2/50 DIRECT ACTING SERVO ASSEMBLEY

(Vacuum/Hydraulic Models)

Description:

This Direct Acting Servo is a more powerful version of a servo of equivalent diameter. This is accomplished by utilising two rolling rubber diaphragms and supporting pistons instead of one, so effectively doubling the force exerted onto the output pushrod. (See Fig. 2).

This pushrod is in line with and operates the master cylinder pistons (Fig. 1 & 7), and on application of the brake pedal, controlled entry of air at atmospheric pressure to the rear of the servo pistons exerts a force much greater in proportion to the effort exerted by the driver on the pedal. In the absence of servo assistance due to loss of vacuum, the brakes can still be applied since there will be direct mechanical action on the servo pushrod. Obviously this would demand heavier foot pressure to achieve the same degree of braking as with servo assistance.

Operation:

Note: The illustrations (Fig. 3A, B, C, D) show the action of the servo in diagramatic form whilst retaining a close resemblance to the actual layout and relative size of the components.

With the vacuum servo in operation, and with the servo at rest in the **"brakes off"** position, the same degree of vacuum exists in chambers A, B, C and D owing to the open inter-connecting passage through the valve body. (See Figs. 2 and 3A).

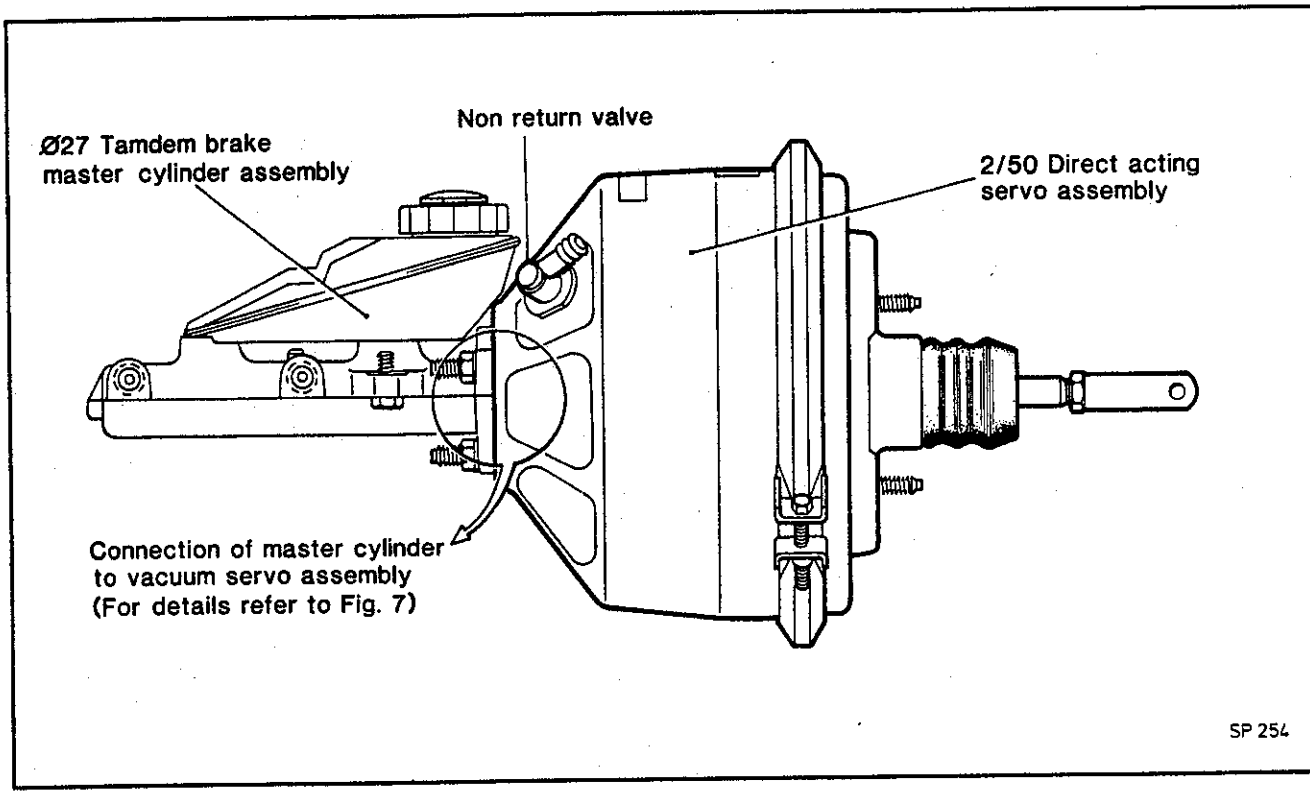


Fig. 1 *Assembly of Vacuum Servo and Tandem Brake Master Cylinder*

On the partial application of the footbrake pedal, initial forward movement of the valve and pushrod assembly allows the spring loaded rubber air valve to close the vacuum passages between chambers A and B, C and D (Fig. 3B).

Slight further movement releases the rear seat of the pushrod assembly from the face of the valve to admit air at atmospheric pressure to chamber D through the plastic foam filter at the end of the

