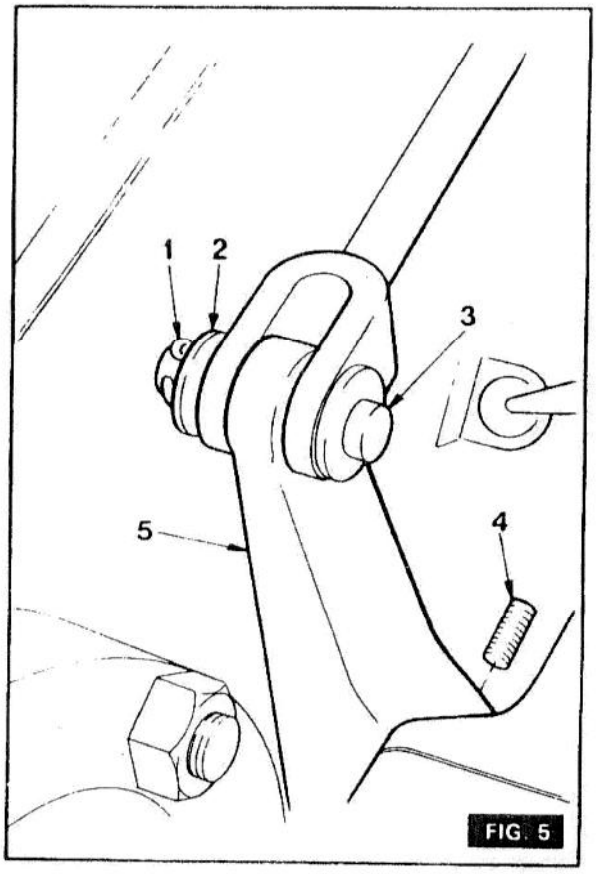


FIG. 5

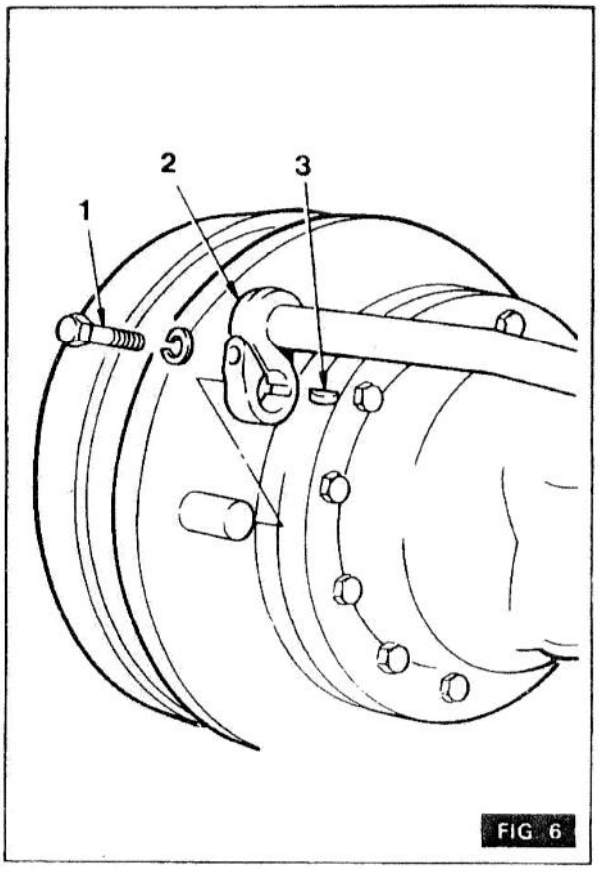


FIG. 6

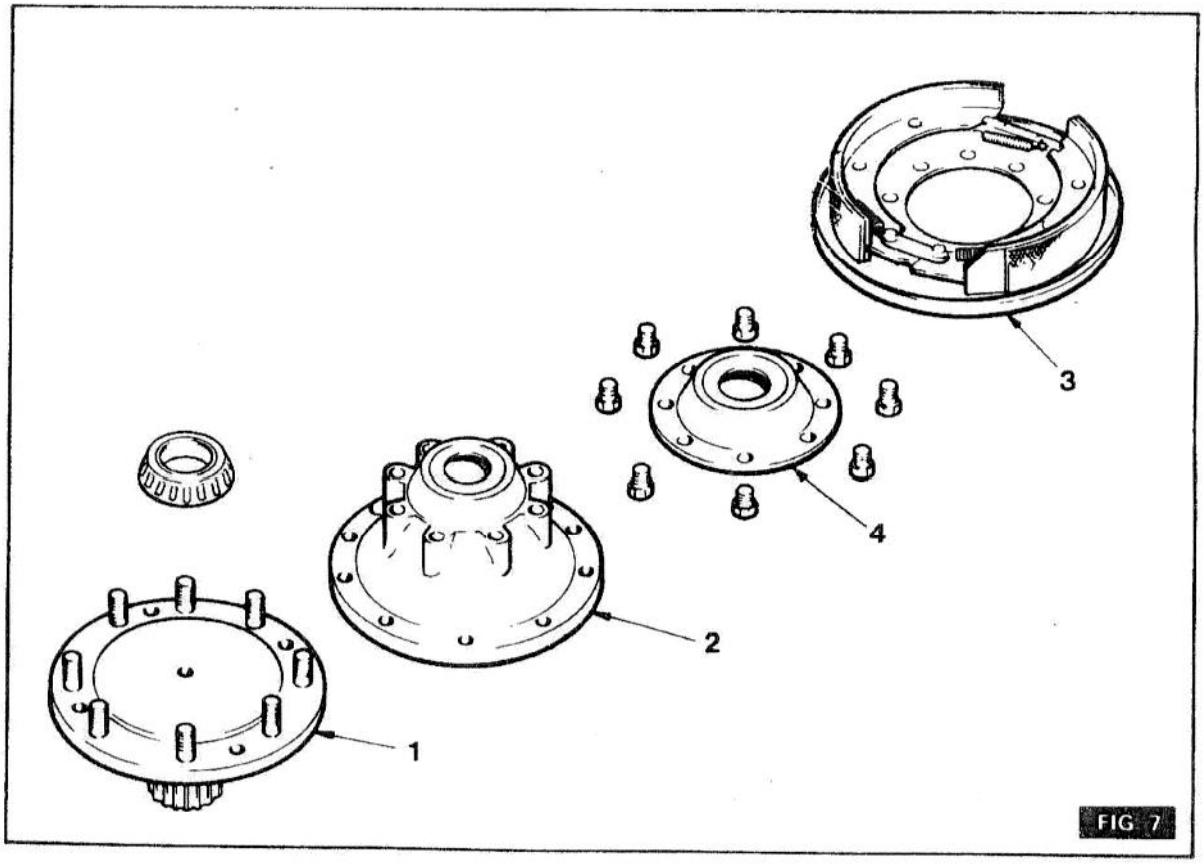


FIG. 7

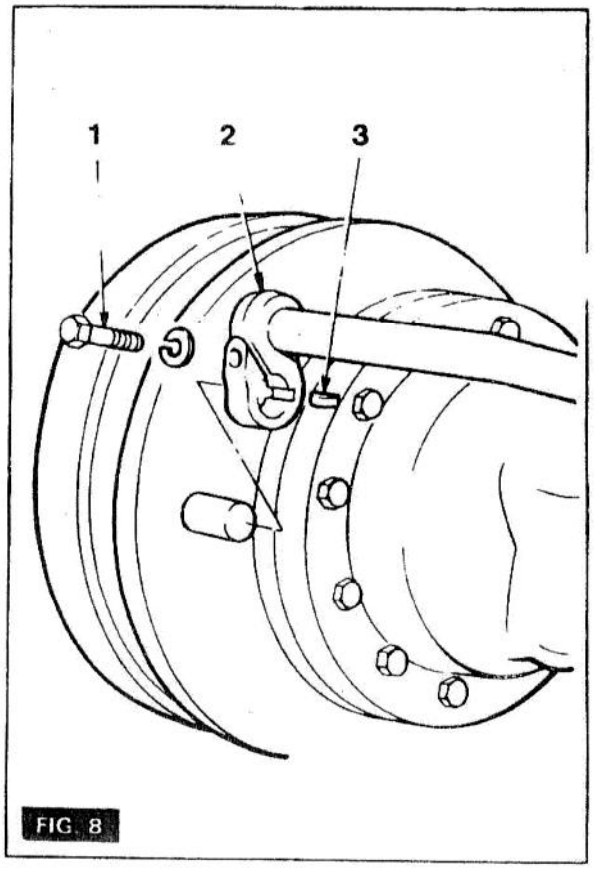


FIG. 8

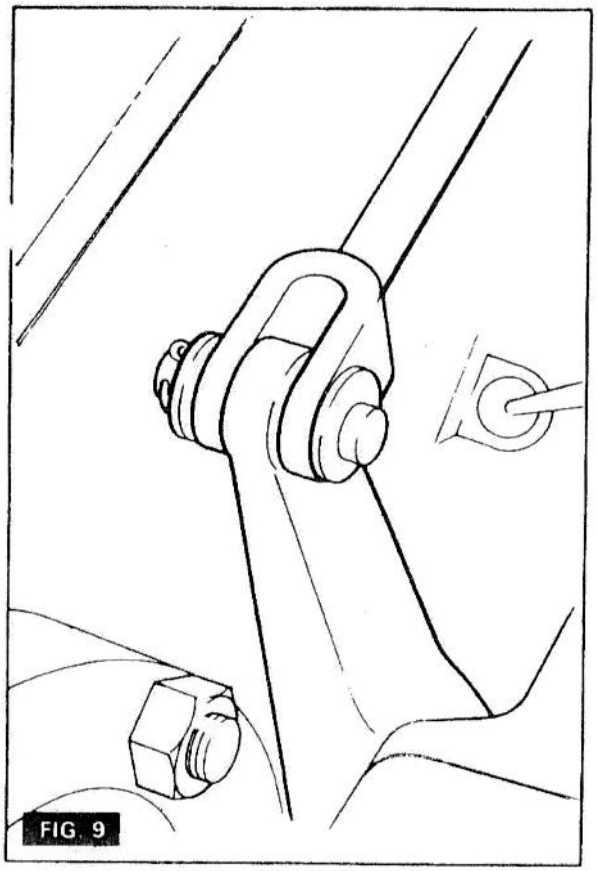


FIG. 9

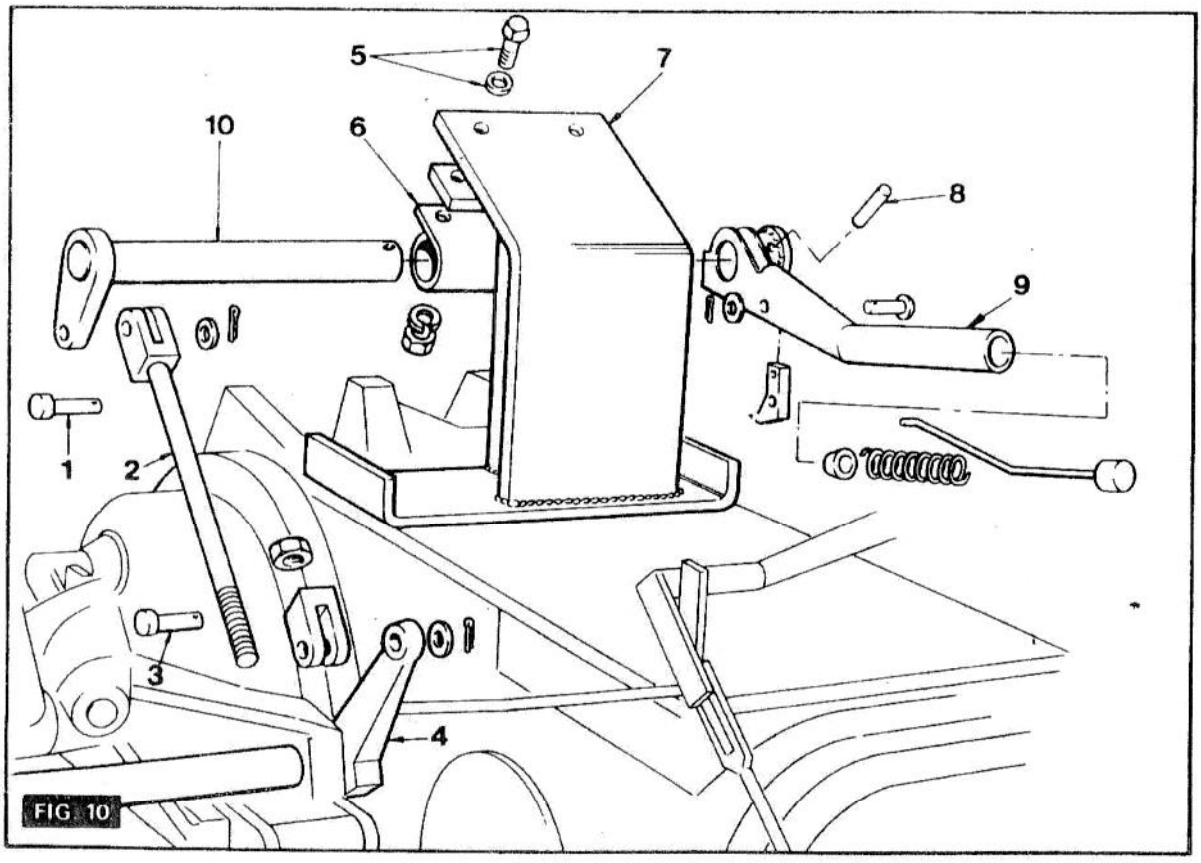


FIG. 10

BRAKE SHOES

Removal and Refitting . . . . Cont'd

6. On reassembly, it is advisable to smear a light application of white grease or petroleum jelly to the pivot posts and adjuster thread.

Note

Take care not to alter the adjustment of the steady posts as these are pre-set on manufacture.

COMPLETE DRUM BRAKE ASSEMBLY

Removal and Disassembly (8B/3)

1. Securely wedge the front axle between the axle support and the axle beam in order to prevent the machine tilting.
2. Place a jack under the centre axle housing and raise the machine until the rear wheels are clear of the ground. Place suitable stands or supports under the rear axle. Remove the wheel and brake drum.
3. (Fig. 4) Remove the springs (anchor pin to shoe) and remove the anchor pin plate (1).
4. Remove the shoe retaining springs (2), cups (3) and pins (4).
5. Remove the brake shoes (5), adjuster (6) and spring (7). Separate the shoes from the spring.
6. (Fig. 5) Disconnect the parking brake actuating rod from the parking brake linkage by removing the split pin (1), washer (2) and clevis pin (3).
7. Remove the setscrew (4) from the brake actuating lever (5).
8. Suitably mark the epicylic unit to facilitate reassembly and drain the oil from the epicyclic unit.
9. Remove the twelve bolts, nuts and washers and lift the epicyclic unit, complete with parking brake cross shaft, away from the machine.
10. (Fig. 6) Remove the bolt (1) from the cross shaft (2) and remove the shaft, taking care not to misplace the key (3).
11. Dismantle the epicyclic unit as described in operation 8A/2, items 4 to 9 inclusive.
12. (Fig. 7) Remove the wheel axle (1) from the drive cover (2) as described in operation 8A/9 items 3 to 6 inclusive.
13. Mark the drive cover (2) to the brake back-plate (3) and the back-plate to the oil catcher (4). Remove the eight bolts and lift the back-plate from the drive cover.
14. Remove the spring and washer from the brake camshaft remove the camshaft.
15. Remove the steady posts, anchor pins and washers from the back-plate.

COMPLETE DRUM BRAKE ASSEMBLY

Reassembly and Refitting (8B/4)

1. Fit the steady posts, anchor pins and washers to the back-plate.
2. Fit the camshaft into the back-plate and refit the washer and spring to the camshaft.
3. Renew the gasket between the oil catcher and drive cover, align the marks on the drive cover and back-plate and the back-plate and oil catcher. Replace the eight bolts to hold the assembly together.
4. Reassemble the wheel axle and drive cover assembly as described in operation 8A/10.
5. Reassemble the epicyclic unit and refit to the wheel axle as described in operation 8A/3.
6. (Fig. 8) Refit the parking brake cross shaft (2) to the brake actuator, ensuring that the key (3) is correctly located. Lock the shaft in place with the bolt (1).
7. Renew the gasket between the axle shaft housing and planetary ring gear. Fit the ring gear (check the marks for correct alignment) to the axle shaft housing. The step in the ring gear must face OUTWARDS.
8. Fit a new gasket between the planetary ring gear and the epicyclic unit, align the unit correctly and fit to the planetary ring gear and axle housing. Replace the bolts, washers and nuts to hold the unit securely in place.
9. Locate the parking brake cross shaft in the actuating lever. Refit the grub screw to the actuating lever.
10. (Fig.9) Connect the parking brake actuating rod to the parking brake linkage with the clevis pin, split pin and washer.

COMPLETE DRUM BRAKE ASSEMBLY

Reassembly and Refitting . . . . Cont'd

11. Replace the brake shoes and springs and retain them in place with the pins, springs and cup.
12. Replace the brake adjuster, correctly aligned with the hole on the back-plate.
13. Replace the anchor pin plate and springs.
14. Refill the epicyclic unit with the recommended grade of oil up to the correct level.
15. Replace the drum brake and wheel, oil the threads of the wheel nuts and tighten with a torque load of 190/200 lb ft (27,3–27,7 kg/m).
16. Adjust the brakes as described in operation 8B/1
17. Lower the machine to the ground and, remove the wedges from between the front axle beam and front axle support.

PARKING BRAKE LINKAGE

Removal and Replacement (8B/5)

1. Before starting the removal of the brake linkage, ensure that the wheels are securely chocked and that the machine cannot move.
2. (Fig. 10) Remove the split pin and withdraw the clevis pin (1) which secures the R.H. rod assembly (2) to the parking brake cross shaft.
3. Remove the split pin and clevis pin (3) which secures the R.H. rod assembly (2) to the brake actuator shaft (4). Remove the rod assembly.
4. Remove the L.H. rod assembly in the same manner.
5. Remove the two bolts, washers and nuts (5) securing the handbrake bracket (6) to the support (7). Remove the handbrake and bracket.
6. Remove taper pin (8) and separate the handbrake (9) from the cross shaft (10).
7. Slacken the setscrew (11) and slide the brake lever (12) off the cross shaft (10). Take care that the key (13) is not misplaced.
8. Remove the bolt (14) from the cross shaft (4) and lift the cross shaft clear of the axle, taking care not to misplace the key (15).
9. To replace the parking brake linkage, reverse the above procedure.

BRAKE SHOE RENEWAL

Check the condition of the brake shoes and linings at frequent intervals. When the linings become worn to within 1/16 in. (1.59 mm) of the shoe face, new or reconditioned shoes and linings should be fitted..

To fit new or reconditioned shoes and linings, refer to operation 8B/2.

HYDRAULIC SYSTEM
GENERAL

HYDRAULIC SYSTEM

GENERAL

The hydraulic system on the MF 50B Tractor/Digger/Loader consists of the following components: Fig. 1.

1. Hydraulic oil reservoir	Incorporated in the left hand side frame of the loader. An oil level indicator is fitted to the outside of the vertical pivot post.
2. Filter	Situated on the inside of the left hand side frame, just in front of the rear axle.
3. Gear Pump	Driven directly by the engine crankshaft and fitted at the front of the machine.
4. Two spool control valve	Mounted on the left hand side frame.
5. Two double acting lift rams	Fitted between the base of the lift arms and the vertical pivot post. One each side of the machine.
6. Two double acting bucket rams	Fitted to the Loader side frame and the bucket transfer link one each side of the machine.
7. Seven spool control valve	Mounted forward of the main frame. Directly in front of the reversed operators seat.
8. Rotary actuator	Mounted at the rear of the main frame. Actuates the slew of the digger.
9. Clamping cylinders	Fitted on the rear frame. When activated clamps complete digger to frame.
10. Stabilizer cylinders	Housed in the main frame and independently operated.
11. Boom ram	Fitted inside the boom. Raises or lowers the boom.
12. Dipperstick ram	Rod side is fitted to the dipperstick and head side is fitted to the boom.
13. Bucket ram	Mounted on the dipperstick. Crowds or dumps the bucket.

Hydraulic oil is drawn from the reservoir through the filter by means of the engine driven gear pump. The oil then is pumped to the two spool control valve at a pressure of 2500/2650 p.s.i. (175.7–186.3 kg/sq.cm). From the two spool valve oil can be directed to either the lift rams or the bucket rams, depending on which control lever is operated. If both levers are in neutral the oil passes through the open centre of the control valve and returns to the reservoir. When a digger is fitted oil is circulated via the pressure beyond port to the digger seven spool valve. From the seven spool valve oil can be directed to any of the seven services as required.

The reservoir for the hydraulic oil is incorporated in the L. H. side frame. The filter cap, which is situated on the top of the L.H. vertical pivot post, has also built into it a breather/cleaner which should be cleaned every 50 hours.

On the underside of the reservoir is a double drain plug. When the centre plug is removed it will allow oil to drain out to a level at which the oil filter element can be changed without draining the entire reservoir. When the large plug is removed the entire system will be drained.

A visual oil level indicator is located on the outside of the left hand vertical pivot post.

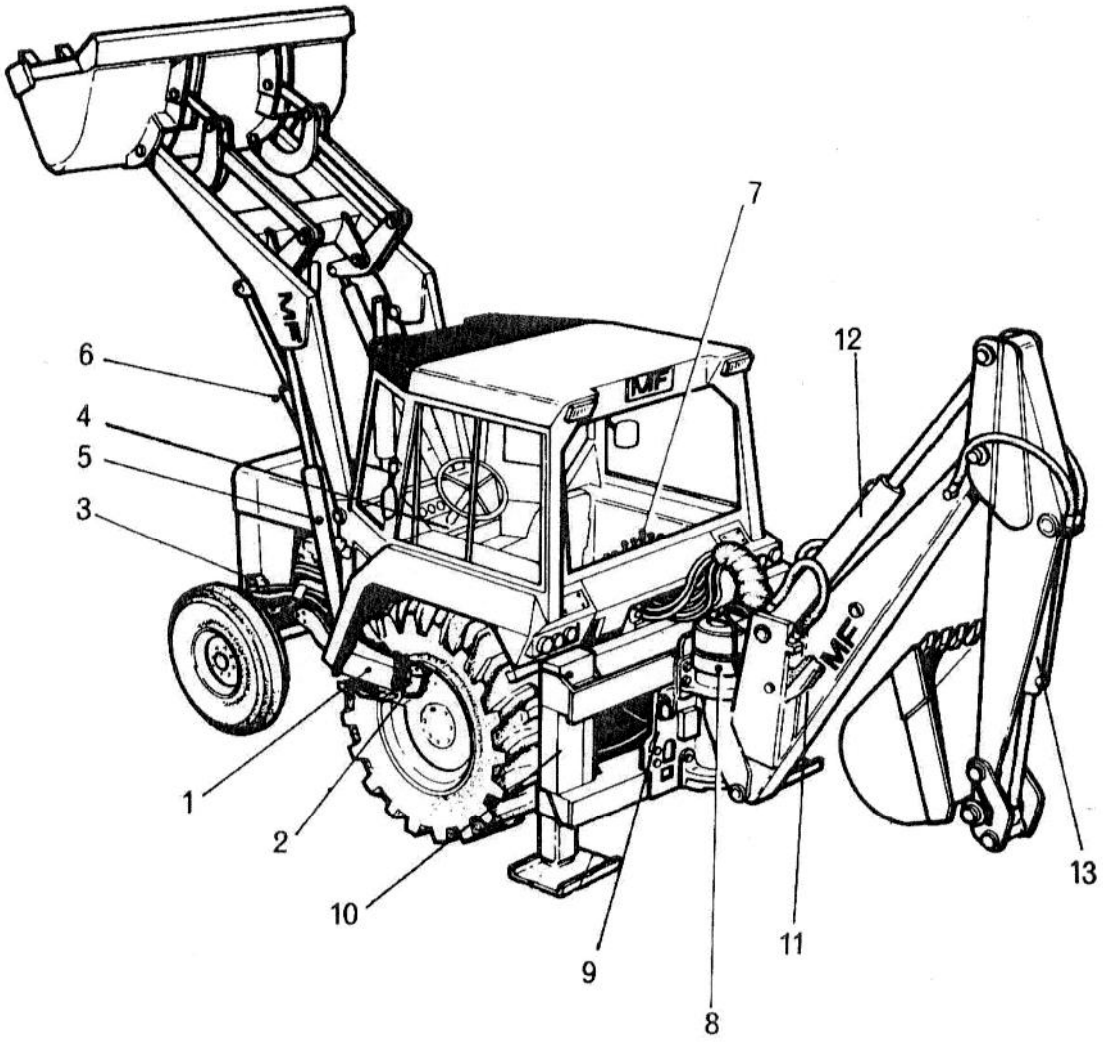


FIG 1

HYDRAULIC FILTER

CONTENTS

LIST OF ILLUSTRATIONS

HYDRAULIC FILTER

General

Oil is drawn by the pump from the reservoir through a filter which is fitted on the side of the reservoir. The oil flows into the filter through the intake orifice. It is then drawn through the paper element, through the inner mesh filter, down into the lower part of the canister and out through the lower discharge orifice.

The filter is designed to remove foreign matter from the hydraulic oil, correct maintenance of the filter is therefore a necessity.

The element should be changed after the first 15 hours work and again after 40—45 hours. Thereafter the element should be renewed every 200 hours.

The filter is a full flow type with a paper element. The rated efficiency is 12 microns at 95% with a cut off of 30 microns.

FILTER

Removal and Replacement

1. Drain hydraulic fluid from reservoir.
2. Fig. 2 Remove the hydraulic oil filter securing bolt and nut (1).
3. Slacken the two main suction hose clips (2) and pull the hose off the filter.
4. Pull the complete filter unit (3) from the frame.
5. Replacement is a direct reversal of the above procedure.

When replacement is complete refill the reservoir with a recommended oil.

FILTER ELEMENT

Removal and Replacement

1. Extend all ram units to the fully open position.
2. Remove the inner drain plug and drain off the amount of fluid that this plug will allow (approx 3/4 gall. 3.4 litre.)
3. Remove the filter access panel from the floorplate in the cab.

4. (Fig. 3). Clean then remove the filter canister cap (1) by unscrewing the handle (2).
5. Remove filter element (3) insert new element and replace canister cap. Ensure that the gasket (4) between the cap (1) and container (5) is in good condition.

If during changing the filter element, the mesh assembly is blocked and requires cleaning, proceed as follows:

1. Remove the main drain plug and drain remaining oil from reservoir.
2. Unscrew wing nut (6) and remove washer and cap (7).
3. Withdraw mesh assembly (8) and clean in paraffin.
4. Wipe out inside of canister (5) with a clean, non fluffy cloth.
5. Replace mesh (8) washer and cap (7) and wing nut (6).
6. Replace filter element (3). and cover (1).
7. Ensure that the reservoir is refitted with a recommended oil before starting the engine.

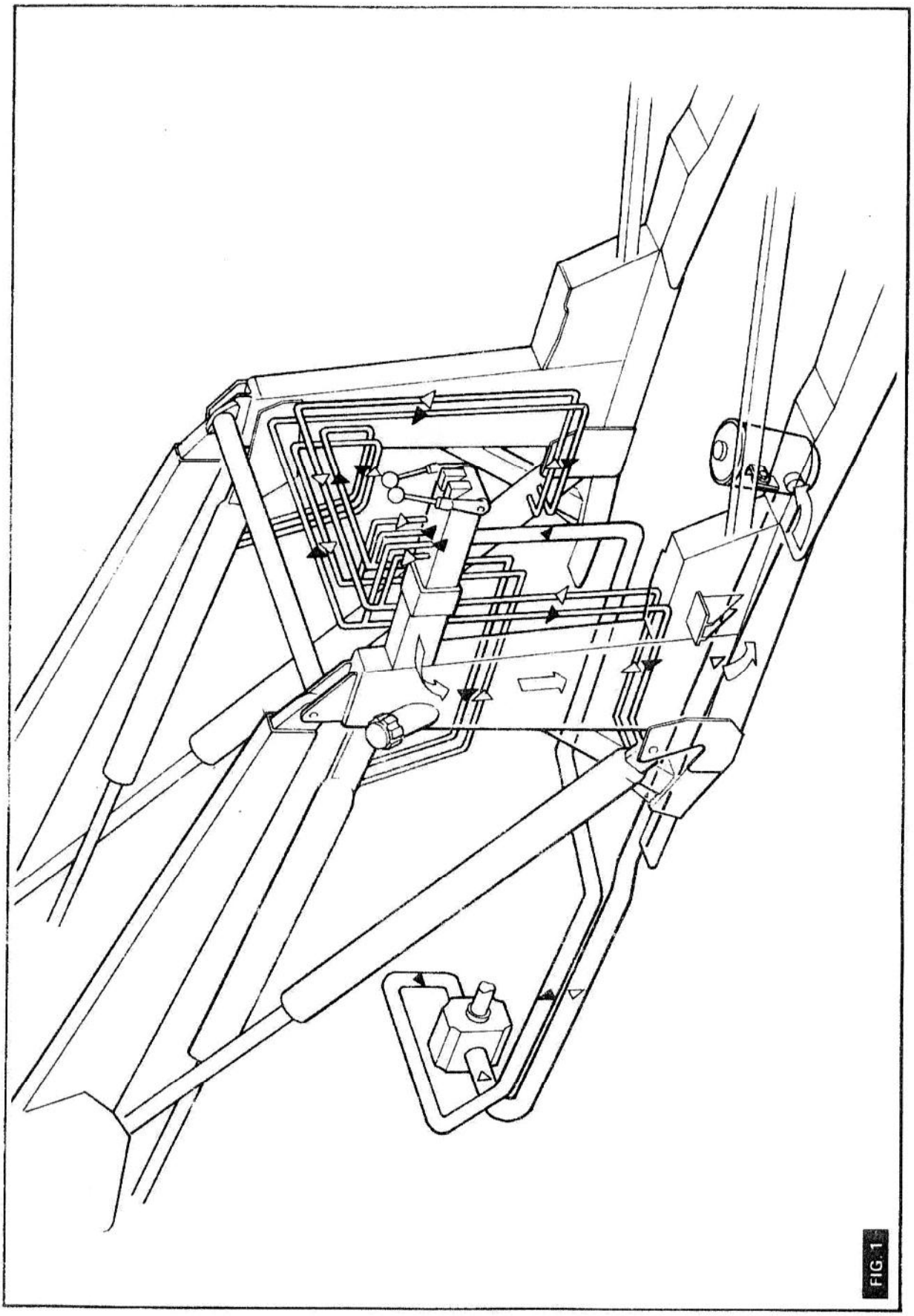


FIG. 1

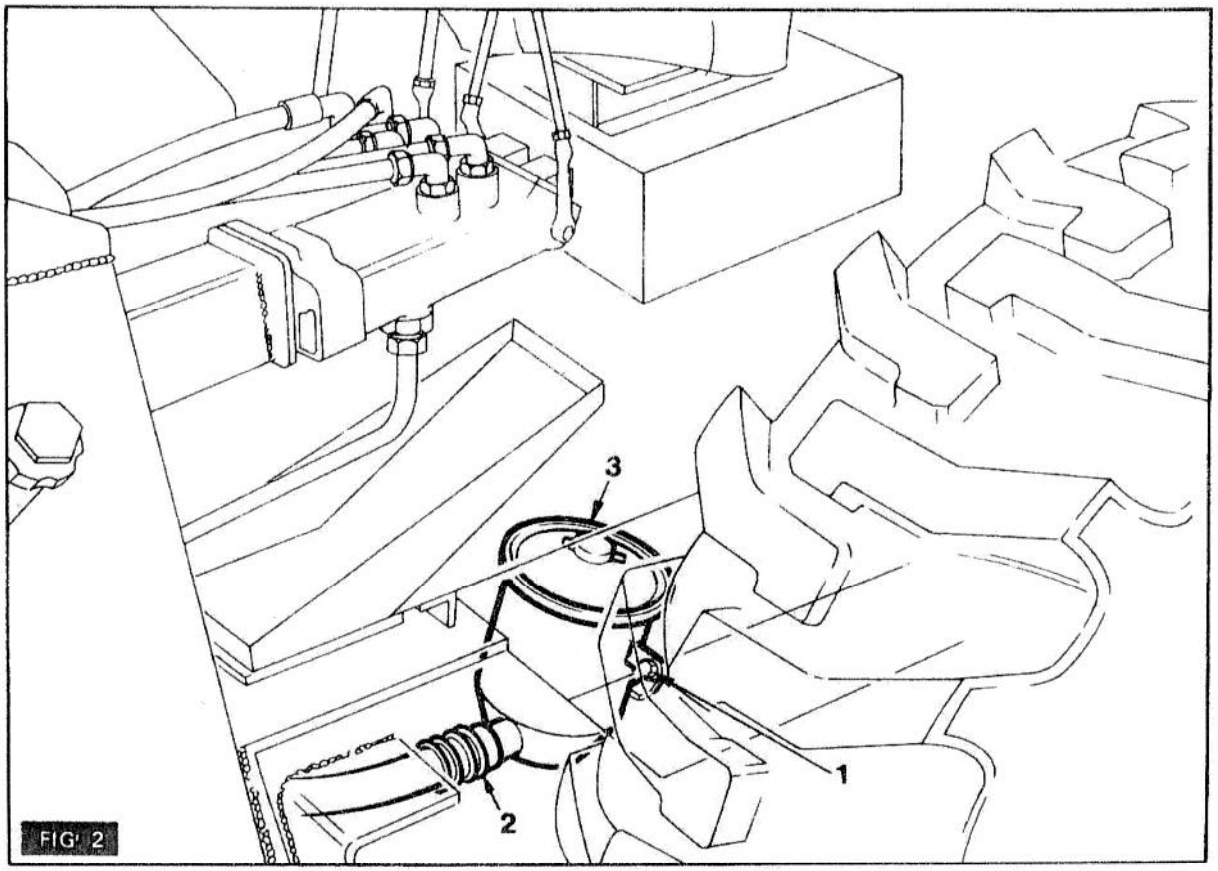


FIG 2

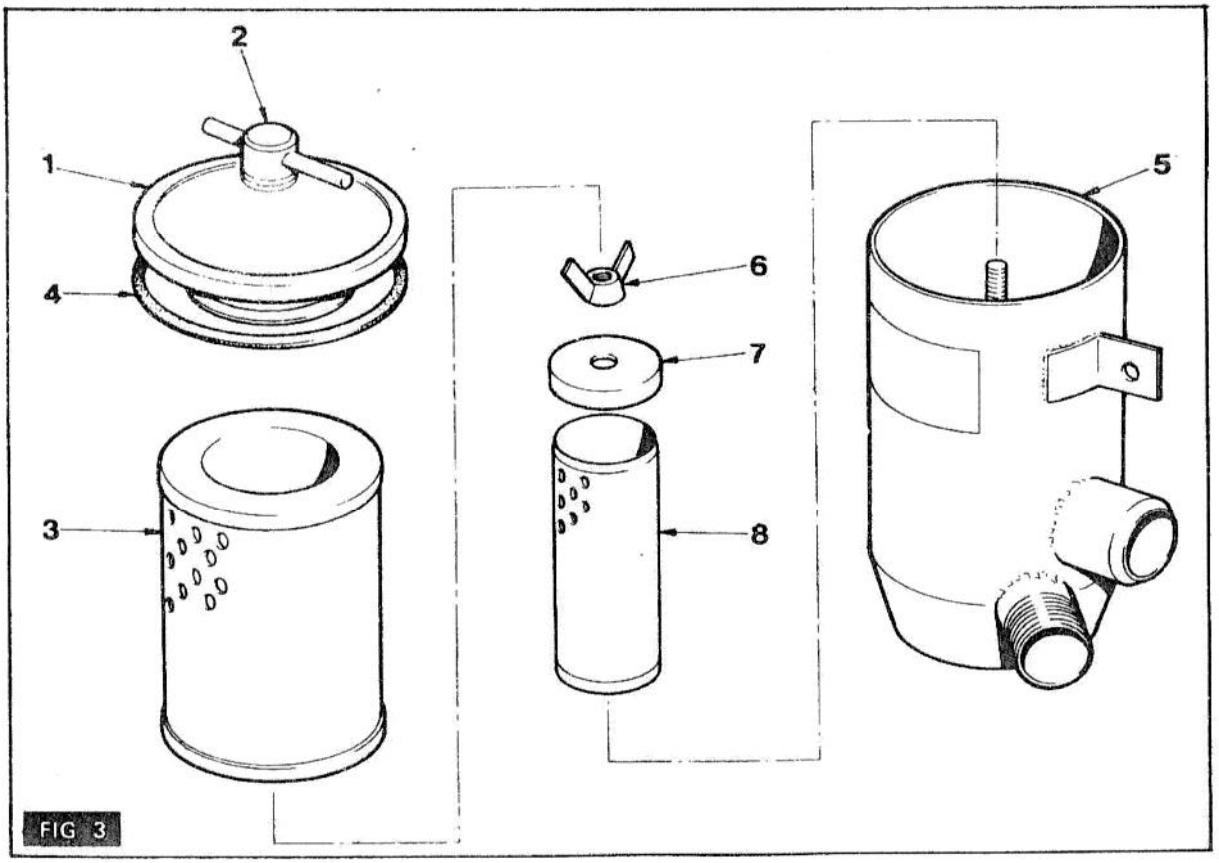


FIG 3

HYDRAULIC PUMP

CONTENTS

LIST OF ILLUSTRATIONS

HYDRAULIC PUMP

General

The main hydraulic pump is mounted at the front of the machine and connected by a drive shaft to the engine crankshaft. The pump output is 23.8 imp. gall./min. (108.19 litres/min.) at 2000 engine r.p.m. and at a pressure of 2500 p.s.i.

The direction of the pump rotation is clockwise when viewed from the front of the machine.

Oil is drawn from the reservoir situated in the left hand loader frame into the pump through the larger (suction) port. It is then carried round by the gears to the smaller (pressure) port and up to the loader control valve.

The pump gears are supplied as a matched pair and should only be replaced as such.

The pump gears are supported by bronze bushes in the bearing blocks. The bearing blocks also act as pressurised wear plates against the gear faces. Oil from the pressure side is forced behind the blocks, via the cut out section in the blocks, thus pushing them against the gears to take up any wear. A small drilling in each block allows lubricating oil from the bushes to return to the inlet side of the pump.

HYDRAULIC PUMP AND PUMP DRIVE SHAFT

Removal and Replacement (9C/1)

1. Raise the lift arms and place ram stops in position.
2. Remove front grille completely.
3. Drain the hydraulic system by removing the large drain plug in the underside of the reservoir, into a suitable receptacle.
4. Disconnect the suction and pressure hoses from the pump and plug the end of the hoses.
5. (Fig. 2). Remove the two pump securring bolts.(1).
6. Slide the pump splined drive gear out of the drive shaft (2).
7. Insert tool No. MF 341 into the splined end of the drive shaft and extract the shaft by turning in a clock - wise direction.
8. Lift the drive shaft clear of the machine.
9. Replacement is a reversal of the above procedure.

HYDRAULIC PUMP

Disassembly (9C/2)

1. Remove the pump from the machine as described in operation 9C/1.
2. Clean the exterior of the pump, then using a sharp tool mark the front plate, body and back plate to facilitate reassembly.
3. (Fig. 3). Remove the eight bolts (1) which hold the three sections of the pump together. Lift off the end section (2).
4. (Fig. 4). Remove the two nylon backing washers (1), lobe seal (2) and 'O' ring (3).
5. (Fig. 5). Remove the bearing blocks from the pump body.
6. (Fig. 6). Slide the gears out of the pump body.
7. Remove the front plate, nylon backing washer, lobe seal and 'O' ring.
8. Extract the two remaining bearing blocks from the pump body.

HYDRAULIC PUMP

Reassembly (9C/3)

1. Ensure that all parts are perfectly clean and in good condition. Lubricate them with the oil to be used in the pump.
2. Fit a new wiper seal into the drive end plate. Pack the cavity between the sealing lips of the seal with a high melting point mineral grease.
3. (Fig. 7). Fit the first pair of bearing blocks (1) into the pump body (2).

