE PEDAL EFFORT	(a) Brake fluid, oil or grease on linings.	(a) Install new shoe linings as required.
	(b) Incorrect lining.	(b) Remove lining and install correct lining.
	(c) Frozen or seized pistons.	(c) Disassemble caliper and free up pistons.
	(d) Power brake malfunction.	(d) Check and correct power unit.
PULL	(a) Brake fluid, oil or grease on linings.	(a) Install new shoe and linings.
	(b) Unmatched linings.	(b) Install correct lining.
	(c) Distorted brake shoes.	(c) Install new brake shoes.
	(d) Frozen or seized pistons.	(d) Disassemble caliper and free up pistons.
	(e) Incorrect tire pressure.	(e) Inflate tires to recommended pressures.
	(f) Front end out of alignment.	(f) Align front end and check.
	(g) Broken rear spring.	(g) Install new rear spring.
	(h) Rear brake pistons sticking.	(h) Free up rear brake pistons.

Condition	Possible Cause	Correction
	(i) Restricted hose or line.	(i) Check hoses and lines and correct as necessary.
	(j) Caliper not in the proper alignment to braking disc.	(j) Remove caliper and reinstall. Check alignment.
NOISE	**Groan**—Brake noise emanating when slowly releasing brakes (creep—groan) (a) Not detrimental to function of disc brakes—no corrective action required. (Indicate to operator this noise may be eliminated by slightly increasing or decreasing brake pedal efforts.)	
	Rattle—Brake noise or rattle emanating at low speeds on rough roads, (front wheels only).	
	(a) Shoe anti-rattle spring missing or not properly positioned.	(a) Install new anti-rattle spring or position properly.
	(b) Excessive clearance between shoe and caliper.	(b) Install new shoe and lining assemblies.
	Scraping—(a) Mounting bolts too long.	(a) Install mounting bolts of correct length.
	(b) Loose wheel bearings.	(b) Readjust wheel bearings to correct specifications.
FRONT BRAKES HEAT UP DURING DRIVING AND FAIL TO RELEASE	(a) Operator riding brake pedal.	(a) Instruct owner how to drive with disc brakes.
	(b) Stop light switch improperly adjusted.	(b) Adjust stop light switch to allow full return of pedal.
	(c) Sticking pedal linkage.	(c) Free up sticking pedal linkage.
	(d) Frozen or seized piston.	(d) Disassemble caliper and free up piston.
	(e) Residual pressure valve in master cylinder.	(e) Remove valve. (See Fig. 15).
	(f) Power brake malfunction.	(f) Check and correct power unit.
LEAKY WHEEL CYLINDER	(a) Damaged or worn caliper piston seal.	(a) Disassemble caliper and install new seal.
	(b) Scores or corrision on surface of cylinder bore.	(b) Disassemble caliper and hone cylinder bore. Install new seal.
GRABBING OR UNEVEN BRAKING ACTION	(a) Causes listed under "Pull."	(a) Corrections listed under "Pull."
	(b) Power brake malfunction.	(b) Check and correct power unit.
BRAKE PEDAL CAN BE DEPRESSED WITHOUT BRAKING EFFECT	(a) Air in hydraulic system or improper bleeding procedure.	(a) Bleed system.
	(b) Leak past primary cup in master cylinder.	(b) Recondition master cylinder.
	(c) Leak in system or caliper.	(c) Check for leak and repair as required.
	(d) Rear brakes out of adjustment.	(d) Adjust rear brakes.
	(e) Bleeder screw open.	(e) Close bleeder screw and bleed entire system.

GENERAL INFORMATION

The Kelsey-Hayes single piston, floating caliper disc brake assembly (Fig. 1), consists of the hub and disc assembly, the caliper, shoes and linings, splash shield and adaptor.

The cast iron braking disc has 40 (forty) cooling fins (or louvres) that are cast integrally between the two machined braking surfaces (Fig. 2). When the wheel is in motion, the rotation of the disc cooling fins supplies air circulation between the braking surfaces for efficient cooling of the disc and prolonged lining life. The braking disc is protected from road splash (inboard side) by a shield bolted to the steering knuckle and by the wheel and tire on the outboard side.

The single piston caliper assembly floats through four rubber bushings on two steel guide pins threaded into the adaptor. Two of the bushings are inserted in the outboard portion of the caliper and two on the inboard side (Fig. 3). Four machined abutments on the adaptor, position and align the caliper, fore and aft. Two positioners installed over the guide pins, control the movement of the caliper along with the piston seal, and assists in maintaining proper shoe clearance and are also required to hold the inner bushing in place.

The guide pins are also used to radially locate and restrain both shoes, while all of the braking force is taken by the caliper on the outboard shoe and ma-

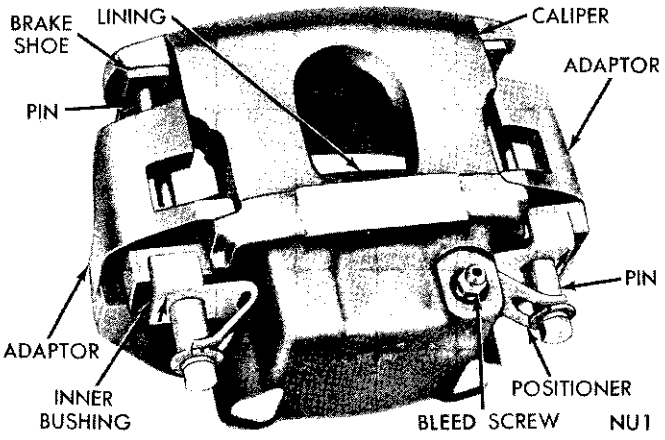

Fig. 1—Floating Caliper Assembly (Single Piston)

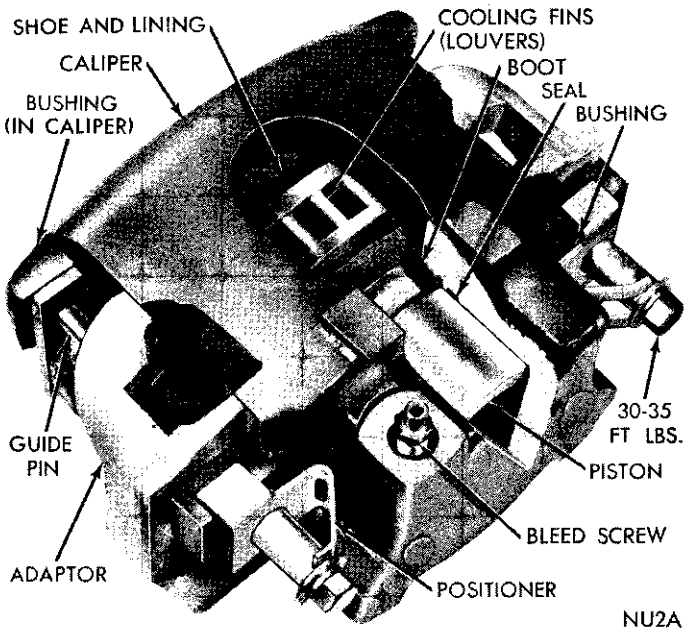

Fig. 2—Floating Caliper Assembly (Sectional)

chined lug (Fig. 9) on the adapter for the inboard shoe.

The caliper is a one piece casting with the inboard side containing the single piston cylinder bore. The steel piston is 2-3/4 inches in diameter and is nickle and chrome plated for anti-corrosion and long wear. The square cut rubber piston seal is located in a machined groove in the cylinder bore and provides a hydraulic seal between the piston and the cylinder wall (Fig. 4). The adaptor is mounted to the steering knuckle by two special nylock bolts (Fig. 5).

A moulded rubber dust boot installed in a groove in the cylinder bore and piston, keeps contamination from the cylinder wall and piston. The boot has a wiping lip (Fig. 6) that prevents contamination in the bore area.

As the brake pedal is depressed, hydraulic pressure is applied against the piston. This force is transmitted to the inboard brake shoe and lining and the inboard