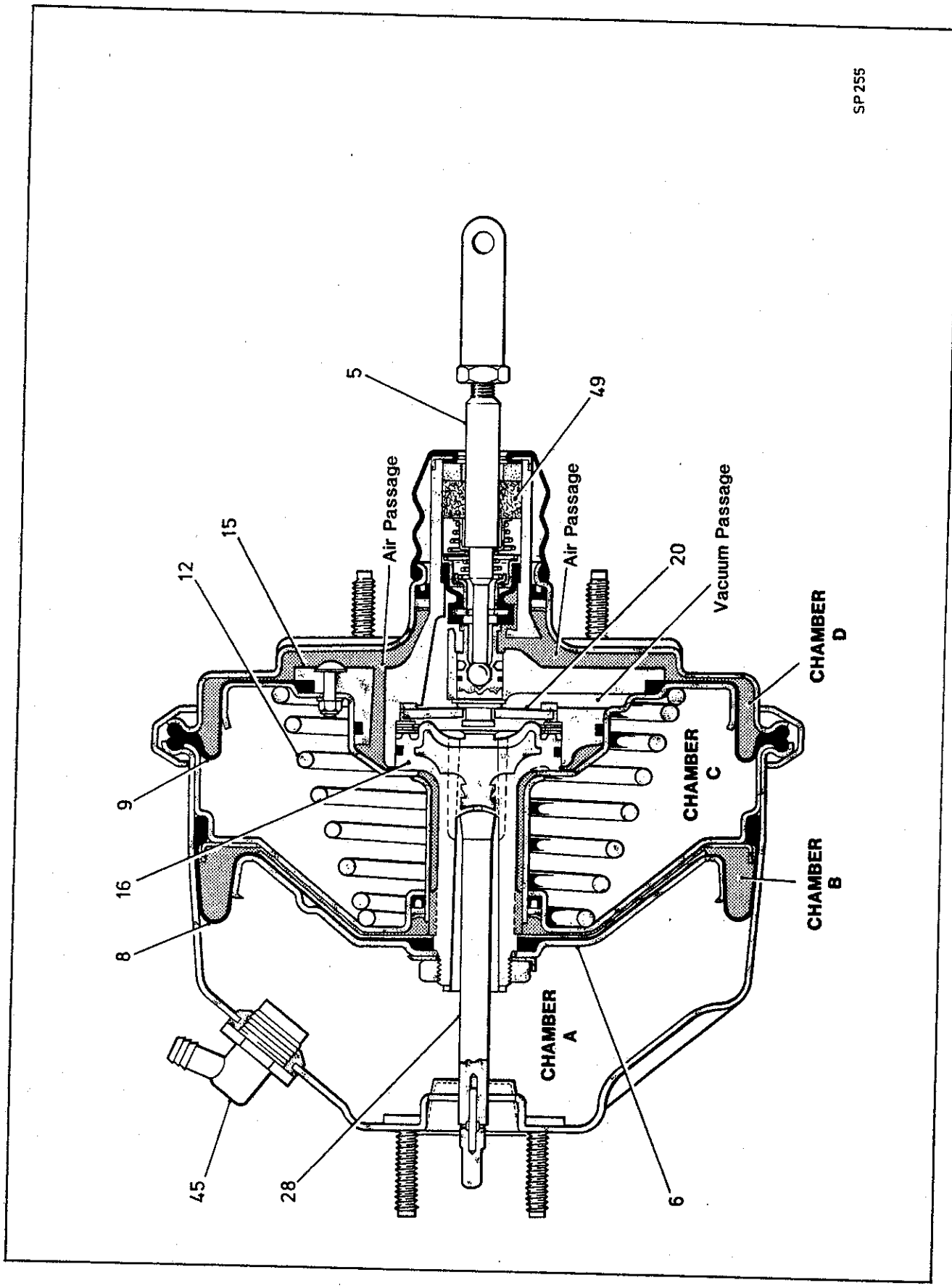


Fig. 2 Section Through 2/50 Direct Acting Servo

Fig.3A
Brakes in the "OFF" position