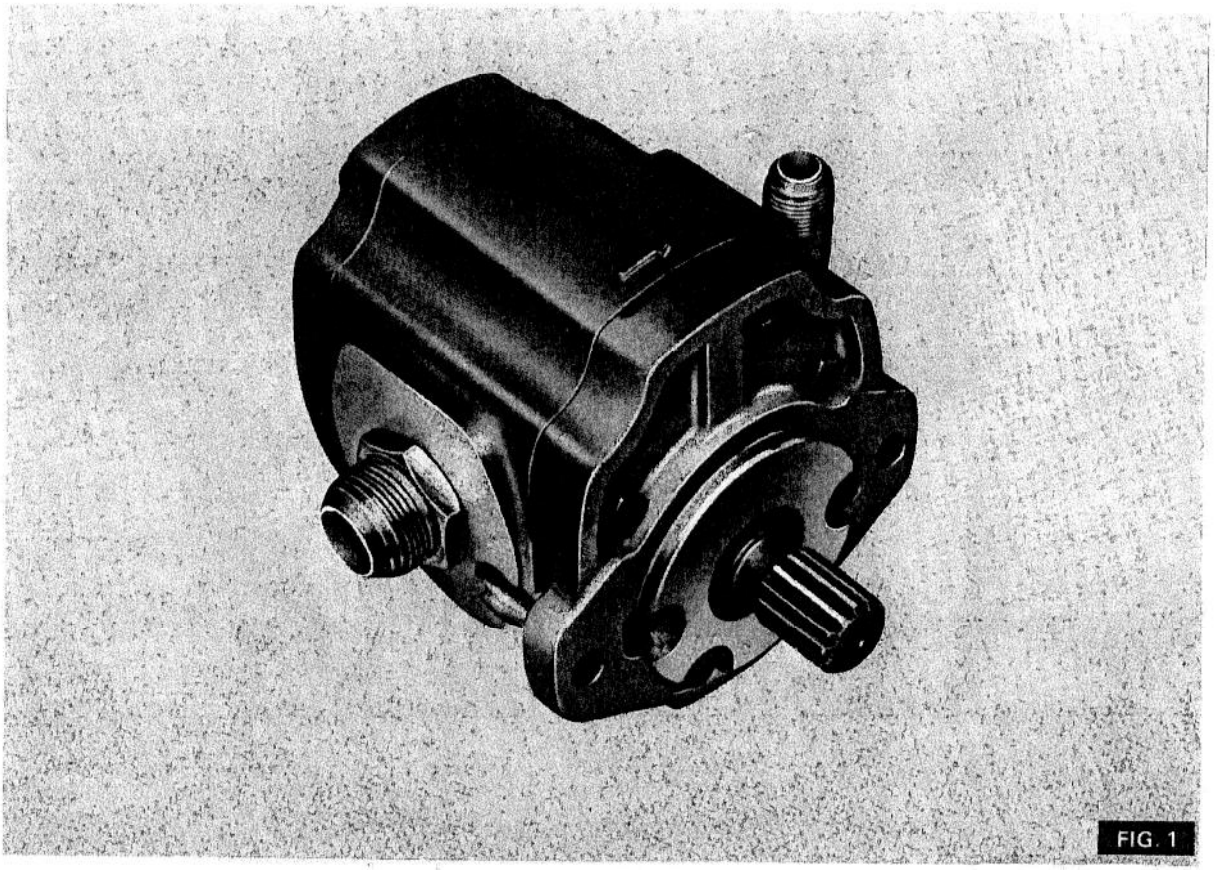


FIG. 1

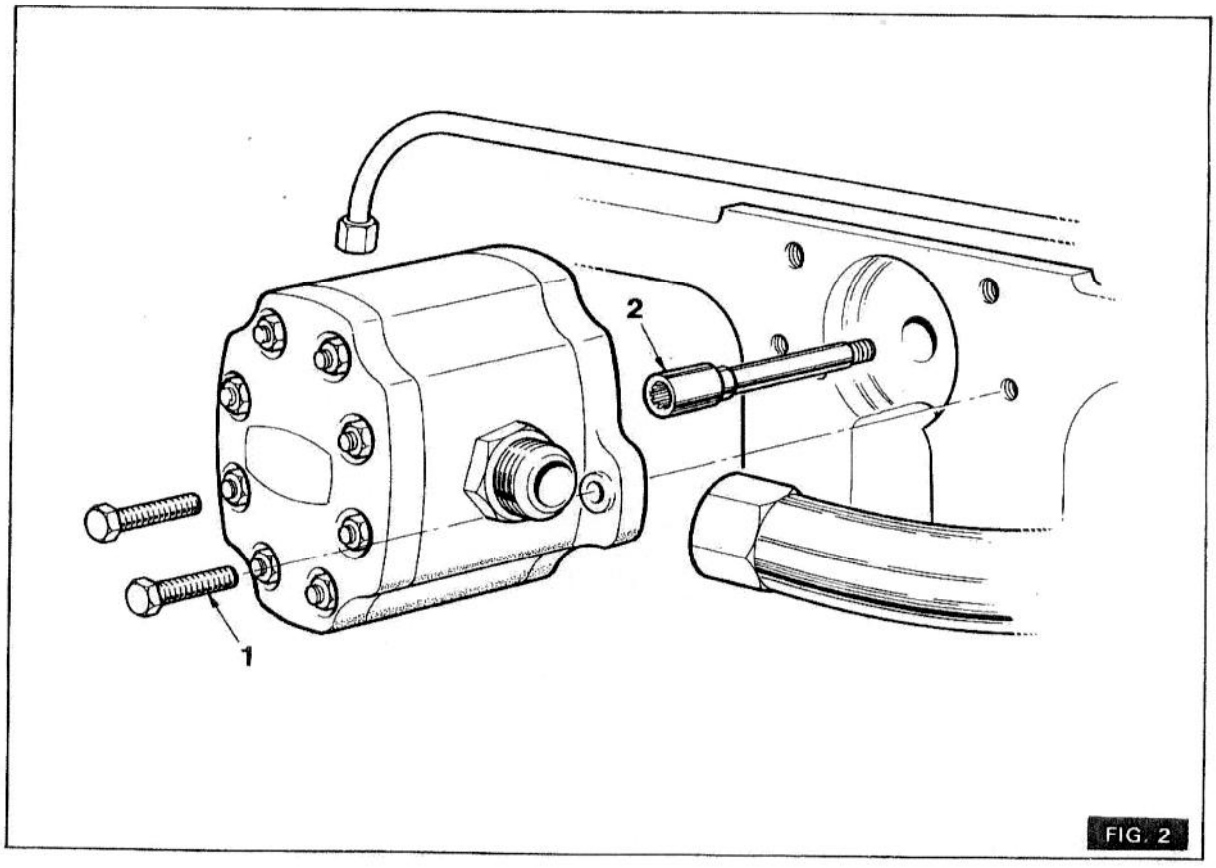


FIG. 2

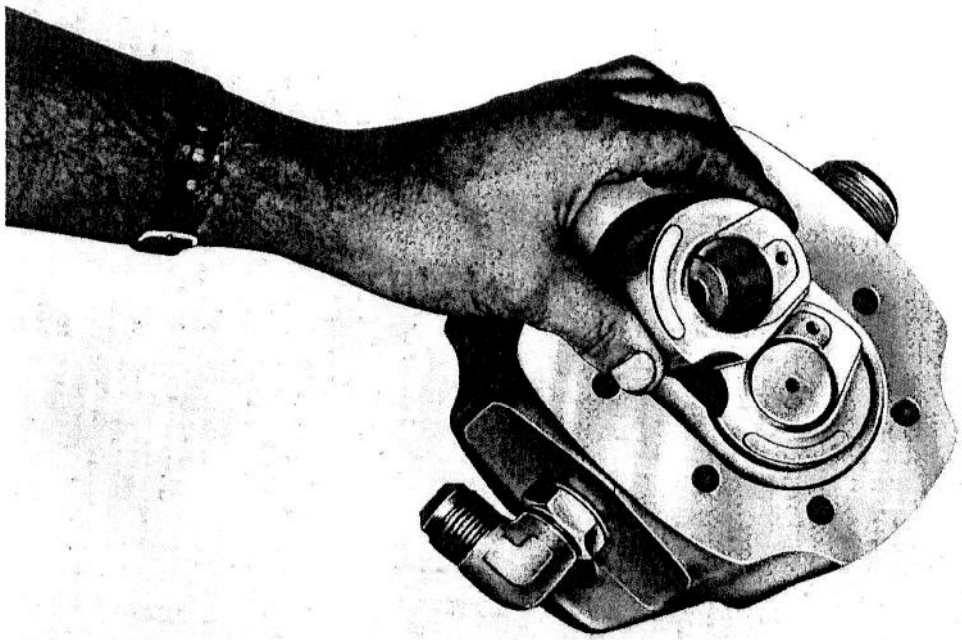


FIG. 5

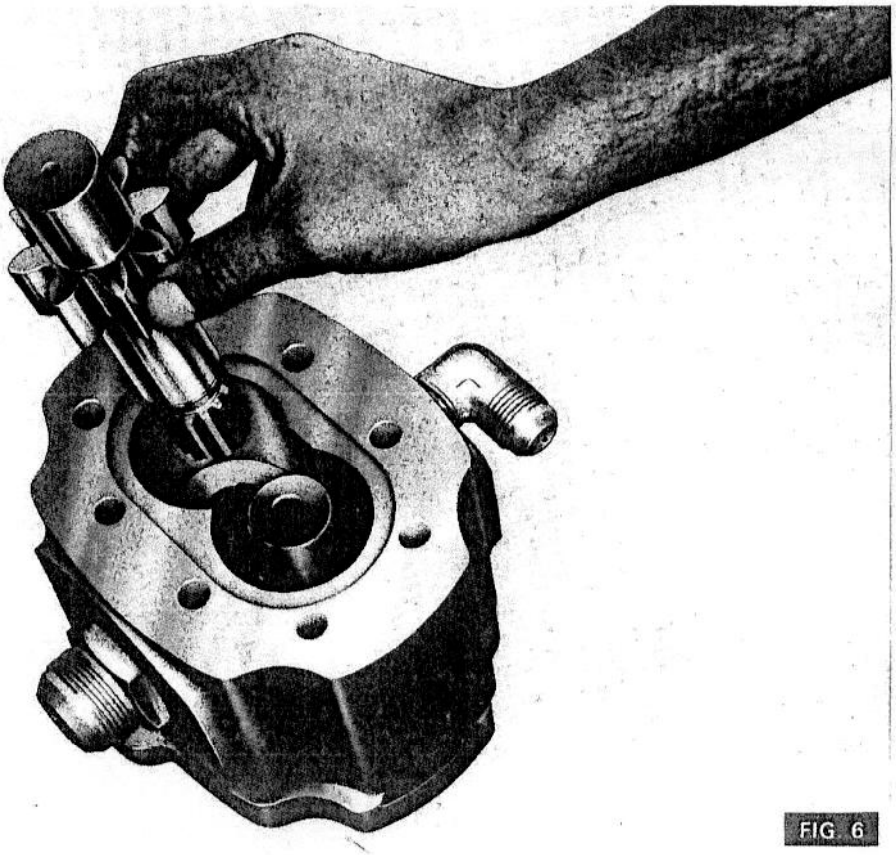
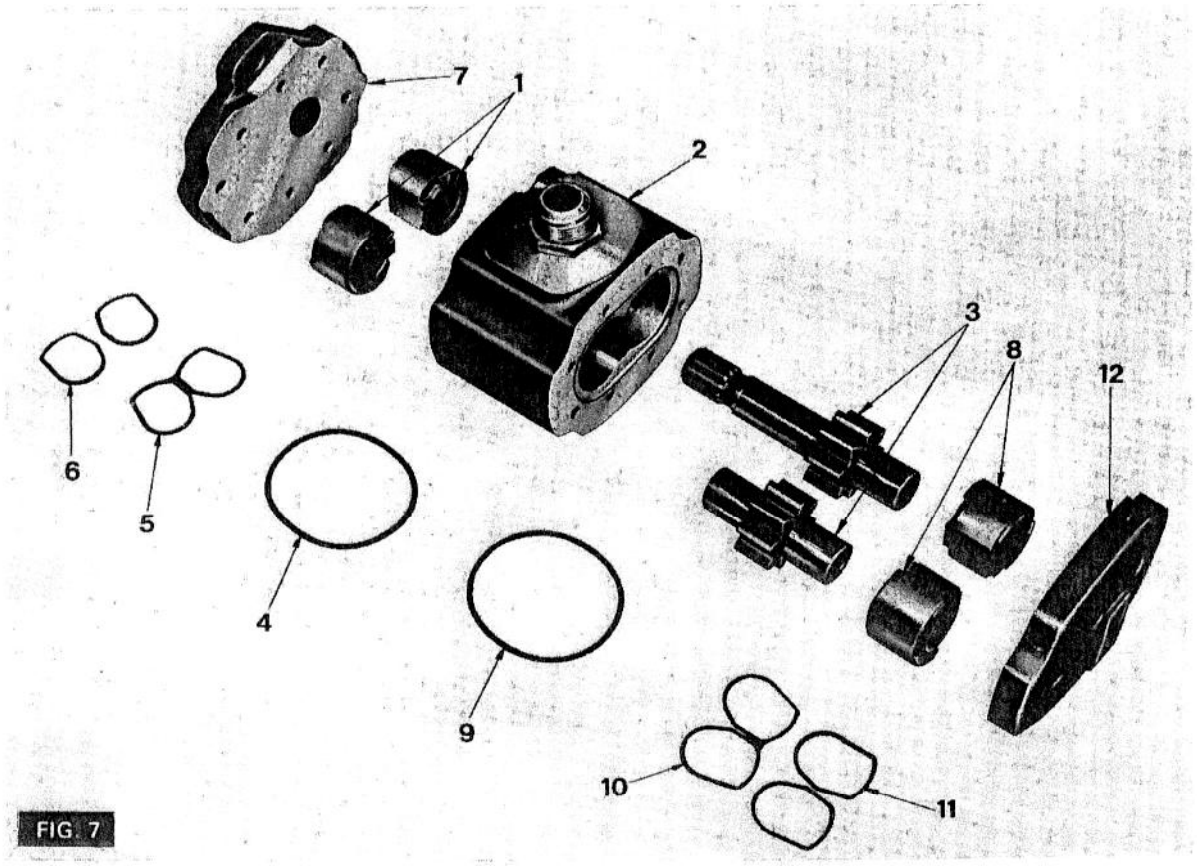


FIG. 6



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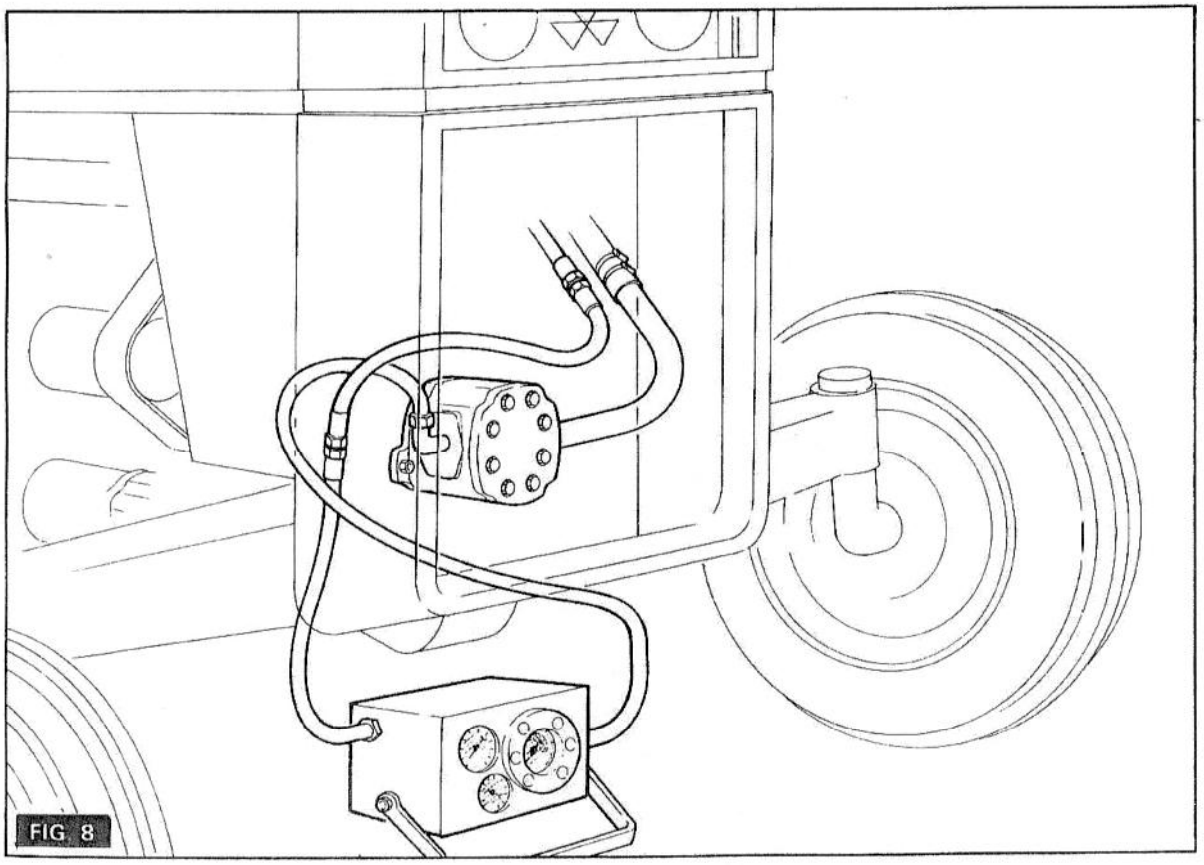
FIG. 8

HYDRAULIC PUMP

REASSEMBLY . . . Cont'd.

NOTE:
When fitting the bearing blocks, the cut out side of the bushes must face the pressure side of the pump.

4. Replace the pump gear (3) into the pump body.
5. Fit a new 'O' ring (4), lobe seal (5) and back up washers (6) between the pump body and the drive end plate. Fit the drive end plate (7) to the pump. When fitting the end plate over the pump drive shaft, use extreme care to ensure that the wiper seal in the end plate is not damaged. Replace the circlip to hold the wiper seal in place.
6. Fit the second pair of bearing blocks (8) into the pump. The cut out side of the blocks must face the pressure side of the pump.
7. Fit new 'O' ring (9) seal (10) and back up washers (11) between the pump body and end cover (12). Fit the end cover to the pump and replace the eight bolts to hold the pump sections together. Tighten the bolts with a torque loading of 34–36 lb. ft. (4.7–4.98 kg.m) in a diagonal sequence to pull the pump together squarely.
8. Pour a small quantity of hydraulic oil into the ports and check the pump freedom of rotation.
9. Replace the pump as described in operation 9C/1.

HYDRAULIC PUMP

FLOW CHECK

9C/4

1. Check that the hydraulic oil is up to the correct level.
2. Operate the loader system to bring the hydraulic oil temperature within the operating range.
3. Raise the loader arms and position ram stops on the lift rams.
4. Release any residual pressure by operating the control levers.
5. (Fig. 8). Remove the radiator grille, disconnect the pressure hose from the pump and connect the flow meter into the circuit as shown. The circuit is now continuous. Check all connections for tightness.
6. Start the engine and allow to idle until the hydraulic oil has filled the circuit. Increase the engine speed to 2000 r.p.m. and check the flow reading as indicated on the flow meter. The flow should be 23.8 imp.gall./min. (108.19 litres/min.)
7. If the flow rate is less than 80% of the specified flow rate, the hydraulic pump should be serviced or renewed.
8. After checking the flow rate, stop the engine, release any residual pressure in the system and disconnect the flow meter from the system.
9. Reconnect the hose to the pump, replace the grille and remove the ram stops.

SEVEN SPOOL VALVE

Removal and Replacement

Reassembly . . . Cont'd

Note

All 'O' rings must be renewed every time the block is dismantled.

2. Fit the outlet end cap (5) over the last section.
3. Fit the nut (2) and washer (3) to the apex tie bolt (4).
4. Fit the other two tie bolts (1) through the assembled section and tighten to a torque of 20/25 lb. ft. (2.76/3.46 Kg.m.).
5. Tighten the nut on the apex bolt to 35/55 lb. ft. (4.84/7.60 Kg.m.).
6. Replace onto machine as described in operation 9E /1.

Note

Each working section, if necessary, should be dismantled and rebuilt individually to ensure correct re-assembly.

WARNING

Before refitting the valve to the machine re-check to ensure that the sections are in correct locations and that the relief valves are correctly placed. Incorrectly replaced relief valves will cause inefficiency and serious damage to the machine.

STABILIZER SECTION

Disassembly and Reassembly (9E/4)

1. (Fig. 13) Remove the valve from the machine as stated in operation 9E/1.
2. Dismantle the valve as stated in operation 9E/2 until the required section is reached.
3. Unscrew the cap (1) and withdraw the spool (2) complete with bush (3) and 'O' ring (4).
4. If a further breakdown of the spool is required remove the screw (5), washer (6), spring (8), sleeve (7) and washer (9).
5. Remove 'O' ring (10) from valve body.
6. Remove the check valve assembly and extract the seat (11) and spring (12).
7. Remove the 'O' ring (13) and back up washer (14) from the valve body (15) then remove the 'O' ring (16) and back up washer (17).
8. Check all parts for wear. If any scoring has taken place the spool and section will have to be replaced as they are matched.
9. When reassembling renew all 'O' rings and back up washers.

Note

When reassembling the check valve, ensure that the 'O' rings are on the pressure side. Fit them to the back up washer which has one side pre-shaped for the 'O'ring to seat into.

BOOM, DIPPERSTICK AND BUCKET SECTIONS

Disassembly and Reassembly (9E/5)

Fig. 14 Disassembly and reassembly of these sections is exactly the same as the disassembly and reassembly of

SEVEN SPOOL VALVE
BOOM, DIPPERSTICK AND BUCKET SECTIONS

Disassembly and Reassembly

the stabilizer section operation 9E/4, except that these sections have included shock valves (1) of varying pressures. If these are removed it should be ensured that the valves are refitted into the correct sections with new 'O' rings.

SLEW SECTION

Disassembly and Reassembly (9E/6)

1. (Fig. 15) Remove the valve from the machine as stated in operation 9E/1.
2. Dismantle the valve as stated in operation 9E/2 until the required section is reached.
3. Unscrew the cap (1) and withdraw the spool (2) complete with bush (3) and 'O' ring (4).
4. Remove the screw (5), washer (6), spring (7), sleeve (8) and washer (9).
5. Unscrew the plug (10) and remove the nylon ball (11).
6. Unscrew the clevis (12) and remove from the spool. Remove the nylon ball (13).

Note

On later sections the spool is manufactured in one piece and the nylon anticavitation balls have been removed.

7. Remove the shock valves (14) and (15).
8. Remove the 'O' ring (16) from the section body (17).
9. Remove the check valve (18) then extract the seat (19) and spring (20).
10. Remove the 'O' ring (21) and back up washer (22) from the valve body (18).
11. Check all parts for wear. The spool and section body are a matched pair, if any scoring has taken place both parts will have to be renewed.
12. When reassembling renew all 'O' rings and back up washers.

Note

When reassembling the check valve, ensure that the 'O' rings are on the pressure side. Fit them to the back up washer which has one side pre-shaped for the 'O' ring to seat into.

CLAMP SECTION

Disassembly and Reassembly (9E/7)

1. Remove the valve from the machine as stated in operation 9E/1.
2. Dismantle the valve as stated in operation 9E/2 until the required section is reached.
3. (Fig. 16) Remove the cap (1) and withdraw the spool (2) complete with bush (3), 'O' ring (4) and detent mechanism.
4. If necessary the detent mechanism can be removed from the spool by unscrewing the spool screw (14), removing the spring cup (15), spring (16), stroke control spacer (17) and spring plate (18).

Note

If the spool screw is removed it will be seen that inside the spool is a small screw. DO NOT REMOVE THIS SCREW. IT IS LOCTITED INTO POSITION.

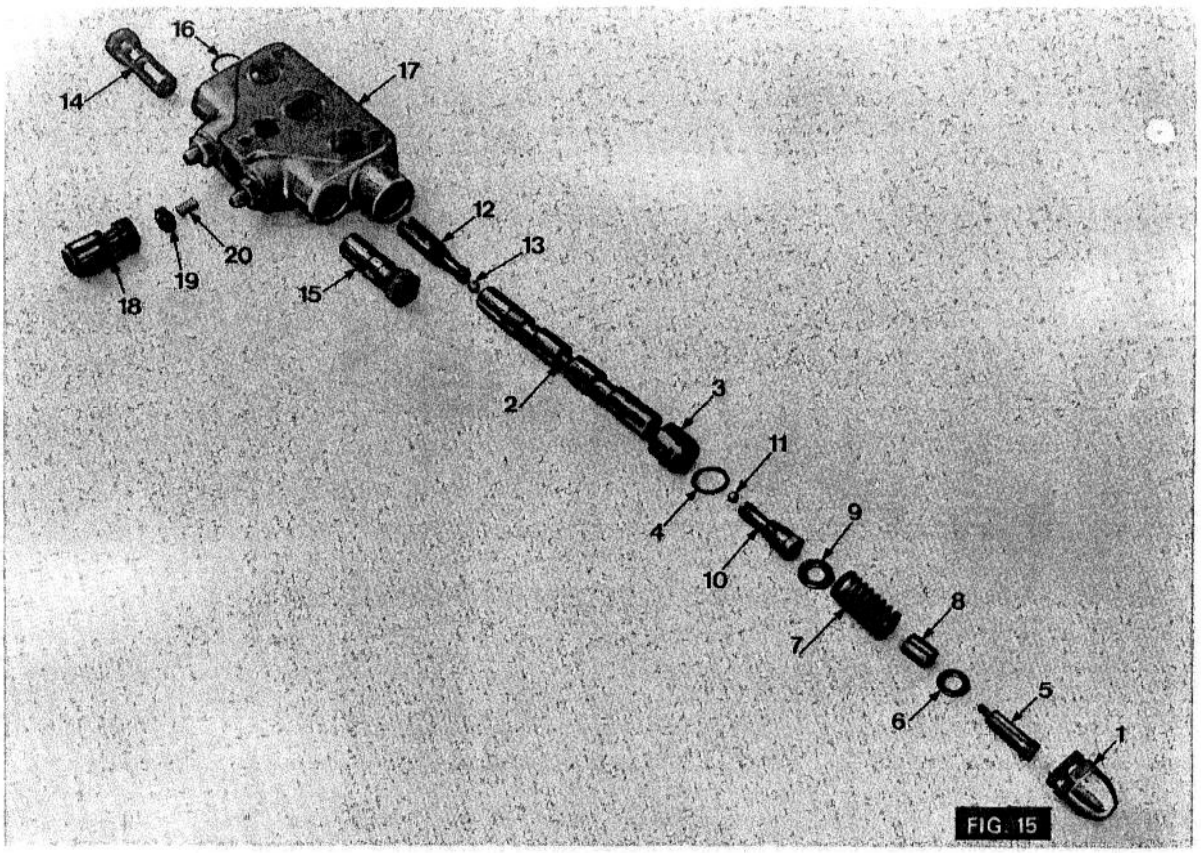
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FIG. 15

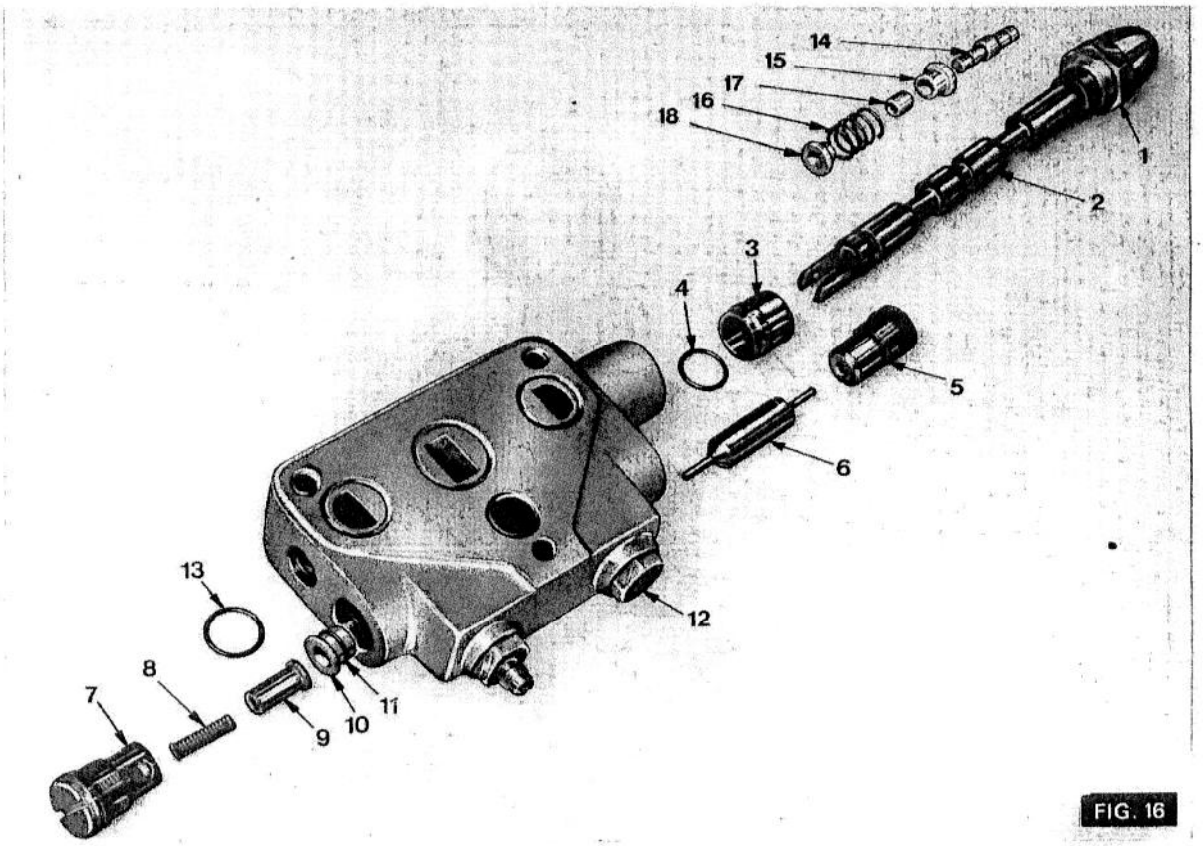
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FIG. 16

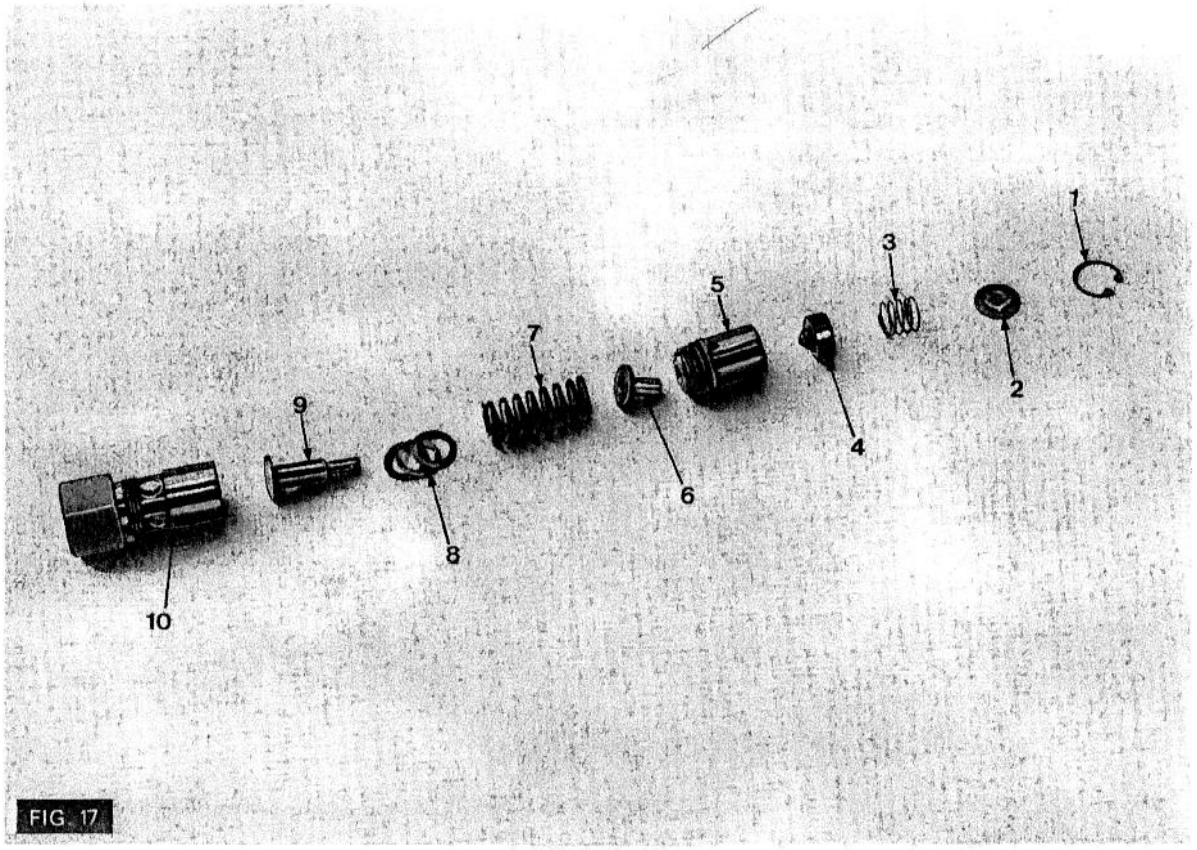


FIG. 17

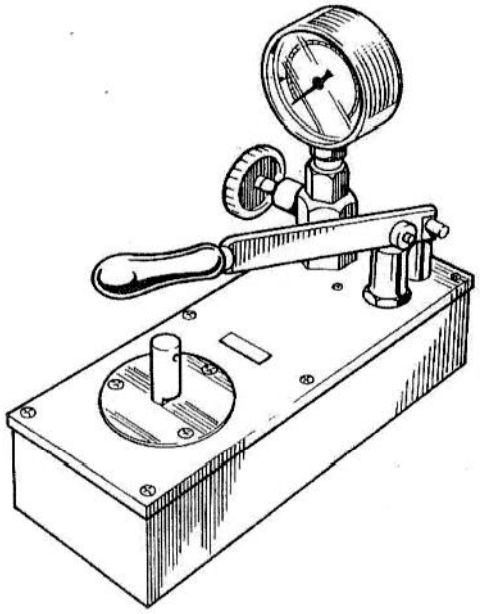


FIG. 18

SEVEN SPOOL VALVE
CLAMP SECTION

Disassembly and Reassembly . . . Cont'd

5. Remove the plug (5) and slide plunger (6) out of the body.
6. Remove the plug (7) and withdraw the spring (8) and plunger (9).
7. Withdraw the lock out seal (10) complete with 'O' ring (11).
8. Remove the plug (12).
9. Remove the 'O' ring (13) from the body.
10. Reassembly is a reversal of the above procedure.

Note

All 'O' rings should be renewed on reassembly.

ANTI SHOCK VALVE

General (9E/8)

The anti shock valves can be stripped down and adjusted to the required pressure by either inserting or removing shims. If the valve fails it must be renewed as a complete item since the component parts are not serviced individually. To disassemble a valve proceed as follows :–

1. (Fig. 17) Remove the circlip (1), extract the spring retainer (2), spring (3) and the ball and retainer assembly (4).
2. Unscrew the lower half of the valve body (5), remove the seat (6), spring (7), adjusting shims (8) and guide (9) from the body (10).
3. Replace in a reverse order of the above procedure.

The 50B II (& Probably 50D).
Use a Laser Multiple Block
+ Separate Clamp Spool. } Diagram enclosed in Brown Envelope
MF Wheel Register
Feb 82.

TWO SPOOL CONTROL VALVE

CONTENTS

LIST OF ILLUSTRATIONS

TWO SPOOL CONTROL VALVE

General

The two spool control valve which is mounted on the L.H. side frame, receives the oil from the pump and directs it through any one of the four ports to the loader lift rams and bucket rams.
Incorporated in the control valve are the following valves:-

Main Relief valve set at 2,500 2,650 lbs. in^2 (175.7 186.3 kg cm^2)
Shock Relief valve–bucket ram head side set at 3000 lbs./in^2 (210.9 kg cm^2)
Shock Relief valve–bucket ram rod side set at 5000 lbs./in^2 (351.5 kg cm^2)
Shock Relief valve–lift ram head side set at 3500 lbs./in^2 (246 kg cm^2)
Shock Relief valve–lift ram rod side set at 5000 lbs./in^2 (351.5 kg cm^2)

Oil enters the spool through the port at the base of the valve and is directed along the two galleries. If the controls are in neutral position the flow of oil is permitted to go straight through the open centre of the valve and go back to the reservoir. If one or both of these services is being used the oil is directed by movement of the lever, to either the bucket rams or the lift rams.
If a digger is fitted, oil is directed to the seven spool control valve through the pressure beyond port in the valve.

TWO SPOOL VALVE
Removal and Replacement 9D/1

1. Lower the bucket to the ground then ensure that the pressure has been relieved by operating the levers backwards and forwards several times.
2. Mark the four supply hoses to facilitate reassembly then remove hoses from valve.
3. Disconnect the main supply pipe from the base of the valve. If a digger is fitted, also remove the digger feed pipe from the base of the valve.
4. Extract the three bolts which secure the valve to the main side frame then remove the valve.
5. When replacing the valve renew the gasket between the mounting and the side frame, then reverse the above process.

TWO SPOOL VALVE
Disassembly 9D/2

1. Remove the valve as stated in operation 9D/1
2. (Fig. 2). Extract the two restrictors from the return ports.
3. (Fig. 3). Extract the main relief valve (1), the bucket ram head side relief valve (2), the bucket ram rod side relief valve (3), the lift ram head side relief valve (4) and lift ram rod side relief valve(5).
4. (Fig. 4). Extract the boom check valve by carefully unscrewing the check valve body (1). Remove the spring (2) then remove actual valve (3).
5. Unscrew the four hex. head screws (4) and remove the side cover (5).
6. Carefully unscrew the check valve body (6), remove the spring (7) and extract the check valve (8).
7. (Fig. 5). Unscrew the three screws (1) which secure the mounting (2) to the body (3) and remove the mounting. Extract the centering spring stop (4).
8. Unscrew the centering spring screw which secures the detent mechanism to the boom spool (5) remove the detent mechanism (6) spring cup (7) centering spring (8) stroke control spacer (9) and spring plate (10).
9. Unscrew the centering screw (11) which holds the spring to the bucket spool (12), remove the spring cup (13), stroke control spacer (14), centering spring (15) and spring plate (16).
10. Remove the screws (17) and lift off the handle end covers (18) and seals (19).
11. Extract the locking clips (20), remove the chain links (21) and withdraw both spools from the body.
12. (Fig. D6). If the handles are to be removed, mark the mating teeth on the handle shaft (1) and the link (2).
13. Place a suitable spanner on the cone nut (3) and unscrew the handle shaft screw (4).
14. Extract the screw complete with 'O' ring (5). Remove the handle shaft assembly complete with 'O' ring (6).
15. Remove the link and cone nut (7) from inside the valve body.
16. Repeat the process on the remaining handle.