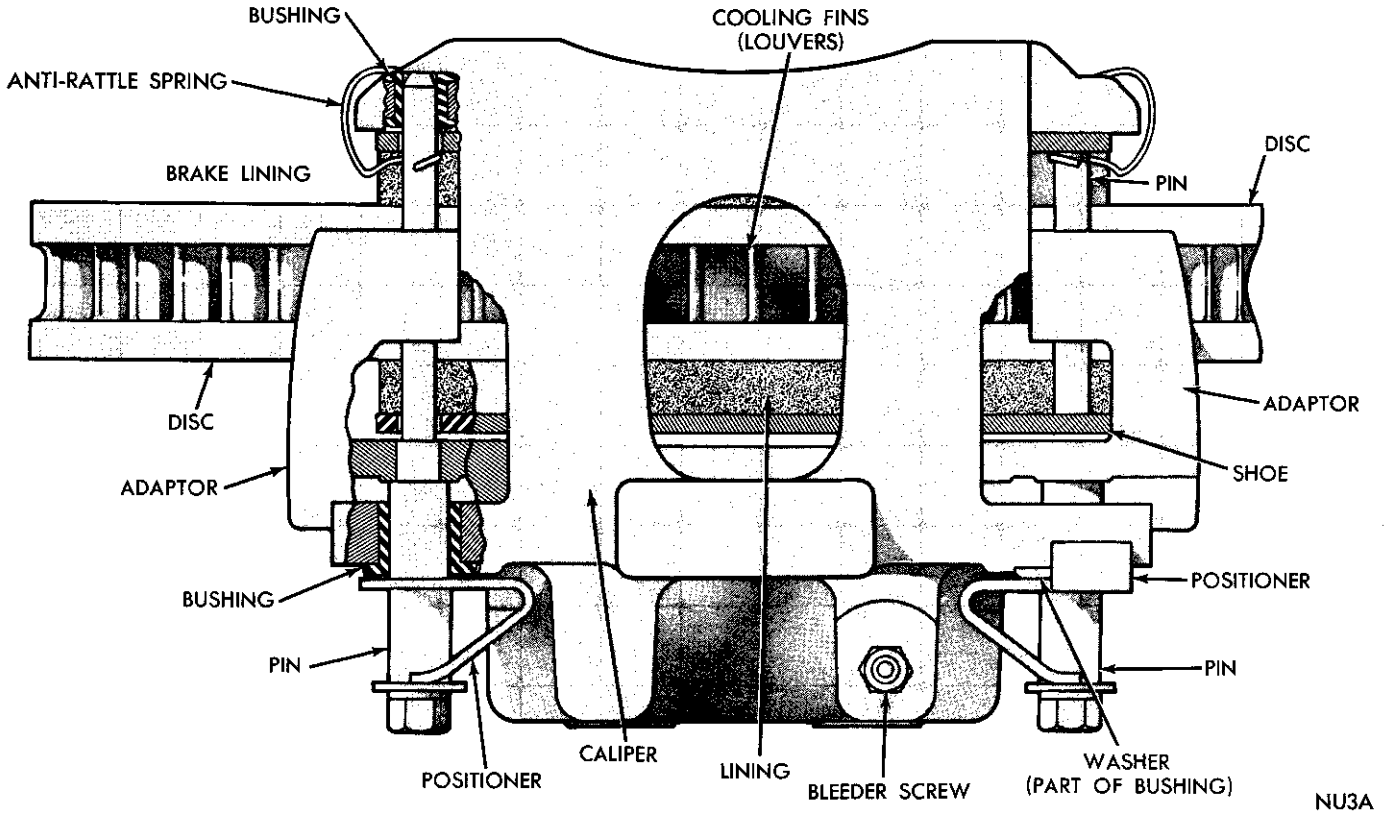

Fig. 3—Floating Caliper Assembly (Sectional) Shoe Mounting

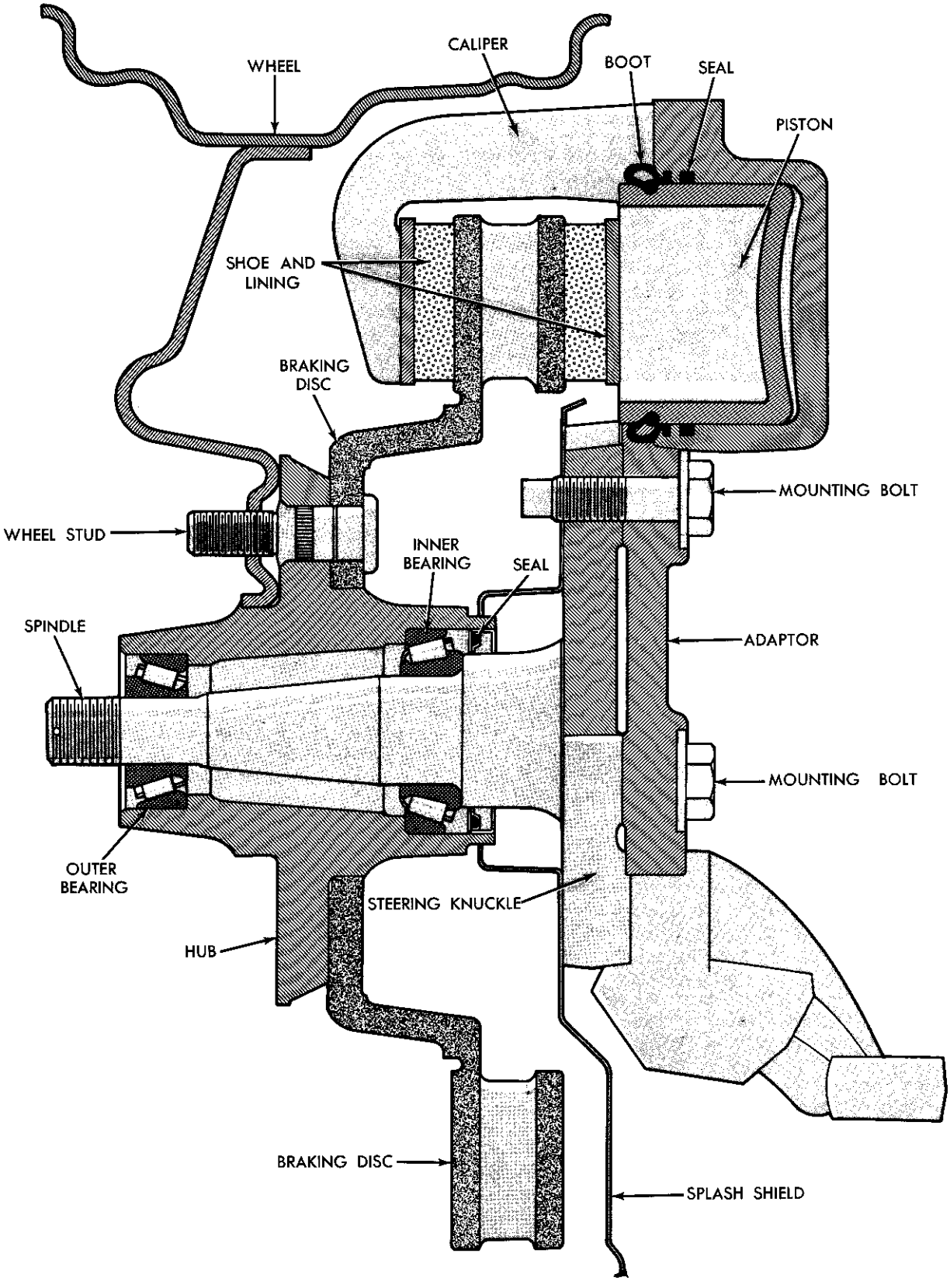

Fig. 4—Disc Brake Assembly (Sectional)

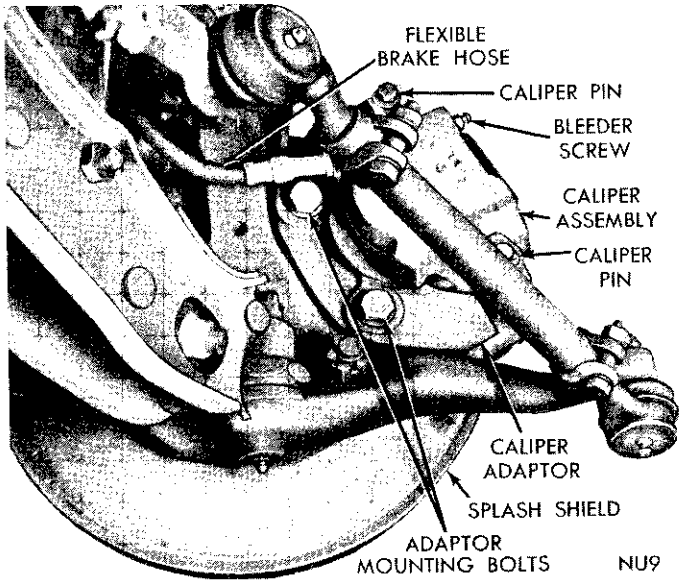

Fig. 5—Disc Brake Caliper Mounting

braking surface of the disc. As force increases against the disc from the inner lining, the caliper assembly moves inboard, sliding on the guide pins, thus providing a clamping force on the disc.

When the brake pressure is released, the piston seal (distorted by applied pressure) returns to its normal position, pulling the piston back to released position, while the two positioners force the caliper outboard to create a slight running clearance between outer shoe and the disc.

Automatic adjustment is obtained by outward relocation of the piston as the inboard lining wears and the inward movement of the caliper as the outboard lining wears, thus maintaining correct adjustment at all times.

METERING VALVE

All Kelsey-Hayes Floating Caliper disc brake equipped vehicles are equipped with a pressure metering valve. The valve is located on the left frame rail, directly under the battery tray. The use of the metering valve is to better match the front disc brakes with the rear drum brakes on the vehicle. This results in improved braking and steering control on icy surfaces.

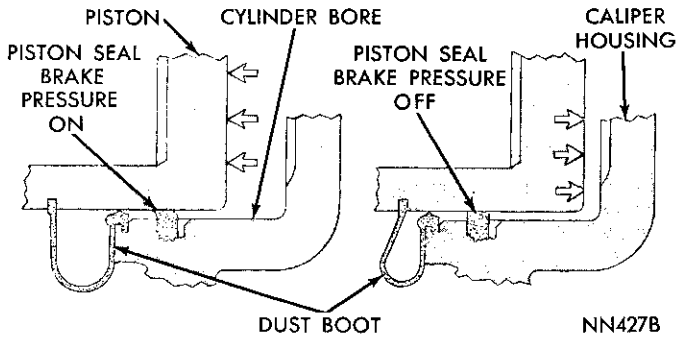

Fig. 6—Piston Seal Function for Automatic Adjustment

ROUTINE MAINTENANCE—30,000 Miles

Check Brake Lines, Hoses and Linings

Raise all four wheels. Remove one of the front wheel and tire assemblies and inspect the braking disc, linings and caliper. Inspect front brake flexible hose for signs of cracking or deterioration. **Replace brake hose if rubber cover is penetrated.** (The wheel bearings should be inspected at this time and repacked if necessary). **The caliper assembly must be removed in order to inspect the inner wheel bearing.** (Refer to "Brake Shoe Removal" paragraph.)

Do not get oil or grease on the braking disc or linings. If the linings (pads) are worn to within .030 inch of the shoe, replace both sets of shoe and lining assemblies, (inboard and outboard) on the front wheels. It is necessary that both front wheel sets be replaced whenever a respective shoe and lining is worn beyond specifications or damaged.

Check all brake tube connections for possible leaks. Install new flexible hoses as required.

Check adapter plate to knuckle bolts for specified torque (75 to 100 foot-pounds).

Shoe and Lining Wear

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the wheel and tire assemblies, and the calipers. Remove the shoe and lining assemblies. (See "Brake Shoe Removal" paragraph). Three (3) thickness measurements with a micrometer should be taken across the center of the shoe and lining; One reading at each end and one reading in the center. When an assembly has been worn to a thickness of .180 inch, it should be replaced. If a shoe and lining does not require replacement, reinstall, making sure each shoe and positioner is returned to their original positions. (See "Brake Shoe Installation" paragraph). It is normal for the inboard lining to show slightly more wear than the outboard.

Brake Roughness

The most common cause of brake roughness (or chatter with disc brakes are excessive variation in disc thickness and/or excessive disc face runout. These can be easily checked with a dial indicator and a 2" micrometer (vernier type preferred). If either of the measurements are out of specification, the disc must be refinished or replaced. Refer to "Refinishing (Refacing) Braking Disc paragraph.

Other less prevalent causes of roughness can be the use of some types of non-standard lining and extreme abrasion of the disc faces. Also, vehicles which

stand unused for periods of time in areas of high humidity or salt air may incur rust on the disc which could cause a temporary brake surge and roughness. Normally however, this condition should correct itself after a short period of usage. If rust is severe enough roughness will not clear up and disc must be resurfaced or replaced.

DISC BRAKE SERVICE PRECAUTIONS

(1) Grease or any other foreign material must be kept off the caliper assembly, surfaces of the braking disc and external surfaces of the hub, during service procedures. Handling the braking disc and caliper should be done in such a way as to avoid deformation of the disc and scratching or nicking the brake linings (pads).

(2) If inspection reveals that the square sectioned caliper piston seal is worn or damaged, it should be replaced.

(3) During removal and installation of a wheel and tire assembly, use care not to strike the caliper.

(4) The front wheel bearing end play is important and must be within specifications.

(5) Be sure vehicle is centered on the hoist before servicing any of the front end components to avoid bending or damaging disc splash shield on full right or left hand turns.

(6) Before vehicle is moved after any brake service work, **be sure and obtain a firm brake pedal.**

(7) Dragging the brakes (common result of left foot application) should be avoided during vehicle operation.

(8) The wheel, tire, hub and disc assembly **cannot** be removed as an assembly. The caliper assembly must be removed before removal of the hub and disc assembly.

(9) As lining wears, reservoir level will go down. If fluid has been added between relines, then reservoir overflow may occur when the piston is pushed back into the new lining position. Overflowing can be avoided in this case by removal of a small amount of fluid before overflow occurs.

SERVICE PROCEDURES

BRAKE SHOE REMOVAL

(1) Raise vehicle on a hoist or jackstands.

(2) Remove front wheel covers, and wheel and tire assemblies.

(3) Remove caliper guide pins positioners that attach caliper to adaptor and anti-rattle spring.

(4) Remove caliper from disc by slowly sliding caliper assembly out and away from braking disc (Fig. 7). Support caliper firmly so as not to damage flexible brake hose.

(5) Slide outboard shoe and lining assembly out of caliper. Slide inboard shoe and lining assembly out of adaptor (Fig. 8).

(6) Remove outer bushings from caliper by pressing out of bore (Fig. 13), using a suitable tool. Discard bushings.

(7) Slide inner bushings (flanged) off guide pins and discard. Remove positioners from guide pins and discard.