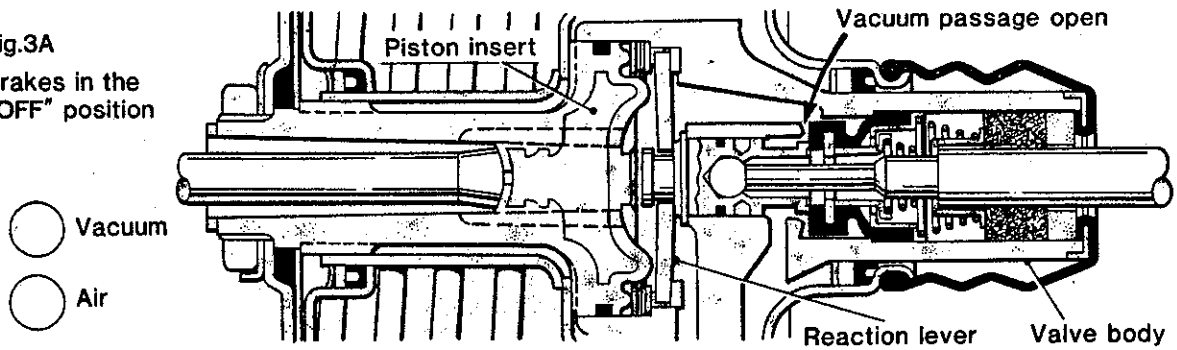


Fig.3B
"BRAKES OFF" Vacuum cut off to rear chamber

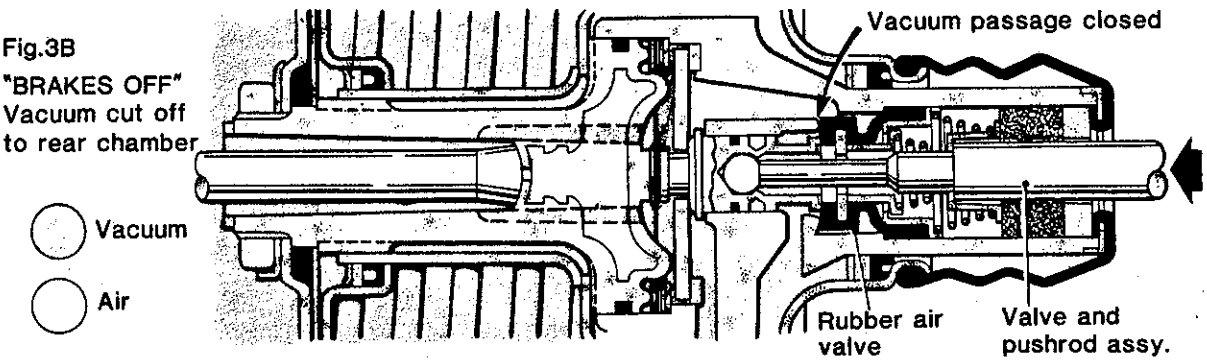


Fig.3C
Brakes being "APPLIED"