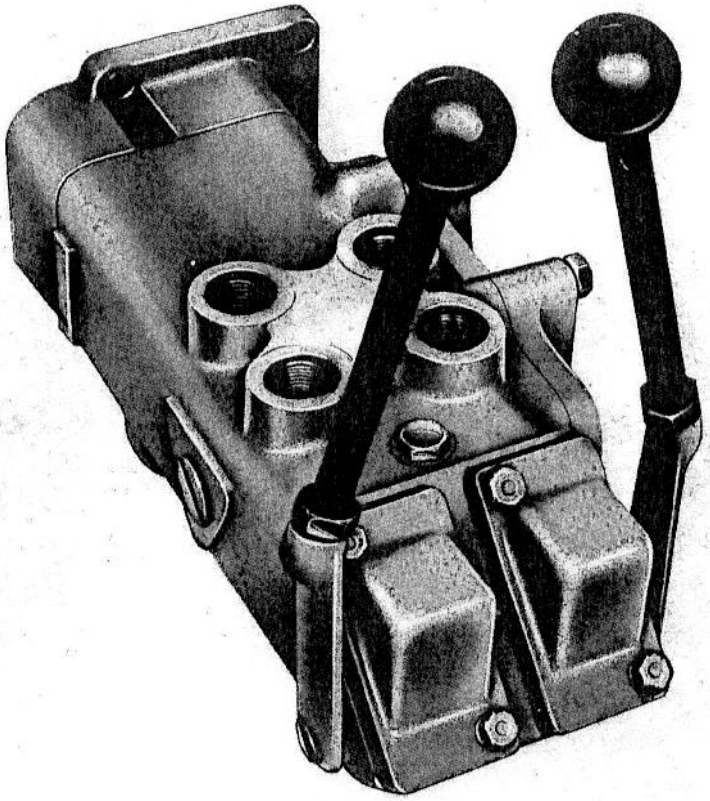


FIG. 1

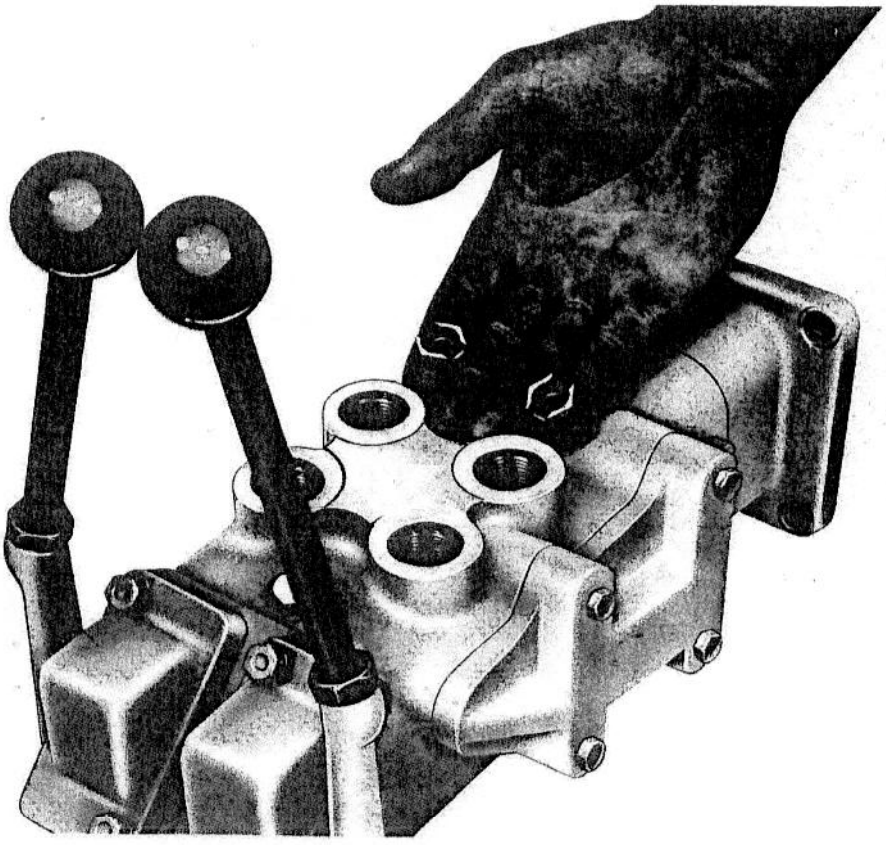


FIG. 2

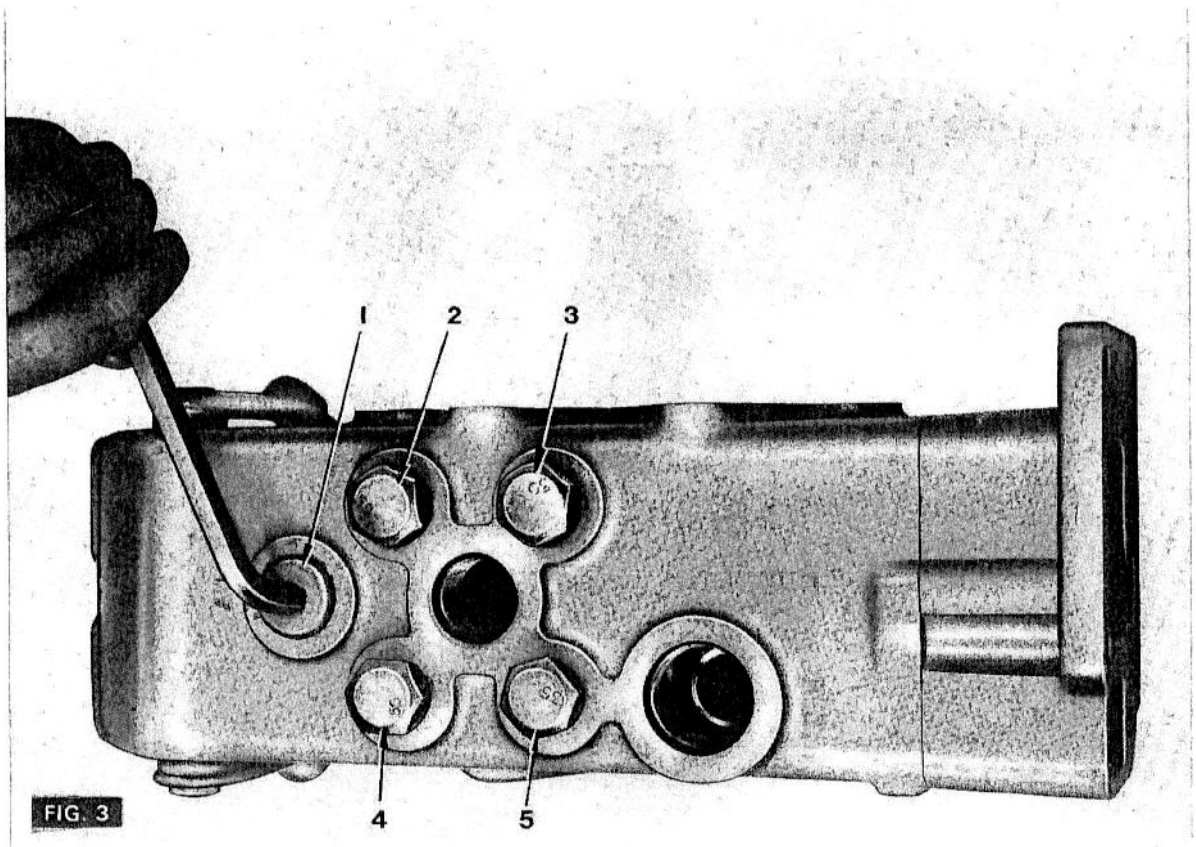


FIG. 3

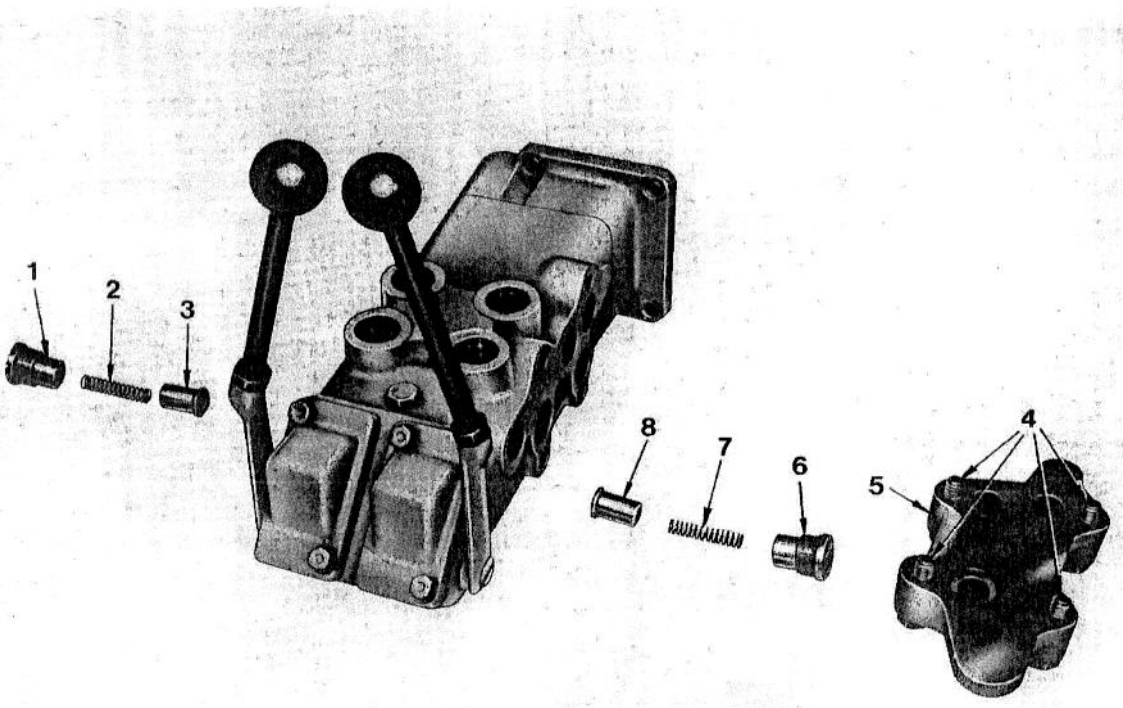


FIG. 4

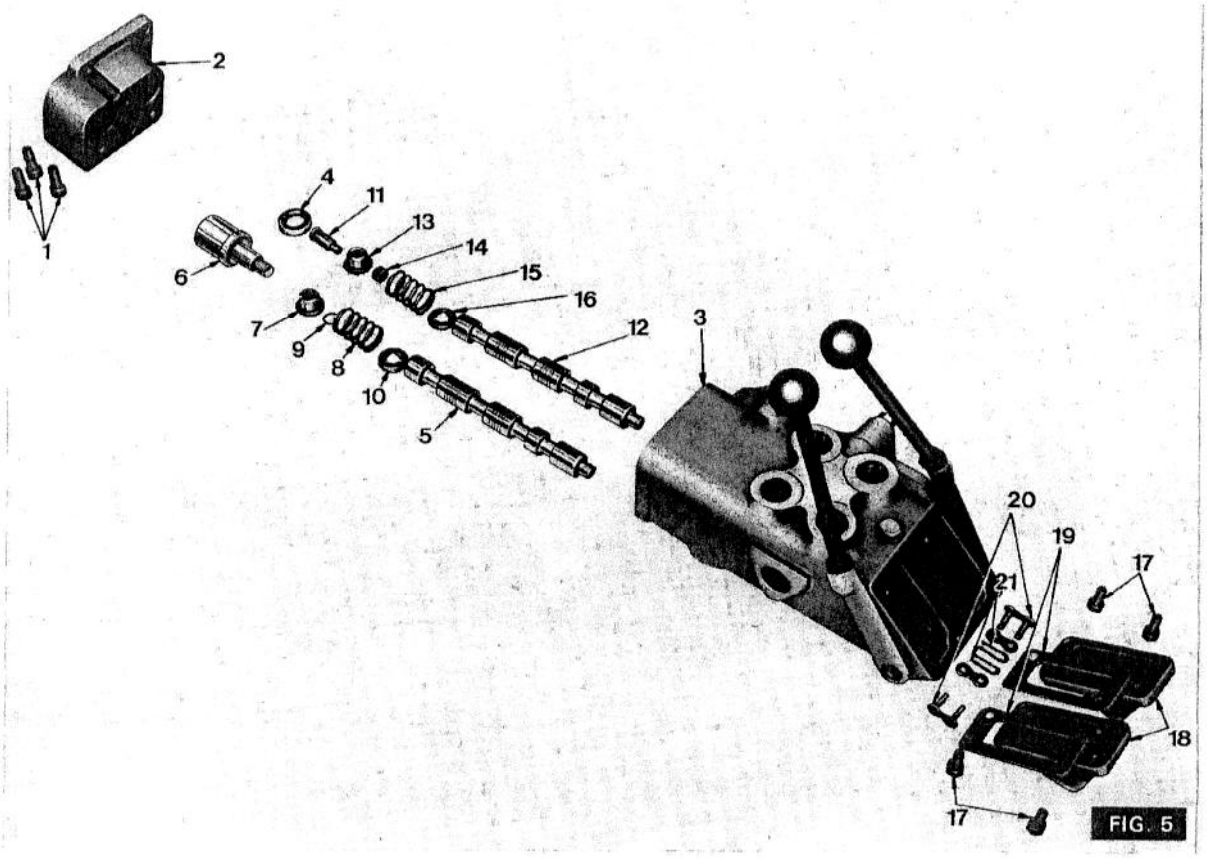


FIG. 5

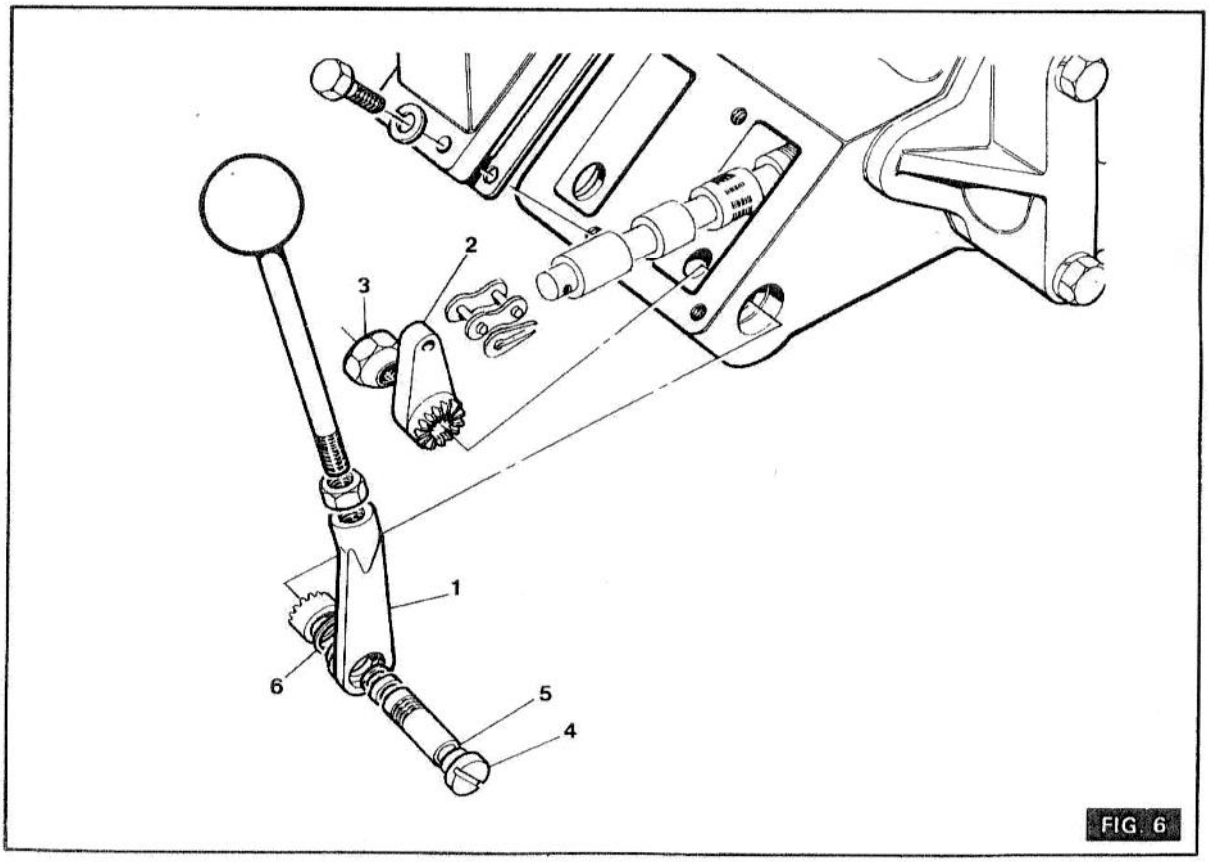


FIG. 6

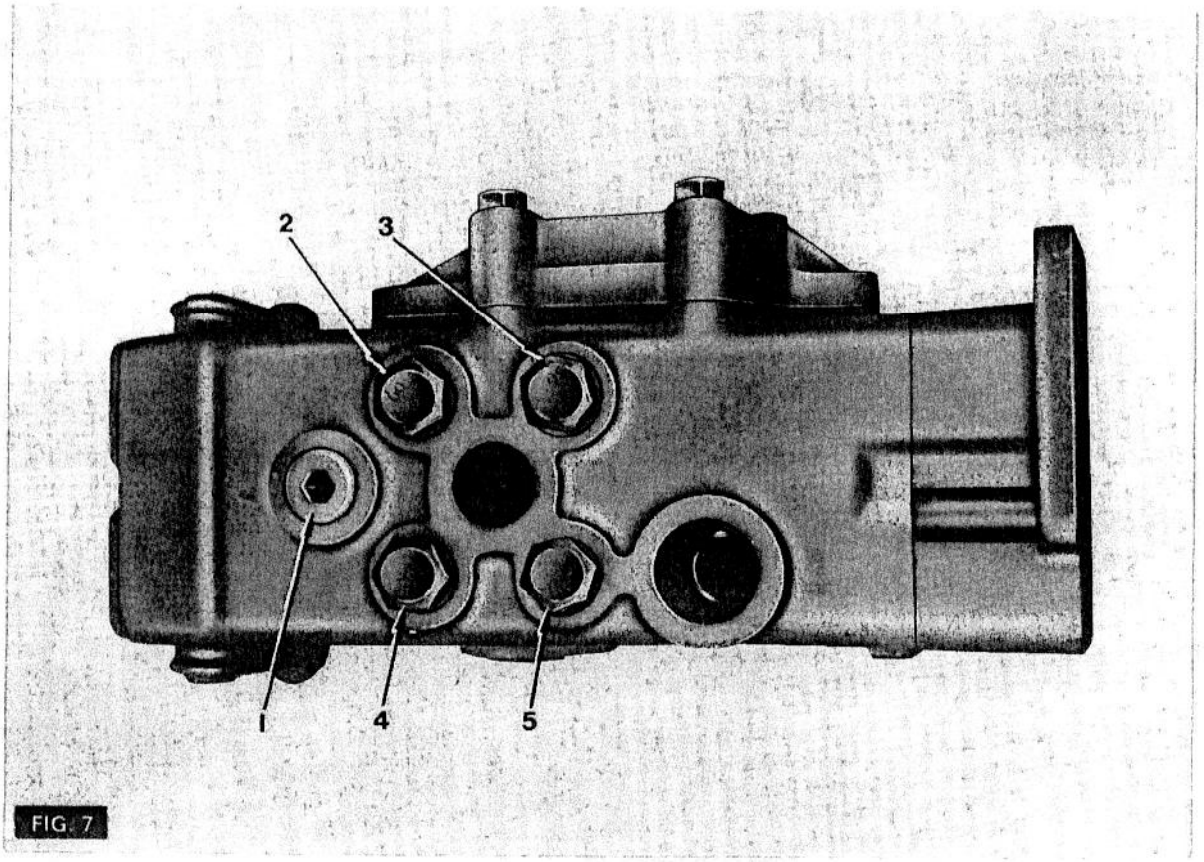


FIG. 7

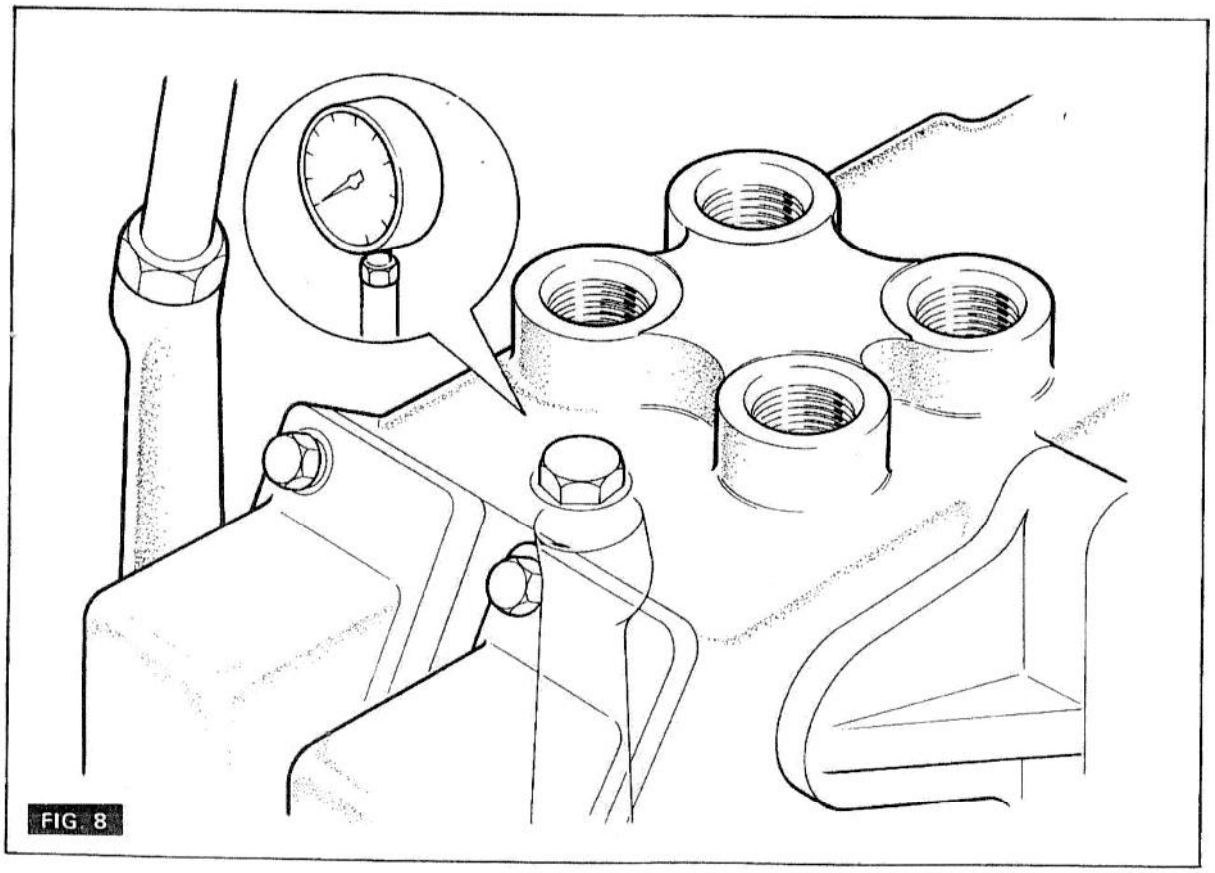


FIG. 8

TWO SPOOL VALVE

REASSEMBLY

9D/3

Note

1. When reassembling the two spool valve all 'O' rings and seals should be renewed.
2. Before reassembly check all parts for wear.

1. (Fig. 6). Place the bucket spool link (2) and cone nut (3) inside the body. Fit the handle assembly (1) with new 'O' ring (6), into place ensuring that the markings on both sets of teeth are matched, then screw the pivot screw (4), complete with new 'O' ring (5), into place. Repeat the process with the other handle and link.
2. (Fig. 5). Before inserting the boom spool (5) and bucket spool (6) lightly lubricate them with hydraulic oil. Insert the spools into their respective holes then attach them to the links with the chain links (21) and locking clips (20).
3. Replace the handle end covers (18) using new seals (19). Secure with the four screws (17).
4. Put the spring plate (16), stroke control spacer (14), centering spring (15) and spring cup (13) into position at the end of the bucket spool, then secure with the centering spring screw (11).
5. Assemble the spring plate (10), stroke control spacer (9), centering spring (8) and spring cup (7) at the end of the boom spool then screw the detent assembly (6) to the spool with the detent screw going through the centre of the pre-assembled items.
6. Position the centering spring stop (4) over the end of the bucket spool.
7. Renew the 3 'O' rings in the valve mountings (2) and assemble the mounting to the body (3) with the three screws (1).
8. (Fig. 4). Replace the check valve (8), spring (7) and check valve body (6), renew the 'O' ring on the valve body. Renew the five 'O' rings which form the seal between the side cover and the body, then replace the side cover (5) using the bolts (4).
9. Replace the boom check valve (3), spring (2) and check valve body (1), renew the 'O' ring on the check valve body.
10. Replace the four circuit relief valves and the main relief valve, ensuring that they are fitted in their correct positions as shown in Fig. 7. Renew the 'O' ring on each valve.
11. (Fig. 7). Refit the restrictors in each of the ports connected to the head side of the rams. The restrictor with the largest hole dia. 0.205 in. (5 mm), is fitted in the lift ram port. The other restrictor with hole dia. 0.125 in. (3 mm) is fitted in the bucket ram port.
12. Refit the complete spool valve as described in operation

KEY TO FIG. 7

1.	Relief Valve—Main	2125 p.s.i. (149.4 kg/cm²)
2.	Relief Valve—Bucket Ram, Head Side	5000 p.s.i. (351.5 kg/cm²)
3.	Relief Valve—Bucket Ram, Rod Side	3000 p.s.i. (210.9 kg/cm²)
4.	Relief Valve—Lift Ram, Head Side	5000 p.s.i. (351.5 kg/cm²)
5.	Relief Valve—Lift Ram, Rod Side	3500 p.s.i. (246 kg/cm²)

MAIN RELIEF VALVE

PRESSURE CHECKING

9D/4

1. Check that the hydraulic oil is up to the correct level.
2. Operate the loader system to bring the hydraulic oil temperature within the operating range.
3. Lower the bucket to the ground. Stop the engine and release any residual pressure within the system by working the loader control levers to and fro while the engine is stopped.
4. (Fig. 8). Remove the plug and connect in its place gauge No. MF 148A and adaptor No. MF 148-9.
5. Start the engine and operate the bucket control lever to crowd the bucket. Increase engine speed and crowd the bucket again thus causing the main relief valve to blow. Record the pressure at which the relief valve blows. If the relief valve is set correctly it should blow at 2125^{+100}_{0} p.s.i. ($149.4\ kg/cm^2{}^{+7}_{0}\ kg/cm^2$).
6. If the gauge registers an incorrect pressure renew the relief valve.

THE SEVEN SPOOL VALVE

CONTENTS

LIST OF ILLUSTRATIONS

SEVEN SPOOL VALVE

General

The seven spool control valve is mounted forward of the main frame. The seven services which operate the digger are controlled by the movement of the seven levers. The seven spools are shown on Fig. 1.

Key to Fig 1

1. Left hand stabilizer
2. Right hand stabilizer
3. Boom
4. Slew
5. Dipperstick
6. Bucket
7. Clamp

Each service can be used in conjunction with another. If a service other than the clamping service is operated, the clamping service also receives a boost of oil to ensure that the pressure of oil in the clamp cylinder is maintained.

Oil goes to the seven spool valve via the loader two spool valve and is free to flow through the block along the centre gallery which zig zags through each spool. When all the levers are in neutral, oil is free to flow through the centre gallery to the return pipe and back to reservoir.

The hydraulic circuit is shown in Fig. 2.

Key to Fig 2

1. Inlet Pressure Port
2. Clamping section
3. Bucket section
4. Dipperstick section
5. Slew section
6. Boom section
7. Left hand stabilizer section
8. Right hand stabilizer section
9. Outlet Port
10. Loader 2 spool valve
11. Left hand Stabilizer
12. Right hand Stabilizer
13. Boom Cylinder
14. Rotary Actuator
15. Dipperstick Cylinder
16. Bucket Cylinder
17. Clamping Cylinders

Fig. 3 Shows the seven spool valve with the boom spool in an operating position. The movement of the spool has blocked the centre gallery thus causing a build up of pressure in the gallery parallel to the centre. It is this oil which operates the service.

Fig. 4 Illustrates the flow of oil through the Stabilizer spool then out through the hoses to the rams. When the spool is raised oil is fed to rod side and the stabilizer retracts.Conversely when the spool is raised oil is fed to the head side and the stabilizer extends.

Key to Fig 4

1. Stabilizer feet
2. Spool
3. Parallel Gallery
4. Check Valve

Fig. 5 Illustrates the oil circuit for the boom. The lever is in a neutral position, the oil will thus be flowing through the open centre and not operating the service. Direct operated relief valves are incorporated in this section.

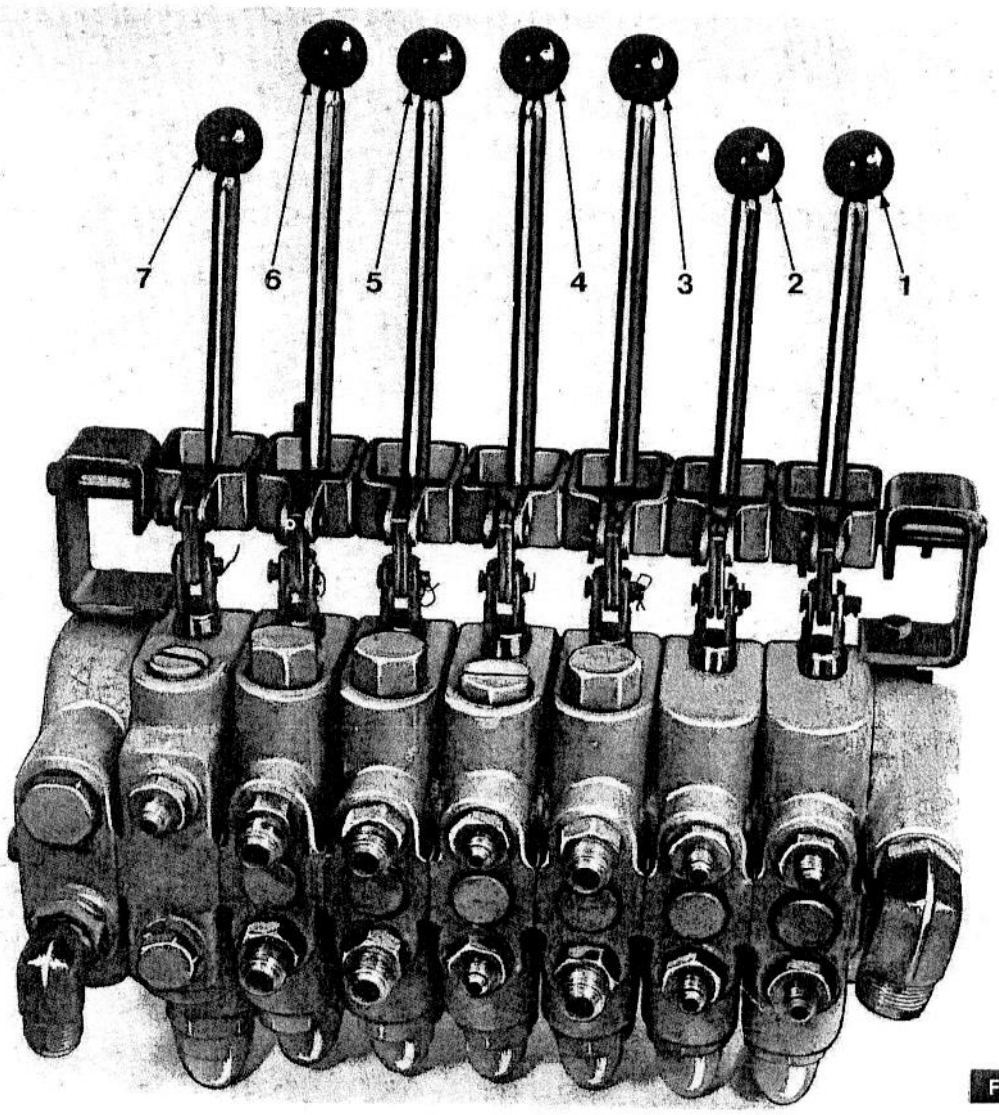


FIG. 1

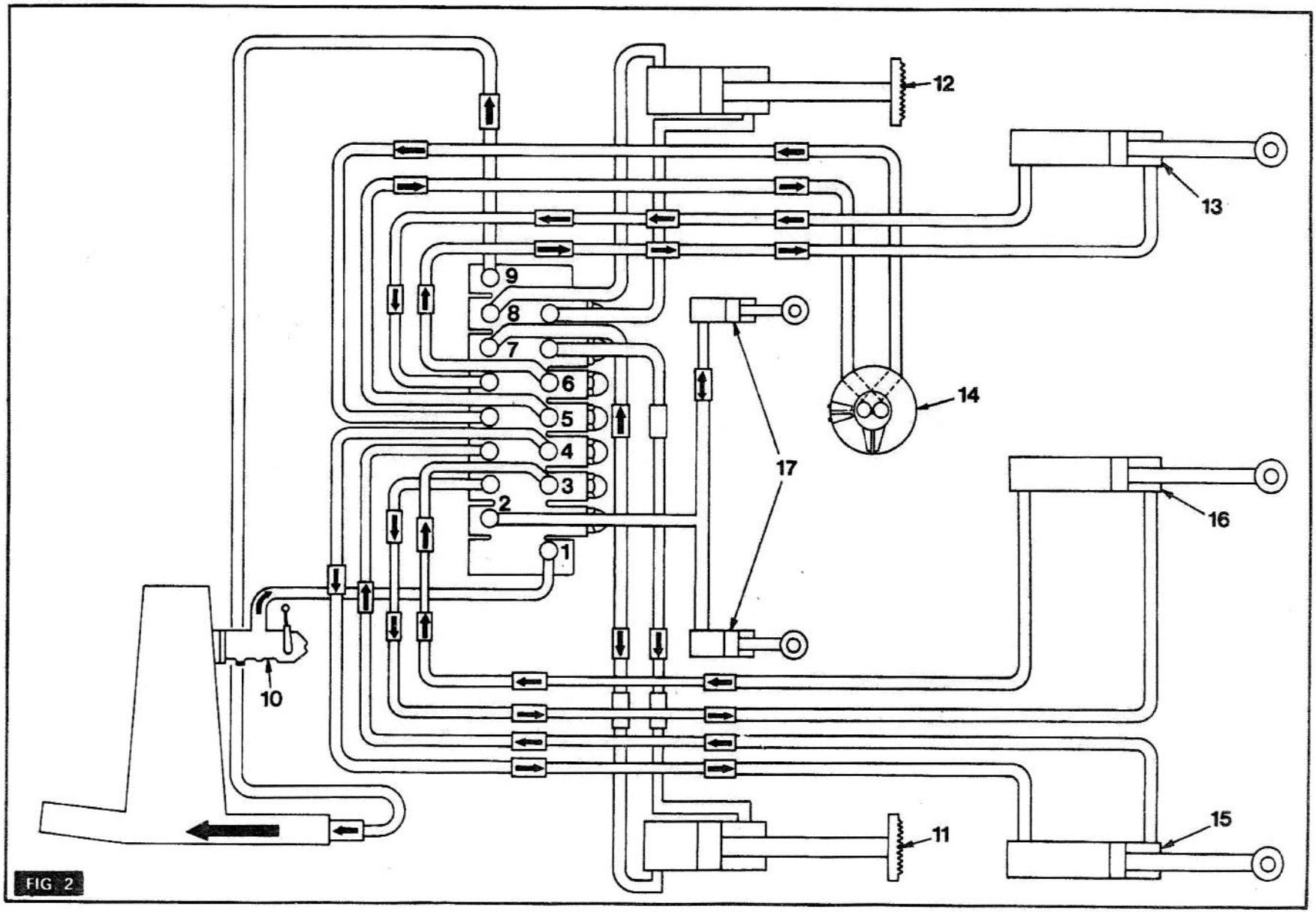


FIG 2

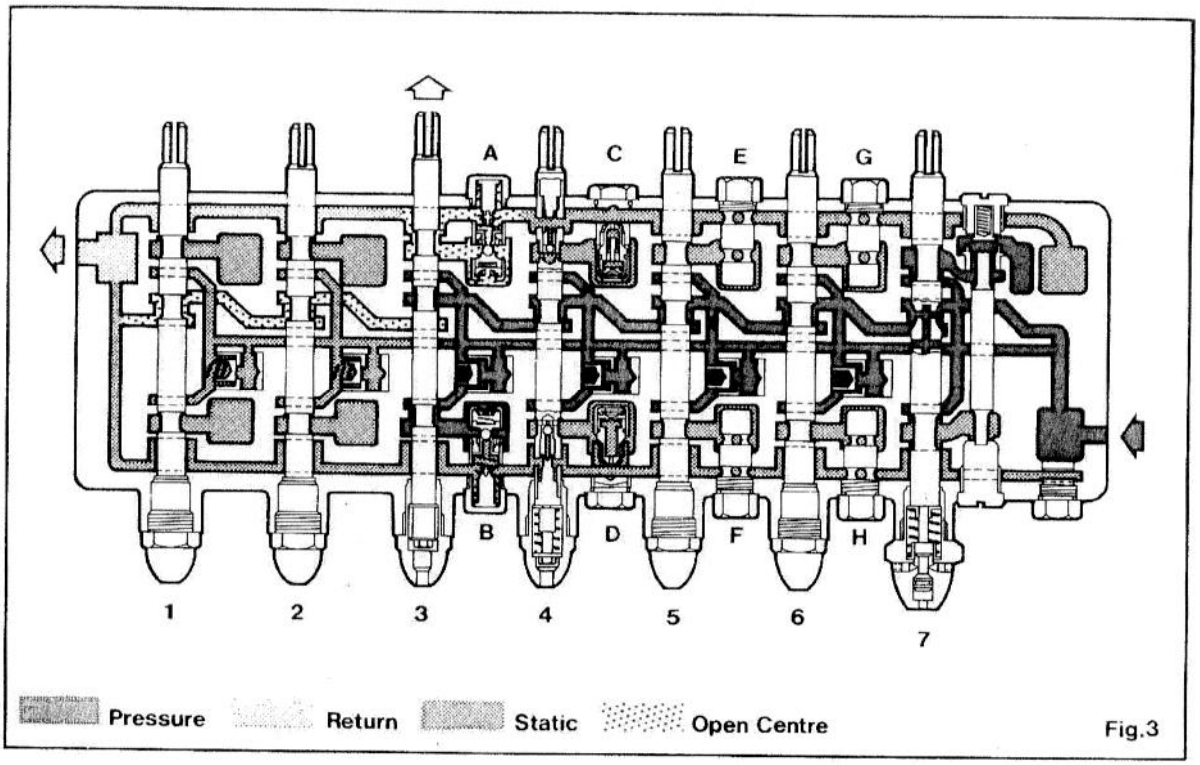


Fig.3

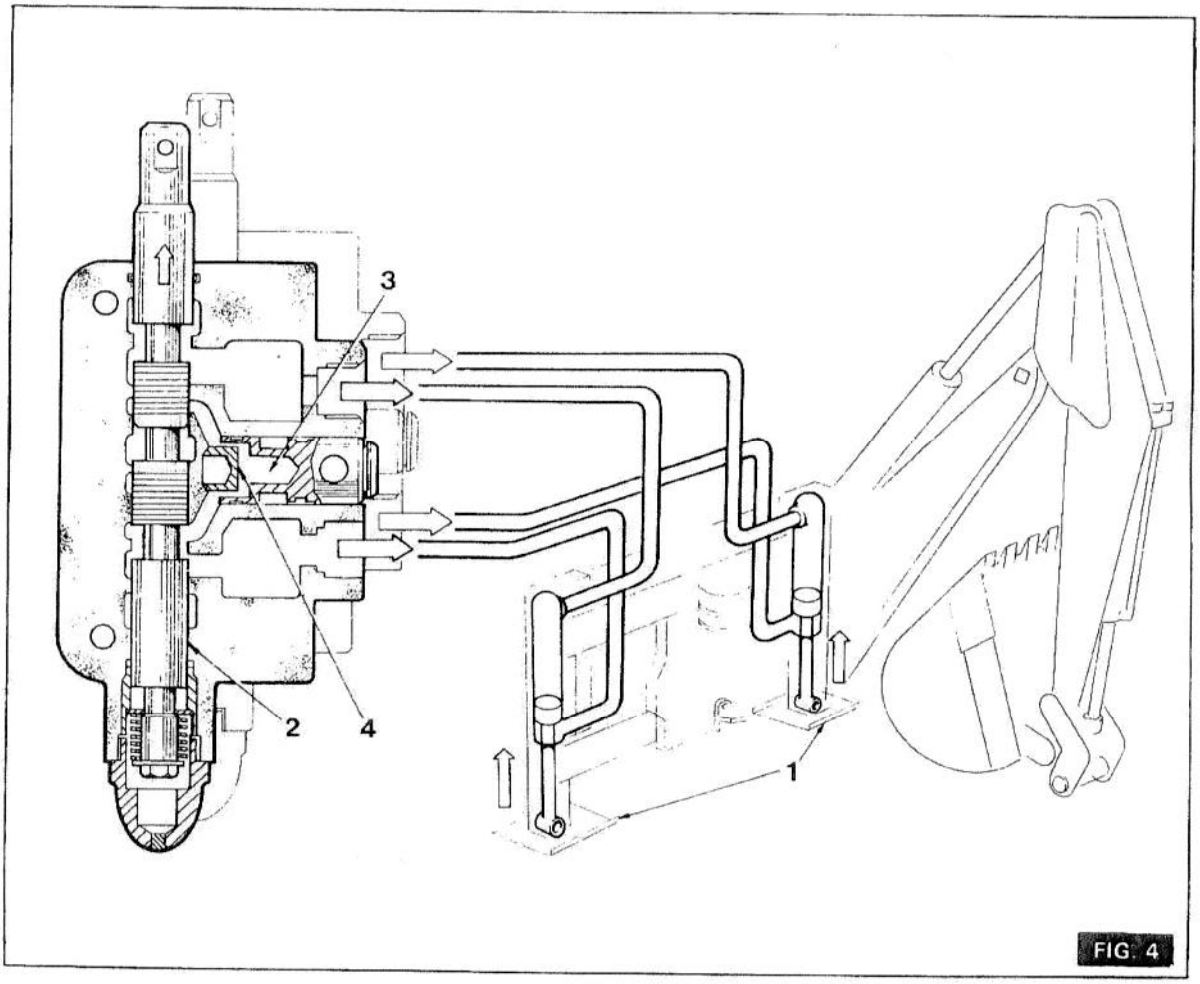


FIG. 4

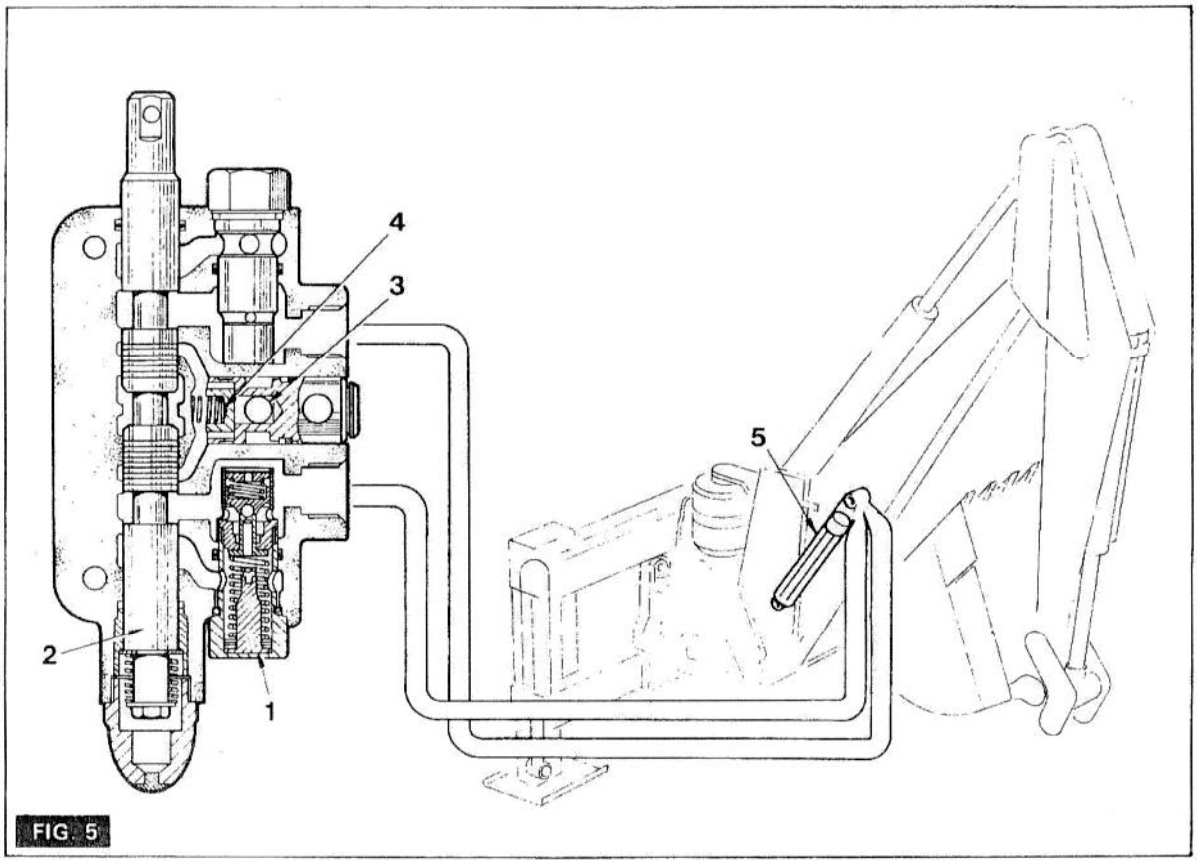


FIG. 5

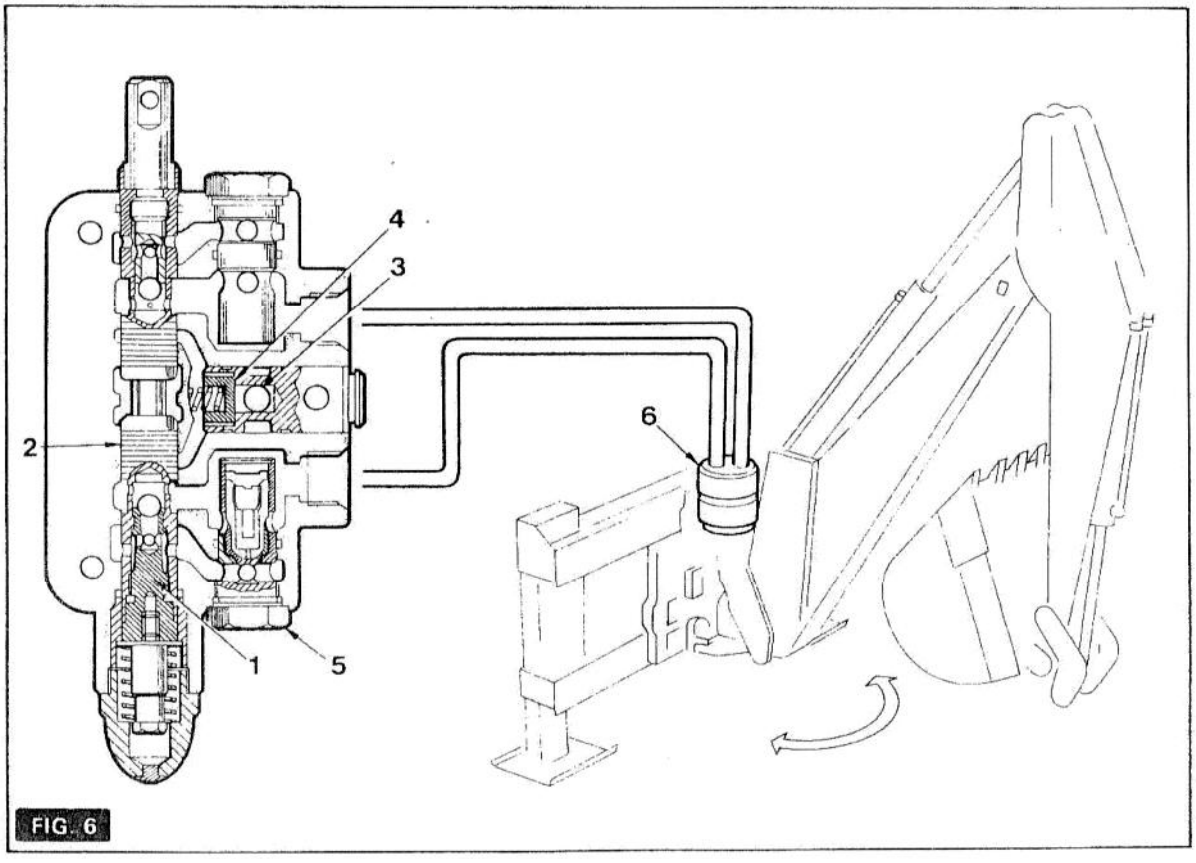


FIG. 6

SEVEN SPOOL VALVE

General . . . Cont'd

Key to Fig 5

1. Relief Valve 3000 lbs/in^2 (211 Kg/cm^2)
2. Spool
3. Parallel Gallery
4. Check Valve
5. Boom Cylinder
6. Relief Valve 2750 lbs/in^2 (193.3 Kg/cm^2)

Fig. 6 Shows the hydraulic lines between the slew spool section of the seven spool block and the actuator. The service is not being operated thus oil will be flowing through the open centre and returning to the reservoir.