CLEANING AND INSPECTION

Check for piston and seal leaks (evident by brake fluid in and around boot area and inboard lining) and for any ruptures of piston dust boot. If boot is damaged, or fluid is evident, it will be necessary to disassemble caliper assembly and install a new seal, boot, (and piston if damaged or corroded.) (Refer to "Disassembling Caliper Assembly" paragraph). Check the mating surfaces of the abutments on the caliper and adaptor. If corroded or rusty, clean surfaces with wire brush. Inspect braking surfaces of disc.

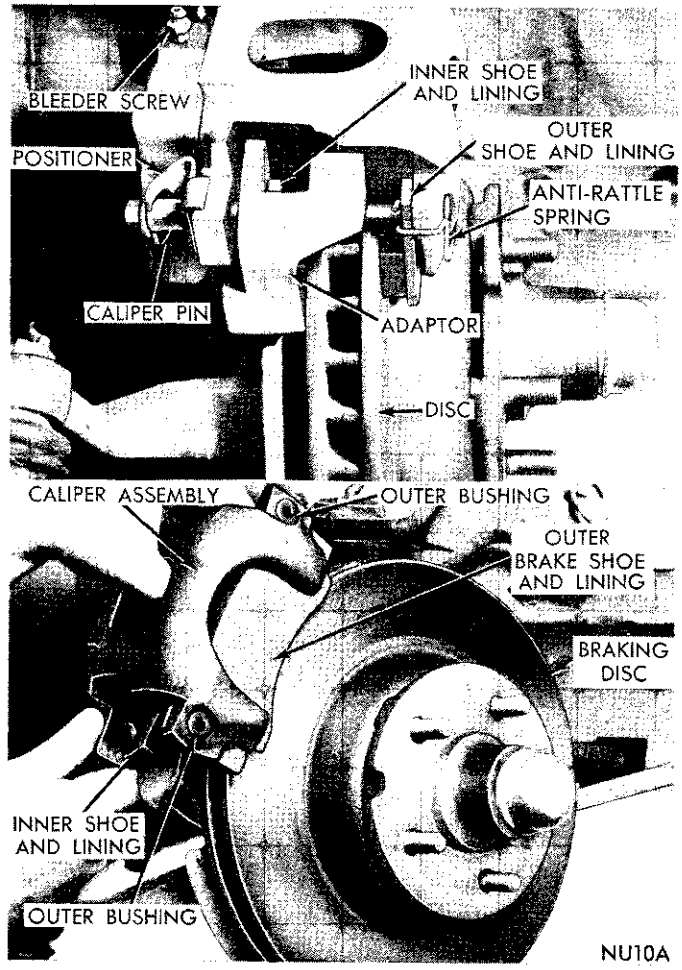

Fig. 7—Removing or Installing Caliper

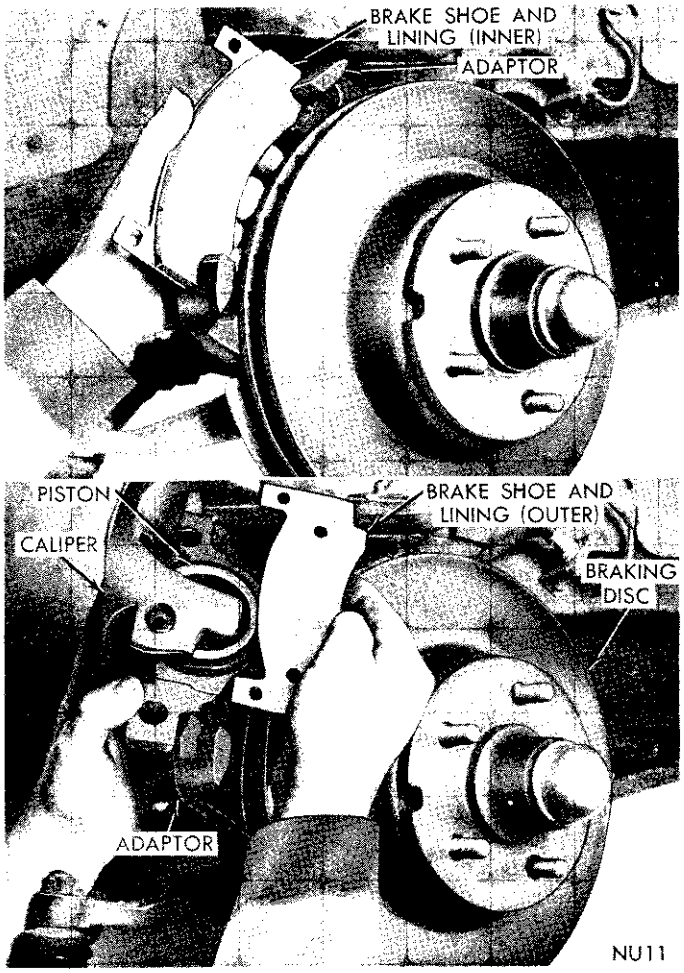

Fig. 8—Removing or Installing Brakes Shoes and Lining

BRAKE SHOE INSTALLATION

When installing new shoe and lining assemblies, it will be necessary to also install new positioners, inner bushings and outer bushings.

(1) Slowly and carefully push piston back into bore until it is bottomed. Watch for possible reservoir overflow. See Step 9 of "Disc Brake Service Precautions".

(2) Install new inner guide pin bushings in caliper with flanged end on inboard side (Fig. 3). Compress flanges of outboard bushing in fingers and work into position in hole from the outboard side of caliper (Fig. 18).

(3) Slide new shoe and lining assemblies into position in adaptor and caliper (Fig. 8), being sure that metal portion of shoe is fully in recess of caliper and adaptor.

(4) Holding outboard lining in position, carefully slide caliper down into position in adaptor and over disc. Align guide pin holes of adapter, inboard and outboard shoes. (Fig. 3).

(5) Install new positioners over guide pins with open ends toward outside, **and with stamped arrows pointing upwards** (Fig. 1). Install assembled guide pins through bushing, caliper, adaptor, inboard outboard shoes and into outer bushings in caliper and anti-rattle spring.

(6) Press **IN** on end of guide pins and thread pin into adaptor, **USING EXTREME CARE SO AS NOT TO CROSS THREADS.** Tighten from 30 to 35 foot-pounds. Be sure tabs of positioners are over machined surfaces of caliper (Fig. 1).

(7) Pump brake pedal several times until a firm pedal has been obtained.

(8) Check and refill master cylinder reservoirs (if necessary) with approved brake fluid as required. (It should not be necessary to bleed the system after shoe and lining removal and installation). However, if a firm pedal cannot be obtained bleed the brake system as described in "Bleeding Brake System" paragraph. **It may have been necessary to remove fluid to put in new linings as fluid is pushed back into master cylinder.**

(9) Install wheel and tire assemblies and wheel covers.

(10) Remove jackstands or lower hoist.

REMOVING CALIPER FROM VEHICLE

It will be necessary to remove the caliper to install a new piston seal and boot.

(1) Raise vehicle on a hoist or jackstands.

(2) Remove front wheel covers and wheel and tire assemblies.

(3) Disconnect front brake flexible hose from tube at frame mounting bracket. Plug brake tube to prevent loss of fluid or prop brake pedal to any position **below** the first inch of travel. Disconnect hose from caliper.

(4) Remove guide pins and positioners that attach caliper to adaptor. Carefully slide caliper out and away from disc and adaptor, while holding outboard shoe and lining assembly. Remove inboard shoe and lining from adaptor.

DISASSEMBLING CALIPER

(1) Mount caliper assembly in a vise equipped with protector jaws (Fig. 10). (Caution: **Excessive vise pressure will cause bore distortion and binding of piston.)**

(2) Remove dust boot. (Fig. 11).

(3) Using Tool C-4087, remove piston from caliper (Fig. 10). Care must be used so as not to scratch, burr or otherwise damage piston on outside diameter. To do so effects sealing qualities of piston. Draw piston straight out of its bore. If a piston becomes cocked removal is more difficult and piston or bore may be damaged. **CAUTION: UNDER NO CONDITION SHOULD AIR PRESSURE BE USED TO REMOVE PISTON FROM BORE. PERSONAL INJURY COULD RESULT FROM SUCH PRACTICE.**

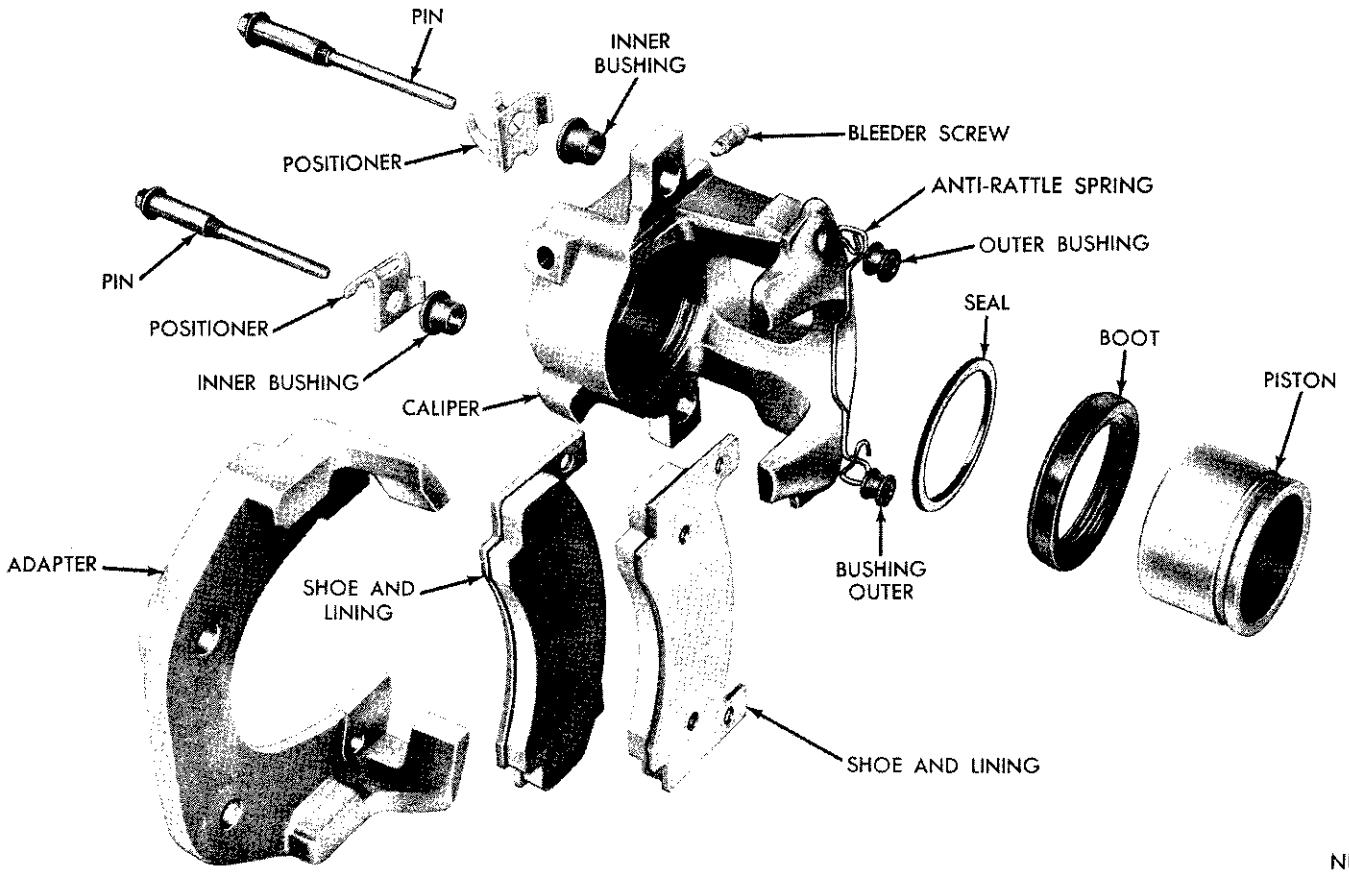

Fig. 9—Caliper Assembly (Exploded View)

(4) Using a small, pointed, wooden or plastic stick, work piston seal out of its groove in piston bore (Fig. 12). Discard old seal. **Do not use a screwdriver or other metal tool for this operation, because of possibility of scratching piston bore or burring edges of seal groove.**

(5) Remove outer bushings from caliper by pressing out of bore, (Fig. 13) using a suitable tool. Discard bushings.