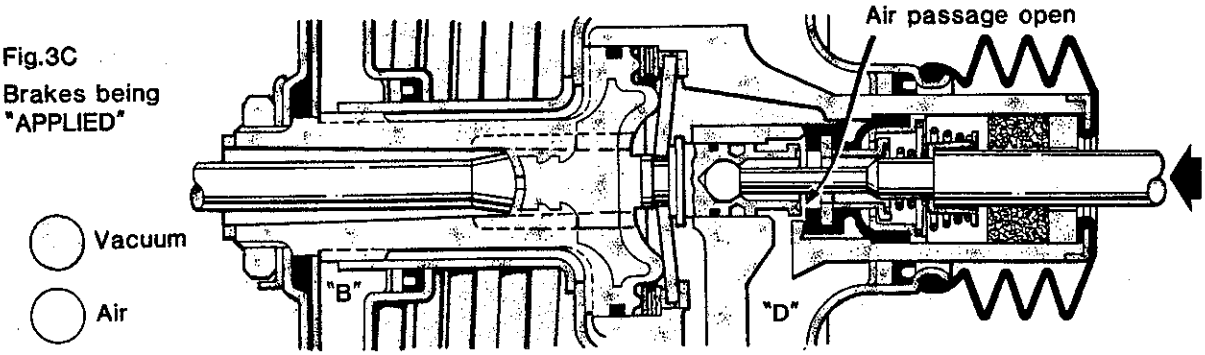
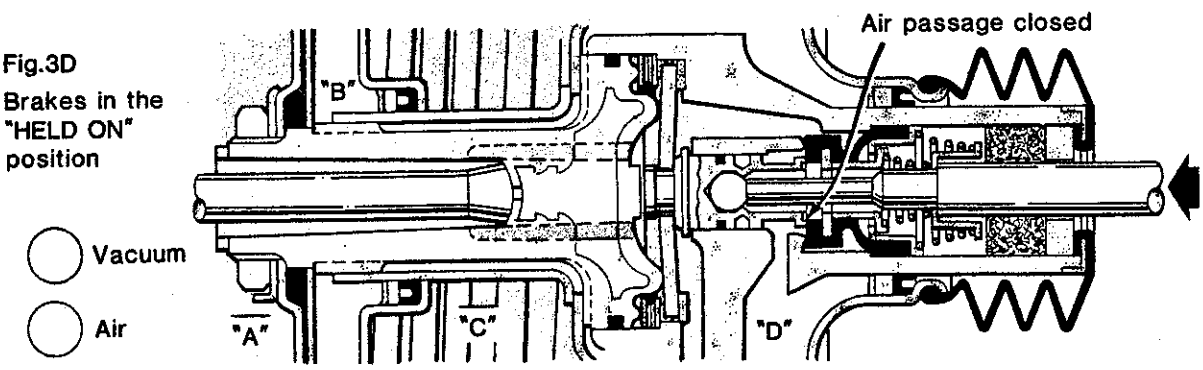