Key to Fig 6

1. Anti-Cavitation Valve
2. Spool
3. Parallel Gallery
4. Check Valve
5. Circuit Relief Valve 2000 lbs/in^2 (140.6 Kg/cm^2)
6. Actuator

Fig. 7 The oil circuit between the dipperstick ram and the dipperstick section of the seven spool valve is shown in this figure. The spool is in an operating position pressurising the head side of the ram and retracting the dipperstick. The returning oil enters the valve through the upper port and then to the reservoir. The direct operated relief valves which are incorporated in this section are designed for operation on induced pressures only and are not main line reliefs.

Key to Fig 7

1. Relief Valve 3000 lbs/in^2 (211 Kg/cm^2)
2. Spool
3. Parallel Gallery
4. Check Valve
5. Dipperstick ram
6. Relief Valve 2750 lbs/in^2 (193.3 Kg/cm^2)

Fig. 8 This shows the flow of hydraulic oil when the bucket is crowded. The spool is raised pressurising the lower port which is connected to the head side of the bucket ram. Returning oil is directed to the reservoir through the upper port. Two identical direct operated relief valves are incorporated into this circuit.

Key to Fig 8

1. Relief Valve 2750 lbs/in^2 (193.3 Kg/cm^2)
2. Spool
3. Parallel Gallery
4. Check Valve
5. Bucket ram
6. Relief Valve 2750 lbs/in^2 (193.3 Kg/cm^2)

Fig. 9 The clamping section of the seven spool valve is the only one fitted with a detent. This section is fitted with a one way valve which allows oil into the clamping cylinder but does not allow it to retain except when the spool is held in the detent position. This section also allows the clamping cylinder to be pressurised when any other section of the spool valve is operated.

Oil enters the spool valve and travels along the centre gallery. When any other service is operated the centre gallery is blocked, pressure builds up in the parallel gallery and the check valve is lifted allowing oil through into the clamping cylinder.

When the spool is operated to clamp the unit, oil is diverted to the base of the check valve from the centre gallery. This lifts the check valve, allowing oil to flow to the clamping cylinder.

SEVEN SPOOL VALVE

General . . . Cont'd

When the spool is held in detent, the build up of pressure in the parallel gallery operates on the base of the plunger which lifts the check valve from its seat and allows oil to flow from the cylinder to the return pipe. The cross drilling in the spool itself is provided to allow a flow of oil along the centre or "zig zag" gallery when this spool is held in detent; this allows other services to be operated when offsetting the digger.

Key to Fig 9

1. Detent
2. Spool
3. Cross Drillings
4. Check Valve
5. Plunger
6. Clamp Cylinders

Colour Code for Figs 3, 4, 5, 6, 7, 8 & 9

Red	Pressure
Yellow	Flow
Blue	No Flow

SEVEN SPOOL VALVE

Removal and Replacement (9E/1)

1. (Fig. 10) Extract the two bolts (1) and remove the indicator plate (2).
2. Remove the four securing bolts (3) and lift the valve cover over the valve handles.
3. Disconnect the oil return pipe from the valve.
4. Disconnect the oil pressure pipe at the union under the left hand wheel arch.
5. Quickly connect the return pipe to the fixed pressure pipe thus forming a hydraulic circuit which excludes the digger.
6. Disconnect the services supply and return pipes from the valve.
7. Remove the three securing bolts and lift the valve, complete with levers, clear of the machine.
8. To replace the valve, reverse the above procedure.

SEVEN SPOOL VALVE

Disassembly (9E/2)

1. (Fig. 11) Remove the split pins (1) and linch pins (2) which connect the links (3) to the spools (4).
2. Unscrew the two screws (5) and remove the complete handle assembly from the spool valve.
3. Mark each section to ensure correct reassembly.
4. (Fig. 12) Unscrew and remove the two front tie bolts (1).
5. Remove the nut (2) and washer (3) from the apex tie bolt (4) and carefully withdraw the outlet end cap (5) then each section from the tie bolt.

SEVEN SPOOL VALVE

Reassembly (9E/3)

1. Fit the apex tie bolt (4) through the inlet end cap (6) then reassemble the complete block ensuring that the sections are in their appropriate place.

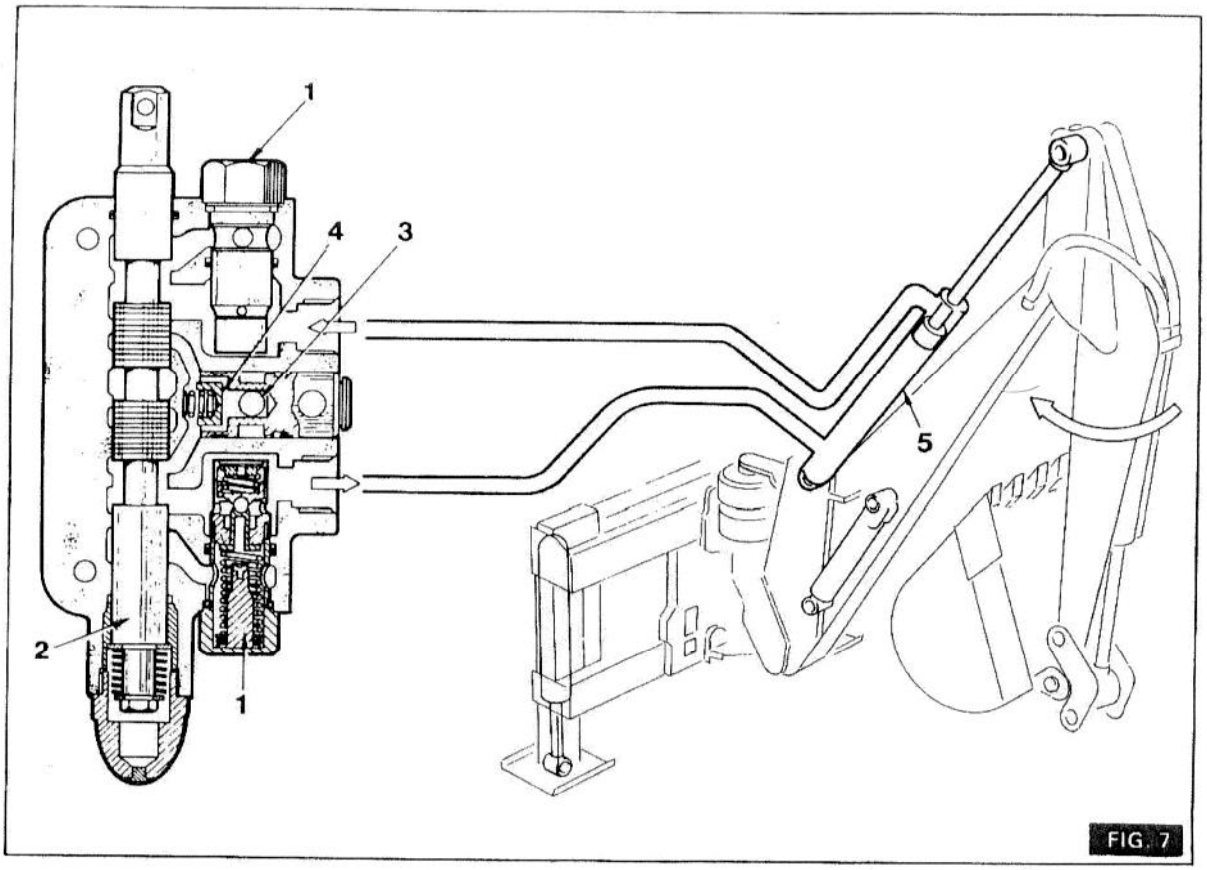


FIG. 7

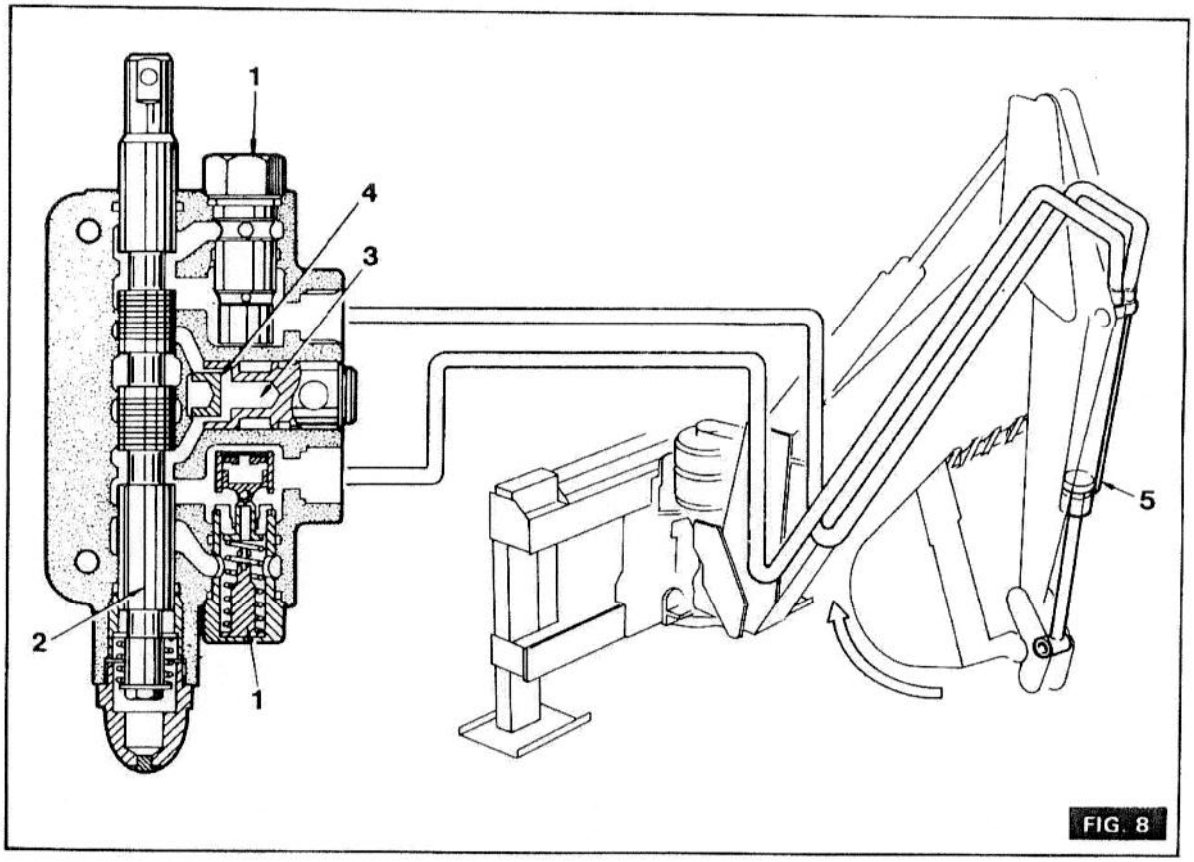


FIG. 8

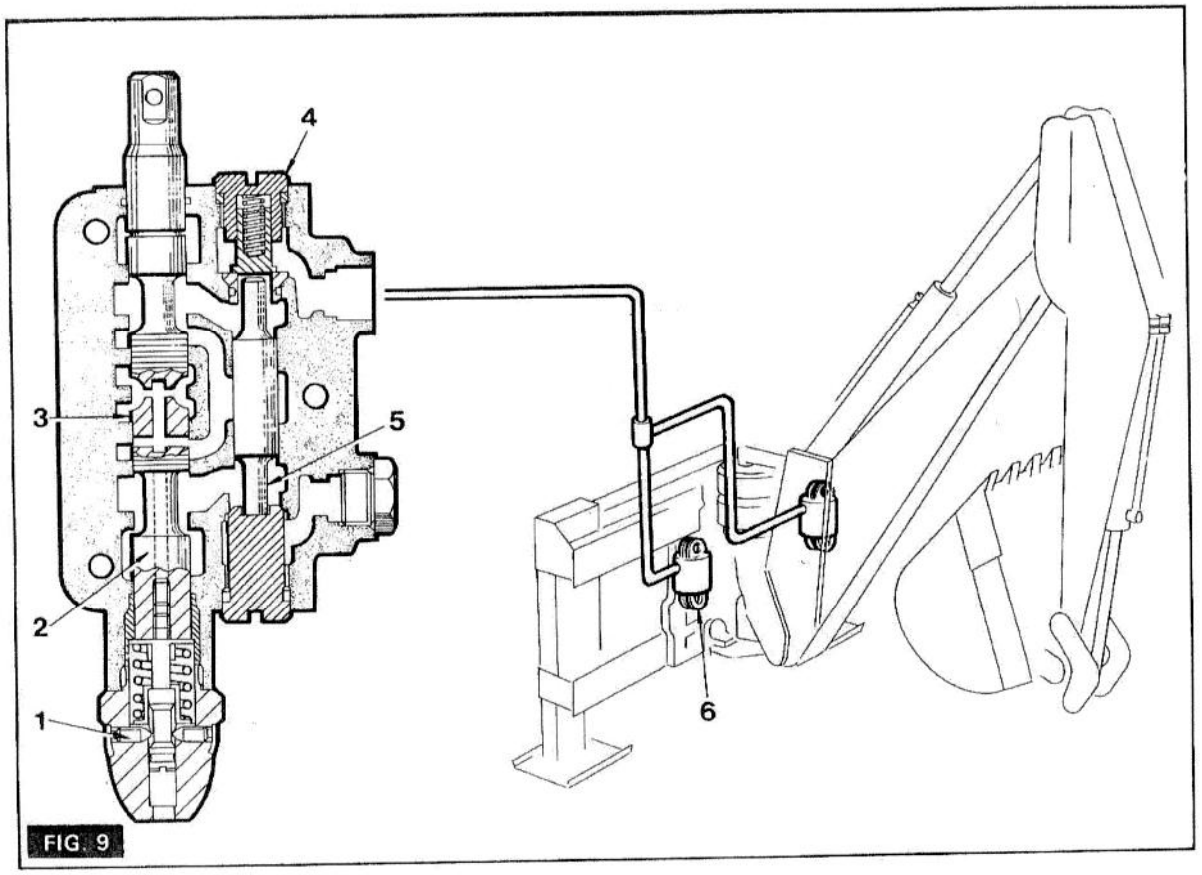


FIG. 9

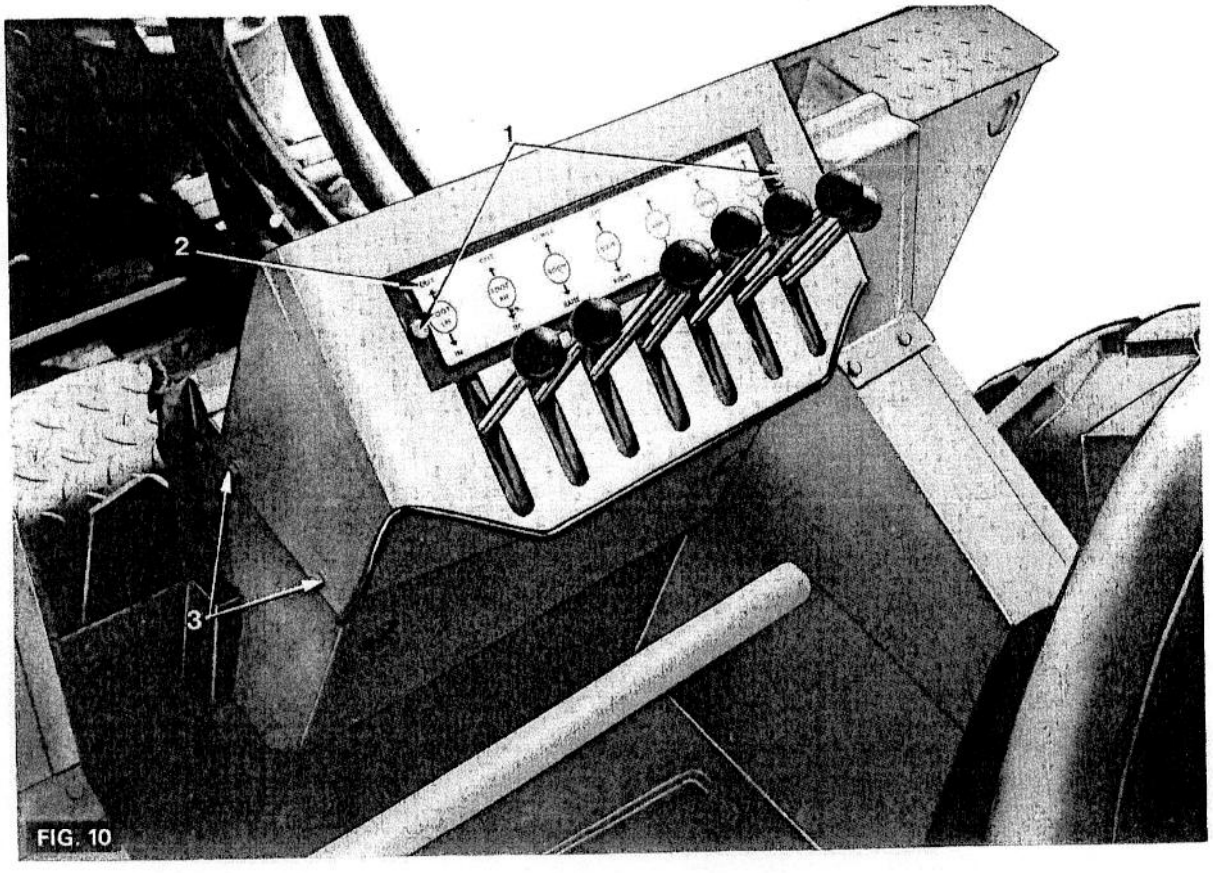


FIG. 10

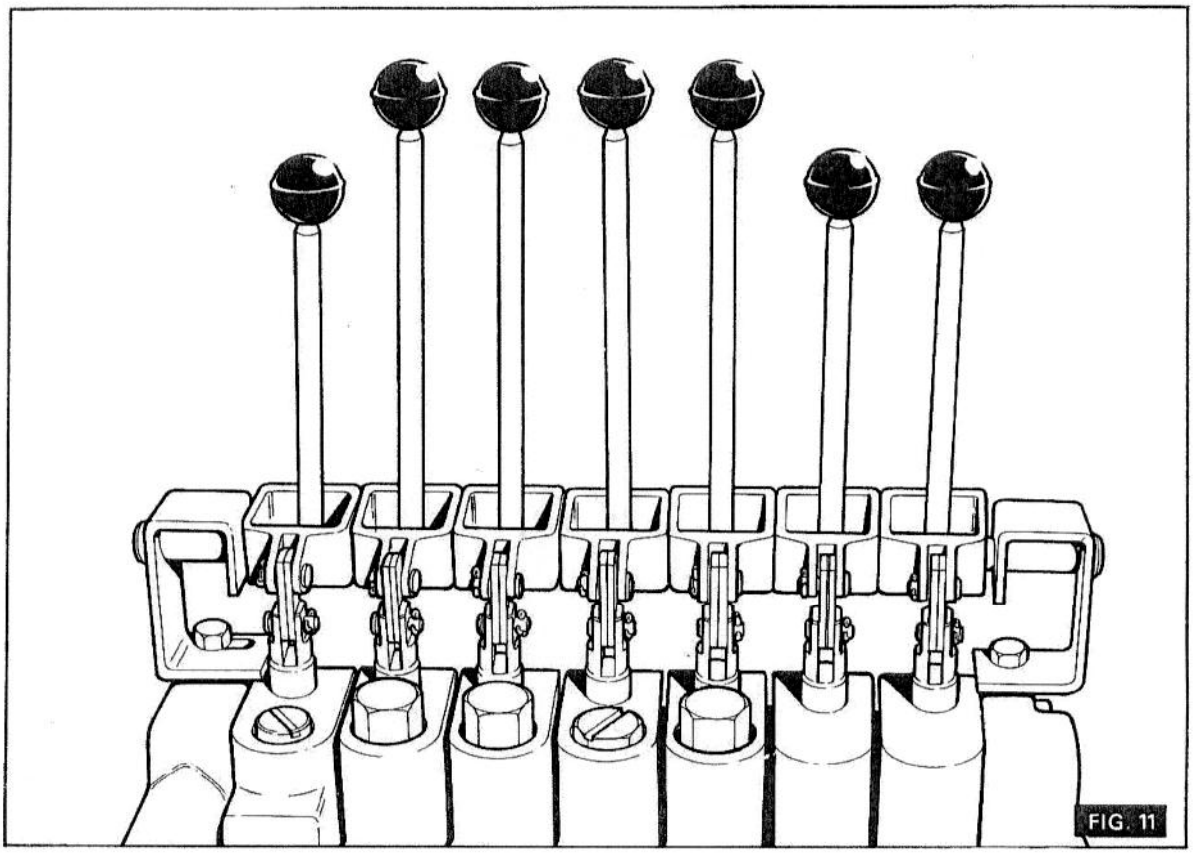


FIG. 11

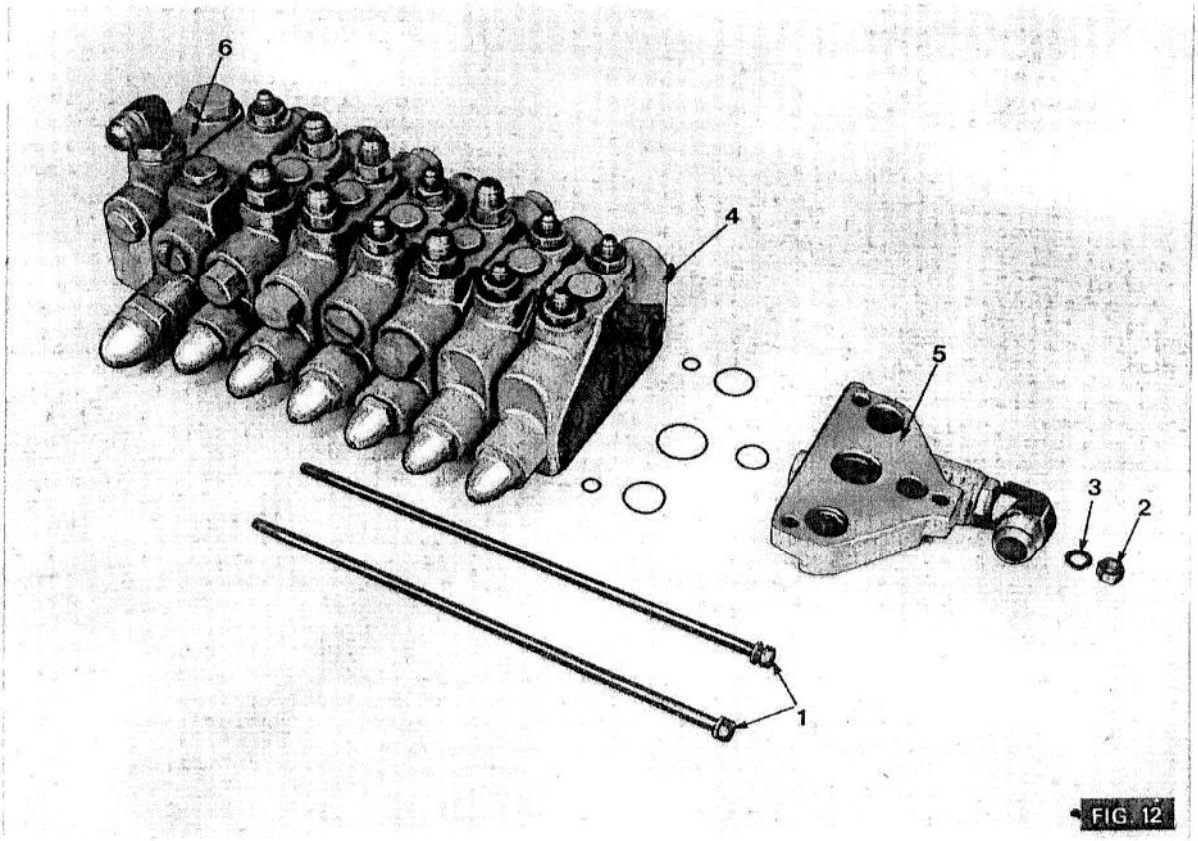


FIG. 12

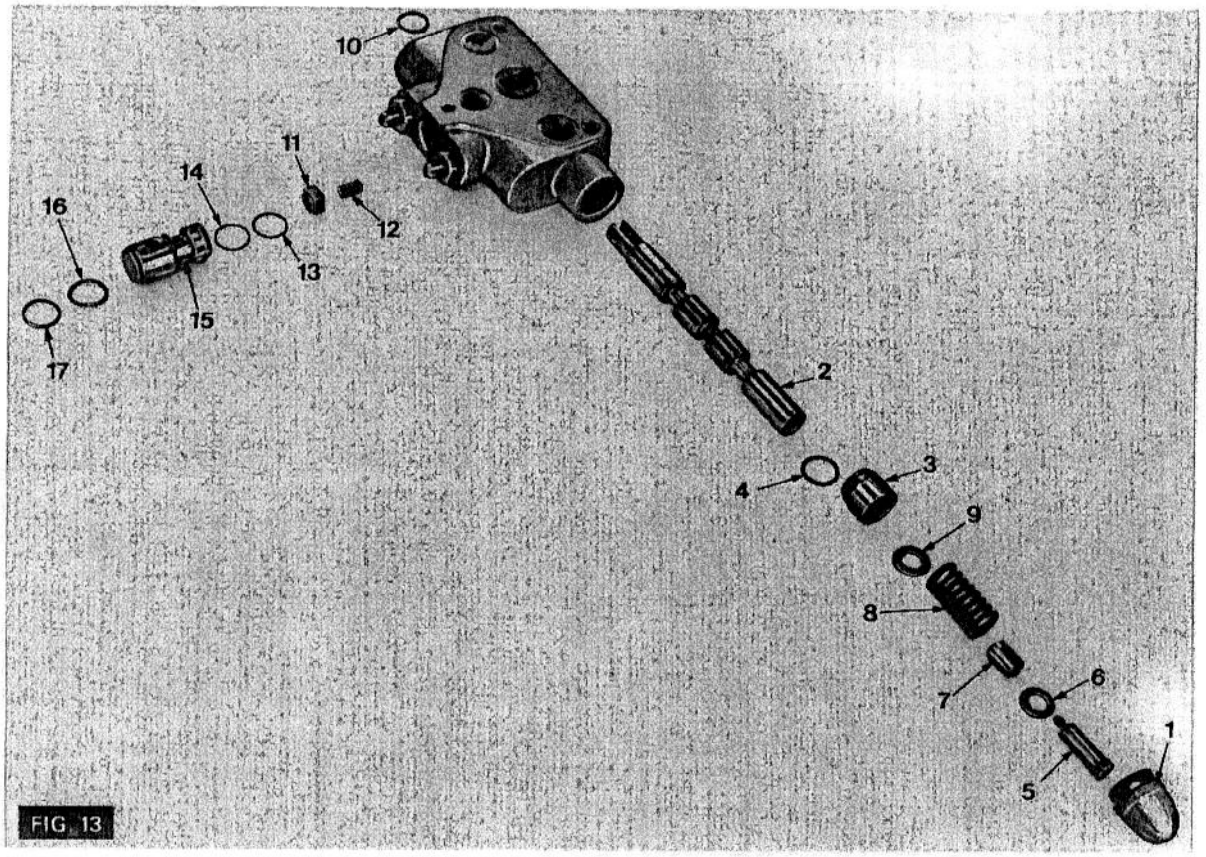


FIG. 13

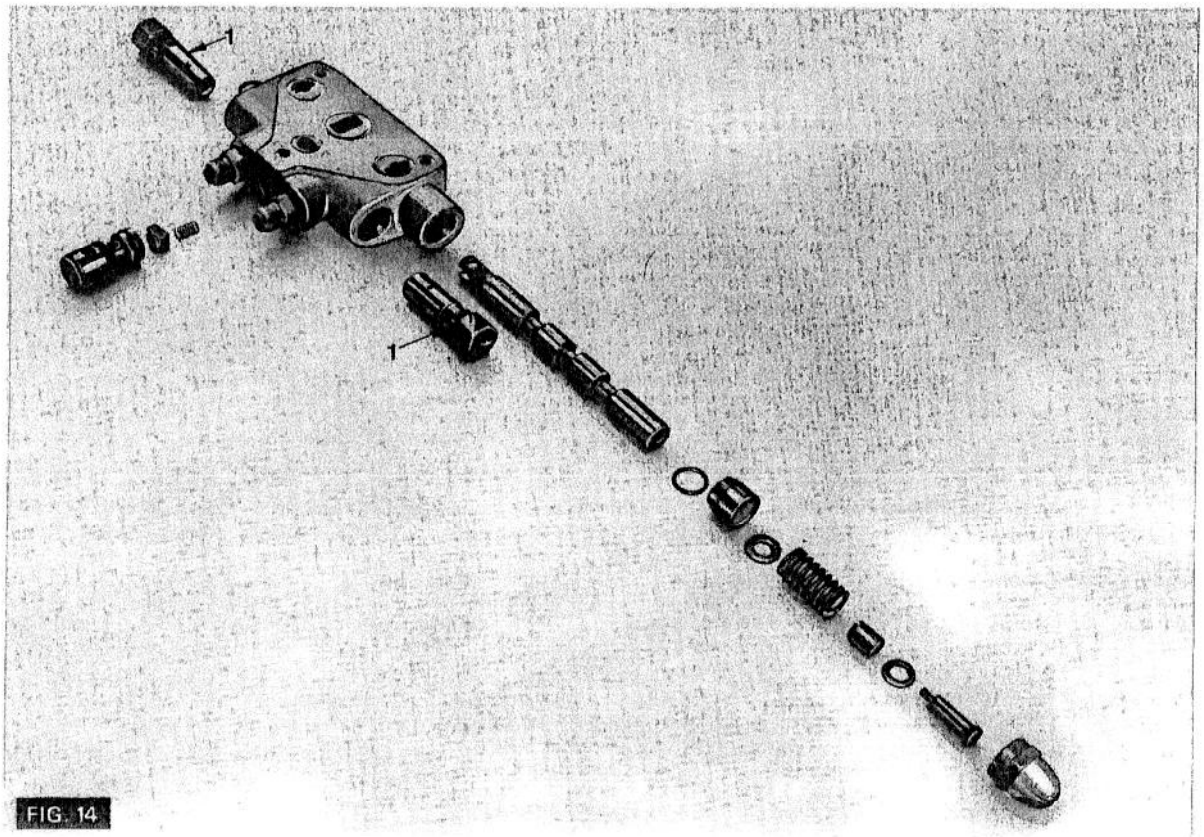


FIG. 14

ROTARY ACTUATOR

CONTENTS

LIST OF ILLUSTRATIONS

ROTARY ACTUATOR

GENERAL

The actuator is operated hydraulically and provides rotary movement of an output shaft over an arc of up to 186° maximum. External stops must be provided to limit this travel.

The unit comprises a cylindrical barrel housing a vane located lengthwise and fixed by cap screws and dowels to the barrel wall. Two end covers enclose the barrel and support a splined output shaft which passes axially through their centres. A second vane is formed integral with the shaft and can move over a 186° arc inside the barrel. The vanes are sealed by quad-section rubber seals sandwiched between anti-extrusion washers. Oil leakage from the shaft ends is prevented by an O-ring seal and backing washer located in a groove in each end cover.

Two oil ports are provided in the upper end of the shaft and these alternate as supply and exhaust ports according to the direction of rotation selected. When the output of the system pump is supplied to the actuator pressure is generated against the shaft vane causing the shaft to rotate inside the anchored barrel. Oil in the opposite side of the vane is directed back to the system oil reservoir. Torque reaction is taken by two dowels in the drive end cover locating in holes provided on the machine structure.

Two cushioning valves are housed in the shaft and these control the slewing speed and provide cushioning at each end of the vane stroke. Protection against excessive pressure caused by inertia loads is provided by two cross-line relief valves housed in the ported end cover.

Working in conjunction with the cushioning valves are two orifice plates fitted on top of the barrel vane, one on each side of the vane oil seal groove. These provide a cushioning zone over the last 47° of travel at each end of the vane stroke. The curved edges of these plates are spring loaded into contact with the surface of the shaft and the curvature of each plate is generated on a different centre to the shaft circumference, the effect being to produce a tapered slot. As the shaft rotates, the exhaust port travels across this slot, and the passage of exhaust oil from the actuator is progressively restricted.

A 'third line' feature comes into use if adverse operating conditions are causing cavitation to occur in the actuator. A third oil port in the end cover provides for the connection of a pipe from the return side of the system to supply make-up oil to either oil chamber of the actuator through the appropriate check valve. This port is blanked by a sealed plug until the actuator is installed.

ROTARY ACTUATOR OIL FLOW

The four conditions encountered in the operating cycle of the actuator are described below and illustrated in Parts I, II & III of fig. 2. For the purpose of description the shaft is shown rotating clockwise. A similar sequence of operations will take place when the shaft rotates in the opposite direction.

Part I Start of the Slewing Cycle

Oil flow directed by the operator control spool enters the actuator at **port** (A) passes into the oilway, through **control restrictor** (B) and into the lower **sleeve annulus** (C) of the **cushioning valve** (D). From here it passes along the waist of the valve into the **centre annulus** (E) along **transfer oilway** (F) in the centre of the shaft pressurising damping **restrictor plate** (G) against its return spring, thereby ensuring an unrestricted oil flow into the right hand side of the actuator barrel. Oil pressure generated against the **shaft vane** (H) causes the shaft to rotate in a clockwise direction.

Oil from the exhaust side of the shaft vane (Left Hand) passes along the **centre shaft oilway** (I) and into centre **sleeve annulus** (J) along the waist of **cushioning valve** (K) to the lower **sleeve annulus** (L) continuing into the vertical oilway returning to reservoir via **restrictor valve** (M).

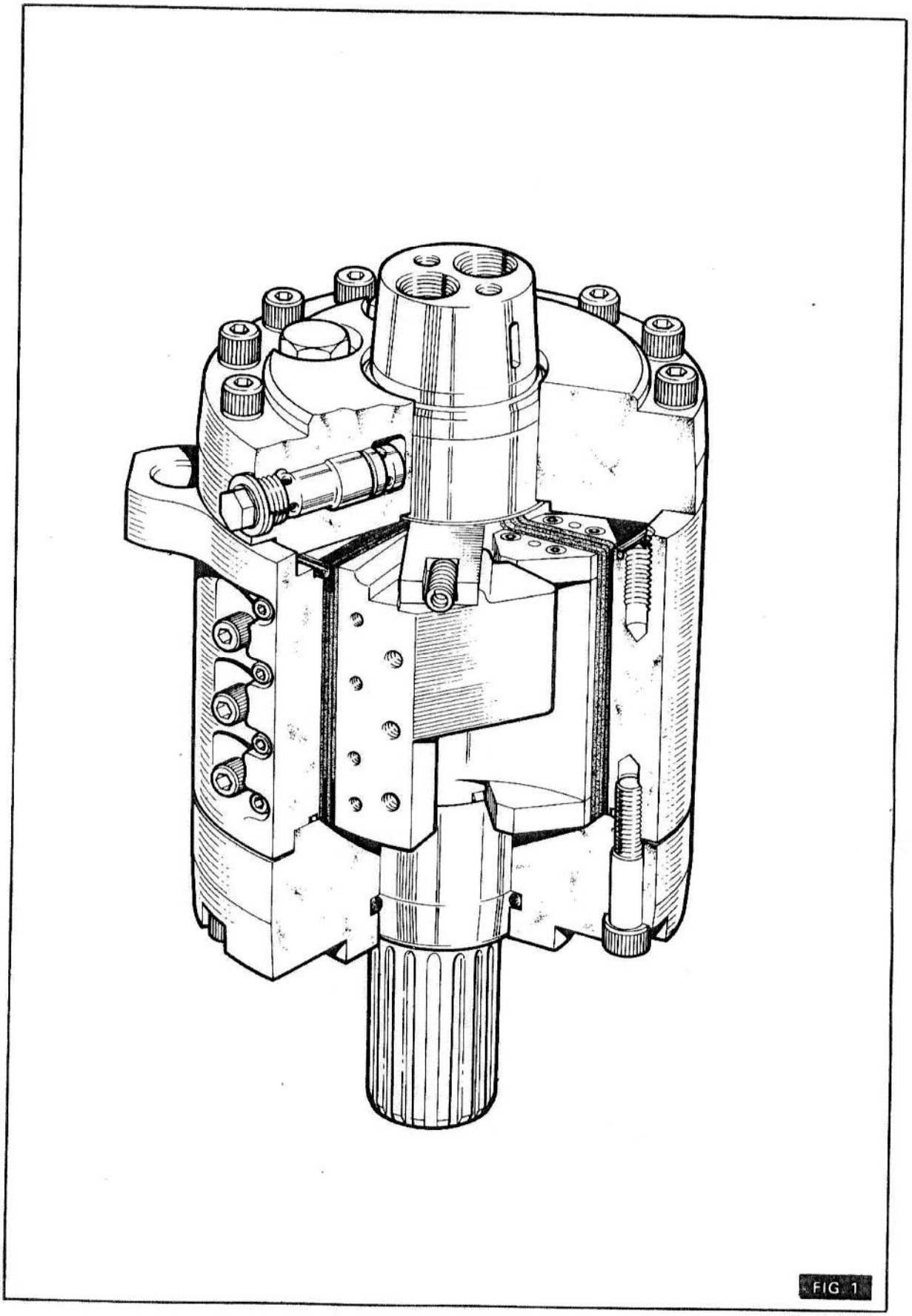
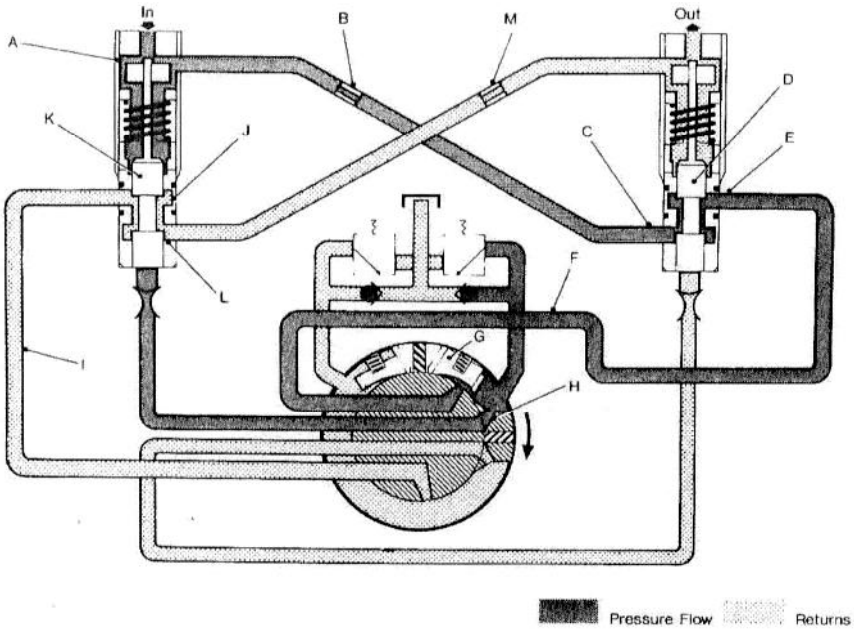


FIG 1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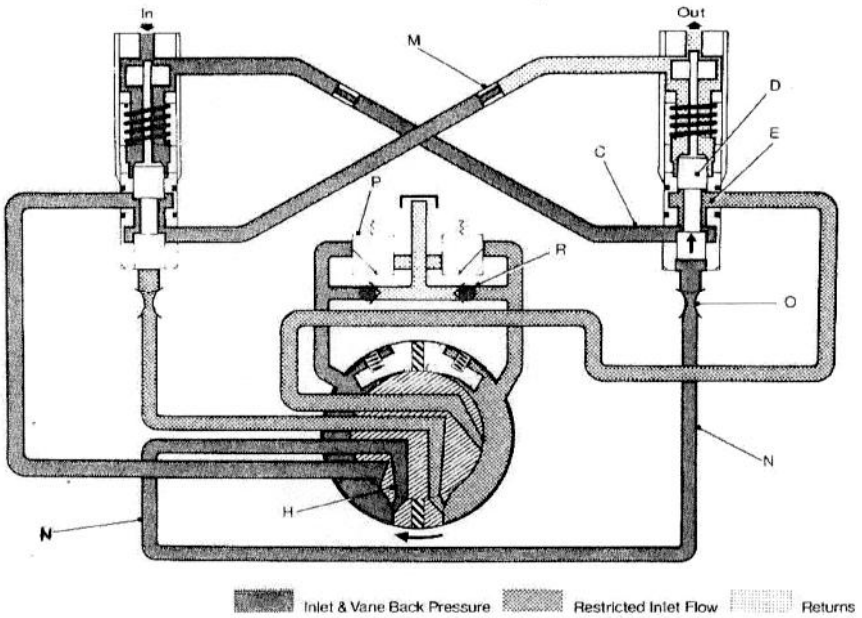
G
I
H
Pressure Flow
Returns


In
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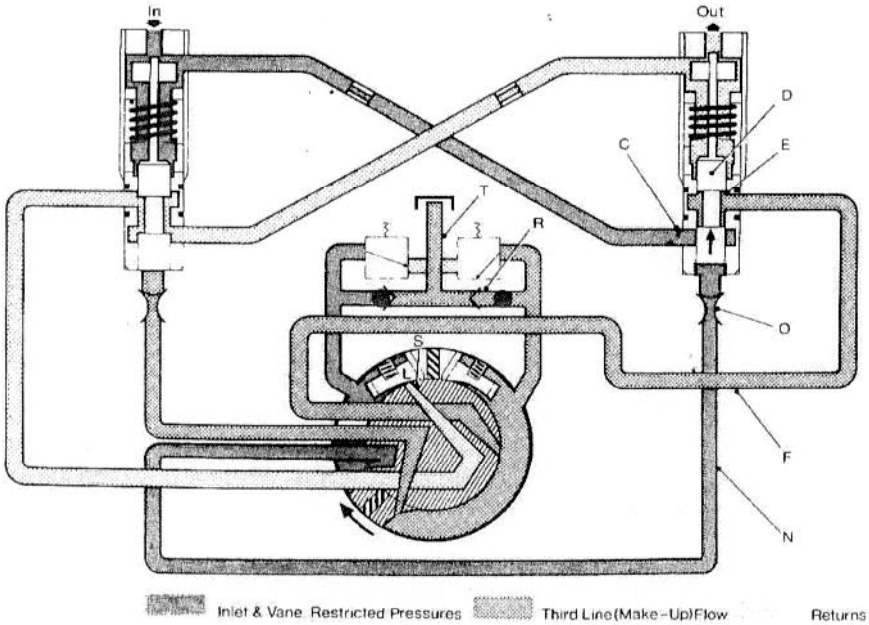
N
Inlet & Vane Back Pressure
Restricted Inlet Flow
Returns


In
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N
Inlet & Vane Restricted Pressures
Third Line (Make-Up) Flow
Returns

FIG.2.