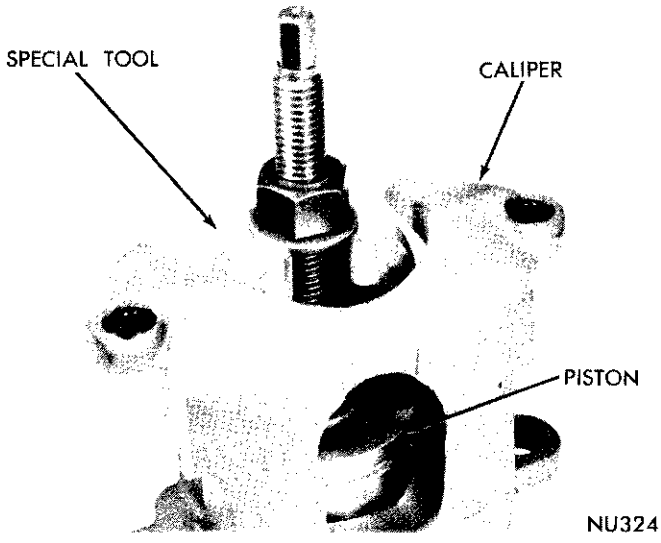

Fig. 10—Removing Piston from Caliper

(6) Remove inner bushing and discard. Remove bleeder screw.

CLEANING AND INSPECTION

Clean all parts using alcohol or a suitable solvent and blow dry, using compressed air. Blow out all drilled passages and bores. (Whenever a caliper has been disassembled, and a new boot and seal must be installed at reassembly). Inspect the piston bore for scoring or pitting. Install a new piston if it is pitted, scored or the plating is severely worn. Bores that show light scratches or corrosion, can usually be cleared with crocus cloth. However, bores that have deep scratches or scoring should be honed, using Tool C-

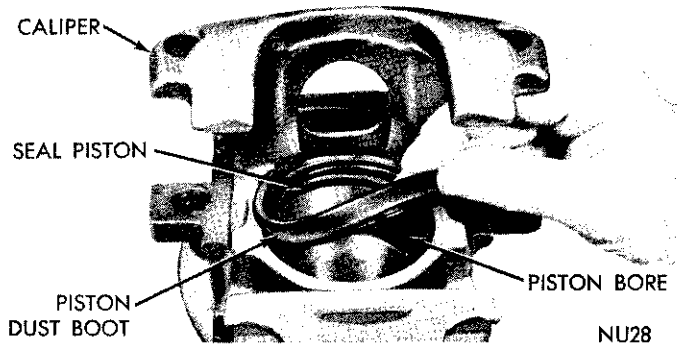

Fig. 11—Removing or Installing Piston Dust Boot

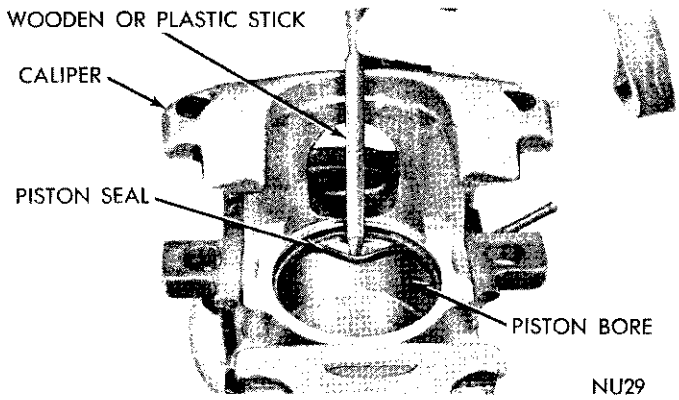

Fig. 12—Removing Piston Seal

4095, providing the diameter of the bore is not increased more than .002 inch. If the bore does not clean up within this specification, a new caliper housing should be installed. Black stains on the piston are caused by the piston seal and will do no harm.

When using Hone C-4095, coat the stones and bore with brake fluid. After honing the bore, carefully clean the seal and boot grooves with a stiff non-metalic rotary brush (Fig. 14).

Use extreme care in cleaning the caliper after honing. Remove all dirt and grit by flushing the caliper with brake fluid; wipe dry with a clean, lintless cloth and then clean a second time in the same manner or until clean cloth shows no signs of discoloration.

ASSEMBLING CALIPER

(1) Clamp caliper in vise (with protector jaws), (Fig. 10). Caution: Excessive vise pressure will cause bore distortion and binding of piston.

(2) Dip new piston seal in lubricant (supplied with kit) Ucon #LB1145Y24 (or equivalent) and install in groove in bore. Seal should be positioned at one area in groove and gently worked around the groove, using **clean** fingers, until properly seated. **NEVER USE AN OLD PISTON SEAL.** (Be sure seal is not twisted or rolled). (Fig. 15).

(3) Coat new piston boot with lubricant (as specified above) leaving a generous amount of lubricant inside of boot. Install in caliper by working into outer groove, using fingers only. (Boot will seem larger than diameter of groove, but will snap into place when properly positioned in groove. (Fig. 16). Using a forefinger, slide around inside of boot to be sure it is seated, or correctly installed.

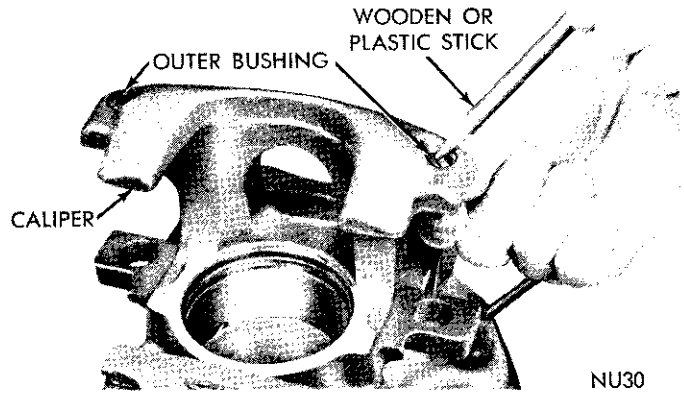

Fig. 13—Removing Outer Bushings

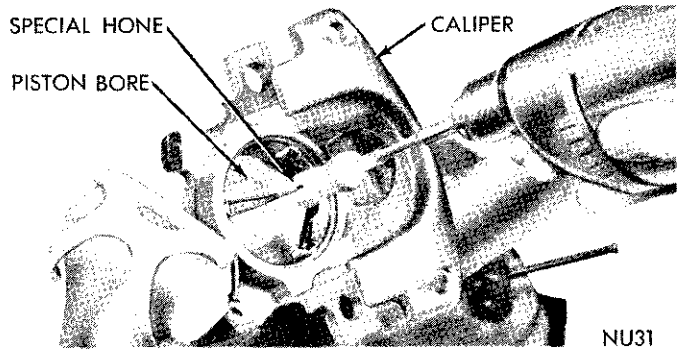

Fig. 14—Honing Piston Bore

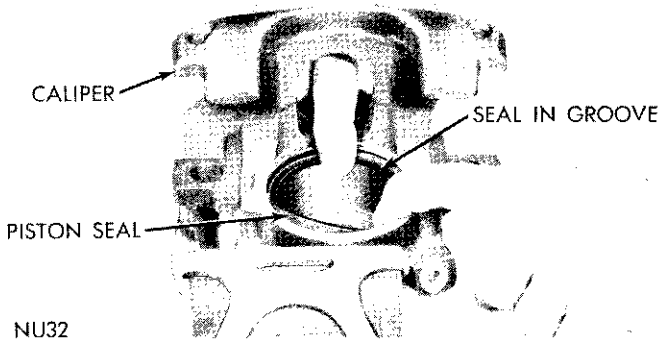

Fig. 15—Installing Piston Seal

(4) Plug high pressure inlet to caliper and bleeder screw hole, then coat piston with a generous amount of lubricant (as specified above). With fingers spreading boot, work piston into boot and press down on piston. (The entrapped air below piston will force boot around piston and into its groove as piston is depressed.) (Fig. 17). Remove plug, then carefully push piston down the bore until bottomed. Caution: **Force must be applied uniformly to avoid cocking.**

(5) Install new inner guide pin bushings in caliper with flanged end on inboard side (Fig. 3). Compress flanges of outboard bushing in with fingers and work

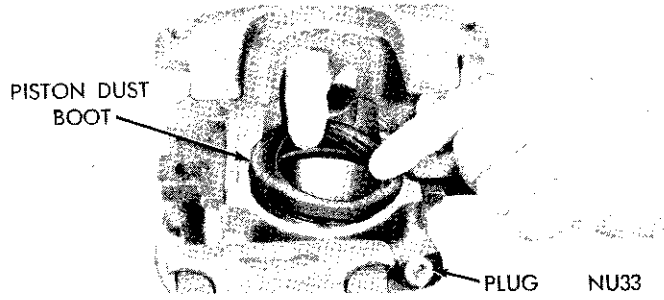

Fig. 16—Installing Piston Dust Boot

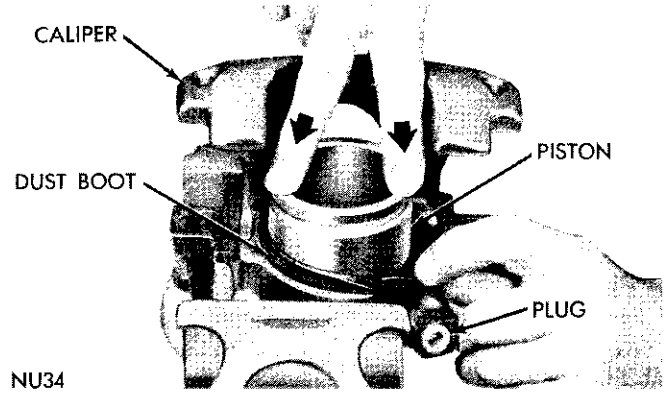

Fig. 17—Installing Piston (through Boot)

into position in hole from the outboard side of the caliper (Fig. 18). Press **IN** on bushing, using finger tips or small plastic stick (Fig. 18) until seated. Be sure flanges extend over caliper casting evenly on both sides. Install bleeder screw.

Before installing caliper assembly on vehicle, inspect braking disc. Conditions as described in "Checking Braking Disc for Runout and Thickness" paragraph.

INSTALLING CALIPER

(1) Examine lining for wear damage, or fluid contamination if its condition is found satisfactory it may be reused. If not usable both front brakes must be relined with new. If old lining is to be reused, be sure linings and positioners are installed in their original position.

(2) Connect flexible brake hose to caliper and tighten securely.