Fig.3D
Brakes in the "HELD ON" position



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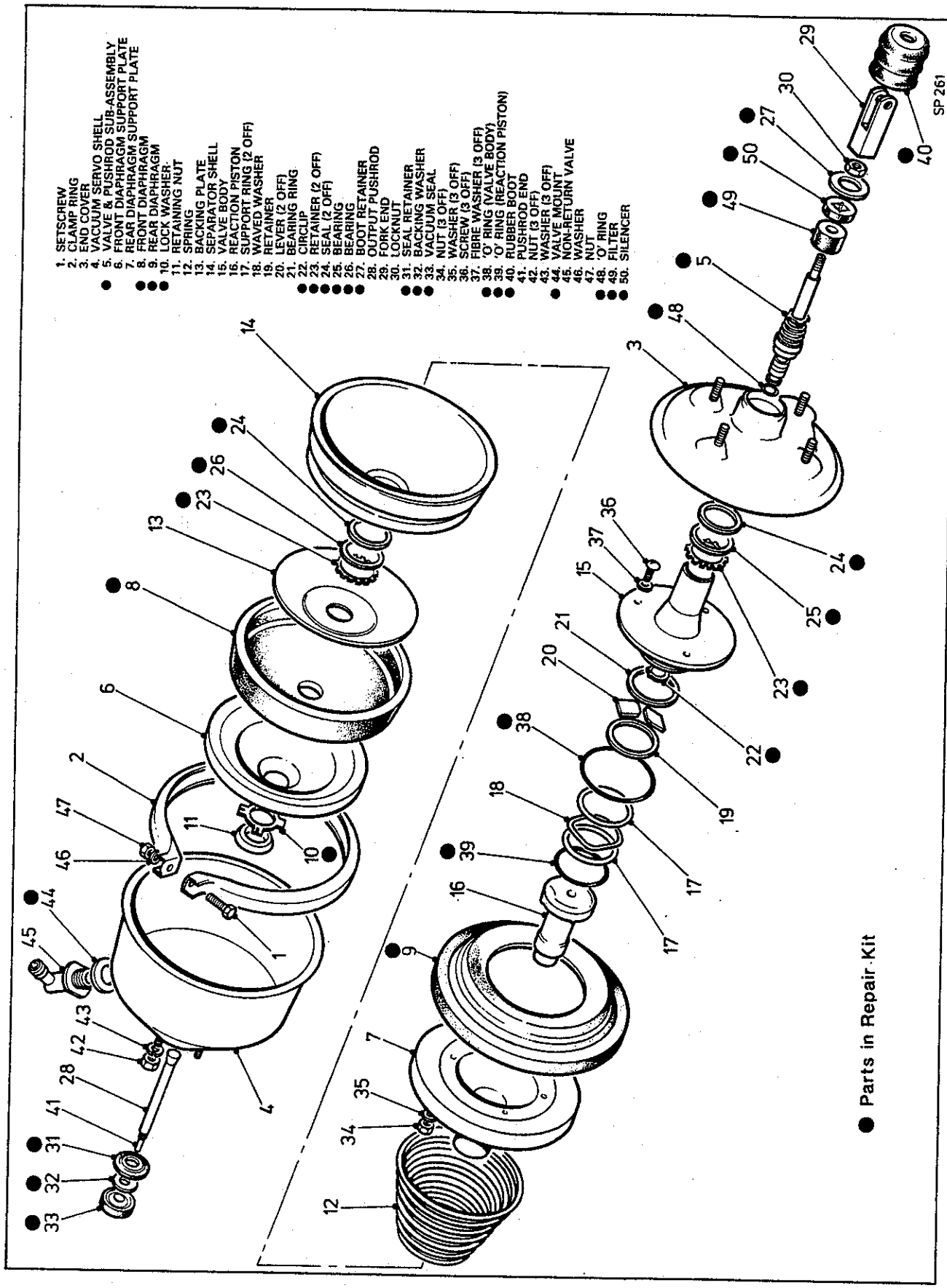

Fig. 4 Exploded View of 2/50 Direct Acting Servo Assembly

valve body, and then through the inter-connecting passage to chamber B (Fig. 3C). The difference of pressure in the chambers causes the valve body, the diaphragms and the output pushrod to move forward to bear on the master cylinder pistons thereby creating fluid pressure in the pipelines for actuation of the brakes.

When the driver partially releases pressure on the footbrake pedal, the valve and pushrod assembly moves rearward to permit the rubber air valve to open the vacuum passages between chambers A and B, C and D but at the same time preventing further entry of atmospheric air through the valve body. The pressure in chambers B and D is thereby reduced to allow the valve body, the diaphragms and the servo pushrod to retract under the influence of the large return spring in chamber C. The loading on the master cylinder pistons is thus eased to cause a proportionate drop in fluid pressure in the brake pipelines. The valve body will stop moving rearwards when a state of balance is again attained in the servo. This occurs as the rear seat of the pushrod assembly contacts the face of the rubber air valve to close the vacuum passages between chambers A and B, C and D. The brakes would then be held partly applied (Fig. 3D).

If the driver removes all load from the footbrake pedal, the servo returns immediately to the state of rest in the **"brakes off"** position. Chambers B and D would then be exhausted of air, the servo output pushrod no longer exerts the force on the master cylinder pistons, and the fluid pressure in the pipelines to the brakes is released.