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Distribution
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EE/D/IM
WEO/D/IM

No. 50H/HX/2200/02

Date 19.7.85

IM Service Bulletin

DOWTY ROTARY ACTUATOR - LOW PRESSURE SLEW CREEP

TRY Springs + Buffers First

ADVICE

A limited number of rotary actuators have been produced with the incorrect letters stamped on the top and bottom of the rotary actuator shaft. As you are aware shafts are stamped on the top and bottom with either the letter "B" or "N", this letter denotes the type of steel corner ring to be fitted on each end of the shaft vane.

Where incorrectly sized corner rings have been fitted a high rate of slew drift will be evident when:

a. The machine is transported without the safety bar fitted or

b. When the digger is being used with the backframe at an angle of 2-5% off horizontal.

It is essential that all machines are checked on first service or on the next visit to the machine.

When checking proceed as follows:

1. Position the machine on level solid ground.

2. Warm the oil to approximately 50° (120°F) and allow the actuator body to warm through by operating the actuator.

3. Extend the dipperstick fully, open the bucket and position the boom so that the bucket is approximately 30" off the ground.

4. Lower the stabiliser legs so that the rear wheels are clear of the ground.

5. Retract one leg slightly to allow the backframe to be 2-5% off horizontal.

6. With the engine at tick over and all controls in neutral check to see if any creep occurs within 5 minutes.

7. If the slew creep is above 1" per minute proceed as follows:

a. Lower the boom onto the ground and stop the engine.

b. Remove the rotary actuator assembly.

c. Note the letter "N" or "B" stamped on the top and bottom of the shaft. Dismantle the actuator.

d. Shaft journals graded 'B' should be fitted with the smallest end seal that will readily fit the journal ie. 'N' or 'U' grade. The 'U' grade being the smallest end seal. Part numbers for end seals are 'N' - MF 1888 303 M1 and 'U' - MF 3474 783 M1. It should also be noted that it is almost impossible to fit a 'U' end seal to a correctly graded 'B' journal and end seals should never be forced onto the journal as this could result in the end seal fracturing.

   'N' graded journals should be fitted with the 'U' grade end seal.

When the actuator has been reassembled it must be RESTAMPED with the letter of the rings used, plus the letter W to signify that it has been reworked.

Having reworked the actuator repeat the slew creep test. If creep above 21" per minute is found please contact Service Department immediately.

WARRANTY

Should an incorrectly identified shaft have been fitted the problem will be found on the machine very early in its life. To this end Warranty will only be accepted on machines with less than 250 hours recorded and this will be provided the following additional information is recorded on the Warranty Claim;

Actuator Serial Number, Creep rate in inches/minute both before and after rework the letter stamped on top and bottom of shaft both before and after rework, and the number of this service bulletin.

ADMINISTRATION

Warranty claims may be submitted for consideration provided the above conditions are complied with.

Massey-Ferguson (United Kingdom) Limited

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Registered in England No. 509133

Distribution UK/Db/IM

No. Addendum to 50D/2200/6
50 /2200/3

Date 4.5.83

IM Service Bulletin

SAFETY

MF 50D and MF 252 Diggers
Rotary Actuator

IM Service Bulletin 50D/2200/6 and 50/2200/3 give details of the changes to the Rotary Actuators which have now cut into production. Interchangeability however, with the earlier Actuators, is affected as follows:-

Warning

Since the porting and internal galleries have changed within the shaft; should a shaft, incorporating the new design flow control valves be fitted to an earlier type actuator, it is essential to alternate the two feel pipes. FAILURE TO COMPLY WITH THIS INSTRUCTION WILL RESULT IN THE DIGGER SLEWING IN THE WRONG DIRECTION AND COULD RESULT IN A SERIOUS ACCIDENT.

Warning

In the event of a new type actuator being fitted to replace an earlier design unit, then the same changes to the pipework, as stated above, must be strictly adhered to.

Parts

In cases where the old design actuator is being overhauled and it is found that the early type shaft is not available from CPO, it is possible to convert the actuator to the new design by use of a conversion kit, part number 1810 739 M91.

This kit comprises of a new shaft complete with flow control valves, plus two new shallow grooved orifice plates. (It is extremely important that the original deep grooved orifice plates are discarded).

Identification

Where early type actuators are converted by use of the above kit, it is important that the actuator is marked to identify that the conversion has taken place. This should be done by embossing with a letter "D" immediately following the actuator serial number. This will obviously assist in identifying the correct pipework layout.

SAFETY

SAFETY

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Distribution UK/Db/IM

No. 50/2200/3
50D/2200/6

Date 24.5.83

IM Service Bulletin

This bulletin replaces issue one dated 4.5.83 which should be removed from your files and destroyed.

MF 50D and MF 252 DIGGERS

ROTARY ACTUATOR

Advice

With effect from the following serial numbers a new Rotary Actuator has cut into production.

MF 50D - 2 Wheel Drive - 2882W1237
MF 50D - 4 Wheel Drive - 2915W509,W510
W529 onwards with the exception of
2915W540 and W545
MF 525 Digger - 2877W20525

This new actuator has a change in the slew characteristics which not only affect performance but also change the hydraulic piping arrangment.

(a) Deletion of the slew cushioning valves and associated cross drillings within the shaft. Deletion also of the recess orifice plates which are spring loaded against the shaft and located on the top of the stationery vane.

(b) The above cushioning valves have now been replaced by flow control valves located in parallel feed ports. The deep recess orifice plates have been replaced with new design shallow orifice plates.

Consequential to these changes, the oil is no longer transferred internally via the cross drillings from one port to the other, hence the change in the hydraulic piping, e.g. on the earlier actuator, oil fed into the left hand feed port, slewed the digger to the left and vice versa for the other direction of slew.

On this new actuator, oil fed into the left hand feed port will slew the digger to the right. Oil fed into the right hand feed port will slew the digger to the left.

Servicing the New Actuator

The servicing procedure remains as detailed in the MF 50D Workshop Service Manual, Group 8, Section C, with the exception of the following:

Servicing the Shaft

In the unlikely event that the flow control valves require replacement, they should be removed by unscrewing the hexagon head. Prior to refitting, the threads on the new valve assembly and the shaft must be thoroughly cleaned and degreased. Apply Loctite Grade 222 to the outer threads of the valve assembly only, fit the valve and tighten to 2.03-2.71Nm (1.5 to 2lbs ft). DO NOT OVERTIGHTEN OR ALLOW LOCTITE TO COME IN CONTACT WITH ANY OTHER PART OF THE VALVE, SINCE THIS WILL RESULT IN CUSHIONING MALFUNCTION.

Parts

The part numbers of these new items will be notified by CPO in the normal way.

Rubber Slew Stops

To allow correct cushioning to take place with the actuator, it is essential that the rubber slew stops, as fitted to the pivot post mast casting, are shimmed to give accurate "stand-out" between the mast and the outer face of the stop. To check this, adopt the following procedure.

1) With the digger central on the frame, slew the boom into the frame and raise the boom to position the transport link bracket (Item 1 on attached sketch) midway up the frame upper slide rail rear (Item 2).

2) Apply full system pressure to hold the boom as close to the frame as possible.

3) Shim the rubber stop to provide 13 to 16mm clearance between the supper slide rail and the transport lug.

4) Repeat for both sides.

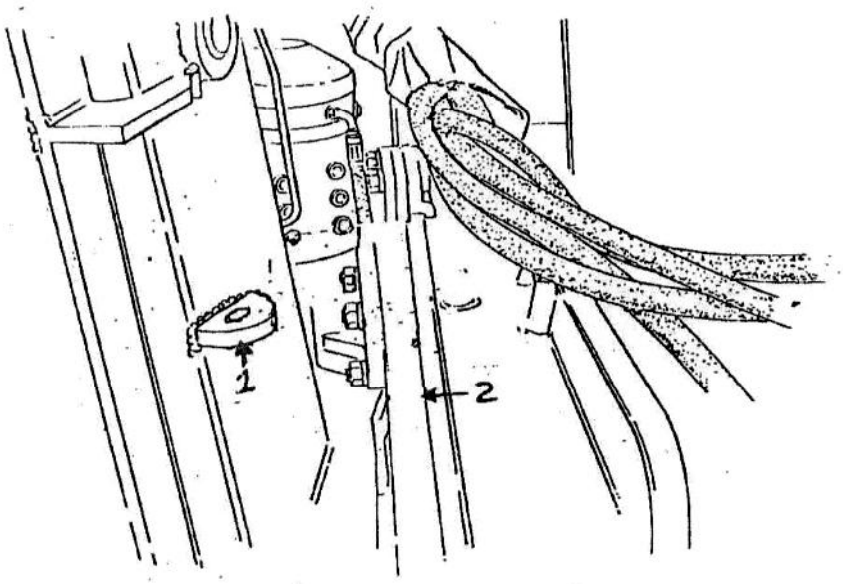
5) Slew the boom assembly through 180 degree arc in both directions for a minimum of 5 times to expel all air from the system and to allow the external stops to settle. Re-check the boom to backframe clearance as detailed in item 3.

Administration

This bulletin is issued for technical advice only and does not constitute authority for mandatory action and warranty claims submission.

GA/cb

50D/2200/6
50/2200/3.



Part II Slewing at Controlled Speed

As the vane shaft rotates and slew speed increases, the restriction afforded by **control restrictor** (M) in the vertical return oilway, causes a rise in back pressure on the exhaust side of **shaft vane** (H). This pressure is also felt along **oilway** (N) and **damping restrictor** (O) onto the area at the base of **cushioning spool valve** (D). When this back pressure reaches a value between 200/500 p.s.i. (14.0/35.1 Kg.cm^2) cushioning spool (D) moves upwards, and out of alignment with the **lower sleeve annulus** (C) thus restricting the input flow to annulus (E) thereby modifying the supply of oil to the pressure side of the vane shaft controlling the slewing speed of the digger unit.

If, however, the operator control spool is returned to the neutral position before the shaft vane has completed its travel, the inertia of the digger assembly load will continue to rotate the shaft. Pressure falls on the input side of the vane and cavitation tends to occur. At the same time pressure increases on the exhaust side and it is this pressure which is sensed by the cross-line shock valve (P). At the pre-determined pressure setting of 2,800 p.s.i. (196.8 Kg.cm^2) the valve will open and allow oil to transfer through check valve (R) into the input side of the actuator barrel to make up for the deficiency in supply. As the pressure falls the valve closes and the vane shaft is then hydraulically locked by oil trapped between each side of the actuator shaft vane and the operator control spool.

Part III Cushioning the End of the Stroke

At a position of 47° from the end of the vane stroke the exhaust port in the shaft starts to move across the tapered slot, formed between the damping **restrictor plate** (L) and the vane shaft, into the cushioning zone, as **port** (S) moves across the slot from the widest to the narrowest part of its taper a progressive restriction of the exhausting oil takes place, causing an increase in pressure on the exhaust side of the vane. This excess pressure is also felt in the **oilway** (N) and **restrictor** (O) onto the base of spool **cushioning valve** (D) causing it to lift and progressively cut off the input supply via **sleeve annulus** (C) and (E).

As load inertia of the digger continues and the input supply of oil is cut off cavitation tendencies will occur within **supply line** (F) and the input side of the actuator barrel, the relief of which is overcome by the third line **check valve** (R) which is drawn off its seat, thus allowing oil to replenish the input side of the actuator via **supply line** (T).

KEY TO FIG. 2

A.	Port	G	Restrictor Plate	M.	Restrictor Valve
B	Control Restrictors	H.	Shaft Valve	N.	Oil Way
C	Sleeve Apparatus	I	Centre Shaft Oilway	O.	Damping Restrictor
D.	Cushioning Valve	J	Sleeve Apparatus	P.	Cross Line Shock Valve
E.	Centre Apparatus	K.	Cushioning Valve	R.	Check Valve
F.	Transfer Oilway	L.	Sleeve Apparatus	S.	Part
				T.	Supply Line

ROTARY ACTUATOR
Removal

9F/1

1. Slew the boom to either left or right to gain access to the actuator.
2. (Fig. 3) Remove the outer half of the hose clamp (1).
3. Disconnect the two hydraulic connections (2).
4. Disconnect the anti cavitation pipe (3).
5. Extract the two securing bolts (4) and remove the bracket (5).
6. Unscrew the six bolts (6) from the underside of the actuator.
7. (Fig. 4) Screw three bolts (1) into the three equi-spaced threaded holes in the actuator attachment flange until the bolts 'bottom' against the base of the actuator.
8. Screw an eyebolt or lifting bracket into the central ½" U.N.F. threaded hole in the top of the actuator centre shaft. This will facilitate the use of adequate lifting apparatus to remove the actuator.
9. Use a scriber and mark each flange and the adjacent housing and pivot post, this will help ensure that the correct relative positions are re-obtained during re-assembly.
10. Taking each of the bolts in turn, screw in each bolt until it is tight. This method will progressively lift the actuator away from the flange and break the friction grip between the location dowels and the actuator mounting flange.
11. Using a hoist and sling lift the actuator away from the pivot post.

Warning

The actuator is heavy and cannot be lifted by one man without the use of lifting apparatus.

ROTARY ACTUATOR
Replacement

9F/2

To ensure that the correct relative positions between the pivot post, the actuator and the actuator centre shaft are re-obtained, align the arrow on the splined end of the shaft with the arrow on the spline of the pivot post.

1. Apply a light coating of grease to the male and female splines.
2. Align the master splines and lower the actuator onto the mounting flange.
3. (Fig. 3) Check that the splines and locating dowels are correctly located and engaged, then tighten the six attachment bolts (6).
4. Remove the eyebolt, replace the bracket (5) and secure with two screws (4).
5. Reconnect the anti-cavitation hose (3).
6. Reconnect the hydraulic connections (2).
7. Re-clamp the hydraulic hoses by replacing the outer half of the clamp (1).

ROTARY ACTUATOR
Disassembly

9F/3

1. Remove the actuator from the machine as stated in Operation. 9F/1
2. Place the actuator on a suitable stand, screw two blanking plugs into the oil ports in the shaft to prevent dirt entering the cushioning valves.
3. (Fig. 5) Remove the 14 cap screws (1) which secure the end cover to the barrel, noting the position of the three waisted screws.
4. (Fig. 6) Insert a 3½in. x ½in. dowel in each of the waisted cap screw holes and refit the screws.
5. (Fig. 7) Screw the three waisted screws down onto the dowels. Progressively tighten the screws to lift the cover, at the same time, using a hide hammer, ensure that the shaft does not lift as this may cause damage to the internally fitted sealing rings.
6. Lift the end cover clear of the shaft and lay on a clean bench with the machined face uppermost, cover with a clean cloth to prevent damage.
7. Position the two vanes at 90° to each other.
8. (Fig. 8) Remove the large O-ring (1) from the barrel recess.
9. Mark then remove the restrictor plates (2) and springs (3) then carefully extract the metal sealing ring (4). Label the sealing ring 'PORTED END'.
10. (Fig. 9) Make up a dummy end cover from 3/8in. material, e.g. wood, plastic, etc., 9½in. O.D. with a 4.1/8in. I.D. hole in the centre. Place this over the shaft and locate in the barrel. Secure the cover with three allen screws and flat washers.
11. Invert the actuator. Remove the bottom cover as in operations 3, 4 and 5.

Note

14 cap screws secure the bottom cover to the barrel, however, 6 of these form part of the mounting for the actuator to machine and when actuator is removed from the machine only 8 cap screws will be found in the bottom cover.

12. (Fig. 10) Remove the large O-ring (1) from the barrel recess and the metal end seal (2) from the shaft. Label the end seal 'DRIVE END'.
13. (Fig. 11) Screw a lifting eye into the end of the shaft and raise the shaft clear of the barrel.

Examine the machined faces of the end covers and the swept surface of the barrel for scoring. Bad scoring will mean renewal of the complete actuator. Examine the vane seals and renew as necessary. If the actuator has had a long service life it is advisable to renew the shaft end seals.

ROTARY ACTUATOR
Reassembly

9F/4

On early models the shaft corner seals are graded into two sizes and are identified by one size of seal being electronically dyed black while the other is left in its natural colour. On later models the corner seals are similarly

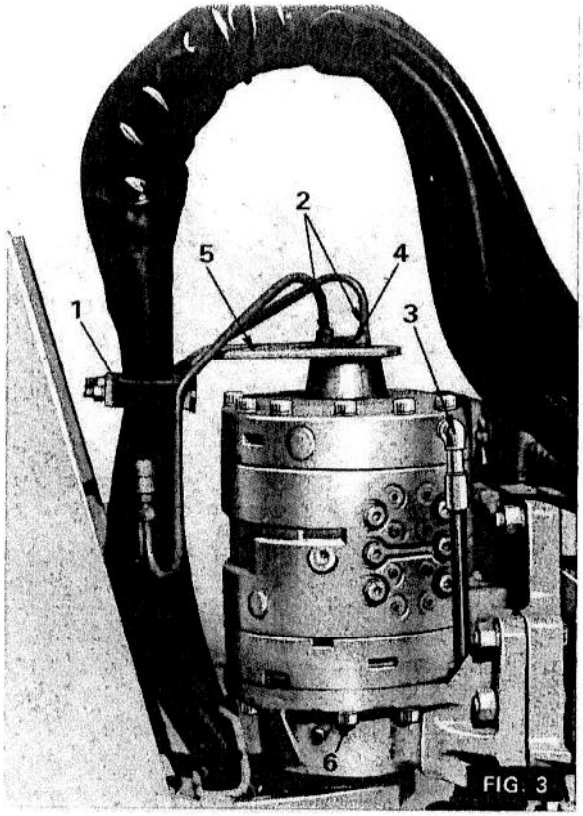


FIG. 3

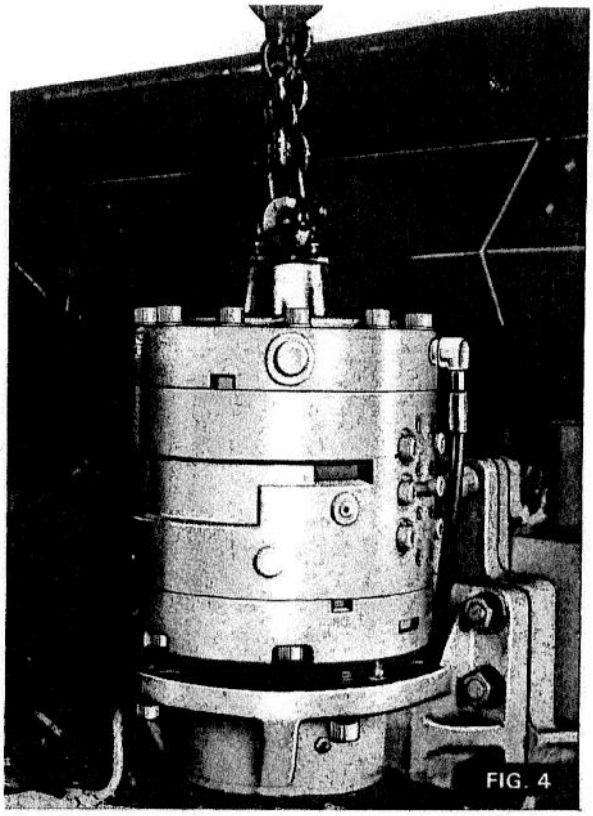


FIG. 4

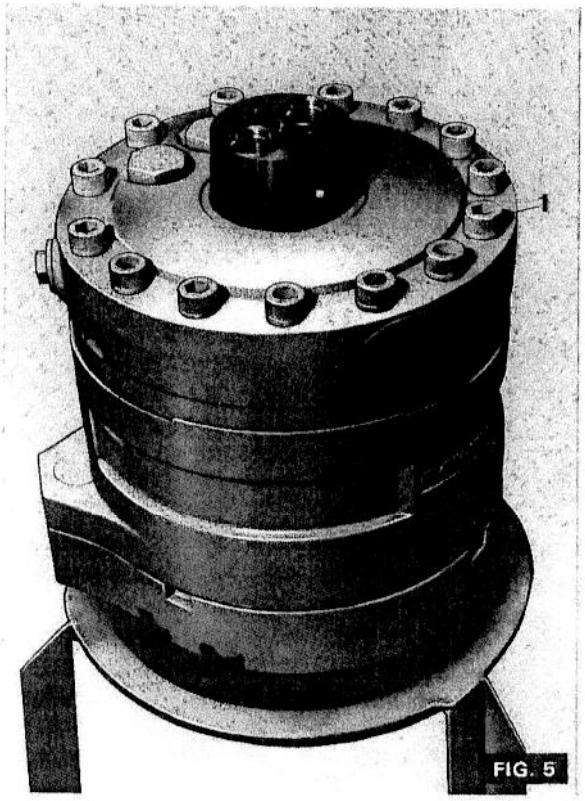


FIG. 5


FIG. 6

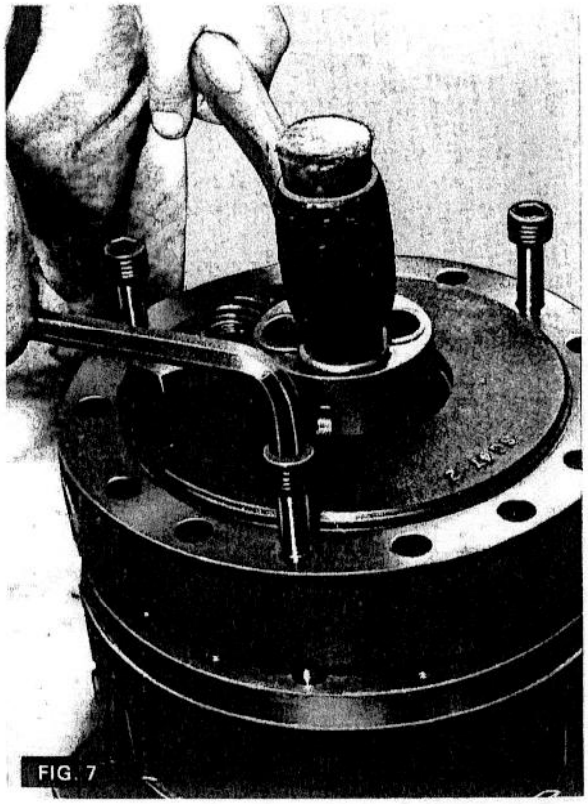


FIG. 7

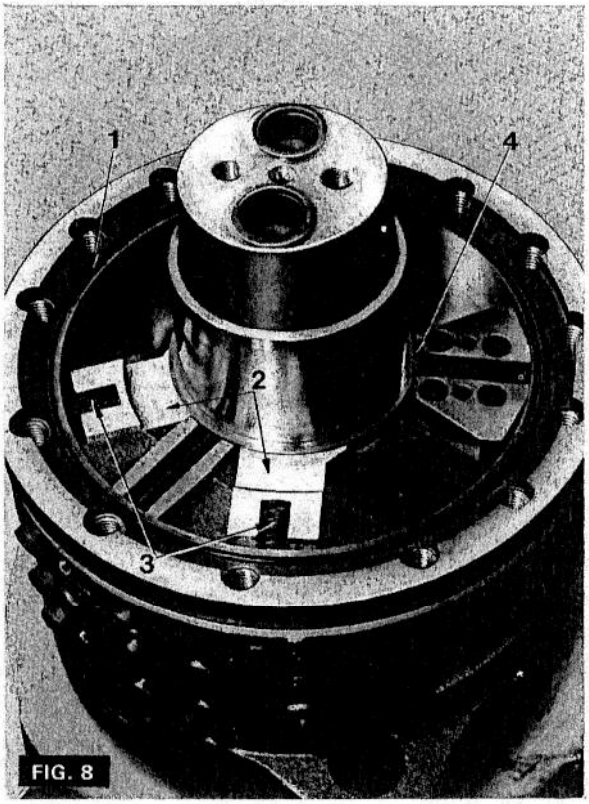


FIG. 8

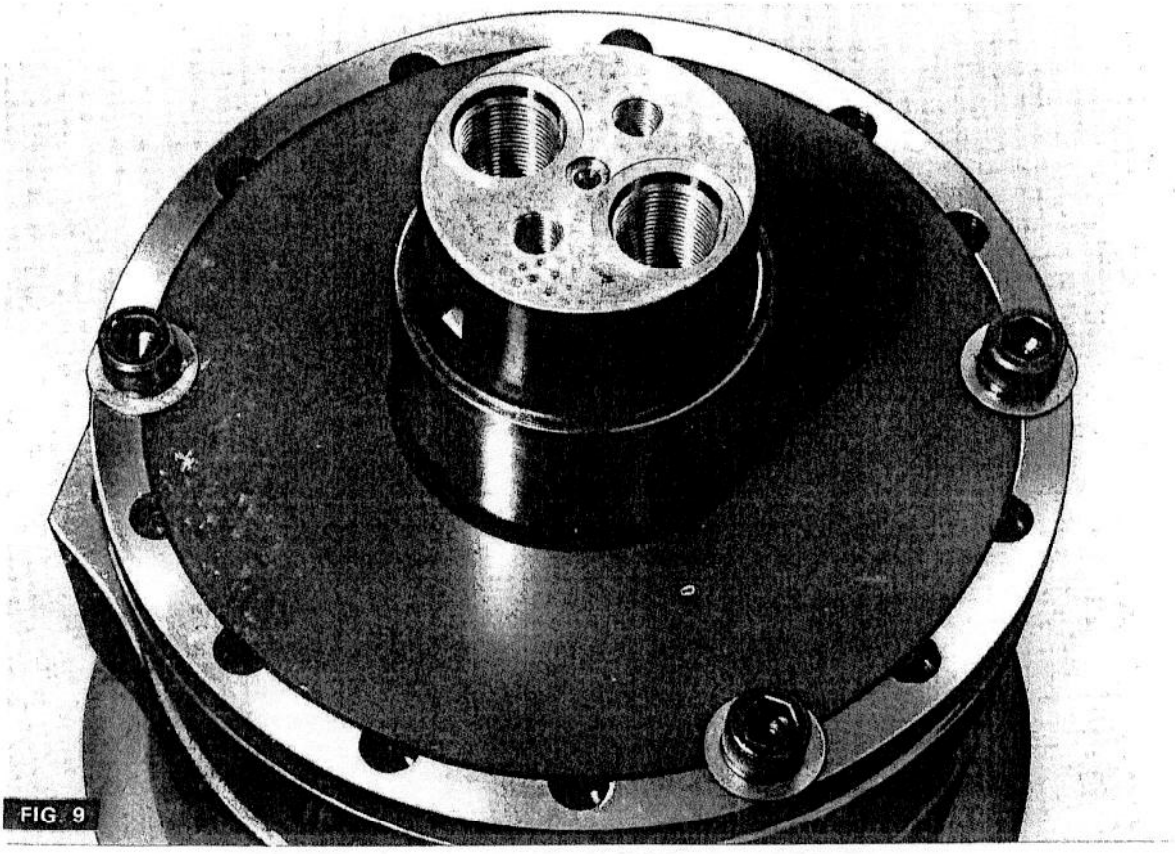


FIG. 9

ROTARY ACTUATOR
Reassembly . . . Cont'd

graded but identification is made by the letter B or N and the appropriate part number being etched on the flat surface of the seal.
If early seals are found in any actuator they must be replaced by the later version.

1. Fit the dummy end cover into the barrel recess and support it on two wooden blocks so that the barrel is vertical with the locating dowel end uppermost.
2. Lubricate a new O-ring with thin, mineral-base grease and place this in the barrel recess.
3. (Fig. 13) Prepare the two end covers for assembly as follows:–
   Fit new O-rings (1) and spiral backing washers (2) in the grooves in the bores. The O-rings must be fitted in the side of the groove nearest the machined face of the end covers. Apply thick, mineral-base grease and push the O-rings and washers radially outwards into the grooves. Oil the bearing bores.
4. Oil the barrel wall and the bearing lands on the shaft with clean oil of the type used in the hydraulic system. If a new shaft assembly is being fitted remove the four blanking plugs from the oil ports in the vane.
5. Screw a ½in. UNF eyebolt into the threaded hole in the splined end of the shaft, attach the hoist and position the shaft above the barrel with the vane at 90° to the barrel vane. Lower the shaft into the barrel, locating it against the dummy end cover.
6. Detach the hoist and fit the metal end seal, labelled 'Drive End', with the flat face uppermost, so that it is seated in the quadrantal cut-outs in the vanes.
7. Clean the machined face of the drive end cover and lower it squarely over the shaft, aligning the dowel hole with the hole in the barrel.
8. Lightly oil all fourteen cap screws and screw in finger tight. Ensure that the six longer screws and the three waisted screws are fitted in the holes previously noted. Oil the locating dowel and tap in until it has just started in the barrel hole.
9. Leave the six longer cap screws finger tight – these secure the actuator to its mounting on the machine and will be removed again when the actuator is installed. Tighten the remaining eight cap screws firmly in a diagonal sequence to pull the end cover down squarely into the barrel. Tap the locating dowel fully home in the barrel. Finally apply a torque load of 200 lbf-ft. (27,5 mkg) to each of the eight cap screws.
10. Invert the barrel, support on the two wooden blocks and remove the dummy end cover. Fit the two orifice plates and springs in the slots in the barrel vane as previously marked.
11. Lubricate and fit a new O-ring seal in the barrel recess.
12. Fit the metal end seal labelled 'Ported End' over the shaft with the flat face uppermost, so that it seats in the quadrantal cut-outs in the vanes.
13. Clean the machined face of the ported end cover and lower it over the shaft into position in the barrel, aligning the marks previously made.
14. Lightly oil the fourteen cap screws and screw in finger tight. Ensure that the three waisted screws are fitted in the holes previously noted. Tighten the cap screws firmly in a diagonal sequence to pull the end cover down squarely into the barrel. Finally apply a torque load of 200 lbf-ft. (27,5 mkg) to each cap screw.

ROTARY ACTUATOR
Performance Test

9F / 5

The object of this test is to ensure that maximum slewing speed and optimum cushioning are being obtained.

Before carrying out the test make certain that there is sufficient room to slew the boom over its full arc of travel without obstruction.

1. Start the engine and set to run at 1200 rev/min.
2. Stabilize the digger and fill the bucket.

ROTARY ACTUATOR
Performance Test . . . Cont'd

3. Crowd the bucket and extend the dipstick to maximum reach. Set the boom so that the bucket is about 2ft. clear of the ground.
4. Slew the boom all the way to the left.
5. Select 'SLEW RIGHT' and hold the control lever in this position.
   During the last 47° of travel the boom should slow down and come to rest gently against the travel stop. If the slewing speed is too fast the cushioning will be insufficient and the boom will hit the stop. To overcome this decrease the slewing speed by decreasing the spring compression in the left hand cushioning valve as described in 9F/11. If the slewing speed is too slow the boom will come to rest before reaching the stop and then creep slowly on to it. To overcome this increase the slewing speed by increasing the spring compression in the left hand cushioning valve as described in Operation.
6. Repeat operation 5, slewing the boom to the left. Any adjustment necessary must be made on the right-hand cushioning valve as described in Operation 9F/11.
7. Return the control lever to neutral and stop the engine.

SHAFT VANE SEALS
Renewal

9F/6

1. Remove the actuator centre shaft as stated in Operation 9F/3.
2. (Fig. 14) Carefully prise out the old seal (1) and back-up washer (2) from the groove in the vane.
3. Clean out the groove and remove any burrs or sharp edges.
4. Lubricate the new seal and back-up washers with mineral-base grease.
5. Fit one back-up washer (3) in the groove. Next fit the oil seal (4) and finally, the second back-up washer (5).
6. Check that the seal and back-up washers are pushed in to the full depth of the groove, especially in the corners where the vane merges with the shaft.
7. Replace the shaft as stated in Operation.

BARREL VANE SEALS
Removal

9F/7

1. Dismantle the actuator as stated in Operation 9F/3
2. (Fig. 15) Remove the eight taper plugs (1) from the barrel.
3. Unscrew and remove the four outer cap screws (2) and their composite seals (3).
4. Using a punch tap the dowels (4) free from the barrel and vane.

   Note: One dowel is shorter than the others. Its position is indicated by the words SHORT PIN and an arrow cast on the outside of the barrel. (Fig. 16).
5. Support the vane (5) remove the two remaining cap screws (6) and composite seals (7) and lift the vane out of the barrel.
6. Remove the old seal (8) and back-up washers, (9) clean out the seal groove and remove any burrs or sharp edges.

BARREL VANE SEALS
Replacement

9F/8

1. (Fig. 15) Lubricate a new seal (8) and two new back-up washers (9) with thin, mineral-base grease. Place one of the back-up washers in the vane groove with the 45° cut in the side of the groove that will be in contact with the barrel wall. Next fit the oil seal and then the other back-up washer with the 45° cut positioned as before.