(3) Install new inboard shoe and lining adaptor (Fig. 8). Holding outboard shoe and lining in position in caliper, carefully slide caliper down into position in adaptor and over disc. Align pin holes of caliper, adaptor and inboard and outboard shoes.

(4) Install positioners over guide pins with open ends toward outside and arrows pointing upwards. (Fig. 1). Install assembled guide pins through bushing, caliper, adaptor, inboard and outboard shoes and into outer bushings in caliper.

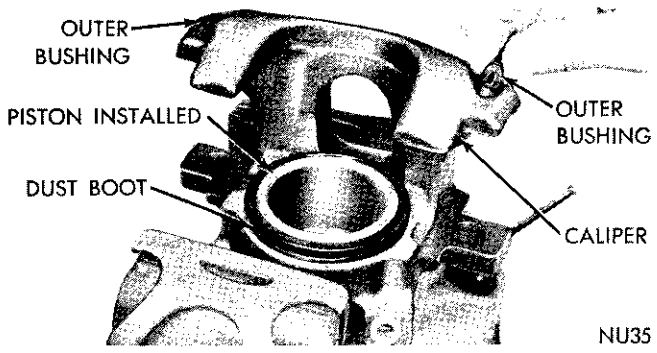

Fig. 18—Installing Outer Bushings

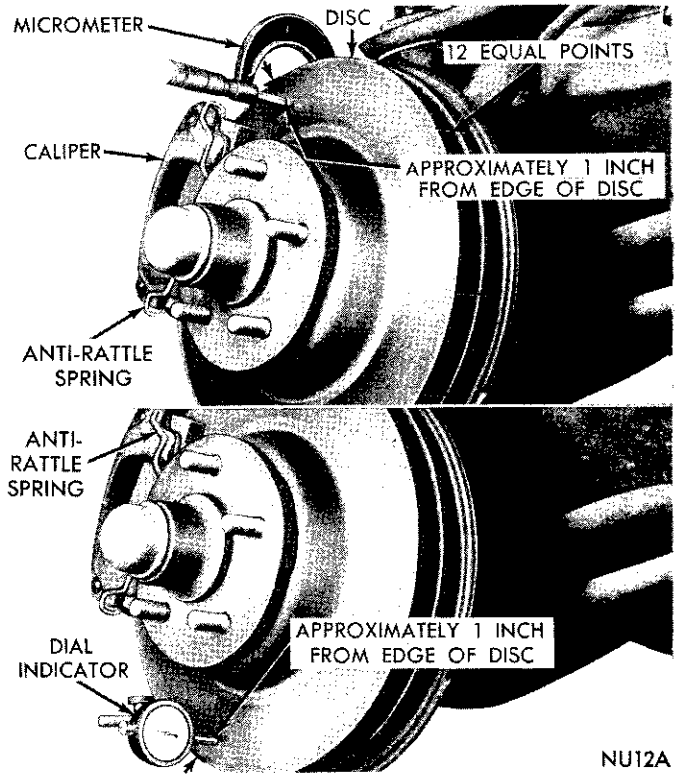

Fig. 19—Checking Braking Disc Run-out and Thickness

(5) Press **IN ON END GUIDE PINS AND THREAD PINS INTO ADAPTOR. USING EXTREME CARE SO AS NOT TO CROSS THREADS.** Tighten from 30 to 35 foot-pounds. (Be sure tabs of positioners are over machined surfaces of caliper (Fig. 1).

(6) Remove plug from brake tube and install flexible brake hose. Tighten securely. Avoid twisting hose.

(7) With bleeder screw open, allow caliper to "gravity" fill with brake fluid, then close bleeder screw. (Be sure all air bubbles have escaped; replenish brake fluid in master cylinder. Bleed brakes as described under "Bleeding Brakes" paragraph.

(8) **Pump brake pedal several times until a firm pedal has been obtained.**

(9) After bleeding caliper, check for fluid tightness under maximum pedal pressures. (Recheck master cylinder reservoir level).

(10) Install wheel and tire assembly and tighten wheel stud nuts to 65 foot pounds. **This is important.** Install wheel cover.

(11) Remove jackstands or lower hoist.

(12) **Road test vehicle and make several stops to wear off any foreign material on the brakes and to seat the linings. The vehicle may pull to one side or the other if this is not done.**

CHECKING BRAKING DISC FOR RUNOUT AND THICKNESS

(1) Mount dial indicator C-3339 on steering arm

with plunger contacting disc approximately one (1) inch from edge of disc. (Fig. 19).

(2) With wheel bearings adjusted to zero end play, check lateral runout. (Both sides of disc). Runout should not exceed .0025 inch. If runout is in excess of specification, install a new disc and hub assembly or reface disc, being careful not to remove more than .015 inch from each side of disc. Be sure and readjust wheel bearings after check.

(3) Thickness variation of disc should be made in conjunction with runout. Measure thickness of disc at twelve (12) equal points with a micrometer at a radius approximately one (1) inch from edge of disc. If thickness measurements vary by more than .0005 inch, disc should be removed and resurfaced or a new disc and hub assembly installed. (Fig. 19).

(4) Light scoring and/or wear is acceptable, if heavy scoring or warping is evident, the disc must be refinished or replaced (See Refinishing (Refacing) Braking Disc). If cracks are evident the hub and disc assembly must be replaced.

REMOVING BRAKING DISC AND HUB

(1) Raise vehicle on hoist or jackstands. Remove wheel cover and wheel and tire assembly.

(2) Remove caliper assembly, as described under "Removing Caliper" paragraph, (but do not disconnect brake line). Suspend caliper from wire hook or loop to avoid strain on flexible hose.

(3) Remove grease cap, cotter pin, nut lock, nut, thrust washer and outer wheel bearing.

(4) Pull disc and hub off wheel spindle.

INSTALLING BRAKING DISC AND HUB

(1) Slide brake disc and hub assembly on spindle.

(2) Install outer bearing, thrust washer and nut.

(3) Tighten wheel bearing adjusting nut to 90 inch pounds while rotating disc and hub. Recheck disc run out as described previously.

(4) Position lock nut on nut with one pair of slots in line with cotter pin hole.

(5) Back off adjusting nut and lock assembly one slot.

(6) Clean grease cap, coating inside with wheel grease (do not fill cap) and install cap. Clean both sides of braking disc with alcohol or suitable solvent.

(7) Install caliper assembly, as described in "Installing Caliper" paragraph.

REFINISHING (REFACING) BRAKING DISC

Before refinishing or refacing a braking disc, the disc should be checked and inspected for the following conditions:

(1) Scoring, rust, impregnation of lining material and worn ridges.

(2) Runout or wobble.

(3) Thickness variation (Parallelism).

(4) Dishing or distortion (Flatness).

If a vehicle has not been driven for a period of time, the discs will rust in the area not covered by the lining and cause noise and chatter, excessive wear and scoring of the discs and lining. Wear ridges on the discs can cause temporary improper lining contact if ridges are not removed before installation of new lining (pads).

Lining deposit on the disc, may cause erratic friction characteristics if new lining is installed without resurfacing or cleaning the disc.

Excessive runout or wobble in a disc can increase pedal travel due to piston knockback and increase seal bushing wear due to necessity of caliper to follow the disc wobble.

Thickness variation in a disc can also result in pedal pulsation, chatter and surge due to variation in brake output when disc section is uneven.

Dishing or distortion can be caused by extreme heat and abuse of the brakes.

Resurfacing Braking Disc

This operation can be used when the disc surface is rusty or has lining deposits. A sanding disc attachment will remove surface contamination without removing much material. It will generally follow variations in thickness which are in the disc.

Refacing Braking Disc

If scoring is deep, runout or thickness variation is beyond limits, or other distortion is apparent, the disc should be refaced on a brake lathe equipped for disc machining. (Fig. 21). After machining a disc, a grinder may be used to remove tool marks.

A new disc and hub assembly should be installed if the old one cannot be refaced to bring it within specifications without removing an excessive amount of material. Do not remove more than .050 inch per disc. Brake operation may be affected if an excess of material is removed.

Both sides of the braking surface should be machined or ground when servicing since small variations in resurfacing machines may cause the newly finished surface to be out of parallel with the opposite unfinished side resulting in a thickness variation beyond acceptable limits. Disc brakes are very sensitive to thickness variation.

The following chart and (Fig. 20) shows the location and tolerances of required specifications when servicing the braking disc:

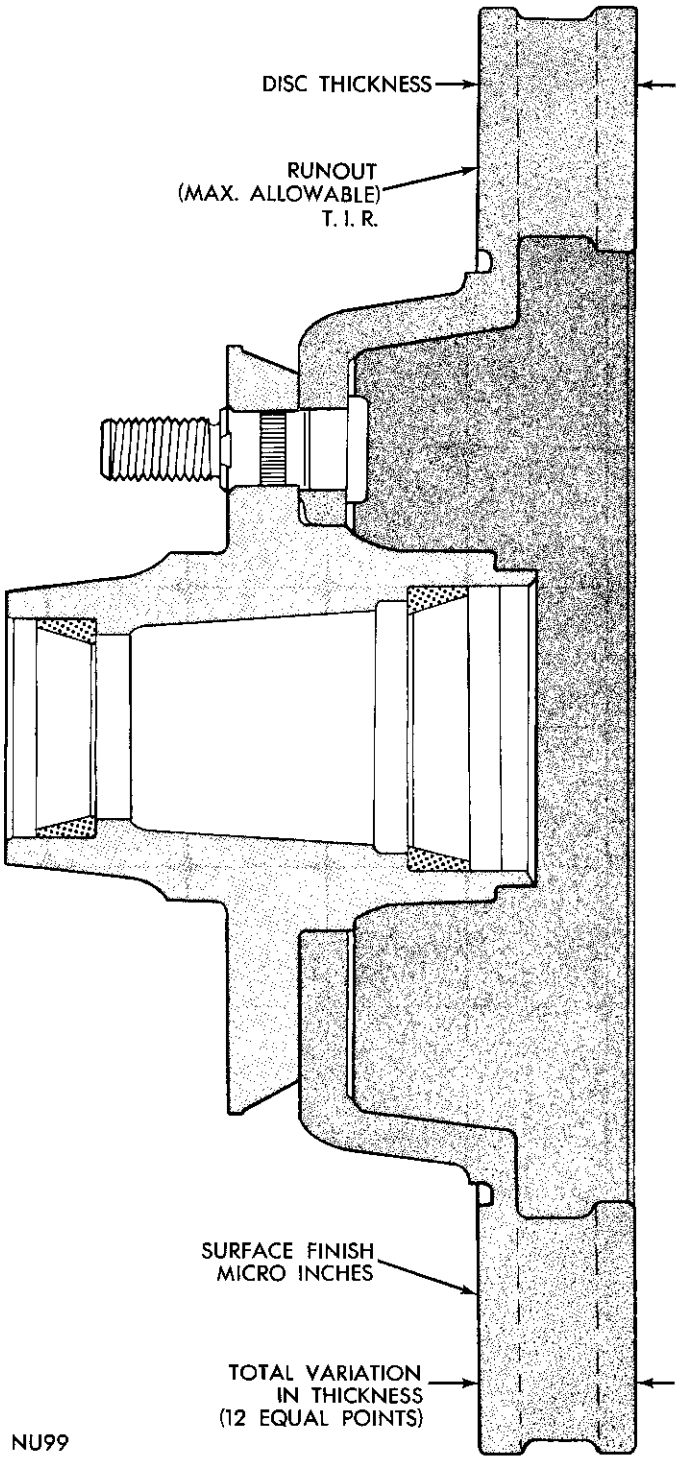

Fig. 20—Disc Specifications

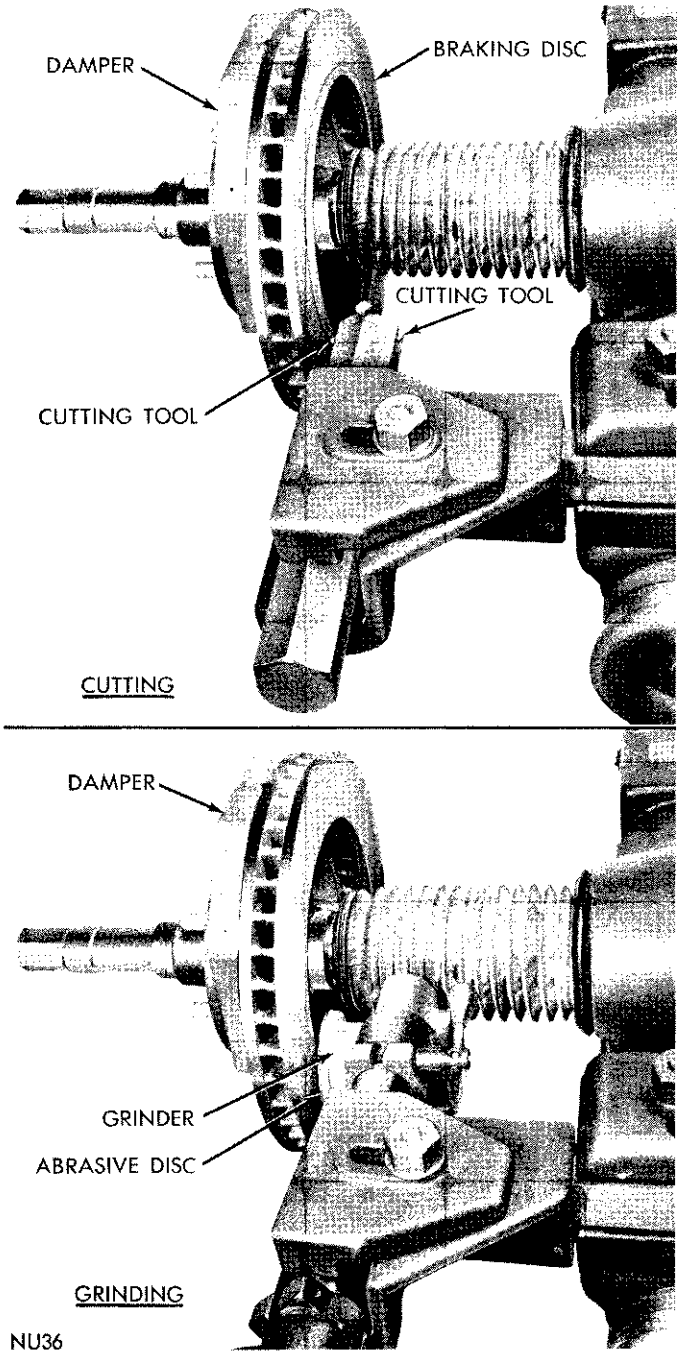

Fig. 21—Refacing Braking Disc

Brake Design	Thickness	Minimum Thickness	Thickness Variation	Runout	Micro Finish
Kelstar Kelsey-Hayes	1.250-1.240	1.20	.0005	.0025″	15-80

CAUTION:

When refacing a braking disc (Fig. 21), the manufacturers of the refacing equipment instructions should be followed closely, and the correct brake disc mounting adaptors must be used to obtain the required specifications.

MASTER CYLINDER

(Disc Brakes)

INDEX

GENERAL INFORMATION

The tandem master cylinder (Fig. 1) (1 and 1/8 inch bore) is of the compensating type with the reservoirs cast integrally. The master cylinder consists of a front and rear piston (in tandem) two outlets, with 1 containing a residual pressure valve and spring (rear brake line outlet only) (Fig. 3).

The **front** outlet tube from the master cylinder is connected to the hydraulic system safety switch (Figs. 8 or 9) and thence to the rear brakes. The **rear** outlet tube from the master cylinder is also connected to the safety switch and the **front** brakes.

The master cylinder used on vehicles not equipped with power brake units is serviced in the same manner as the master cylinder with power brakes with one exception, the master cylinder **for** power brakes does not include the push rod.

The **drum** brake master cylinder is different than the disc brake master cylinder and is covered in the service brake section of this group.

SERVICE PROCEDURES

MASTER CYLINDER REMOVAL

(1) Disconnect front and rear brake tubes from master cylinder and install a plug in **rear** outlet. (The residual pressure valve in **front** outlet will keep cylinder from draining).

(2) Disconnect pedal push rod (drum type brakes) from brake pedal.

(3) Remove nuts that attach master cylinder to cowl panel and/or power brake unit (if so equipped).

(4) Slide master cylinder straight out from cowl panel and/or power brake unit (if so equipped).

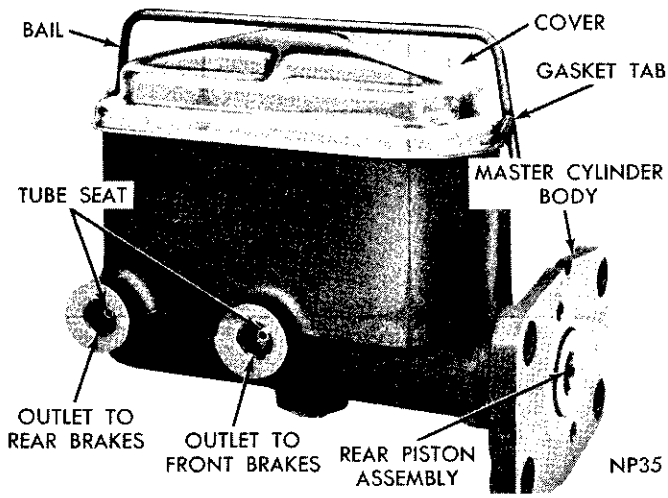

Fig. 1—Tandem Master Cylinder

DISASSEMBLING MASTER CYLINDER

To disassemble the master cylinder, (Figs. 1 and 4), clean the outside of the master cylinder thoroughly.

(1) Press bail to one side and remove cover and gasket. Empty brake fluid from reservoirs.

(2) Remove piston retaining screw and gasket (Fig. 2), then slide rear piston assembly out of cylinder bore.

(3) Upend master cylinder and tamp (open end

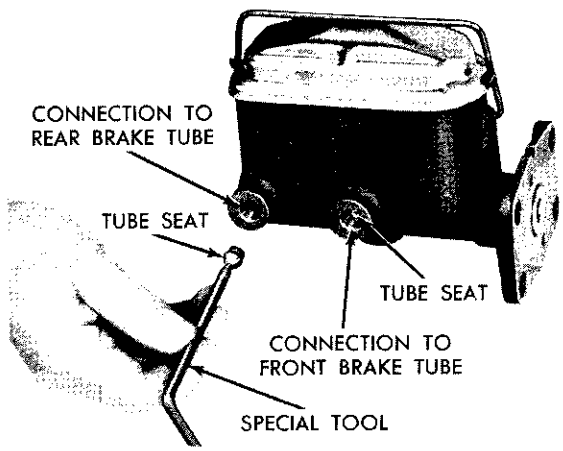

Fig. 2—Removing Tube Seats

down) on bench to remove front piston and spring. If front piston sticks in bore of cylinder, use air pressure to force piston out of cylinder. **New cups must be installed at reassembly if air pressure is used.**

(4) Remove front piston compression spring from bore.

(5) Using Tool T-109-178 (or an easy out) remove tube seats by threading tool firmly into seat, **tap tool** and seat out of cylinder body. (Fig. 2). Discard seats.

(6) Remove residual pressure valve and spring from front outlet (Fig. 3).

(7) Remove rubber cups from pistons after noting position of cup lips. Do not remove center cup of rear piston. If cup is damaged or worn, install a new rear piston assembly.

CLEANING AND INSPECTION

Clean master cylinder thoroughly, using a suitable solvent and dry with compressed air. Wash the cylinder bore with clean brake fluid and inspect for scoring or pitting. Master cylinder bore walls that have light scratches or show signs of corrosion, can usually be cleaned with crocus cloth. However, cylinder bores that have deep scratches or scoring may be honed, providing the diameter of the bore is not increased more than .002 inch. If master cylinder bore does not clean up at .002 inch when honed, the master cylinder should be discarded and a new master cylinder installed.

If master cylinder pistons are badly scored or corroded, replace them with new ones. The piston cups and seals should be replaced when reconditioning a master cylinder.

When overhauling a master cylinder, use all parts furnished in repair kit. **Discard all used rubber parts.**

REASSEMBLING MASTER CYLINDER

Front Piston

Before assembling the master cylinder, dip all component parts in clean brake fluid and place on a clean shop towel or paper (assembling seals dry, can ruin them).

(1) Slide thin washer over stem of front piston, followed by primary cup. (Be sure lip is away from piston.) (Fig. 4).

(2) Carefully work seal piston cup over rear end of piston and into second land. (Be sure lip of cup is facing front of piston.) (Fig. 4).

(3) Carefully work secondary piston cup over piston and into rear land. The lip must be facing toward rear (Fig. 4).

(4) Position small end of pressure spring into retainer, then slide assembly into bore of cylinder (Fig. 5). **Be sure cups enter bore evenly in order not to damage sealing quality of cups. (Keep well lubricated with brake fluid.)**

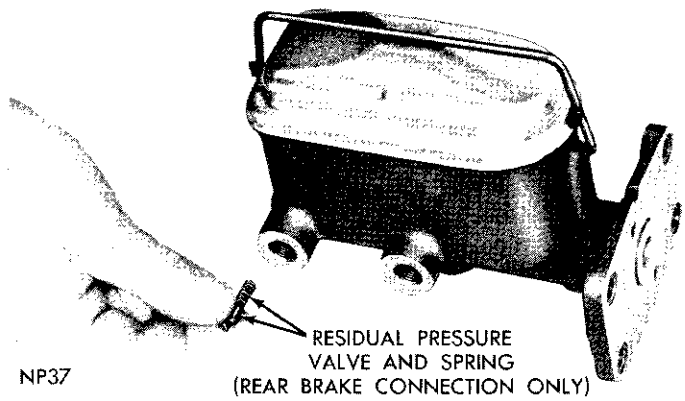

Fig. 3—Removing or Installing Residual Pressure Valve and Spring

Rear Piston

(1) Carefully work secondary cup over rear end of rear piston with lip of cup toward front (Fig. 4).

(2) Center spring retainer of rear piston assembly over shoulder of front piston. Push piston assemblies into bore. Carefully work lips of cups into bore, then seat piston assemblies (Fig. 6).

(3) Holding pistons in seated position, install piston retaining screw and gasket. Tighten securely (Fig. 6).

(4) Install residual pressure valve and spring (Fig. 3) in **front** brake outlet, then install tube seats firmly. (When the bleeding tubes are attached, the tube seats will be positioned correctly.)

BLEEDING MASTER CYLINDER

Before installing master cylinder on vehicle, it must be bled on the bench as follows:

(1) Clamp master cylinder in a vise and attach bleeding tubes Tool C-4029 (Fig. 7).

(2) Fill both reservoirs with approved brake fluid.

(3) Using a wooden stick or dowel (power brake equipped vehicles) depress push rod slowly. (Note air bubbles.) Allow pistons to return under pressure of springs. Do this several times or until bubbles cease to appear (Fig. 7).