Dismantling

Before commencing either overhaul or replacement, operate the brake pedal several times to fully exhaust all residual vacuum from the servo.

Never operate the brake pedal with the master cylinder removed, otherwise the vacuum servo internals will be damaged.

Remove the hydraulic pipes from the master cylinder and plug the exposed ports.

Disconnect the wires from the fluid level sensor unit.

Unscrew the three nuts and separate the master cylinder from the servo.

Drain the reservoir and refit the cap.

The replacement service ensures a factory tested and correct assembly which should be fitted whenever possible. However, if overhaul is undertaken the procedure detailed below must be followed, ensuring that the components do not come into contact with mineral oil (engine oil, grease, etc).

Having removed the tandem master cylinder from the assembly, remove the gland (vacuum) seal (33), backing washer (32), seal retainer (31) and then the output pushrod (28).

Loosen the setscrew (1) on the clamp ring (2) and remove the ring. **Note the relationship of clamping screw and cover (3) and vacuum shell (4) for re-assembly.**

The end cover can now be removed and the valve and pushrod sub-assembly (5), front and rear diaphragm support plates (6 & 7), diaphragms (8 & 9) etc, withdrawn from the shell as a unit.

Knock back the tabs of the lock washer (10) on the retaining nut (11) and remove the nut, holding the front diaphragm support plate against the load of the spring (12). Gradually relax the load, allowing the spring to extend; remove the diaphragm support plate, diaphragm backing plate (13), separator shell (14) and spring.

Dismantle the valve body (15), reaction piston, rear support plate and diaphragm sub-assembly by removing the three nuts (34), washers (35) and screws (36) with fibre washers (37).

Remove the support plate and diaphragm, the reaction piston, support rings (17), waved washer (18), retainer (19), levers (20) and bearing ring (21) from the valve body **carefully noting that the waved washer is interposed between the two support rings.**

Remove the circlip (22), tap off the boot retainer (27) and withdraw the valve and pushrod sub-assembly (5) from the valve body. Extract the rubber 'O' ring (48) from seal groove in valve piston. The valve and pushrod sub-assembly cannot be further dismantled. Using a small screwdriver, prise out the bearing retainers (23) from the end cover and separator shell to permit removal of the seals (24) and bearings (25 & 26).

Note the difference between the two bearings for re-assembly.

Inspection of parts:

Carefully inspect all parts for faults and wear. Be prepared to fit new retainers and new rubber parts throughout. These are contained in the servo repair kit.

If the valve and pushrod sub-assembly is suspect, a new replacement is required as renovation of the old parts is not possible. This is contained in the servo repair kit.

Scrupulous cleanliness of all parts of the servo is essential. Make sure that hands are free of grease and dirt. Lay out the parts to be assembled on a sheet of clean paper spread over the bench.

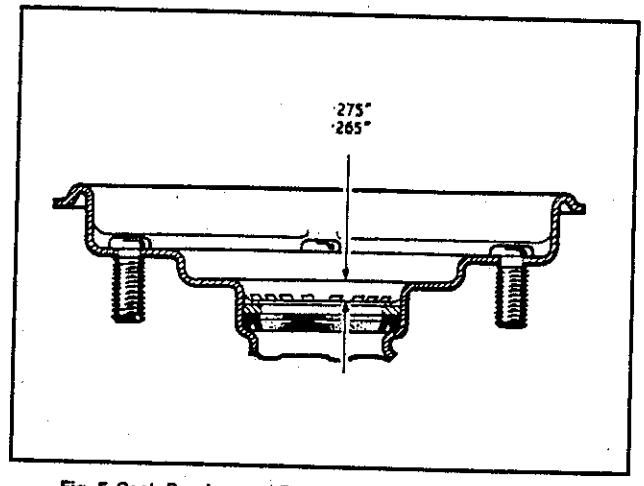

Fig. 5 *Seal, Bearing and Retainer (See special tool section)*

Re-assembly:

Refit rubber 'O' ring (48) into seal groove in valve piston.