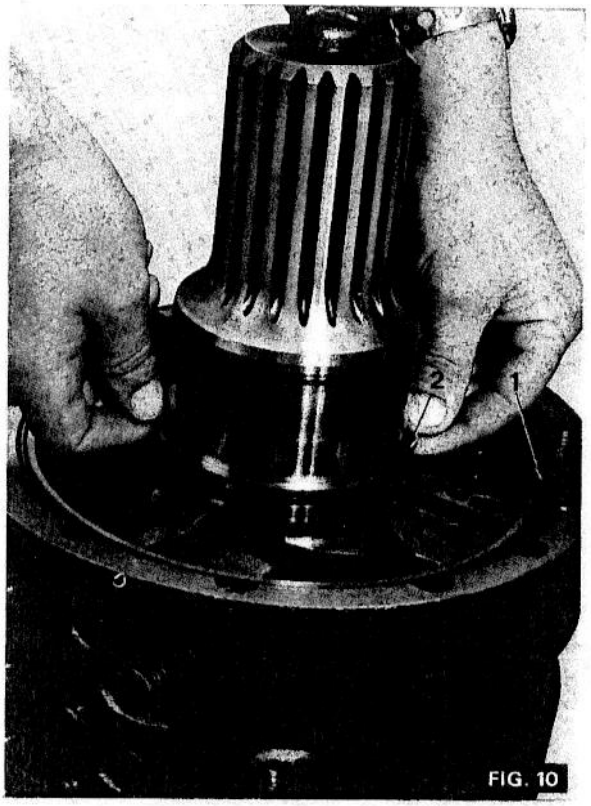


FIG. 10

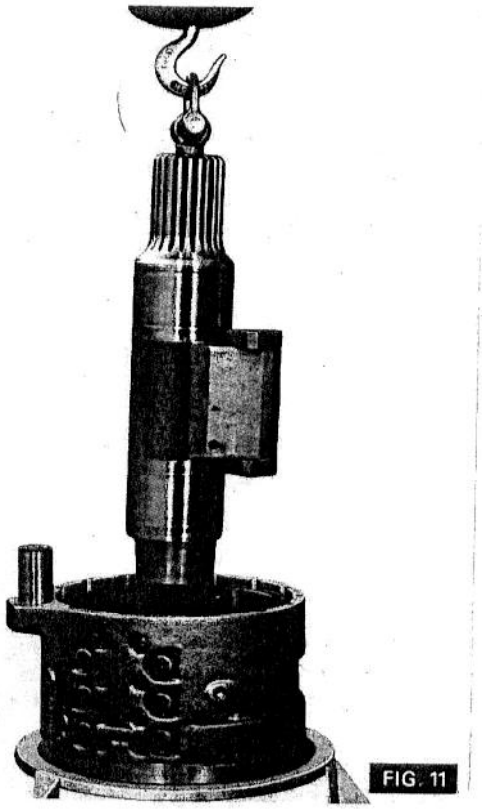


FIG. 11

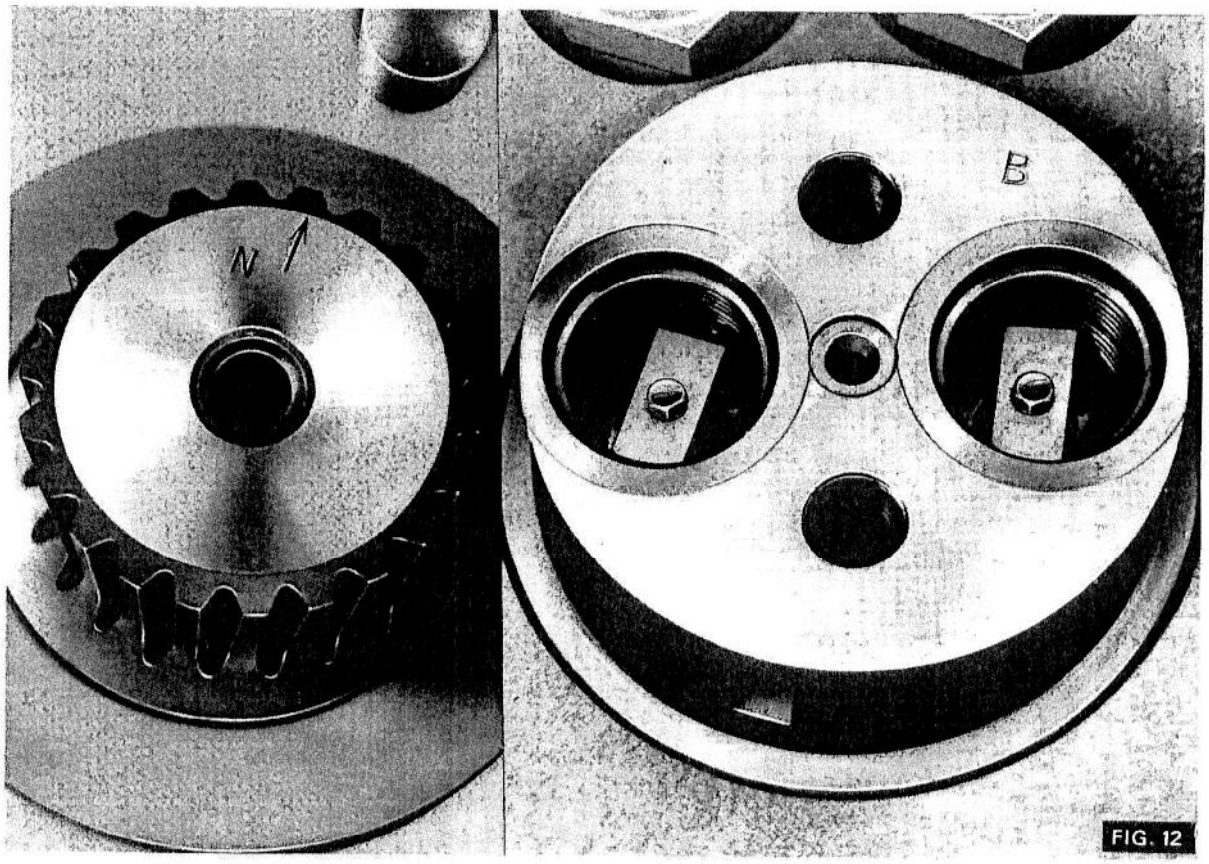


FIG. 12

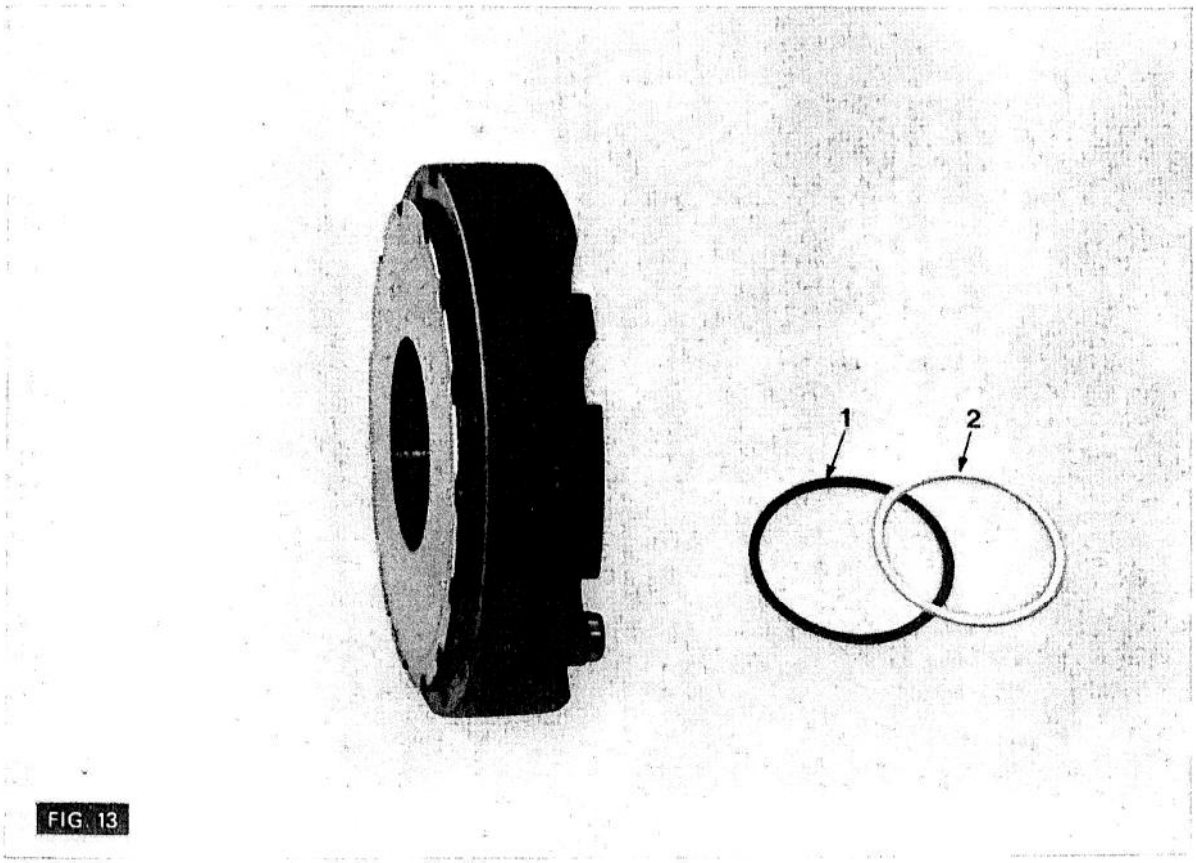


FIG. 13

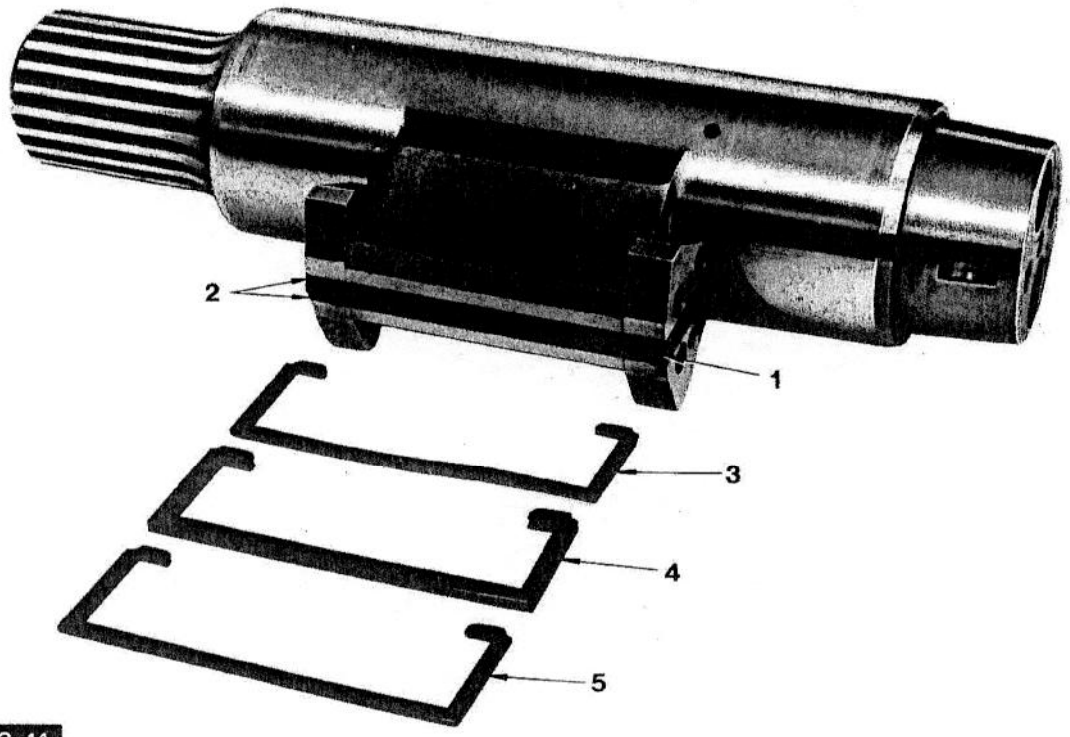


FIG. 14

BARREL VANE SEALS
Replacement . . . Cont'd

2. Replace the vanes (5) in the barrel with the vane stops at the opposite end to the 1.3/8in. dowel hole. Lightly oil the six cap screws, (2) (6) fit the composite seals (3) (7) and screw the cap screws into the vane threads finger tight.
3. Start the dowels (4) into their holes, ensuring that the short dowel is fitted in the hole indicated by the arrow. With a socket wrench tighten the six cap screws so that the vane is in firm contact with the barrel wall.
4. Using a heavy hammer and punch, drive in each dowel until it contacts the shoulder in the vane. As a guide, the heads of the long dowels should then be 0.5in. (12,7mm) below the barrel surface. The short dowel head should be 0.8in. (20mm) below the surface.
5. Tighten each of the six cap screws to a torque of 87 lbf-ft. (12 mkg).
6. Using a wire brush, clean out the old LOCTITE from the threads of the tapered plugs. Run a ¼in. BSPF tap through the threads in the barrel and blow out the old LOCTITE with an air jet. Apply fresh LOCTITE Hydraulic Seal to the plug threads, screw in and tighten to a torque of 45 lbf-ft. (6,2 mkg). Allow a curing time of two hours before applying pressure to the actuator.

CUSHIONING VALVES
Removal

9F/9

The cushioning valves can be removed with the actuator assembled on the machine. Remove the valves as detailed below and keep the parts together as two separate sets.

1. Disconnect the supply pipes from the actuator shaft then remove the adaptors from the ports.
2. (Fig. 17) Lift out the end stop (1) located on the spring guide spigot (2). Measure the distance between the top surface of the collar (3) and the top face of the shaft. This will enable the same spring compression to be maintained on re-assembly. Using the cushioning valve spanner MF.342 unscrew and remove the collar.
3. With a pair of long nosed pliers withdraw the spring guide (2) and spring (4).
4. Using the special tool MF.342 unscrew the sleeve retainer (5).
5. Screw special tool MF.344 into the threaded hole in the end of the spool valve (6). Withdraw the spool from its bore in the sleeve.
6. Bend a piece of 12 SWG wire into the shape of an outside caliper as in (Fig. 18), so that the two legs can be inserted in the two radial holes in the top of the sleeve (7) withdraw the sleeve complete with its two O-rings (8).
7. With the same piece of wire withdraw the O-ring (9) located in the bottom of the shaft bore.

CUSHIONING VALVES
Replacement

9F/10

Clean the spool and sleeve and ensure that the radial ports are clear of obstructions. Examine the spool surface and sleeve bore for scoring; if badly scored renew both parts.

Check that the spool slides freely in the sleeve bore.

1. (Fig. 17) Lubricate the O-rings with the mineral-base grease and place the loose O-ring (9) in the bottom of the shaft bore. The other two O-rings (8) are fitted in the grooves in the sleeve, (7) the smaller diameter ring going in the groove nearest the chamfered end of the sleeve.
2. Lightly oil the sleeve and slide it, chamfered end leading, down into the shaft bore on to the O-ring. Press on the sleeve with a suitable tool to ensure it is fully home in the bore.
3. Screw in the sleeve retainer, (5) slotted side outwards and tighten firmly against the sleeve with the special tool MF.342.
4. Screw the tool MF.344 into the spool, (6) insert the spool in the sleeve, check that it slides freely and

CUSHIONING VALVES
. . . Cont'd

withdraw. Locate the two spring-loaded pegs of special tool MF.343 in the retainer slots. Give the head of the punch two or three sharp blows with a hammer to peen the thread and lock the retainer. Remove the punch.

5. Finally insert the spool and unscrew the threaded rod.
6. Fit the spring (4) over the spring guide (2) and, with the guide spigot outwards, slide the guide into the shaft bore ensuring that it locates inside the retainer.
7. Using the special tool MF.342 screw in the collar (3) to the dimension noted before dismantling. Give the head of the tool two or three sharp blows with a hammer to peen the thread and lock the collar.
8. Remove the tool, place the end stop (1) over the spigot on the spring guide and refit the pipe connection adaptor.

CUSHIONING VALVES
Adjustment

9F/11

1. Disconnect the pipe and remove the pipe union above the cushioning valve to be adjusted.
2. Lift out the spring stop and fit the special tool MF.342 into the slots in the collar.
3. Turn the tool ½ turn clockwise to increase the spring compression, or ½ turn anti-clockwise to decrease it. Remove the tool , replace the spring stop and refit the pipe union and pipe.
4. Repeat the performance test and adjust further as necessary, in ½ turn increments, until the correct performance is obtained.
5. When the correct performance has been obtained, disconnect the pipe and remove the pipe union and spring stop. Locate special tool MF.342 in the collar slots and give the head of the tool two or three sharp blows with a hammer to peen the thread and lock the collar. Remove the tool , replace the spring stop and refit the pipe union and pipe.

CROSS LINE RELIEF VALVE
General

9F/12

The two relief valves are located in threaded bores in the ported end cover. Both valves are identical and are built in capsule form so that they can be renewed as an assembly.

RELIEF VALVE CAPSULE
Renewal

9F/13

1. Using a 0.75in. A/F spanner on the body hexagon unscrew the relief valve capsule from the end cover.
2. On the replacement capsule, lubricate the O-ring in the valve body groove with mineral-base grease and ensure that the bonded seal is in position against the hexagon shoulder.
3. Screw the capsule into the end cover and tighten to a torque of 55 to 60 lbf-ft. (7,6 to 8,3 mkg).

RELIEF VALVE
Disassembly

9F/14

The relief valves can be dismantled for cleaning and inspection of the parts, but means must be available for checking and, if necessary, resetting the pressure after installation on the machine.

1. (Fig. 19) Clamp the hexagon head of the body in a soft-jawed vice.
2. Remove the circlip (1) and lift out the ball and cup sub-assembly (2).

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Distribution
UK/Db/IM

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50B/2200/53
50/2200/5

Date 26.11.84

MF50D AND MF50B DIGGERS

ROTARY ACTUATOR SHAFT END PLATES

ADVICE

In order to reduce the cost of servicing the Dowty Rotary Actuator shaft, a shaft end plate kit Part No. 1810 767M91 has been made available. The kit consists of:

1 off - Shaft end plate
4 off - Cap screws
2 off - Sel Loc dowel pins

In the event of a rotary actuator shaft failure where the shaft end plate requires renewal the following instructions MUST BE STRICTLY ADHERED to:

1. Remove the shaft from the actuator as detailed in the MF50D Workshop Manual Section 8C-02-08.

2. Unscrew the 4 Alan cap screws holding the shaft end plate to the shaft vane.

3. Using a suitable extractor remove the 2 sel loc dowel pins. Then lift off the shaft end plate.

4. Matching Procedure

WARNING

a. Carefully position the old plate directly on top of the new plate. This means the old plate will have the counterbore facing upwards and so will the new plate underneath.

b. Using 4 off 5/16 UNF x 1½" long cap screws and nuts, secure the plates together ensuring that the vae seal grooves match PERFECTLY.

c. Using the top plate as a pilot enter a 5/16" drill bit into the dowel hole and carefully drill out the holes in the new bottom plate.

d. With both plates still bolted together it will be evident that the new plate has a much longer overall length.
It is EXTREMELY IMPORTANT that the new plate is machined to be the same dimension as the old one by removing the step so that it becomes identical to the old plate.

IM Service Bulletin

e. Unbolt the two plates.

5. Cleaning and new plate fitting procedure

a. Thoroughly clean and degrease the dowel and cap screw bores in the shaft and new plate.

b. Apply Loctite 275 to the thread of the 4 new cap screws supplied in the kit and then coat the mating surfaces of the new end plate and the shaft with the same Loctite.

c. Fit the end plate to the shaft and screw in the 4 cap screws finger tight.

d. Fit the new Sel Loc dowel pins ensuring that they do not stand above the upper surface of the plate.

e. Torque the cap screws diagonally to 22 U ft.

6. Final checking instructions

a. Place a straight edge along the complete length of the shaft vane and both end plates close to the seal groove. Using feeler gauges ensure that the end plates do not stand out more than an absolute maximum of 0.003". In the event that the plates stand out more than 0.003", dress the plate accordingly.

WARNING

FAILURE TO COMPLY WITH THESE INSTRUCTIONS WILL RESULT IN EXCESS WEAR OF SEALS AND BARREL.

7. Reassembly

Continue as described in the MF50D Workshop Manual Section 8C-02-10.

Administration

This Bulletin is issued for technical information only and does not constitute authority for mandatory replacement and Warranty claim submission.

GERARD COLLIER

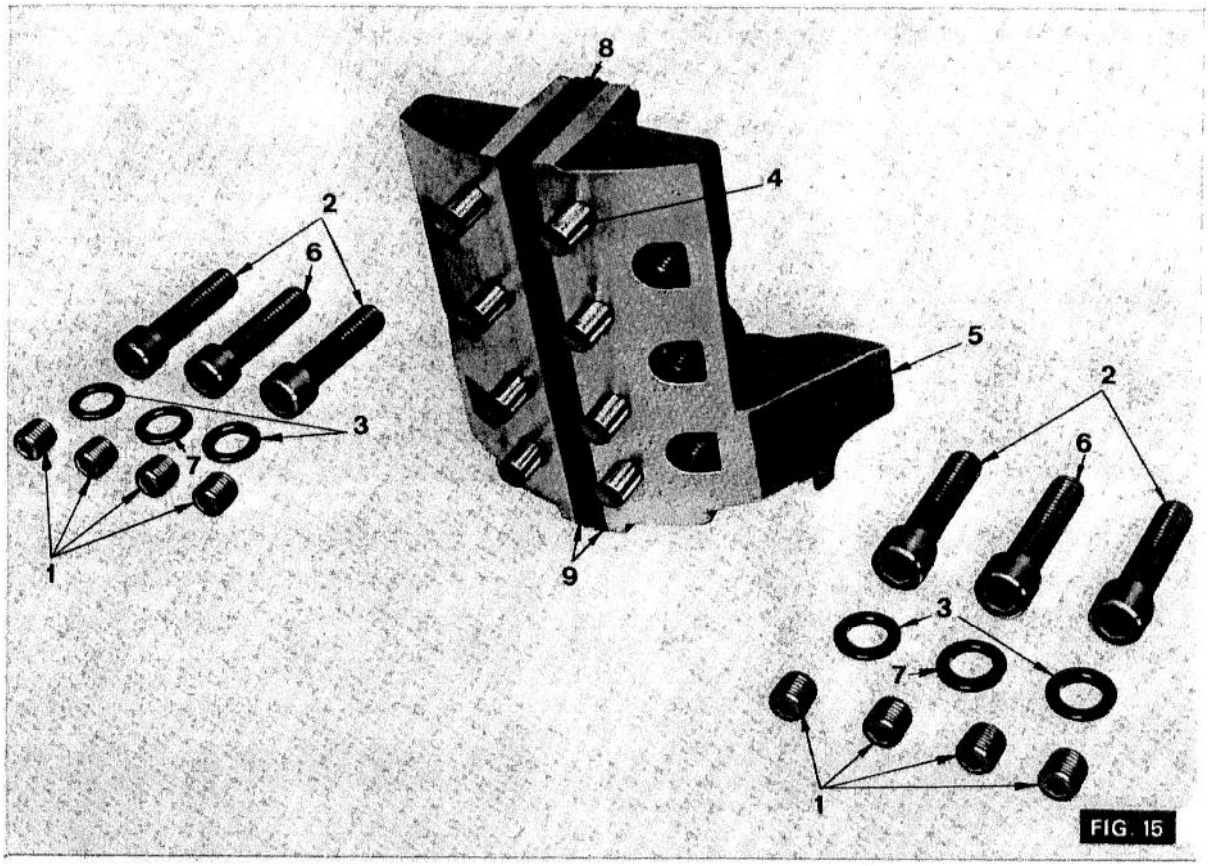


FIG. 15

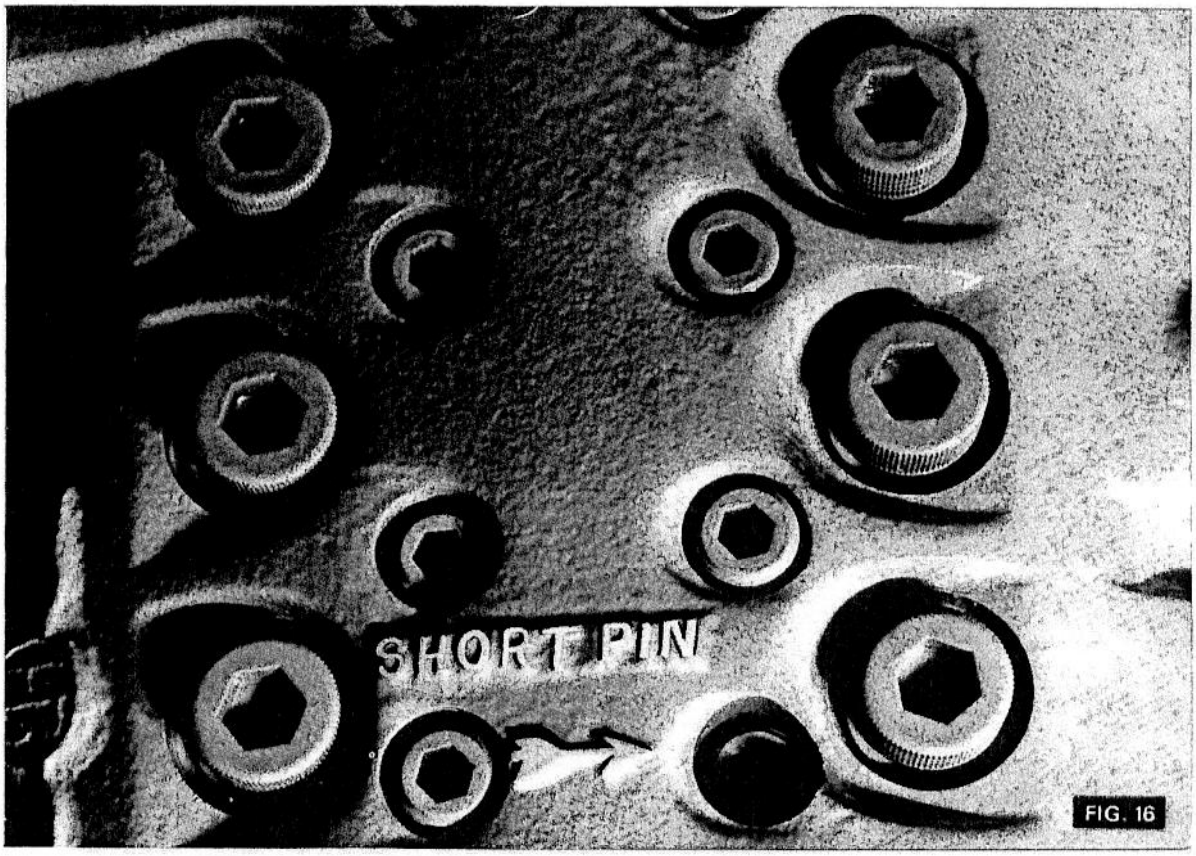


FIG. 16

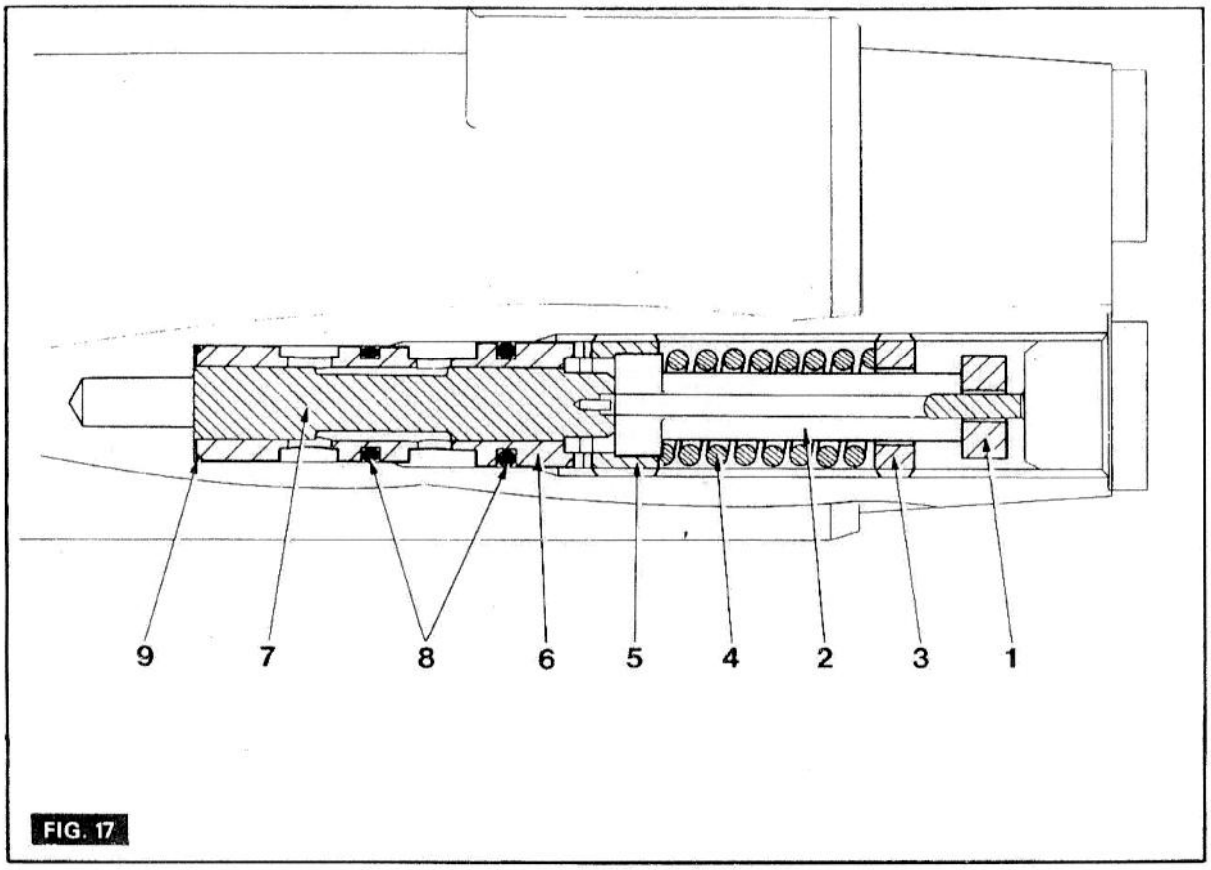


FIG. 17

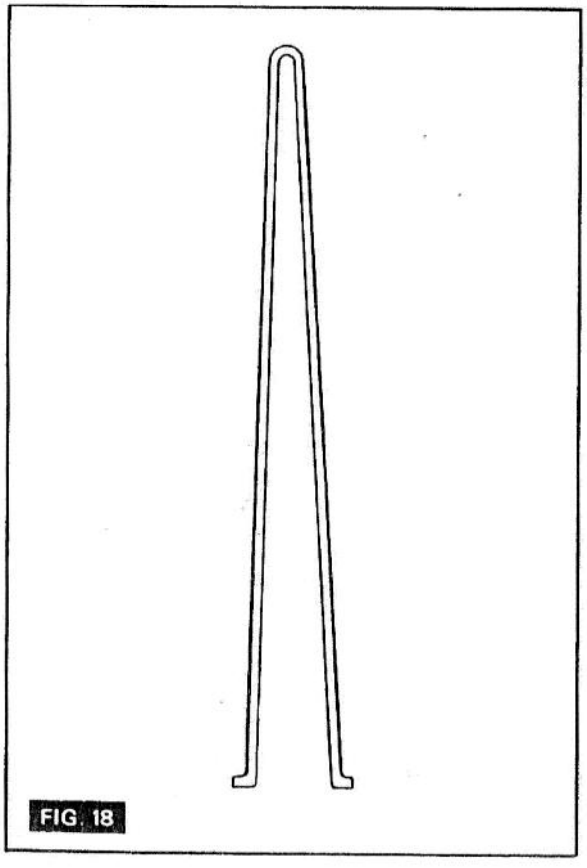


FIG. 18

CROSS-LINE RELIEF VALVE x 2. inside of top cover

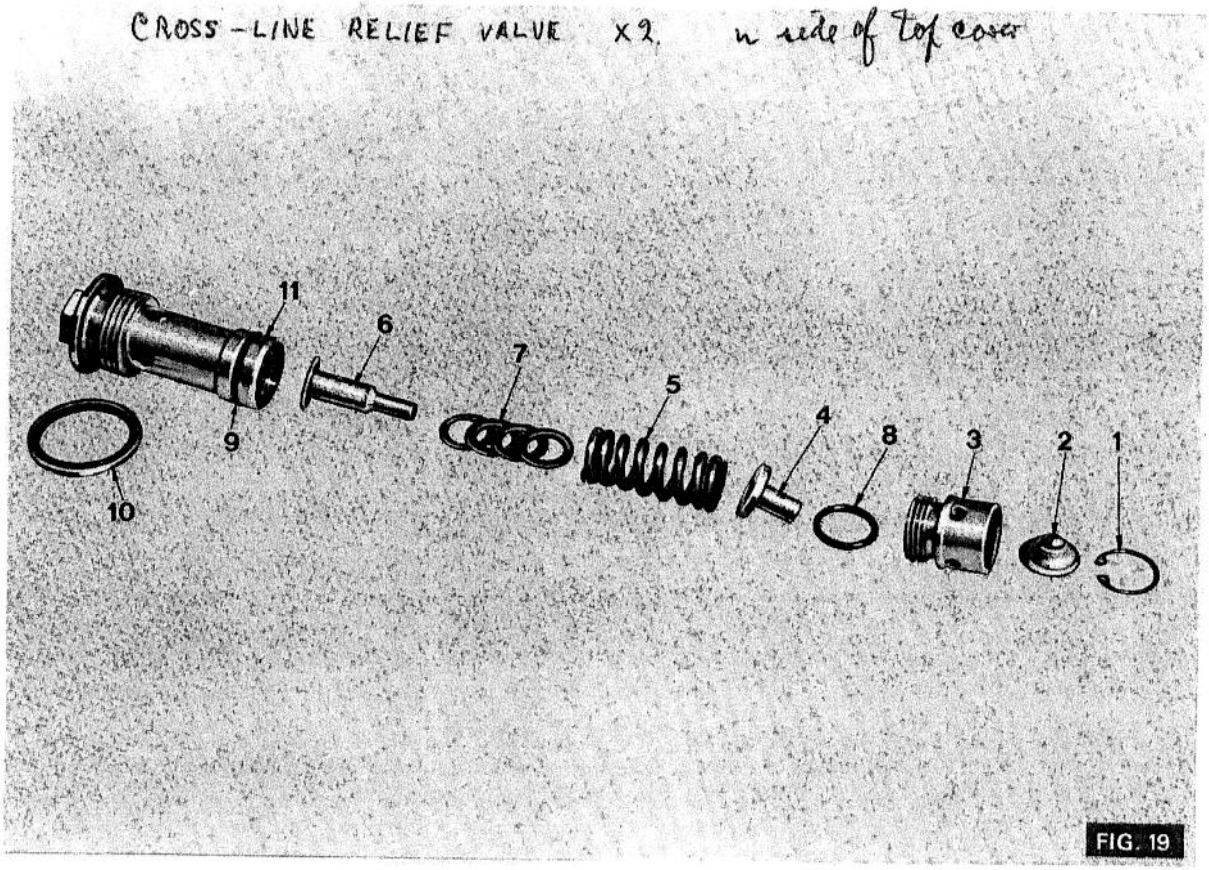


FIG. 19

CHECK VALVE x 2. in top of top cover. on early all 50D
not used at all on 50H
but is internally fitted to underside of top plate

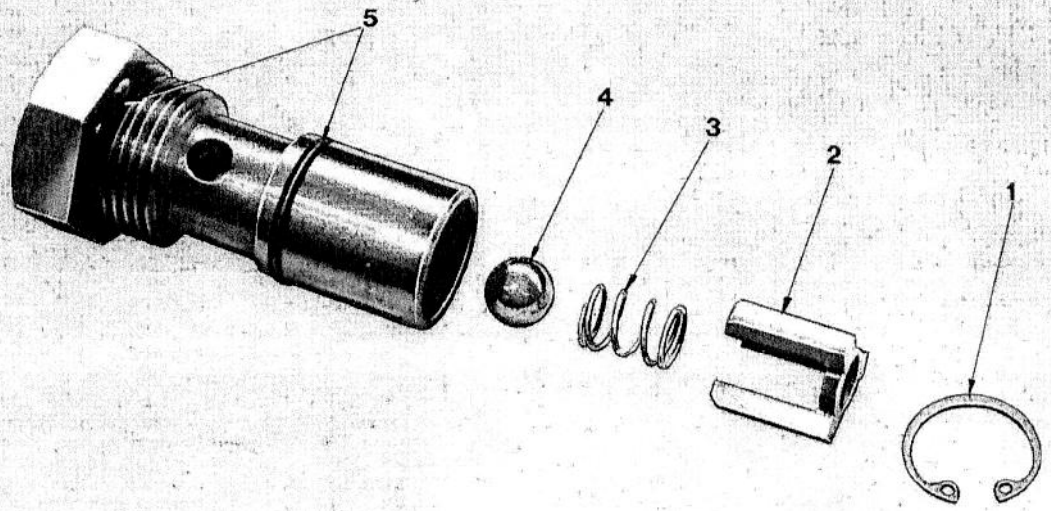


FIG. 20

RELIEF VALVE
Disassembly . . . Cont'd

3. Pass a bar through the radial holes in the retainer (3) and unscrew the retainer from the body. Slide the valve seat (4) out of the retainer.
4. Withdraw the spring, (5) spring guide (6) and shim(s). (7).

Clean all parts thoroughly, examine for damage and renew as necessary.

RELIEF VALVE
Reassembly

9F/15

New oil seals should be fitted on re-assembly. Lubricate the seals with thin, mineral-base grease before fitting.

1. (Fig. 19) Place the shim(s) (7) against the shoulder of the spring guide (6) and slide the spring over the stem of the guide. Insert these items in the body. (11).
2. Renew the O-ring and spiral backing ring located in the internal recess in the retainer. The backing ring must be positioned adjacent to the small diameter end of the retainer. Slide the seat into the retainer.
3. Fit a new O-ring (8) around the shoulder of the retainer below the thread and screw the retainer into the body. Tighten to a torque of 10 to 15 lbf-ft. (1,4 to 2 mkg).
4. Replace the ball and cup sub-assembly (2) and secure with the circlip. (1).
5. Fit a new O-ring (9) in the external groove in the body and a new bonded seal (10) beneath the hexagon shoulder.

RELIEF VALVE
Adjustment

9F/16

1. Remove the relief valve from the actuator.
2. Dismantle the valve as described in Operation. 9F/14
3. To increase the pressure setting add a shim to the guide, conversely, subtract a shim if the pressure setting is to be reduced. The addition or subtraction of one 0.010in. shim will alter the setting approximately 100lb./in^2 (7kgf/cm^2).
4. Reassemble the relief valve as stated in Operation. 9F/15
5. Replace the valve in the actuator and tighten to a torque of 55 to 60 lbf-ft. (7,6 to 8,3 mkg).

CHECK VALVES
Removal and Disassembly

9F/17

The two check valves are located in threaded ports on top of the ported end cover.

To dismantle a check valve:—

1. (Fig. 20) Unscrew the valve from the end cover using a 1.3/8in. A/F spanner.
2. Remove the circlip (1) and withdraw the spring cage, (2) spring (3) and steel ball. (4).

Examine the parts for damage, particularly the ball and its seat in the body. The ball must be free from pitting and the seating face smooth and free from indentations.

CHECK VALVES
Reassembly and Replacement

Reassembly

9F/18

1. (Fig. 20) Lubricate two new O-rings (5) with thin mineral-base grease and place in the external grooves in the body.
2. Place the ball (4) on the seat and fit the spring (3) and spring cage (2) over it. Retain by fitting the circlip. (1).
3. Screw the complete unit back into the end cover and tighten to a torque of 60 lbf-ft. (8,5 mkg).

HYDRAULIC RAMS

CONTENTS

LIST OF ILLUSTRATIONS

HYDRAULIC RAMS

GENERAL

Hydraulic fluid is directed in the loader system by means of a two spool valve, to either the lift rams or the bucket rams. The lift rams are attached to the beam and the base of the vertical pivot post by means of pivot pins which are retained by split pins. One end of each of the bucket rams is also connected by pivot pins and split pins to the top of the pivot post. The rod end of each ram is connected to a main transfer lever fitted to each arm of the beam.

When a digger is attached the oil flow is passed through the two spool control valve and out through the pressure beyond point to the digger hydraulic system.

The flow of hydraulic oil is directed to the various digger rams by means of a seven spool valve. Each ram is secured with pivot pins and split pins and is supplied with oil through flexible pipes.

The hydraulic rams are identified in Fig. 1.

Key to Fig 1

1. Loader Lift Rams.
2. Loader Bucket Rams.
3. Digger Bucket Rams.
4. Digger Dipperstick Rams.
5. Digger Boom Rams.
6. Digger Clamping Cylinders.
7. Digger Stabilizer Rams.

LIFT RAM - LOADER

Removal and Replacement (9G/1)

The procedure for removing either the left hand or right hand ram is exactly the same.

1. Position the loader with the bucket resting on the ground. Check that no pressure remains in the circuit by moving the control levers several times.
2. Disconnect the flexible hydraulic pipes from the ram. Ensure that no foreign matter enters the pipes when disconnected.
3. Remove the split pin from the pivot pin on the piston rod end of the ram and tap the pivot pin out. Lower the ram until it rests on the front axle beam of the tractor.
4. Remove the split pin from the pivot pin at the cylinder end of the ram and tap out the pivot pin.
5. The ram can now be lifted clear for the examination and servicing.
6. To replace the ram reverse the above procedure.

Disassembly (9G/2)

1. Remove the lift ram as stated in operation 9G/1.
2. Hold the ram assembly securely in a suitable clamp or vice.
3. (Fig. 2) With a 'C' Spanner, turn the bearing nut (1) in an anti-clockwise direction, remove and pull to the end of the piston rod.
4. (Fig. 3) Tap the bearing approximately 1½" into the barrel to allow removal of the lock ring.
5. (Fig. 4) Using a screw driver extract the lock ring.
6. Withdraw the piston rod assembly from the barrel.
7. (Fig. 5) Clamp the piston rod assembly securely in a vice. Remove the nut (1), packing retainer (2), piston packing set (3), 'O' ring (4) and retainer washer (5).