(4) Remove bleeding tubes from cylinder and install plug in rear outlet. (As tubes are removed, fluid remaining in tubes will syphon out.)

(5) Place cover and gasket over reservoirs and secure with bail.

(6) Remove master cylinder from vise and install on vehicle as follows:

INSTALLING MASTER CYLINDER

(1) Install master cylinder on vehicle, aligning push rod with cowl panel opening (manual) or power

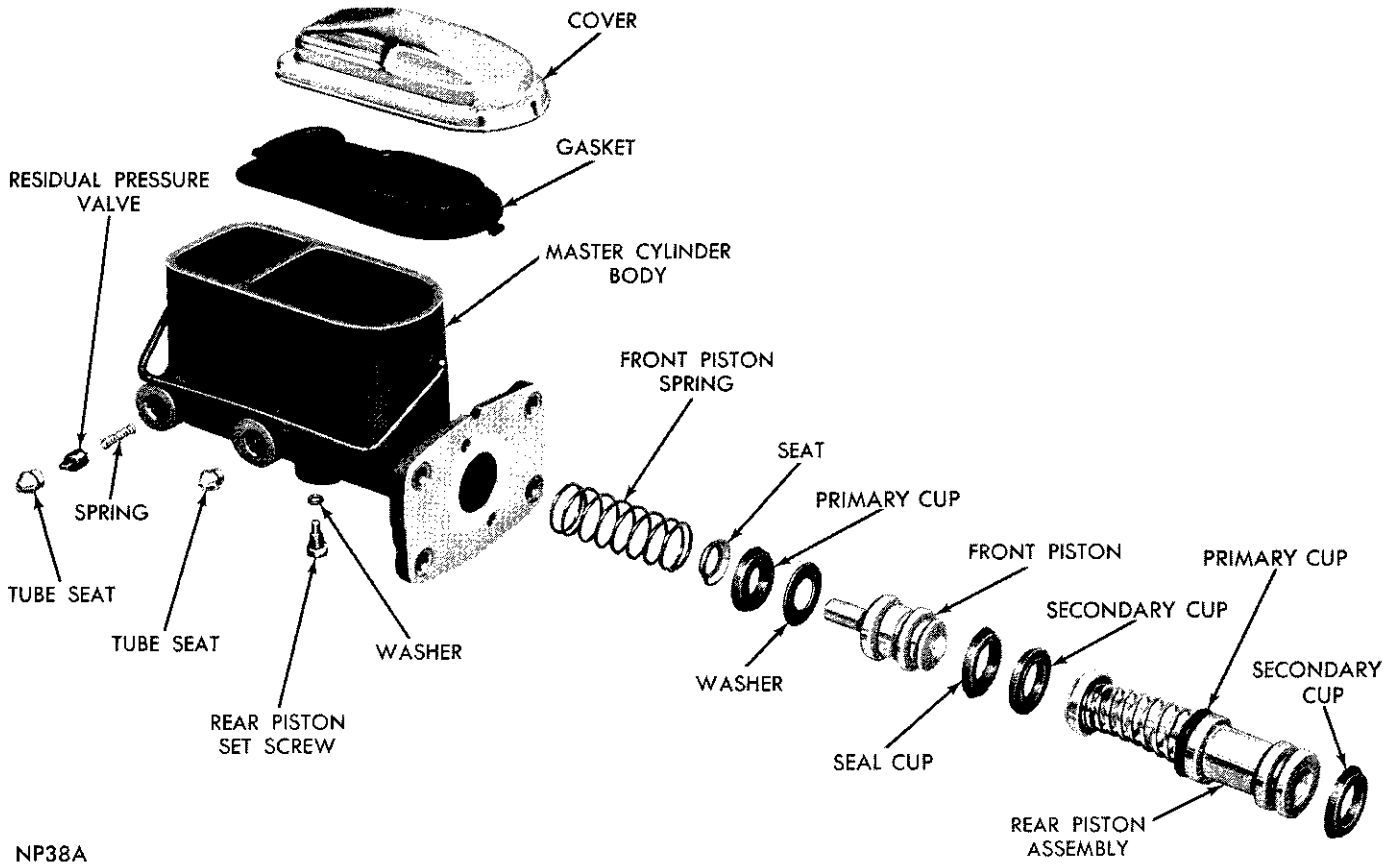

Fig. 4—Tandem Master Cylinder (Exploded View)

brake push rod with master cylinder piston.

(2) Slide over mounting studs. Install attaching nuts and tighten to 9 foot-pounds.

(3) Connect front and rear brake tubes and tighten to 150 inch pounds.

(4) Bleed brakes at wheel cylinders, using regular procedure, being sure fluid level is maintained. (See "Bleeding Brake System".)

TESTING MASTER CYLINDER

Be sure that the master cylinder compensates at both ports. This can be done by applying the pedal lightly with the engine running (power brakes) and observing for a gyser of fluid squirting up in the reservoirs. This may only occur in the front chamber and so to determine if the rear compensating port is

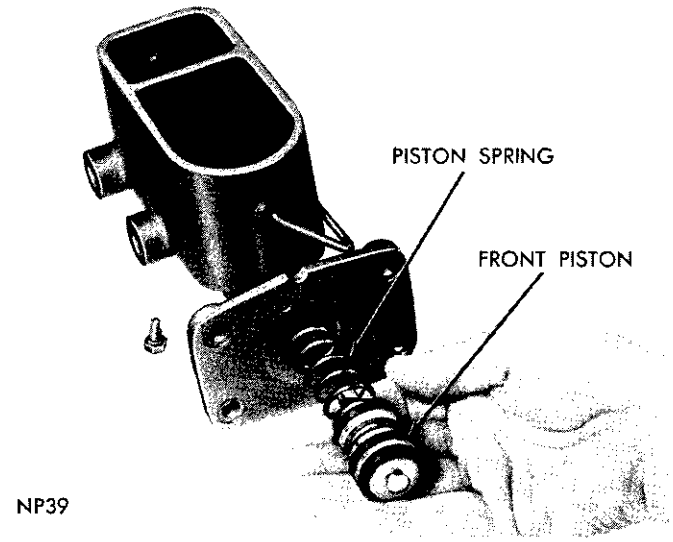

Fig. 5—Installing Front Piston and Spring

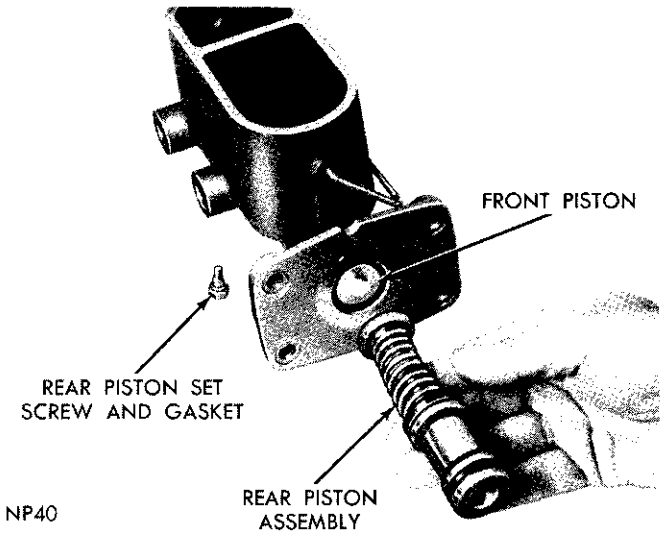

Fig. 6—Installing Rear Piston Assembly

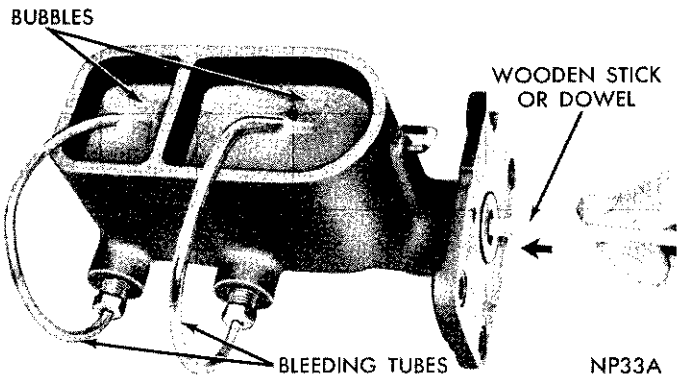

Fig. 7—Bleeding Master Cylinder

open, it will be necessary to pump up the brakes rapidly and then hold the pedal down. Have an observer watch the fluid in the rear reservoir while the pedal is raised. A disturbance in the fluid indicates that the compensating port is open.

HYDRAULIC SYSTEM SAFETY SWITCH

The hydraulic system safety switch (Fig. 8 and 9) is used to warn the vehicle operator that one of the hydraulic systems has failed. A failure in one part of the brake system does not result in failure of the entire hydraulic brake system. As an example, failure of the rear brake system will leave the front brake system still operative.

As pressure falls in one system, the other system's normal pressure forces the piston to the inoperative side; contacting the switch terminal, causing a red

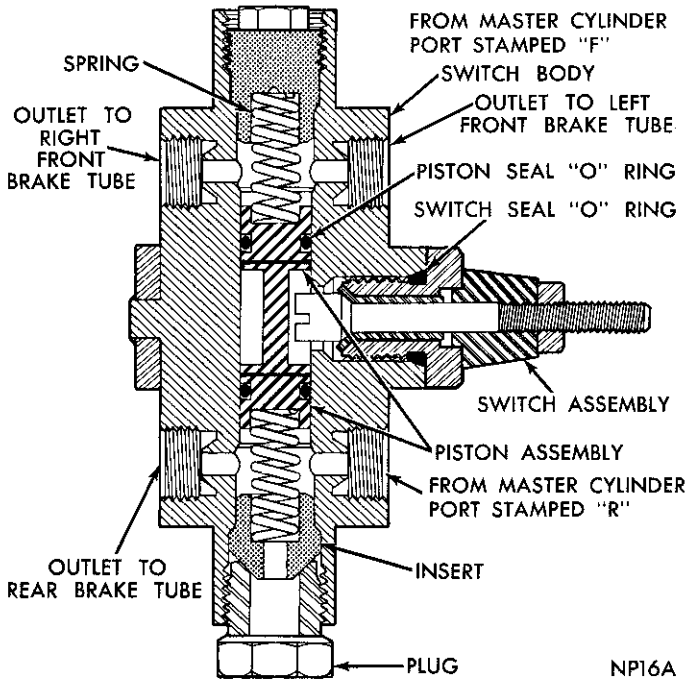

Fig. 8—Hydraulic System Safety Switch (Sectional)

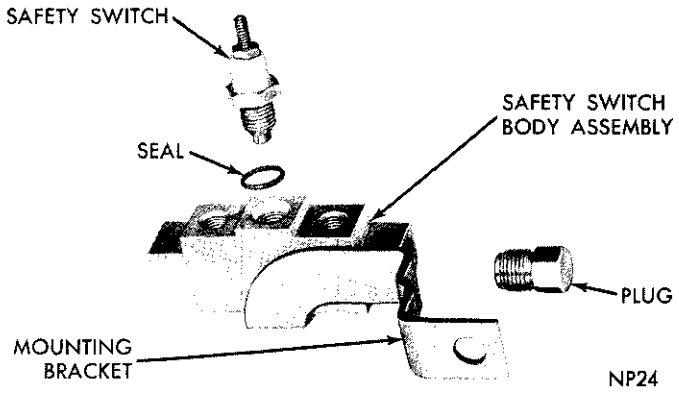

Fig. 9—Hydraulic System Safety Switch (Exploded View)

warning light to come on in the instrument panel, thus warning the operator of the vehicle, that one of the systems has failed and should be repaired.