Lightly coat the rubber seals of the new valve and pushrod sub-assembly with Lockheed Disc Brake Lubricant and press fully into the bore of the valve body. Compress the springs so that the circlip groove is exposed, fit the circlip and push the boot retainer (27) onto the valve body.

Lightly coat the new 'O' ring (38) for the valve body and fit into the seal groove. Assemble into the end of the body, the bearing ring, levers, retainer, support ring, waved washer and finally the second support ring. Grease the levers before fitting and ensure that they are properly located with their chamfered ends in the valve piston groove.

Apply Disc Brake Lubricant to the 'O' ring (39) for the reaction piston, fit into the seal groove and push the assembly into the valve body, making sure that the two projections on the reaction piston are located over the levers in the valve body.

Place the new diaphragm onto the valve body, convex side first, so that the inner diameter locates on the shoulder just outside the three screw holes. **Do not grease the diaphragm.** Follow with the rear diaphragm support plate, lining up the indent in the support plate with the corresponding projection on the valve body. Fit the securing screws, washers and nuts, entering the screws from the valve body side. Tighten to correct torque.

Coat the bearing and seal for the separator shell with Disc Brake Lubricant and press into the shell, flat side first, followed by the bearing, **carefully noting that the chamfer in the bore of the bearing is adjacent to the seal.**

With the use of a setting tool, press in a new retainer, convex side first, until the largest shoulder of the tool meets the face of the shell. See Fig. 5.

Apply Lockheed Disc Brake Lubricant along the length of the tube on the support plate and locate the large diameter of the spring onto the plate.

Build up the assembly of separator shell, backing plate, diaphragm **(concave side first)** and support plate and depressing the spring, slide the assemby onto the tube, **taking care not to damage the seal in the separator shell.** Fit the lock washer and nut. Tighten to correct torque and bend up the tabs of the lock washer to retain the nut.

Locate the outer edge of the front diaphragm into the groove around the separator shell and push the assembly into the servo vacuum shell, ensuring that the diaphragm stays in position.

Coat the bearing and seal for the end cover with Lockheed Disc Brake Lubricant and press the seal into the cover, lips leading, followed by the bearing. With the use of a setting tool, (See Fig. 5), press in a new retainer, convex side first, until the largest shoulder of the tool meets the face of the cover.

Lightly grease the full length of the bearing

surface of the valve body and slide on the cover. Locate the beaded edge of the rear diaphragm between the end cover and the separator shell, ensuring that the vacuum shell and end cover are correctly orientated.

Fit the clamp ring, set screw, washer and nut, tightening to correct torque with vacuum applied to the assembly.

Slide the boot (40) over the pushrod and locate the beaded edge over the flared end of the cover. Push the outer end of the boot **(internal groove)** into the boot retainer.

The output pushrod adjustment must now be checked. The distance the end (41) of the pushrod protrudes at rest from the shell is critical and must be checked and set accurately. **This dimension is 21,63/21,37mm.** Fig. 6 shows how the dimension can be checked. Lay a metal straight edge across two nuts run down the studs to the correct height; the pushrod may then be set correctly.

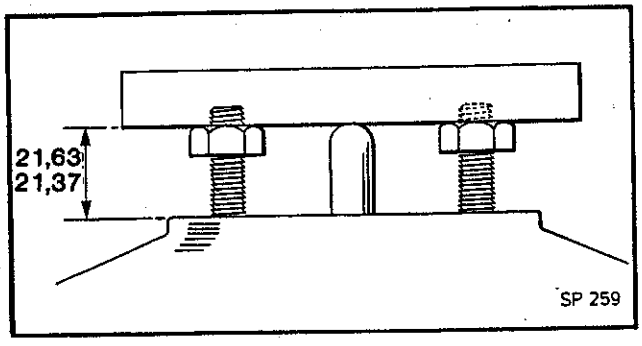

Fig. 6 *Output Pushrod Setting*

If the input pushrod and fork end (29) have been disturbed or dismantled, the dimension from the centre of the fork end clevis pin hole to the servo mounting surface must be reset to 154/152mm and the locknut (30) re-tightened to correct torque

Lightly grease the outside diameter of the output pushrod (28) with Lockheed Disc Brake Lubricant, fit the pushrod, seal retainer (31) dished side inwards and backing washer (32) into the end of the vacuum shell. Smear the seal (33) with Lockheed Disc Brake Lubricant, slide over the end of the pushrod and locate into the end of the vacuum shell, (See Fig. 7).