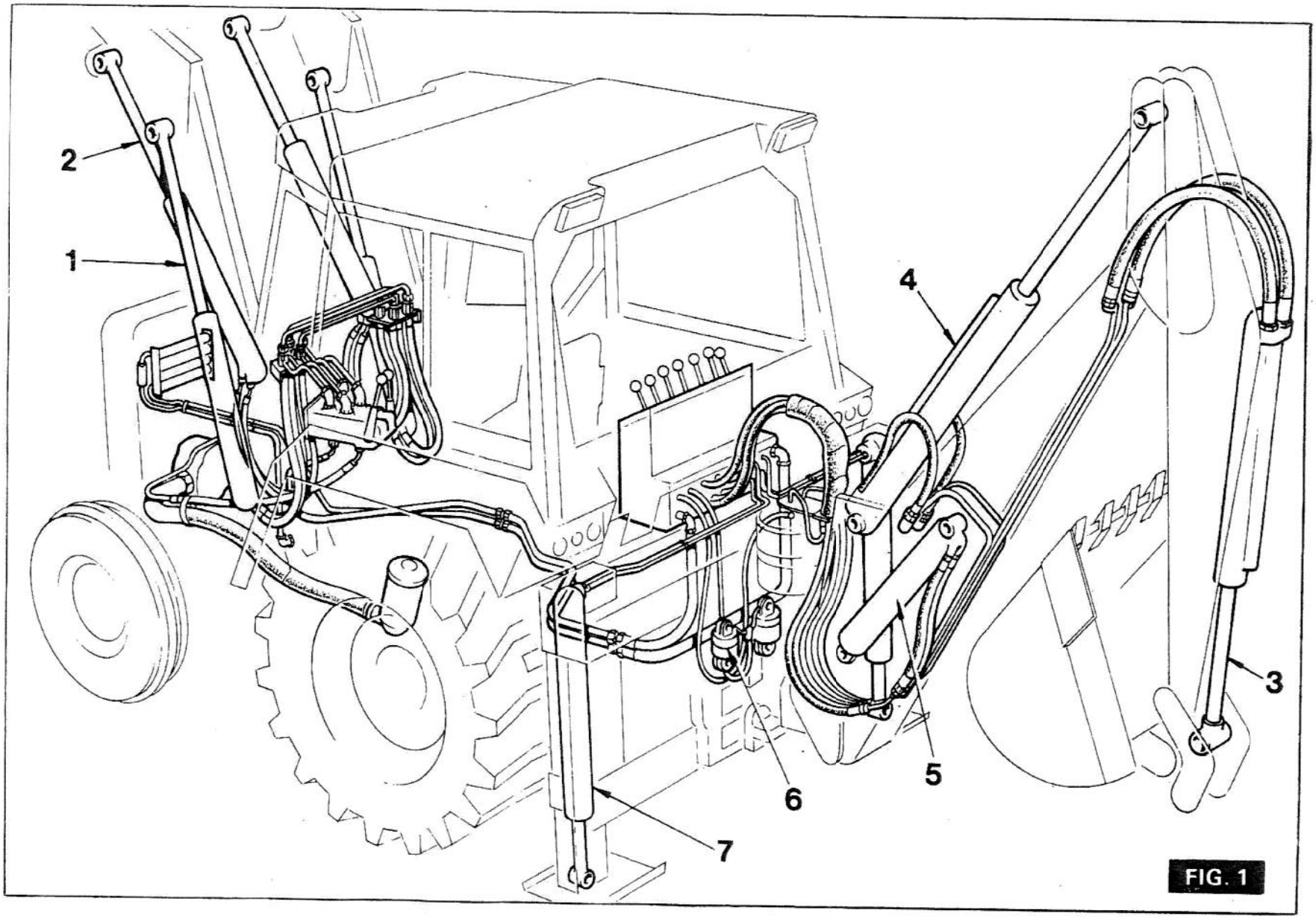


FIG. 1

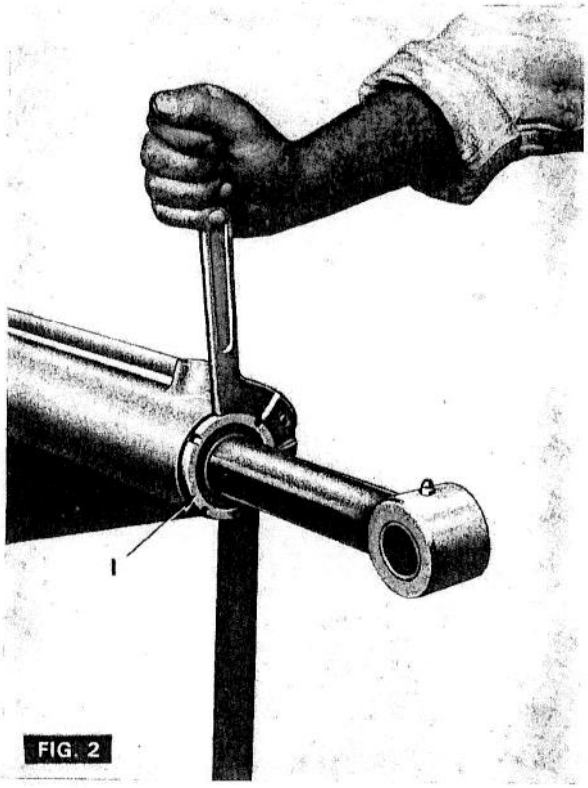


FIG. 2

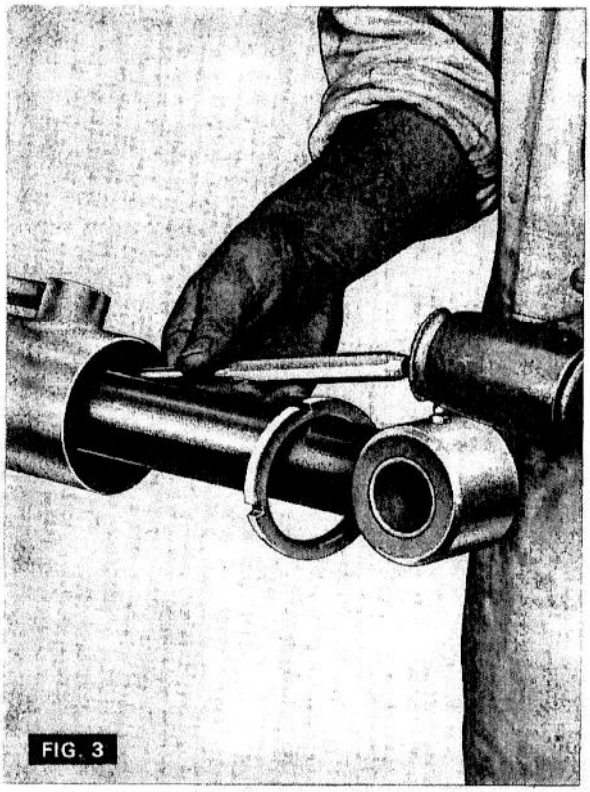


FIG. 3

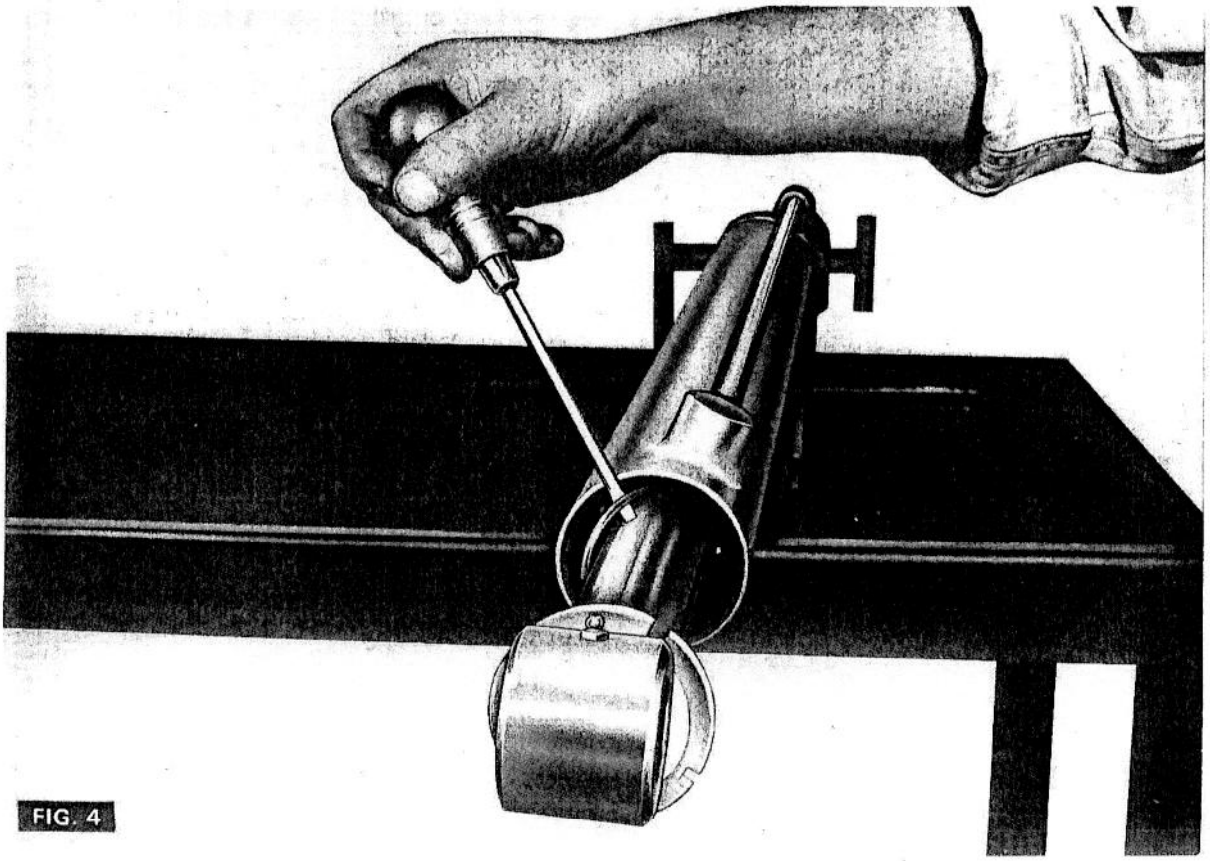


FIG. 4

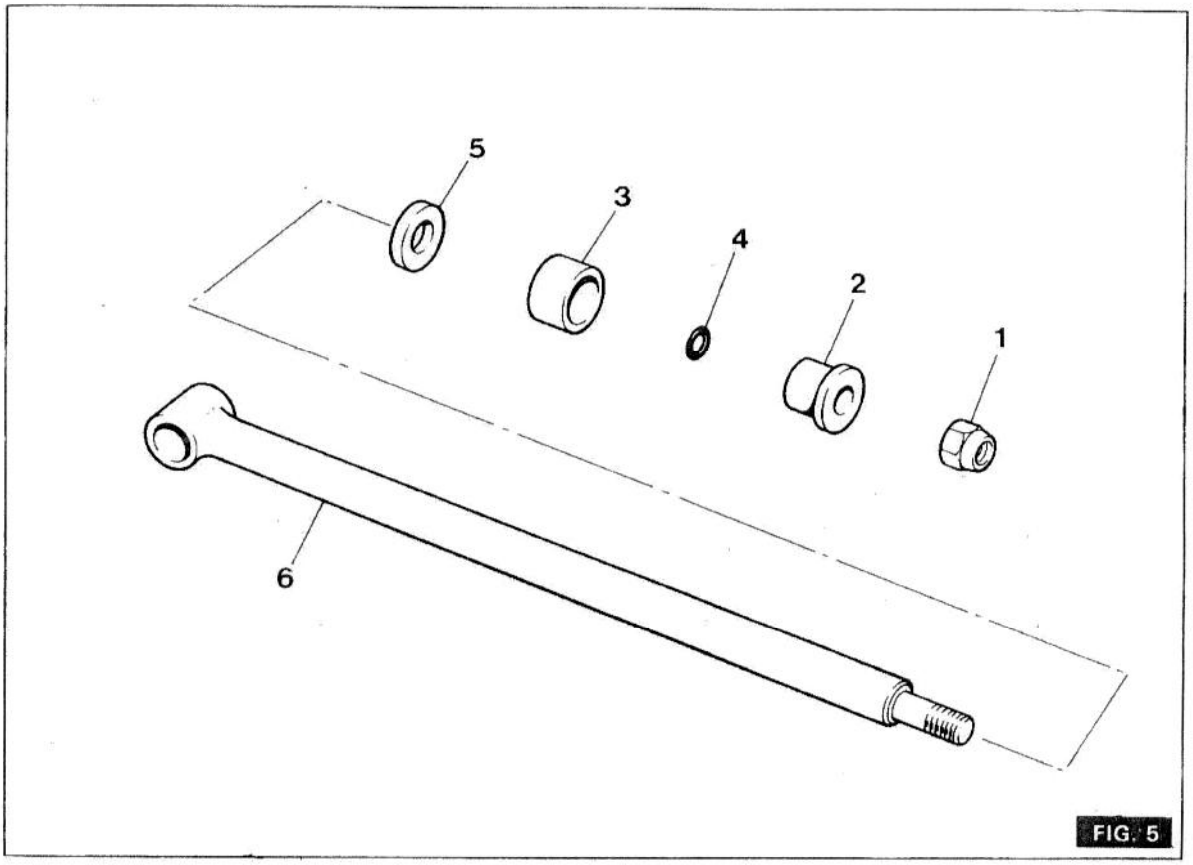


FIG. 5

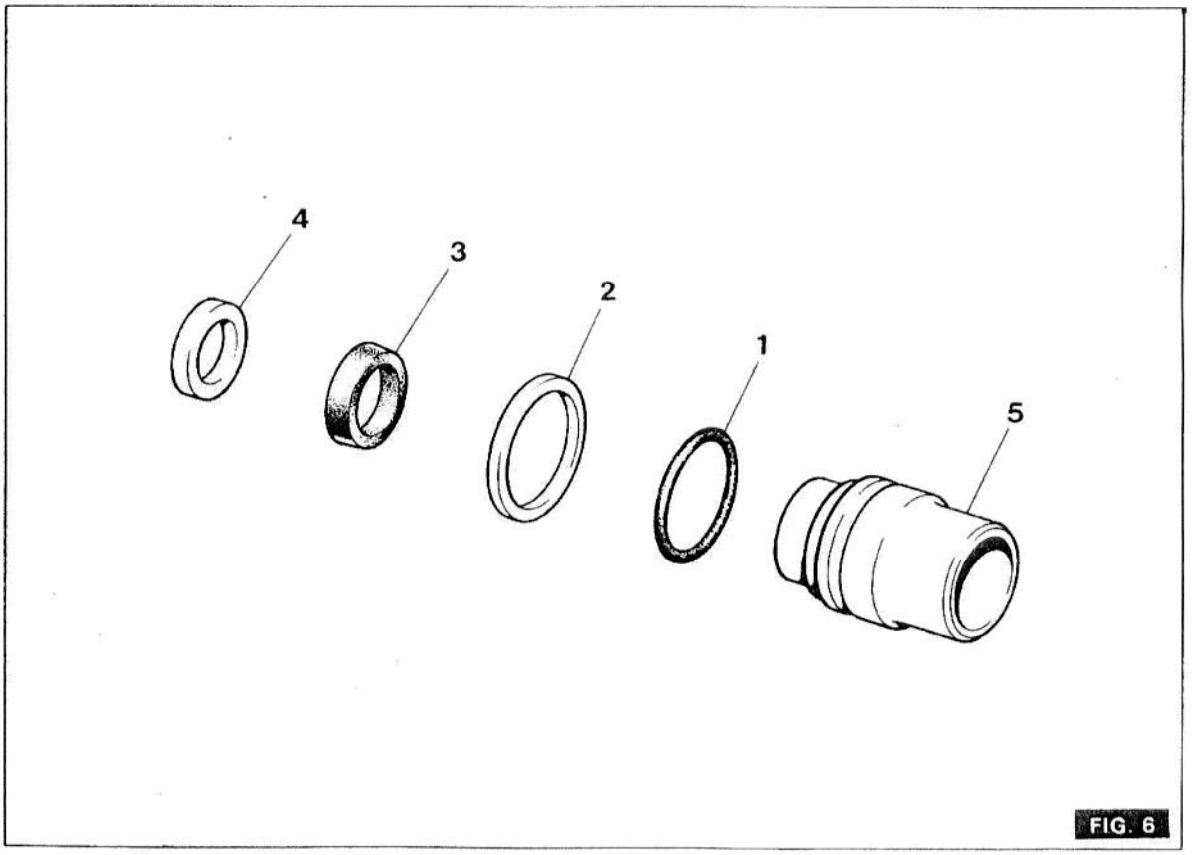


FIG. 6

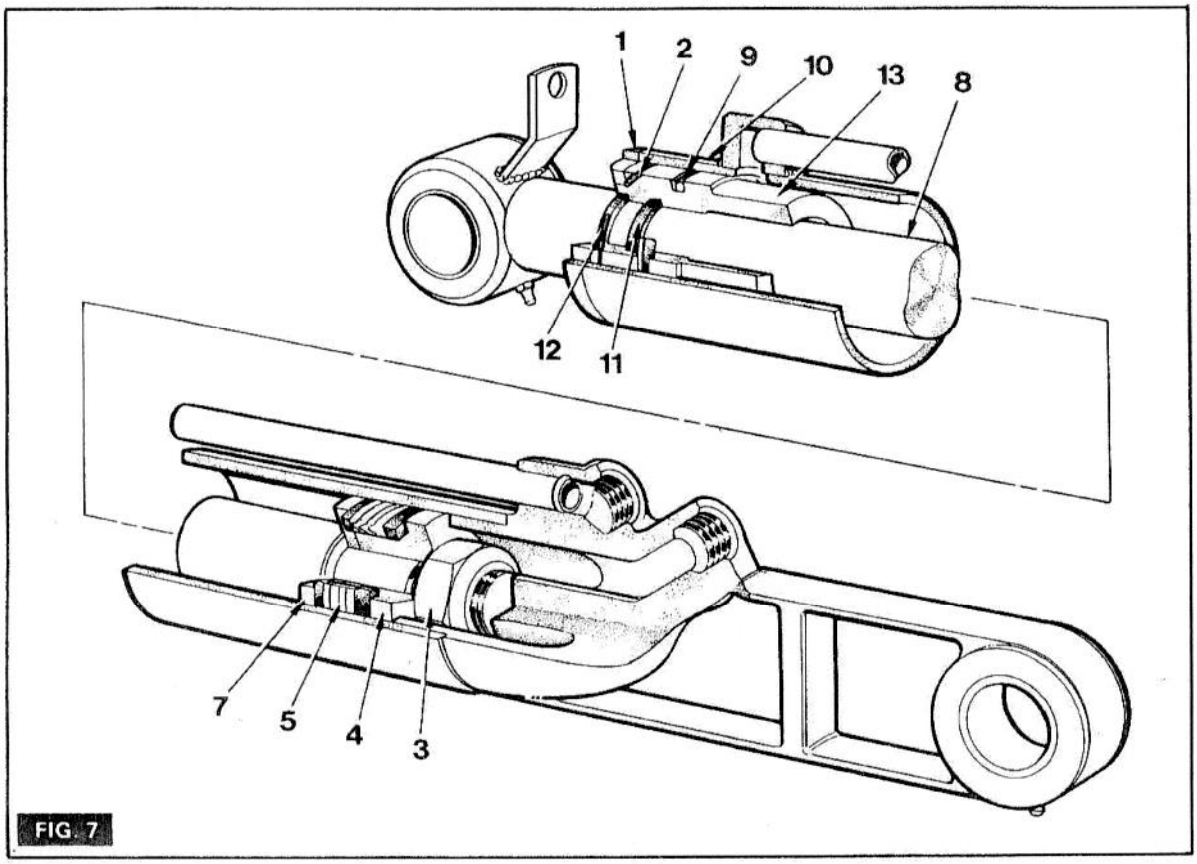


FIG 7

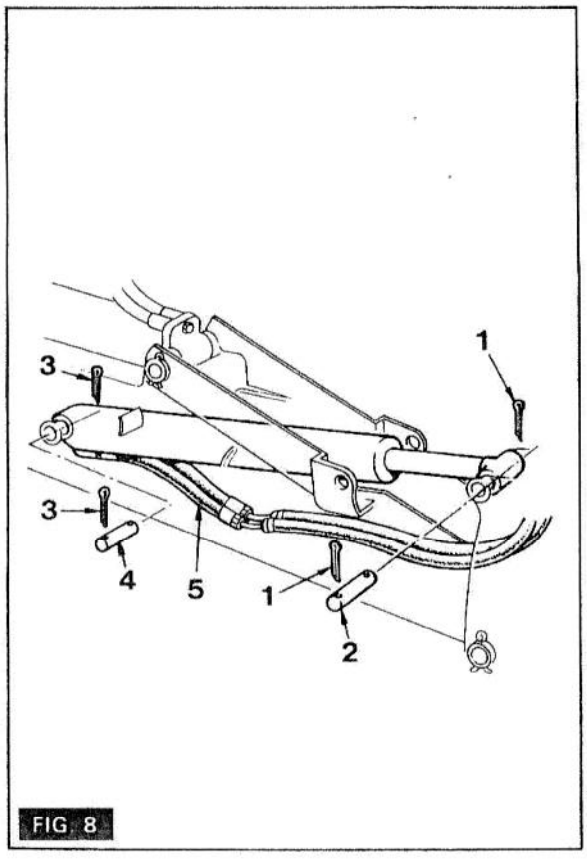


FIG 8

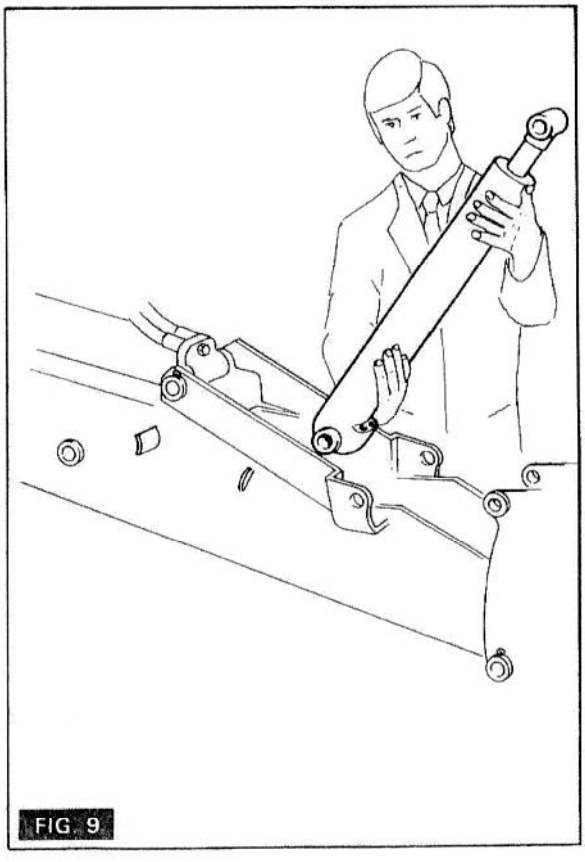


FIG 9

LIFT RAM - LOADER

Disassembly . . . Cont'd

8. (Fig. 6) Slide the bearing assembly off the rod. Remove the 'O' ring (1) back up washer (2) and seals (3) (4) from the body (5).

Reassembly (9G/3)

1. Examine all component parts of the assembly for excessive wear or damage. Thoroughly clean all parts.
2. Slide the bearing nut and lock ring onto the piston rod.
3. (Fig. 6) Fit new 'O' ring (1), new back up washer and new seals (3), (4) to body (5).
4. Lubricate the piston rod with clean hydraulic oil and slide the bearing assembly onto the rod.
5. (Fig. 5) Fit retainer washer (5), new packing (3), new 'O' ring (4) and packing retainer (2). Secure with nut (1) and torque to 300 - 330 lb.ft. (41.49 - 45.63 kg.m.).
6. Lubricate the 'O' rings and seals then insert the piston and rod assembly into the barrel, taking care not to damage the seals.
7. Push the bearing assembly into the barrel far enough to allow the lock ring to be replaced.
8. Withdraw the piston rod against the bearing thus forcing the bearing up to the locking ring. Fit the bearing nut and tighten to a torque of 160/180 lb.ft. (22.13 - 24.89 kg.m.).
9. Replace the lift ram as described in operation 9G/1.

BUCKET RAM - LOADER

Removal and Replacement (9G/4)

The procedure for removing either the left hand or right hand ram is exactly the same except that if a bucket levelling indicator is fitted to the left hand ram it will have to be removed before the following procedure can be commenced.

1. Set the loader with the bucket crowded and resting on the ground.
2. Disconnect the flexible hydraulic pipes from the ram. Ensure that no foreign matter enters the pipes when disconnected.
3. Remove the split pin from the pivot pin on the piston rod end of the ram and lower the ram until it rests on the front axle beam of the tractor.
4. Remove the split pin from the pivot pin at the cylinder end of the ram and tap out the pivot pin.
5. The ram can now be removed for examination and servicing.

Disassembly (9G/5)

1. Remove the bucket ram as stated in operation 9G/4.
2. Hold the ram assembly securely in a suitable clamp or vice.
3. (Fig. 7) With a 'C' spanner turn the bearing nut (1) in an anti-clockwise direction, remove and pull to the end of the piston rod.
4. Tap the bearing approximately 1½" into the barrel to allow removal of the lock ring (2).
5. Using a screw driver extract the lock ring.
6. Withdraw the piston rod assembly from the barrel.
7. Clamp the piston rod assembly securely in a vice. Remove the nut (3) packing retainer (4), piston packing set (5) 'O' ring (6) and retainer washer (7).
8. Slide the bearing assembly off the rod (8). Remove the 'O' ring (9), back up washer (10) and seals (11), (12) from the body (13).

Reassembly (9G 6)

1. Examine all component parts for excessive wear or damage. Thoroughly clean all parts.

BUCKET RAM - LOADER

Reassembly . . . Cont'd

2. (Fig. 7) Slide the bearing nut (1) and lock ring (2) onto the piston rod (8).
3. Fit new 'O' ring (9), new back up washer (10) and new seals (11), (12) to the bearing body (13).
4. Lubricate the piston rod with clean hydraulic oil and slide the bearing assembly onto the rod.
5. Fit retainer washer (7), new packing (5) new 'O' ring (6) and packing retainer (4). Secure with nut (3) and torque to 250 - 275 lb.ft. (34.58 - 38.03 kg.m.).
6. Lubricate the 'O' rings and seals then insert the piston and rod assembly into the barrel, taking care not to damage the seals.
7. Push the bearing assembly into the barrel far enough to allow the lock ring (2) to be replaced.
8. When the lock ring has been replaced withdraw the piston rod against the bearing thus forcing the bearing up to the lock ring. Fit the bearing nut and tighten to a torque of 80 - 100 ft.lb. (11.06 - 13.83 kg.m.).
9. Replace the bucket ram as described in operation 9G/4 .

BOOM RAM - DIGGER

Removal (9G/7)

1. Fully extend the boom ram parallel to the floor.
2. (Fig. 8) Remove the split pins (1) from both ends of boom attaching pin.
3. Remove the pin.
4. Contract the boom ram by using the control valve lever.
5. Remove split pin (2) and drive out the pin (3) to release the ram from the swivel casting.
6. Lift the ram into a standing position and disconnect the flexible hoses (4). To ensure correct reconnection of hoses, attach and identify Tie-on labels to the hoses before disconnecting.
7. Lift the boom ram from the boom.

Replacement (9G/8)

1. Lay a thin plank of wood, approximately the same length as the ram, along the top of the four rigid pipes inside the boom.
2. (Fig. 9) Stand the ram inside the boom, hoses towards the tractor, connect the hoses in accordance with the tie on labels. The embossed arrow head on the ram head should also be on the front face of the ram head, while the ram is in the standing position.
3. Slide the head end of the ram into the boom and align the ram attachment hole with the boom attachment holes, using the plank of wood as a lever to obtain horizontal alignment of the holes.
4. Insert the attachment pin, ensure that split pin holes are correctly aligned.
5. Insert and secure a split pin through each end of the attachment pin.
6. Start the tractor engine and select boom lower on the controls, to extend the ram to engage with the pivot post clevis.
   A precise final alignment between pivot post and ram rod may be obtained by raising or lowering the boom on a lifting jack or hoist.
7. Insert the attachment pin, align the split pin hole, insert and secure the split pin.

Disassembly (9G/9)

1. Remove the ram from the machine as stated in operation 9G/7
2. Hold the ram assembly securely in a suitable clamp or vice.
3. (Fig. 10) With a 'C' Spanner turn the bearing nut (1) in an anti-clockwise direction, remove it from the bearing and rest it on the piston rod.
4. Tap the bearing approximately 1½" (38.1 mm) into the barrel to allow the removal of the lock ring (2).
5. Using a screw driver remove the lock ring and insert in its place special tool MF 327 to facilitate piston removal.
6. Withdraw the piston rod assembly from the barrel.

BOOM RAM - DIGGER

Disassembly . . . Cont'd

7. Clamp the piston rod assembly securely in a vice. Remove the nut (3), piston (4) complete with wear ring (5) and seal set (6) 'O' ring (7) and seal retainer (8).
8. Carefully withdraw the damping sleeve (9); remove retaining pin (10) from the sleeve.
9. Lift the spring (11) from the top of roll pin (12) withdraw roll pin (12) then roll pin (13).
10. Slide washer (14) from the piston rod.
11. Slide the bearing assembly off the piston rod then remove the bearing nut (1) and lock ring (2).
12. Remove the back up washer (15), 'O' ring (16), snap ring (17) and seal set (18) from the body (19).
13. Extract the wiper seal (20).
14. Remove the plug complete with 'O' ring (21), spring (22), shims (23), then withdraw the tube.
15. Remove 'O' ring (24) and back up washer (25) from the tube (26) then 'O' ring (27) and back up washer (28).

Note: If the same tube is to be re-used retain the shims.

Reassembly

(9G/10)

1. Thoroughly clean and dry all parts. Examine for excessive wear or damage.
2. All seals should be renewed as new parts.
3. (Fig. 10) Fit 'O' ring (27) and back up washer (28) to the tube (26), then 'O' ring (24) and back up washer (25).
4. Insert the tube then replace the shims (23). If new tube is to be fitted shim between the tube and spring to ensure a dimension of 1¼" ± 1/32" (31.75 ± 0.793 mm) between the top of the shims and spot face of the plug (Fig10Dimension A).
5. Replace spring (22) thenrefit plug (21) complete with new 'O' ring.
6. Reassemble the bearing (19) with the new back up washer (15) and new O' ring (16).
7. Refit a new wiper seal (20).
8. Refit a new seal set (18) and secure in position with the snap ring (17).
9. Slide the bearing lock nut (1) and lock ring (2) onto the piston rod.
10. Lubricate the piston rod with clean hydraulic oil and slide the bearing assembly onto the rod.
11. Fit the retaining washer (14) up to the shoulder in the rod then fit a new roll pin (13) into the hole in the rod and press to bottom of the hole.
12. Tap a new roll pin (12) into the roll pin (13) until ¼" ± 1/32" (6.35 ± 0.793 mm) only protrudes above roll pin (13).
13. Fit stepped end of retaining pin (10) into hole in sleeve (9).
14. Position new spring (11) on top of roll pin (12). Hold spring compressed using a thin strip of metal then slide the sleeve onto the piston rod.
15. Slip the packing retainer (8) over the rod, push home until it meets the roll pins then rotate the retainer until the roll pins engage into the slot in the face of the retainer.
16. Fit a new 'O' ring (7) on the shaft close to the retainer.
17. Assemble the piston (4), new wear ring (5) and new seal set (6) then slide complete assembly onto the rod until the flat face meets the packing retainer.

Note :- The joint on the wear ring must be in line with the arrow head on the piston rod (Boom ram only).

18. Secure with the retaining nut (3) and torque to 350/375 lb.ft. (48.4 - 51.86 kg.m.).
19. Enter piston rod assembly into barrel ensuring that the arrows 'A' on the rod and barrel are aligned.
20. Push bearing into barrel far enough to allow the replacement of the lock ring (2).
21. When the lock ring has been fitted withdraw the piston rod against the bearing thus forcing the bearing up to the lock ring. Fit the bearing nut (1) and tighten to a torque of 275 - 300 ft.lb. (38.03 - 41.49 kg.m.).

Note :- The bearing nut should be tightened to the recommended torque on a test rig or after it has been refitted to the machine. Procedure is as follows :-

BOOM RAM - DIGGER

Reassembly . . . Cont'd

Note . . . Cont'd

Fully retract the ram and hold the control valve lever until R.V. pressure is obtained. While the bearing is under this pressure, tighten to the recommended torque.

DIPPERSTICK RAM (9G/11)

Removal and Replacement

1. Completely extend the dipperstick arm, lower the boom until it is parallel to the ground with the bucket touching the ground.
2. (Fig. 11) Remove two split pins (1) and extract pin (2).
3. Remove two split pins (3) and extract pin (4).
4. Disconnect the hoses (5).
5. Remove the ram.
6. Replacement is a direct reversal of the above procedure.

Disassembly (9G/12)

1. (Fig. 10) Remove the ram as stated in operation 9G/11.
2. Carry out items 2 to 7 and 11 to 15 of operation 9G/9 .

Reassembly (9G/13)

1. (Fig. 10) Carry out items 1 to 10 of operation 9G/10.
2. Replace the packing retaining washer (14) then carry out items 16 to 21 of operation 9G 10.

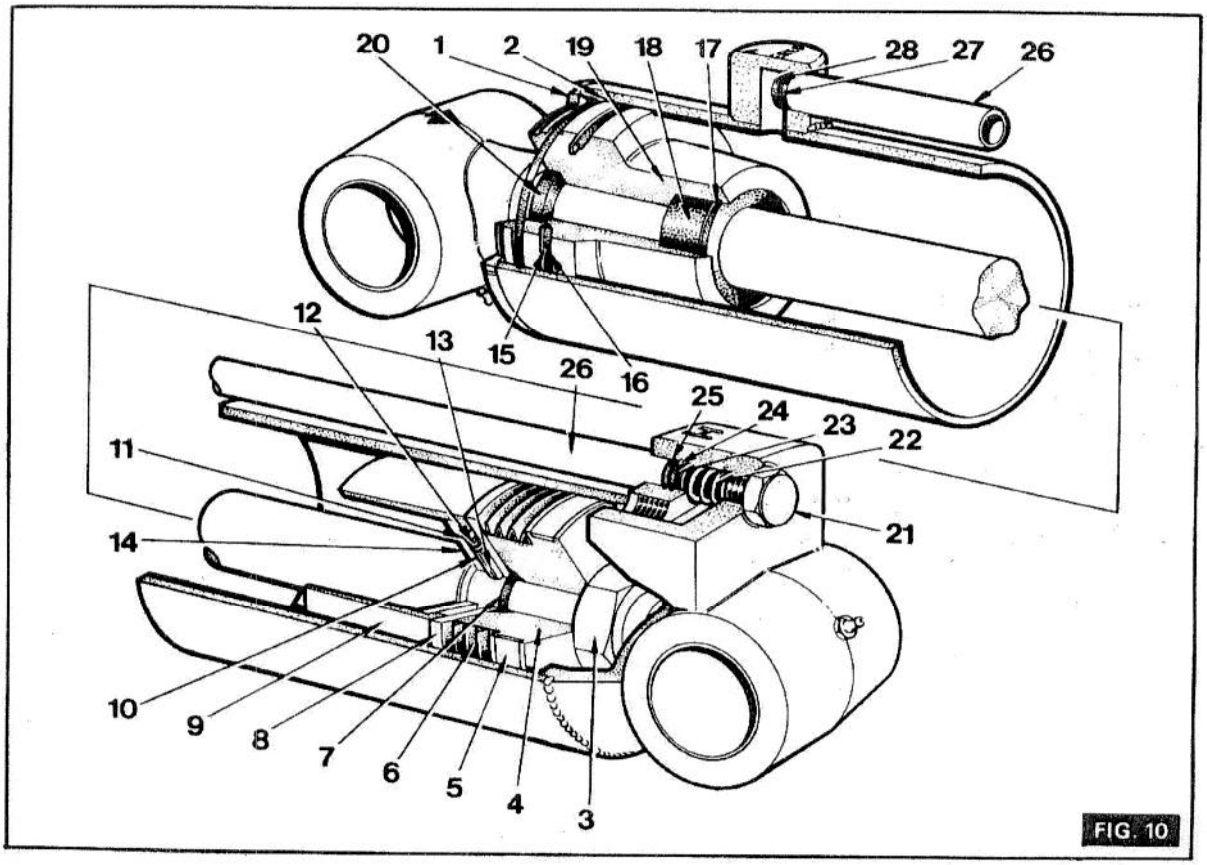
BUCKET RAM - DIGGER

Removal and Replacement (9G/14)

1. Position the boom and dipperstick straight out parallel to the ground with the bucket fully dumped. Release all pressure in system.
2. (Fig. 12) Remove the split pins (1) drive out the pin (2).
3. Remove the split pins (3) drive out the pin (4).
4. Disconnect the hoses (5).
5. Replacement is a reversal of the removal procedure.

Disassembly 9G/15

1. Remove the ram from the machine as stated in operation 9G/14.
2. (Fig. 13) Remove the guard (1) by unscrewing the two screws (2).
3. Hold the ram assembly securely in a suitable clamp or vice.
4. (Fig. 14) With a 'C' Spanner turn the bearing nut (1) in an anti-clockwise direction, remove it from the bearing and rest it on the piston rod.
5. Tap the bearing approximately 1½" (38.1 mm.) into the barrel to allow the removal of the lock ring (2).
6. Using a screw driver remove the lock ring.
7. Withdraw the piston rod assembly from the barrel.
8. Clamp the piston rod assembly securely in a vice. Remove the nut (3), piston (4) complete with wear ring (5).


20
1
2
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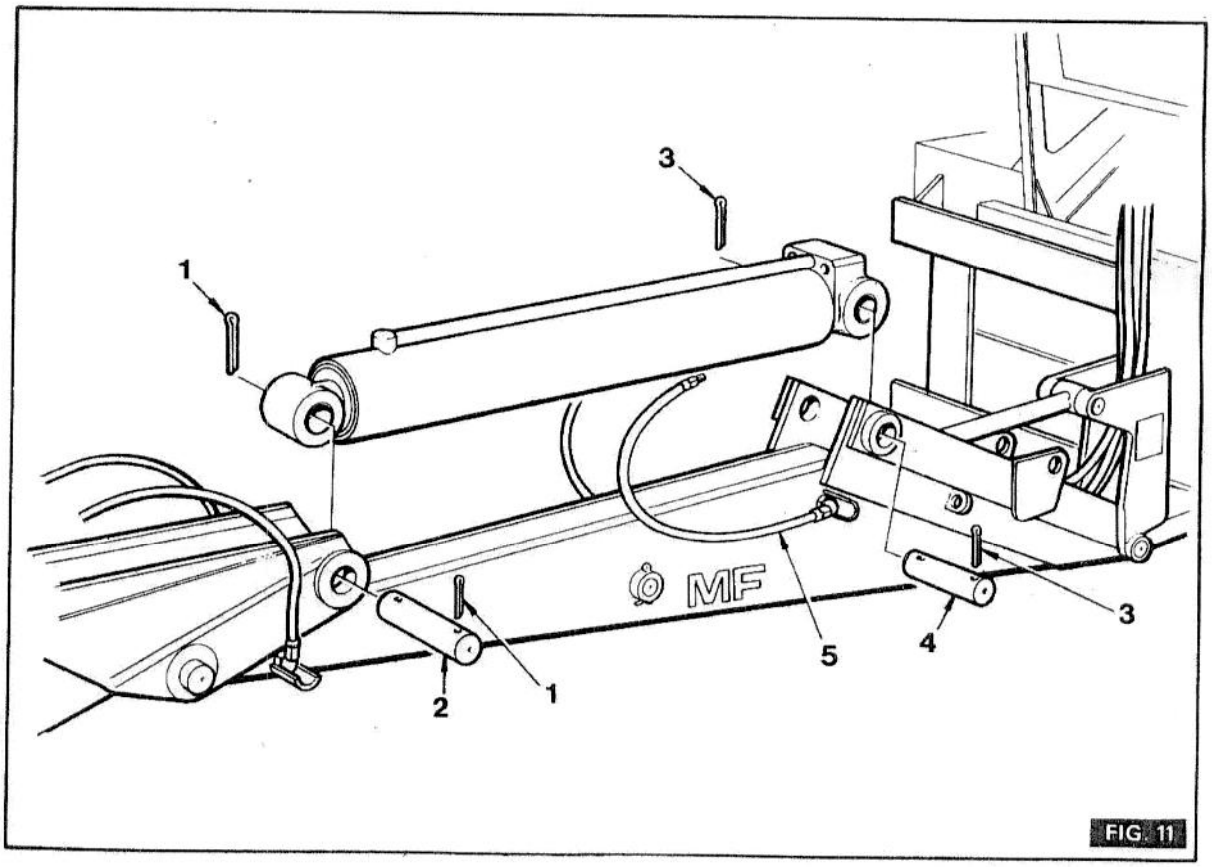
4
3

FIG. 10


3
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MF
5
4
3
2
1

FIG. 11

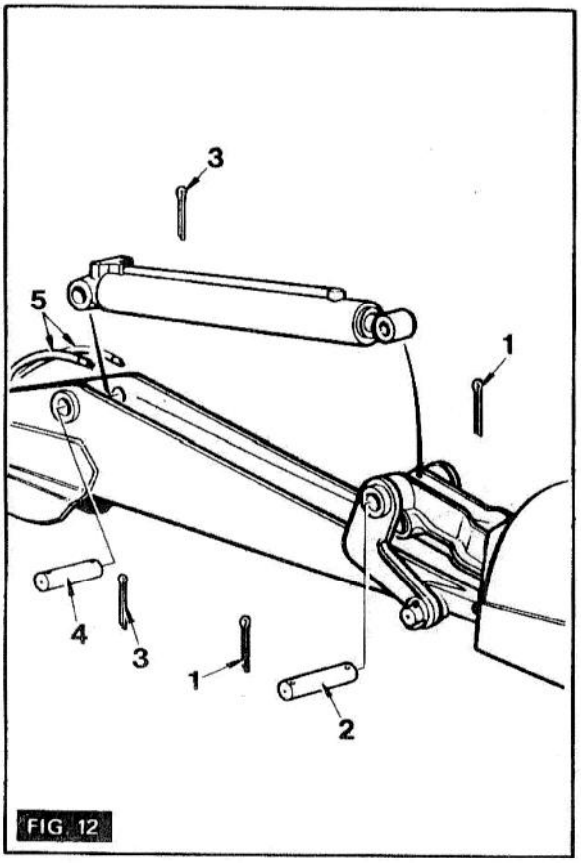

FIG 12

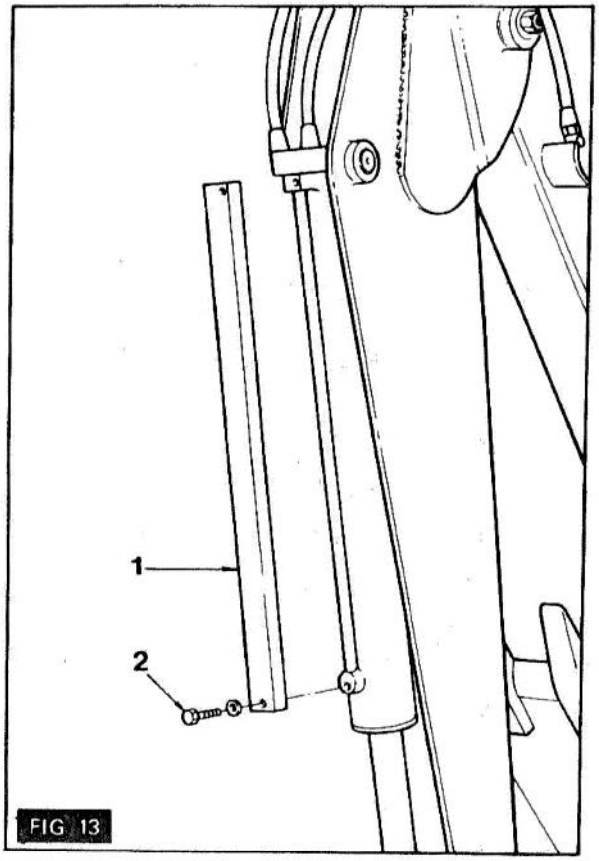

FIG 13

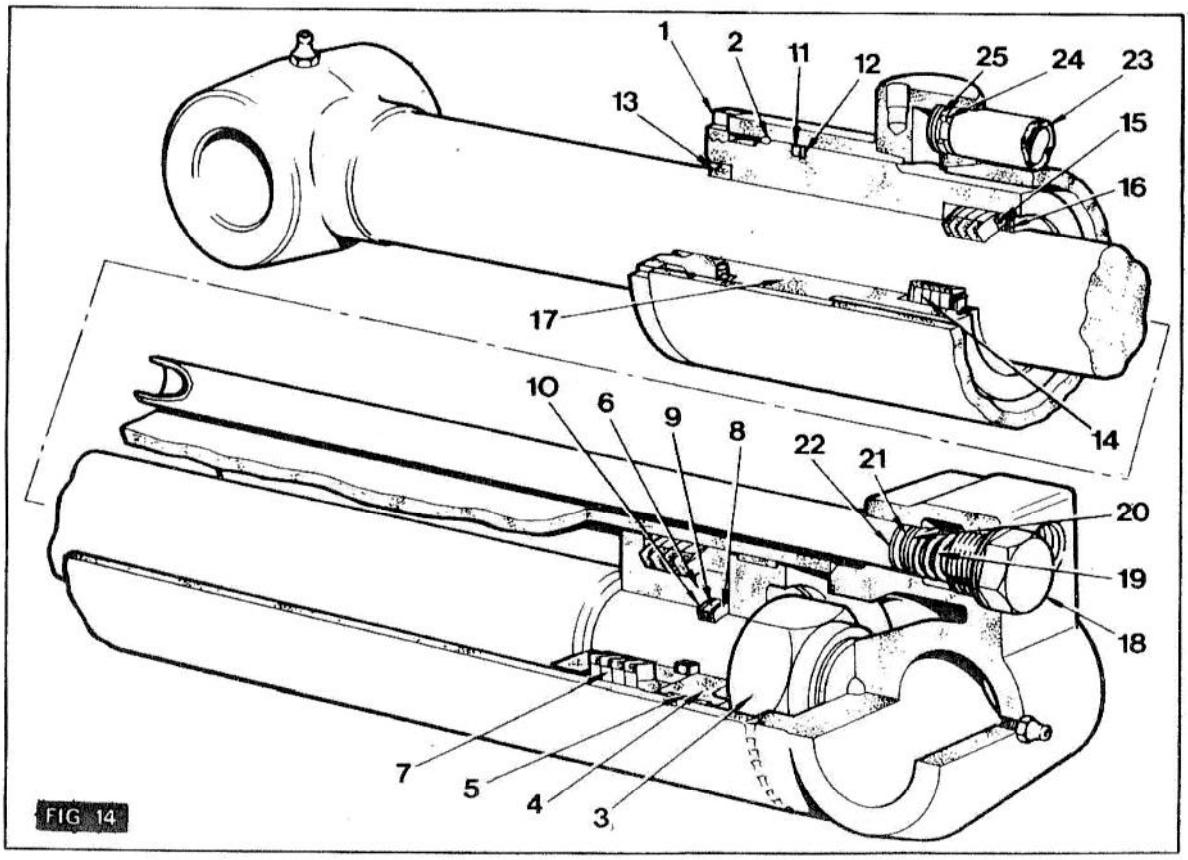

FIG 14

BUCKET RAM - DIGGER

Disassembly . . . Cont'd

9. Slide the packing retainer (6) complete with packing set (7), back up washer (8), 'O' ring (9), back up washer (10) off the rod.
10. Slide the bearing assembly off the rod. Remove the 'O' ring (11), back up washer (12), wiper seal (13), packing set (14) retainer (15) and retainer ring (16) from the body (17).
11. Remove the plug complete with 'O' ring (18), spring (19), shims (20) then withdraw the tube.
12. Remove 'O' ring (21) and back up washer (22) from the tube (23) then 'O' ring (24) and back up washer (25).