The safety switch is mounted on the frame in a vertical position, with the brake tubes connected, as shown in (Fig. 8).

If a malfunction occurs within the switch, disconnect tubes from body assembly and install a new assembly. **The component parts of the switch body are not serviced.** However, the terminal unit can be removed if a malfunction occurs, and a new terminal unit installed.

If a new safety switch body assembly is installed, bleed the brake system.

TESTING HYDRAULIC SYSTEM SAFETY SWITCH

The brake warning light flashes only when the parking brake is applied with the ignition key turned "ON". The same light will also illuminate should one of the two service brake systems fail when the brake pedal is applied. To test the system turn the ignition key "ON", and apply the parking brake. If the light fails to light, inspect for a burned out bulb, disconnected socket, a broken or disconnected wire at the switch.

To test the service brake warning system, raise the car on a hoist and open a wheel cylinder bleeder while a helper depresses the brake pedal and observes the warning light. If the light fails to light, inspect for a burned out bulb, disconnected socket, a broken or disconnected wire at the switch. If the bulb is not burned out and the wire continuity is proven, replace the brake warning switch in the brake line Tee fitting mounted on the frame rail in the engine compartment below the master cylinder.

PRESSURE METERING VALVE

All disc brake vehicles are equipped with a pres-

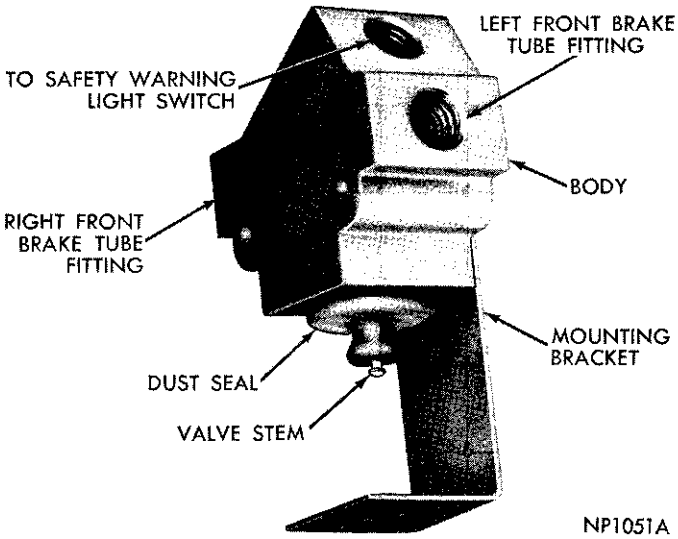

Fig. 1—Metering Valve Assembly

sure metering valve (Figs. 1 and 2). The valve is located on the left frame rail, directly under the battery (Fig. 3). The use of the metering valve is to better match front disc brakes with the rear drum brakes, resulting in improved braking and steering control on icy surfaces.

Due to operating characteristics of the valve, which causes complete shut-off of the flow of brake fluid between approximately 3 and 135 psi, front brake bleeding procedures should be done as follows:

(1) **Gravity Bleed:** This method of bleeding is not effected by the metering valve, as fluid pressures are always below 3 psi. Remove master cylinder reservoir cover and gasket, then fill reservoirs with approved brake fluid. Open disc brake bleeder screws, and allow fluid and air to drain until stream of fluid is free of air.

(2) **Pedal Bleed:** This method of bleeding is not effected by the metering valve, as fluid pressures are in excess of 135 psi. Follow normal procedure of pumping pedal and opening bleeder screws. **Do not pump master cylinder dry!**

(3) **Pressure Bleed:** This method of bleeding is influenced by the metering valve. Bleed pressure, which is normally about 35 psi, is high enough to cause the metering valve to close, stopping the flow of fluid to the front brakes. However, the valve can be held open manually by using Tool C-4121, to pull the valve stem down.

CAUTION: Under no condition should a rigid clamp, wedge or block be used to depress the valve stem as this can cause an internal failure in the valve, resulting in complete loss of front brakes.

It should be noted that the pressure release valve stem is in its uppermost position when there is no

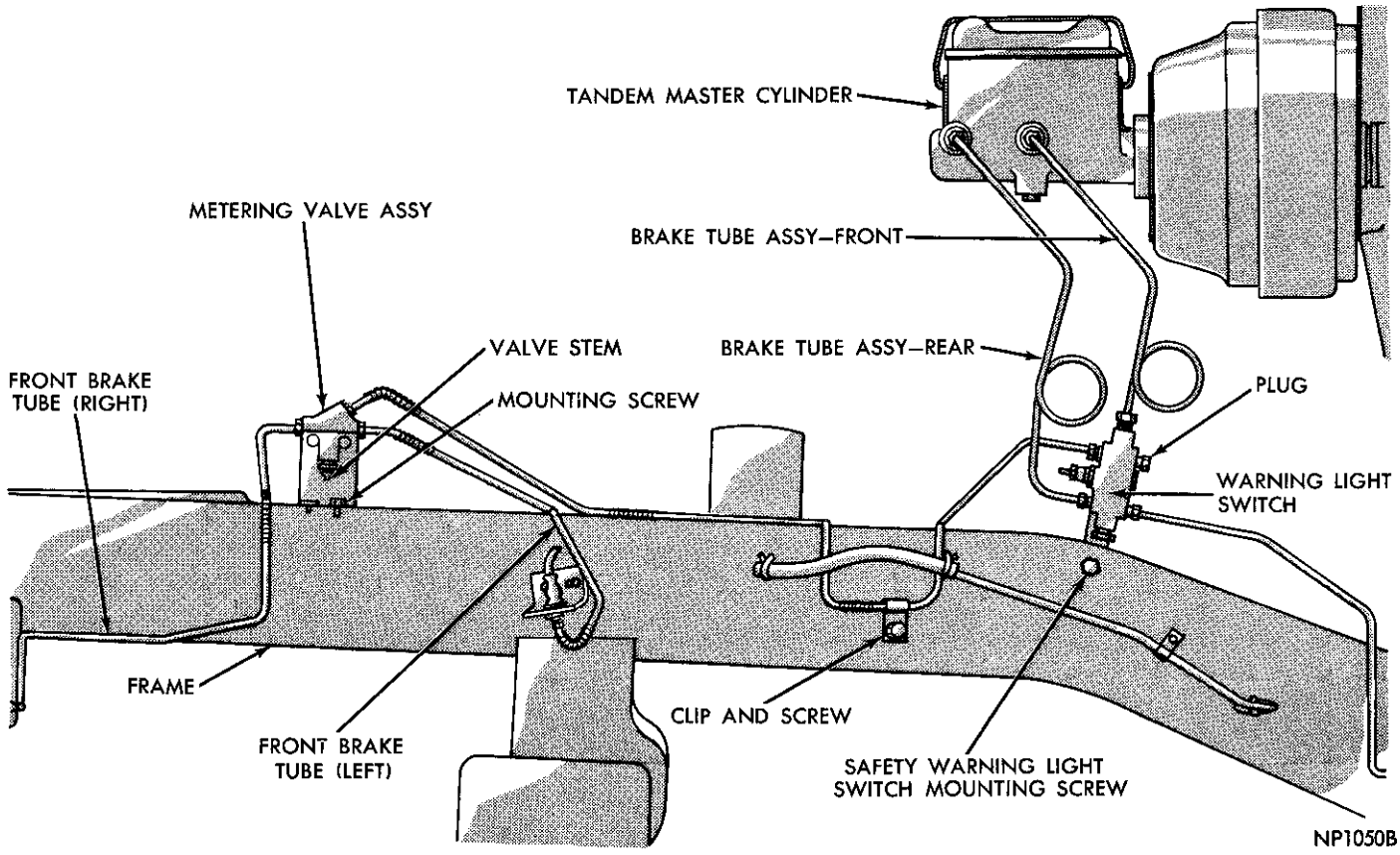

Fig. 2—Metering Valve Mounting

pressure present. No attempt should be made to further depress the valve stem.

Checking Metering Valve

(1) A slight "bump" may be felt by the foot as the brake pedal is stroked. This bump will occur after the pedal has been stroked about 1 inch.

(2) A visual check will show that the valve stem extends slightly when the brakes are applied and retracts when the brakes are released.

(3) In case of a metering valve malfunction, remove valve and install a new one.

SPECIFICATIONS

BRAKES

Model Application	Newport	300 and New Yorker	Imperial
TYPE		Duo-Servo Single Anchor	Rear
DRUM DIAMETER	11 in.	11 in.	11 in.
(Heavy Duty)	11 in.		
NUMBER OF BRAKE SHOES	8	8	4
WIDTH			
Front	2-3/4 in.	3 in.	Disc
Rear	2-1/2 in.	2-1/2 in.	3 in.
(Heavy Duty Including Station Wagon)			
Front	3 in.		
Rear	2-1/2 in.		
BRAKE LINING	Extruded and Moulded Asbestos-Bonded		
LENGTH			
Front Primary	9-1/4"		
Front Secondary	12-1/8"		
Rear Primary	9-1/4"		
Rear Secondary	12-1/8"		

KELSEY-HAYES DISC BRAKE

(Floating Caliper)

Type of Brake	Floating Caliper
Location	Front Wheels Only
Master Cylinder	Horizontal Tandem (Dual)
Metering Valve Location	Left Front Frame Rail
Brake Adjustment	None Required
Residual Valve Location (Rear Brakes Only)	In Master Cylinder Outlet
CALIPER ASSEMBLY	
Shoe and Lining Removal	Bottom, Caliper Removed
Number of Pistons	1 Each Unit
Piston Diameter	2-3/4" (2.751"-2.753")
Piston Bore Diameter Maximum Allowable (After Honing)	2.757"
Piston Seal	Moulded Rubber (Square Section) .126" Wide—120" Radial Thickness
Dust Boot	Moulded Rubber (External) 1 Per Unit
Bleeder Screw Location	Inner Housing 3/8"
BRAKING DISC	
Type	Ventilated Cast Iron
Diameter (Outside)	11.75"
(Inside)	7.725"
Disc Run-out (Maximum Allowable) T.I.R.	.0025"
Disc Surface Finish	15 to 80 Micro Inches

Disc Thickness	1.250-1.240
Disc Parallelism (Total Variation in Thickness)	.0005"

BRAKE SHOE AND LINING

Type	Bonded
Lining Thickness	.460" (Nominal)
Wide	1.80" (At Center)
Long	6.02"
Braking Area	10.0"
Maximum Wear (Minimum Thickness Allowed)	Not less than .030" Lining at any point or a minimum shoe and lining thickness of .180"

MASTER CYLINDER

Piston Bore Diameter	1-1/8"
Maximum Bore Diameter Allowable (After Honing)	.002" O.S.
Residual Valve	Rear Brakes Only

DISC SPLASH SHIELD

Type	Vented-Stamped Steel
Mounting	3 Bolts to Knuckle

WHEELS

Type	Drop Center
Diameter	15 x 5.50 15 x 6.00 15 x 6.50

POWER BRAKE TIGHTENING REFERENCE

Power Brake Pedal Link to Brake Pedal Linkage Bolt Nut	30 Foot Pounds
Master Cylinder Mounting Nuts	100 Inch Pounds
Power Brake Unit to Dash Nuts	150 Inch Pounds