Check that the groove in the end of the vacuum shell is clean before bolting the master cylinder to the servo assembly. Tighten the nuts (42) to correct torque.

Reconnect the fluid feed pipes and torque tighten the tube nuts.

Refill the reservoir with Lockheed Universal 329s brake fluid and bleed the system thoroughly. Replenish the reservoir, reconnect the wires to the fluid level sensor unit and check the hydraulic system for leaks before road testing the vehicle.

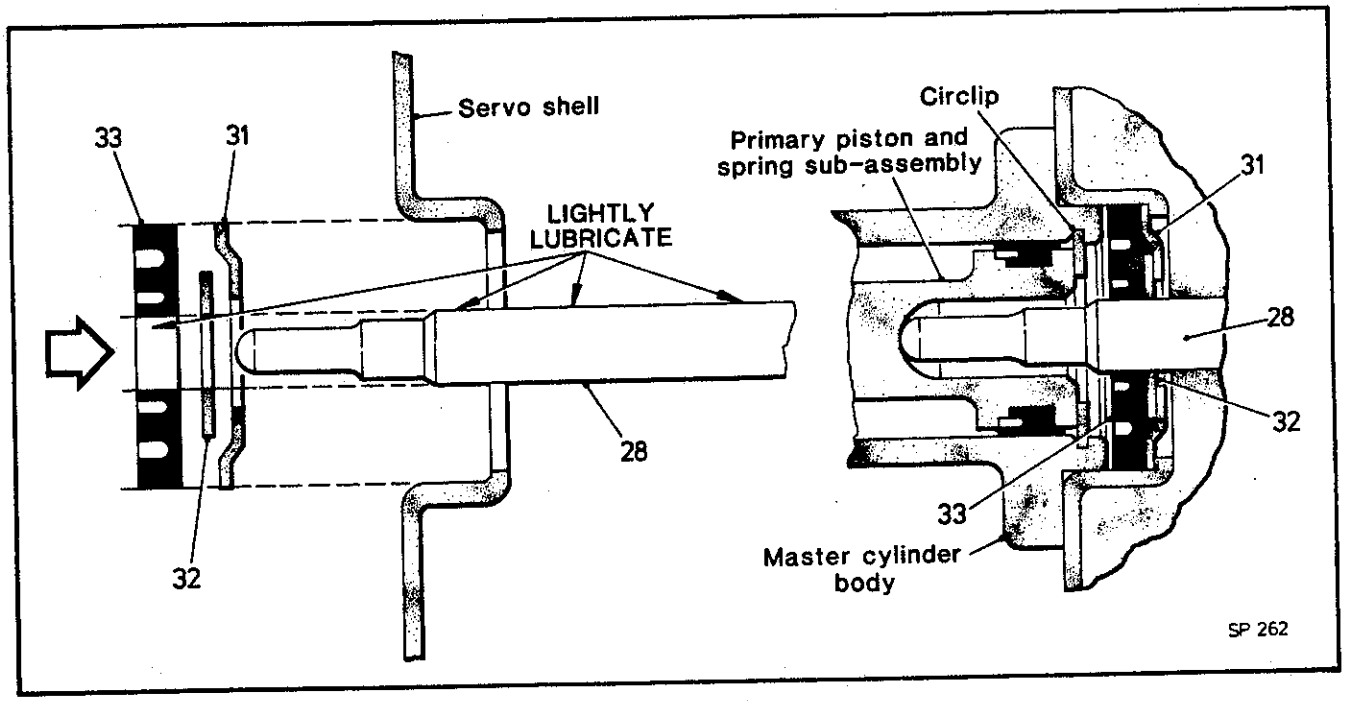

Fig. 7 *Vacuum seal replacement*