Note :- If the same tube is to be re-used retain the shims.

Reassembly (9G/16)

1. Examine all component parts for excessive wear or damage. Thoroughly clean all parts.
2. (Fig. 14) Slide the bearing nut (1) and lock ring (2) onto the piston rod.
3. Fit new wiper seal (13), packing set (14), retainer (15), retainer ring (16), 'O' ring (9) and back up washer (10) to the bearing body (17).
4. Lubricate the piston rod with clean hydraulic oil and slide the bearing assembly onto the rod.
5. Fit back up washer (8), new 'O' ring (9), back up washer (10), and new packing set (7) onto the packing retainer (6) and slide it onto the rod.
6. Fit a new wear ring (5) to the piston (4), slide it onto the rod and secure with nut (3). Tighten to a torque of 330 - 350 lb.ft. (41.49 - 48.4 kg.m.).
7. Lubricate the 'O' rings and seals then insert the piston and rod assembly into the barrel, taking care not to damage the seals.
8. Push the bearing assembly into the barrel far enough to allow the replacement of the lock ring (2).
9. When the lock ring has been replaced withdraw the piston rod against the bearing thus forcing the bearing up to the lock ring. Fit the bearing nut (1) and tighten to a torque of 200 - 220 lb.ft. (27.66 - 30.43 kg.m.).
10. Fit new 'O' ring (21), new back up washer (22), new 'O' ring (24) and new back up washer (25) to the tube (23).
11. Insert the tube then replace the shims (20), If a new tube is to be fitted shim between the tube and spring to ensure a dimension of 1¼" ± 1/32" (31.75 ± 0.793 mm) between the top of the shims and spot face of the plug (Fig 14 Dimension A).
12. Replace spring (19) then refit plug (18) complete with new 'O' ring.
13. (Fig. E13) Replace the guard (1) and secure with screws (2).

CLAMPING CYLINDER

Removal and Replacement (9G/17)

1. (Fig. 15) Release pressure in the cylinder by operating the clamping control lever.
2. Unscrew the 4 bolts (1) which hold the clamp retaining casting (2) to the main casting (3) and remove the clamp retaining casting.
3. Extract the split pin (4) and remove the pin (5).
4. Remove the hydraulic connection (6).
5. Force the ram piston back into the cylinder far enough to allow the clamping plate (7) to clear the 'vee' in the rear frame.
6. Turn the piston and clamping plate then slide the plate from between the cylinder lugs.

Warning: Care should be taken as the piston could drop from the cylinder.

7. Remove the split pin (8) and pin (9) then remove cylinder (10).
8. Replacement is a reversal of the above procedure.

CLAMPING CYLINDER . . . Cont'd

Disassembly and Reassembly (9G/18)

1. Remove the cylinder from the machine as stated in operation 9G/17
2. (Fig. 16) Slide the piston (1) from the cylinder (2).
3. Remove the retaining ring (3) and seal (4).
4. Remove the grease nipple (5).
5. Check all parts for wear or damage.
6. Reassembly is a reversal of the above procedure.

Note :

1. Before reassembly fill the annular cavity in the cylinder with grease.
2. All seals should be renewed on reassembly.

STABILIZER RAM

Removal and Replacement (9G/19)

The procedure for removing either the left hand or right hand ram is exactly the same.

1. Extend the ram until the foot is just touching the floor.
2. (Fig. 17) Remove split pin (1) and extract pin (2).
3. Retract the ram rod.
4. Remove the cover plate (3) from the top of the leg.
5. Disconnect the two hydraulic unions (4).
6. Adequately support the ram assembly, remove split pin (5) then pin (6). Lift out ram assembly (7).
7. Replacement is a reversal of removal procedure.

Disassembly (9G/20)

1. Remove the ram as stated in operation 9G/19
2. Hold the ram assembly securely in a suitable clamp or vice.
3. (Fig. 18) With a 'C' Spanner turn the bearing nut (1) in an anti-clockwise direction, remove it from the bearing and rest it on the piston rod.
4. Tap the bearing approximately 1½" (38.1 mm) into the barrel to allow the removal of the lock ring. (2).
5. Using a screw driver remove the lock ring.
6. Withdraw the piston rod assembly from the barrel.
7. Clamp the piston rod assembly securely in a vice, remove the nut (3) piston (4) complete with wear ring (5) 'O' ring (6), packing retainer (7) complete with packing (8).
8. Slide the bearing assembly off the rod.
9. Remove the 'O' ring (9), back up washer (10), wiper seal (11), snap ring (12), washer (13) and packing (14) from the body (15).

Reassembly (9G/21)

1. Examine all component parts for wear or damage. Thoroughly clean all parts.
2. (Fig. 18) Slide the bearing nut (1) and lock ring (2) onto the piston rod.
3. Fit new packing (14), washer (13), snap ring (12), new wiper seal (11), new back up washer (10) and new 'O' ring to the body (15).
4. Lubricate the piston rod with clean hydraulic oil and slide the bearing assembly onto the rod.
5. Fit new packing (8) onto packing retainer (7) and slide up to the shoulder on the piston rod. Fit new 'O' ring (6).
6. Fit new wear ring (5) onto the piston (4), slide it onto the rod and secure with nut (3). Torque to 300 - 330 lb.ft. (41.49 - 45.6 kg.m.).

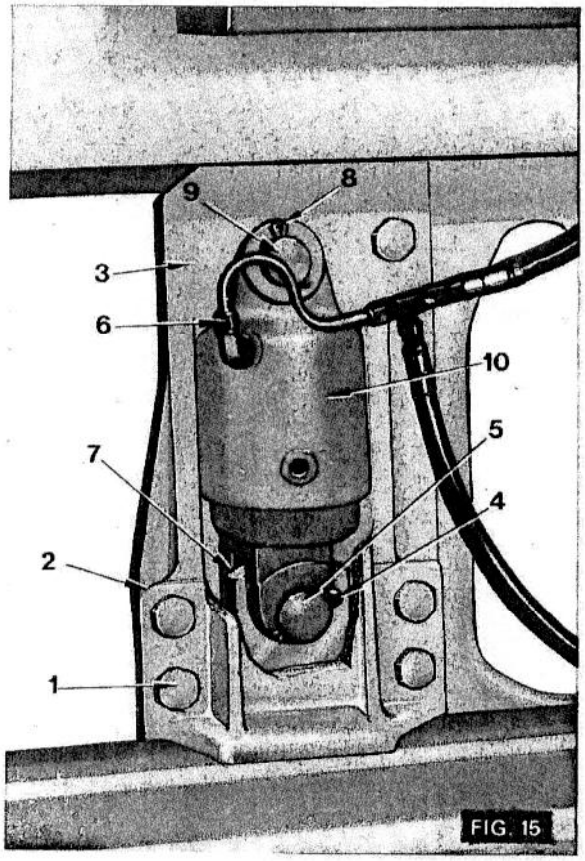

FIG. 15

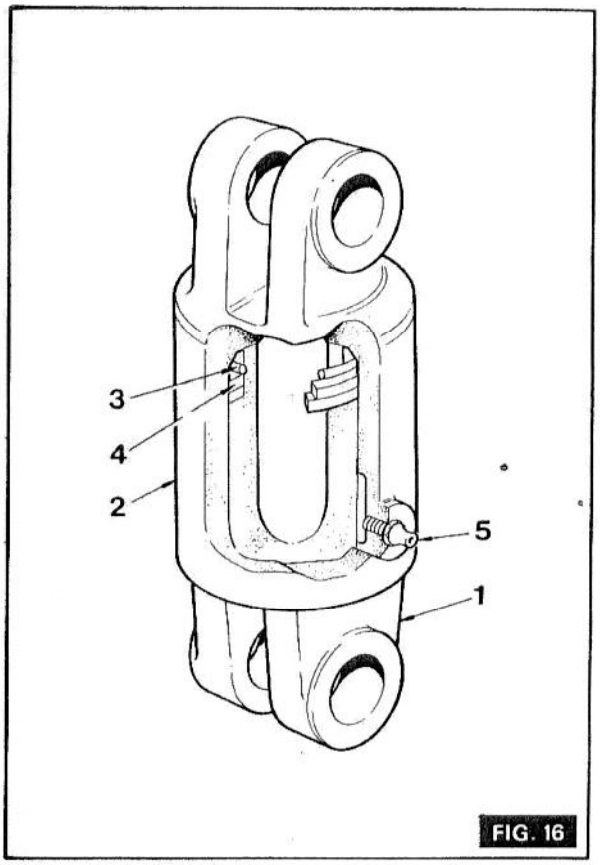

FIG. 16

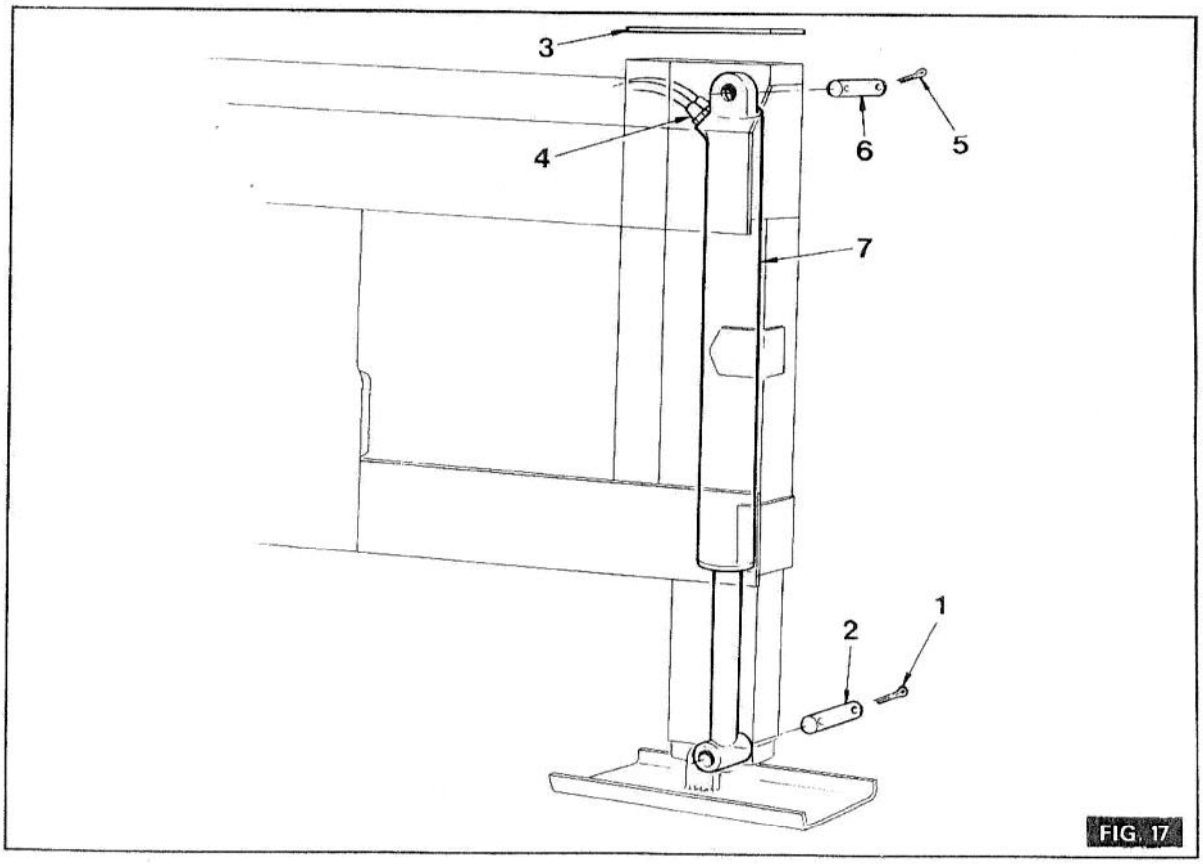

FIG. 17

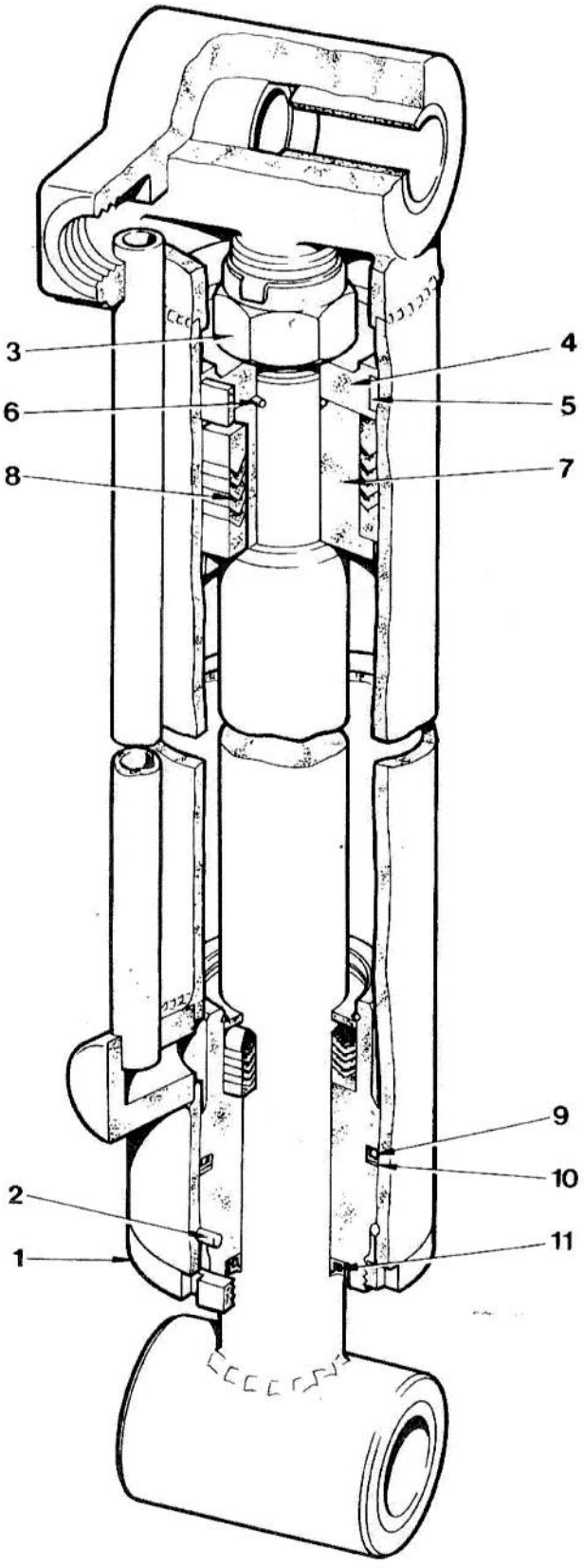

FIG 18

STABILIZER RAM
Reassembly . . . Cont'd

7. Lubricate the 'O' rings and seals then insert the piston and rod assembly into the barrel, taking care not to damage the seals.
8. Push the bearing assembly into the barrel far enough to allow the replacement of the lock ring (2).
9. When the lock ring has been replaced withdraw the piston against the bearing assembly thus forcing the bearing up to the lock ring. Fit the bearing nut (1) and tighten to a torque of 160 - 180 lb.ft. (22.13 - 24.89 kg.m.).

HAMWORTHY
SEVEN SPOOL VALVE

CONTENTS

LIST OF ILLUSTRATIONS

SIX SPOOL VALVE

General

The monoblock construction of the six spool valve has the integral features of 1) an open centre, 2) series flow, 3) parallel pressure feed and a zig-zag open centre. The pressure galleries, which are either side of the zig-zag open centre, link up at the oil inlet port and the return oil galleries link up at the outlet port. With the exception of the stabilizer service each spool incorporates a shock valve assembly interconnected between the service actuator ports and the return oil galleries. The hydraulic system is shown in Fig. 2.

KEY TO FIG I

1. Bucket spool
2. Dipperstick spool
3. Right Hand stabilizer
4. Left Hand stabilizer
5. Rotary actuator
6. Boom spool

SHOCK VALVE SETTINGS

A	Bucket Rod Side	2750 lbs/in² (193.3 kg/cm²)
B	Bucket Head Side	2750 lbs/in² (193.3 kg/cm²)
C	Dipperstick Rod Side	3000 lbs/in² (210.9 kg/cm²)
D	Dipperstick Head Side	2750 lbs/in² (193.3 kg/cm²)
E	Left Slew	2000 lbs/in² (140.6 kg/cm²)
F	Right Slew	2000 lbs/in² (140.6 kg/cm²)
G	Boom Head Side	2750 lbs/in² (193.38 kg/cm²)
H	Boom Rod Side	3000 lbs/in² (210.9 kg/cm²)

KEY TO FIG. 2

(IN) Inlet Manifold.
(C/C) Clamp Cylinder.
1. Bucket Service.
2. Dipperstick Service.
3. Stabilizer, Right Hand.
4. Stabilizer, Left Hand.
5. Actuator Service (Slew).
6. Returns Manifold.

(Fig. 3) shows the bucket selector spool and the flow of oil when the bucket is crowded. The spool is raised pressurising the lower port which is connected to the head side of the bucket ram. Returning oil is directed to the reservoir through the upper port.

KEY TO FIG. 3

1. Open centre gallery
2. Pressure feed gallery
3. Service port
4. Top port
5. Shock valves
6. Service cylinder

(Fig. 4). The oil circuit for the dipperstick operation is shown in this figure. The open centre gallery has been blocked by the operation of the selector spool and pressure has built up in the parallel pressure feed galleries. The pressure is thus transferred to the dipperstick ram through the lower port while the upper port takes the return oil.

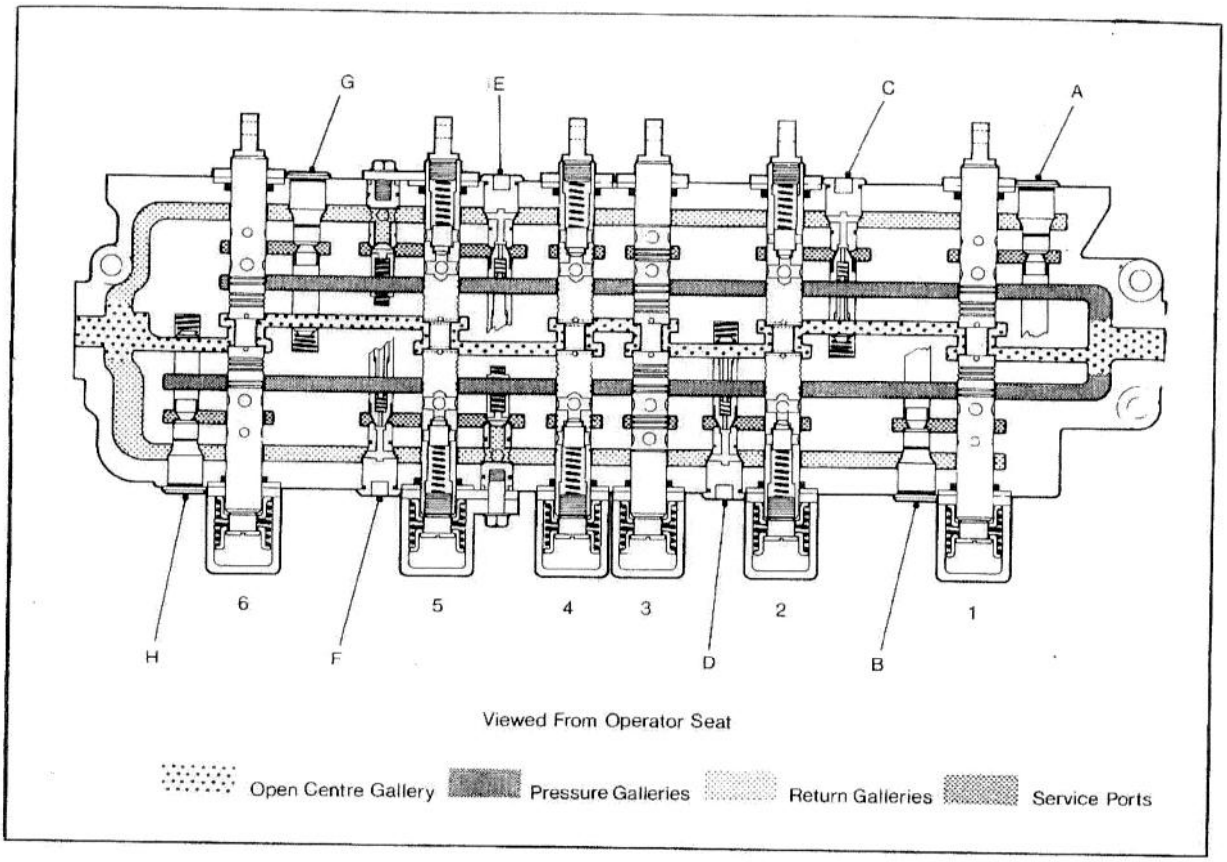
G
E
C
A
6
5
4
3
2
1
H
F
D
B
Viewed From Operator Seat
Open Centre Gallery
Pressure Galleries
Return Galleries
Service Ports

FIG. 1

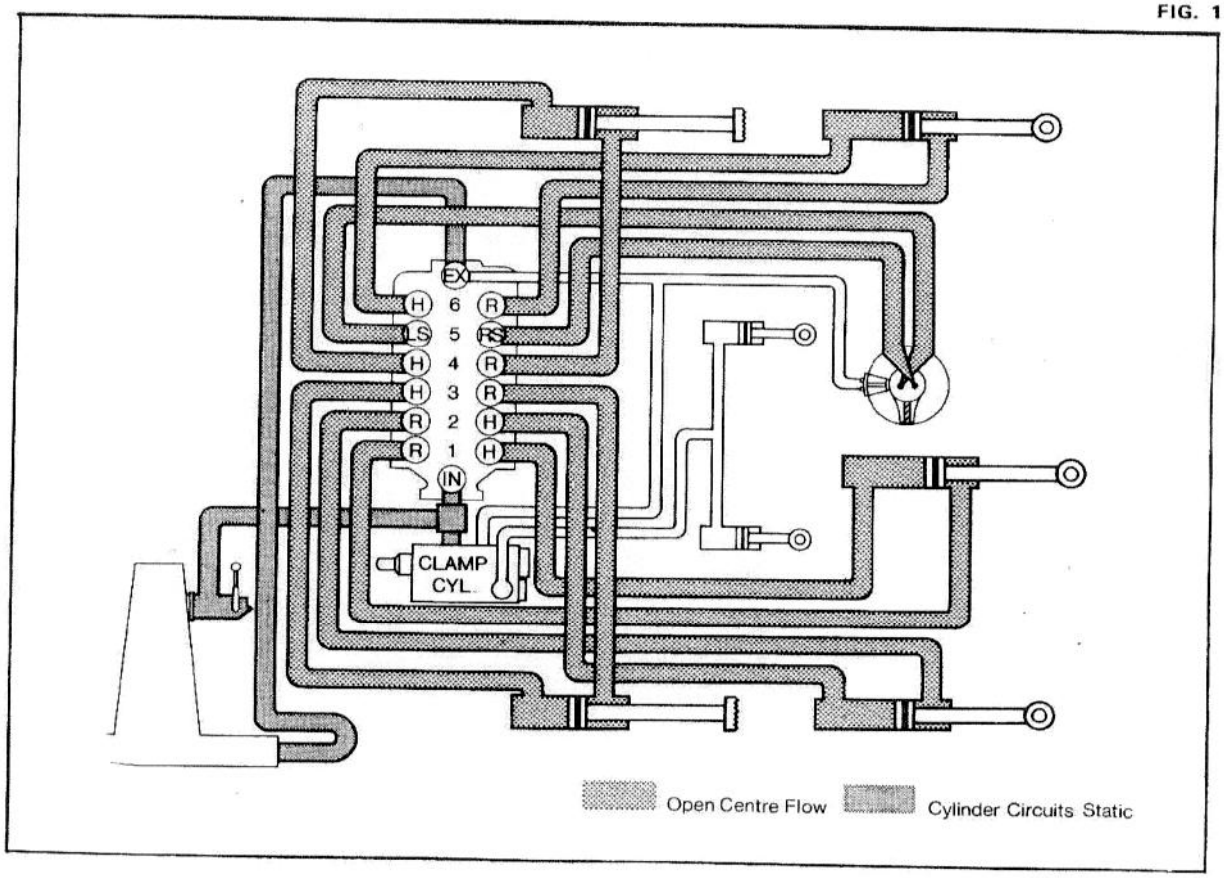
EX
H 6 R
LS 5 RS
H 4 R
H 3 R
R 2 H
R 1 H
IN
CLAMP CYL.
Open Centre Flow
Cylinder Circuits Static

FIG. 2

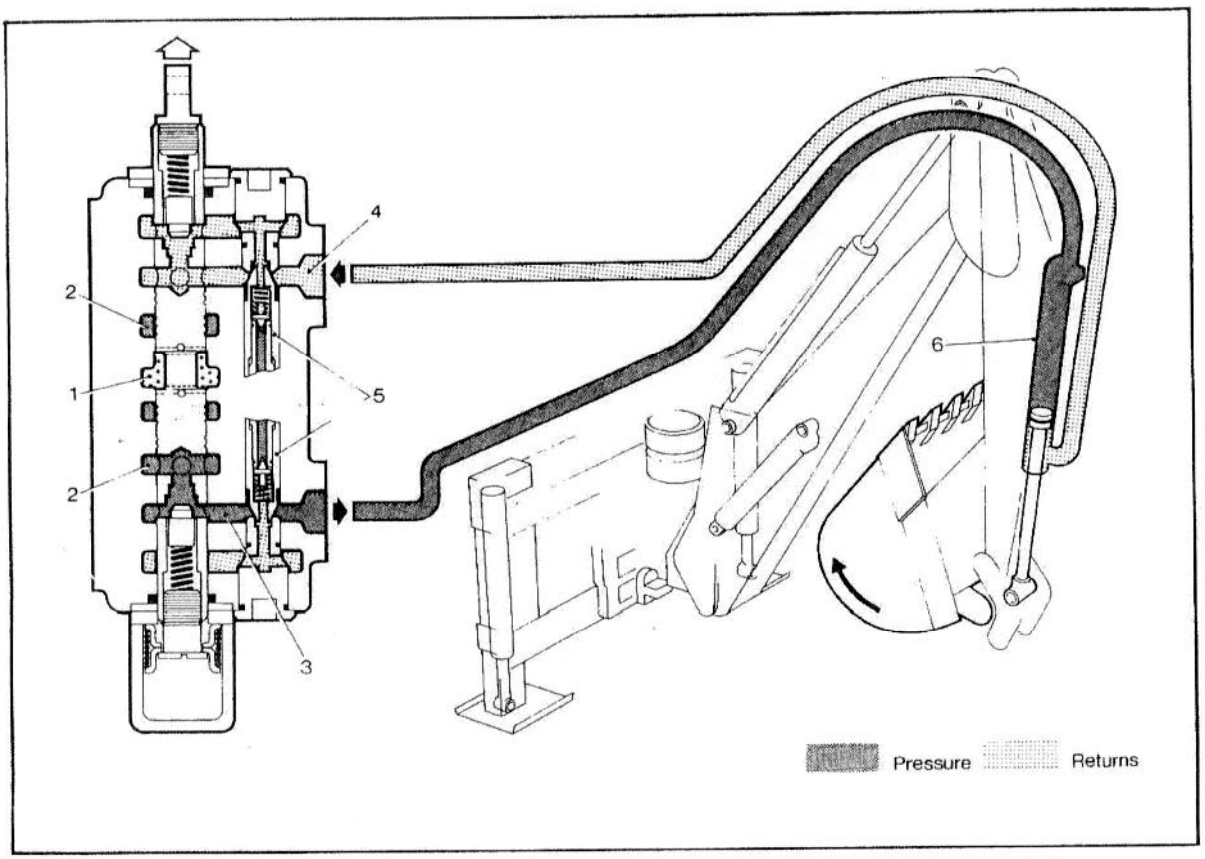

FIG. 3

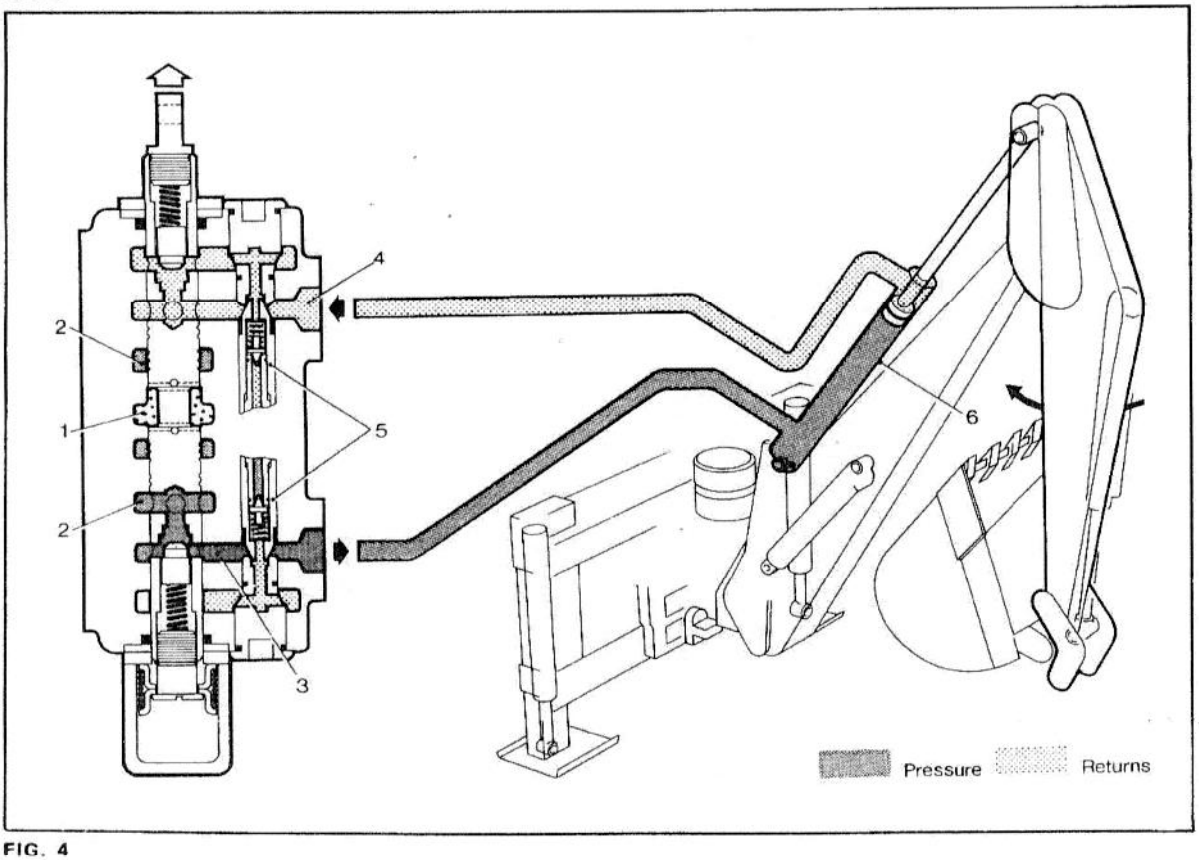

FIG. 4

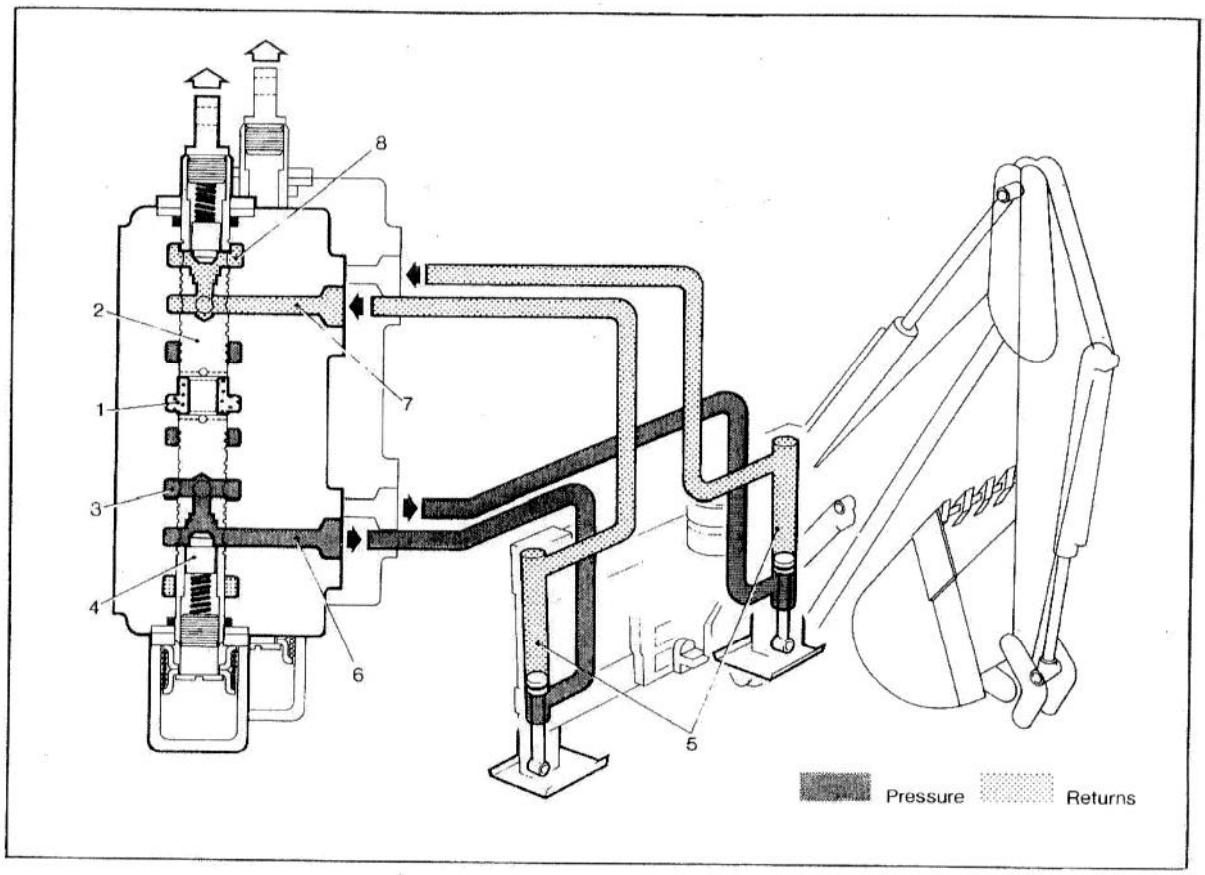

FIG. 5

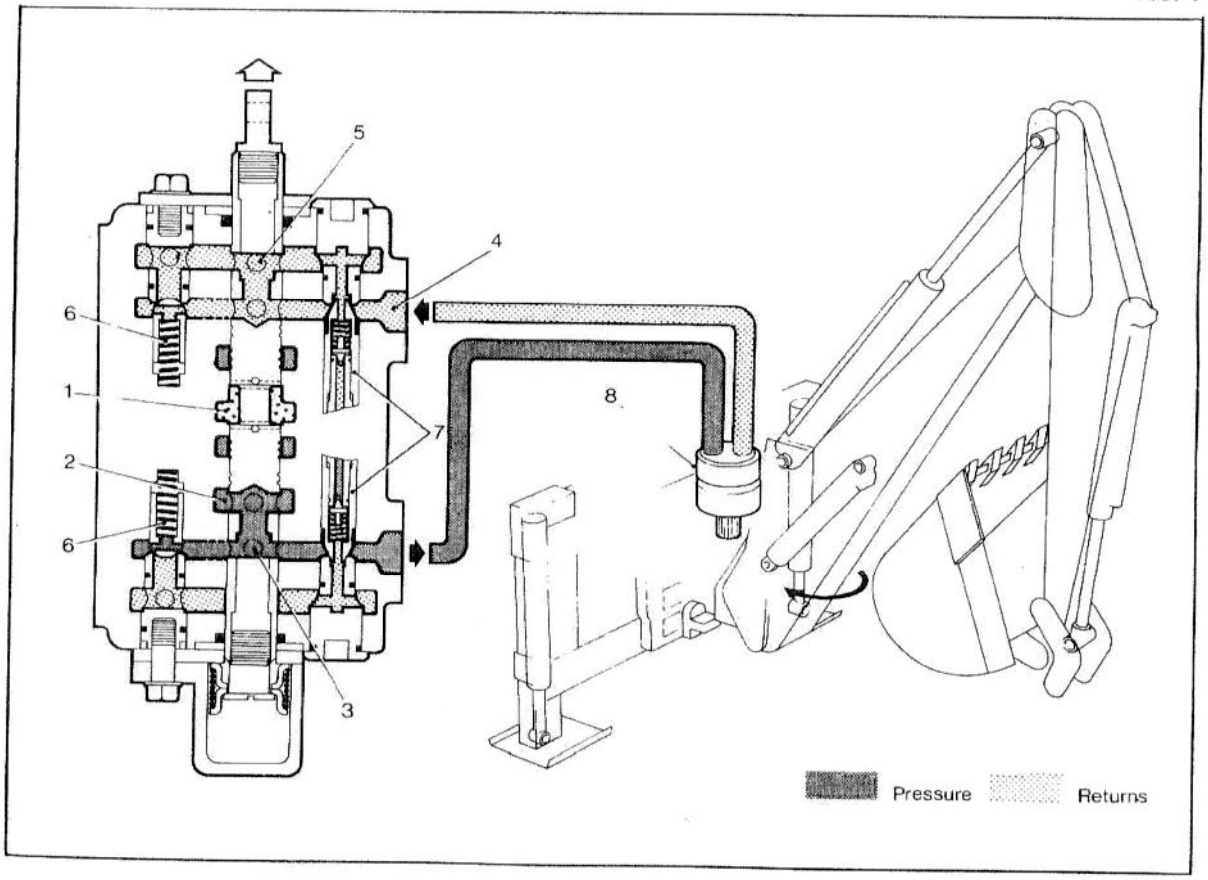

FIG. 6

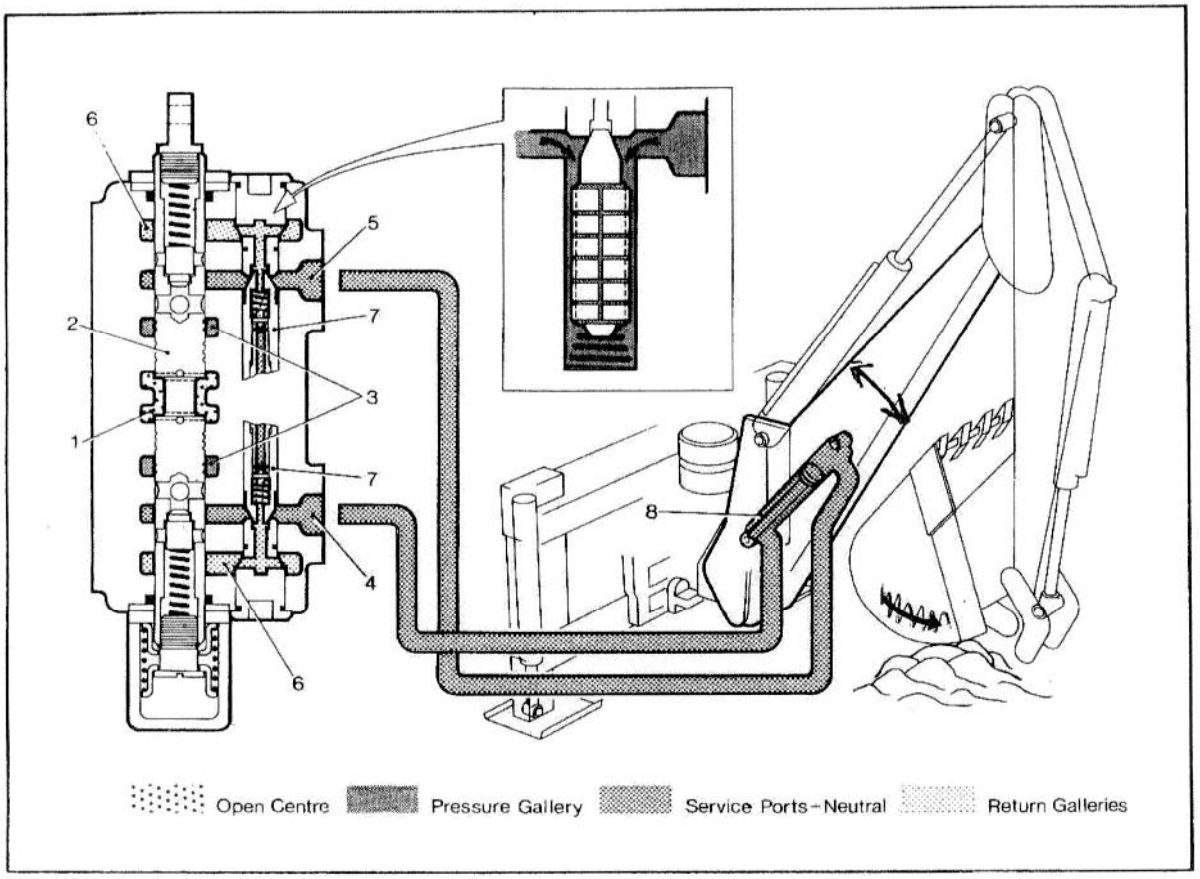
6
5
2
7
3
1
7
8
4
6
Open Centre
Pressure Gallery
Service Ports–Neutral
Return Galleries

FIG. 7

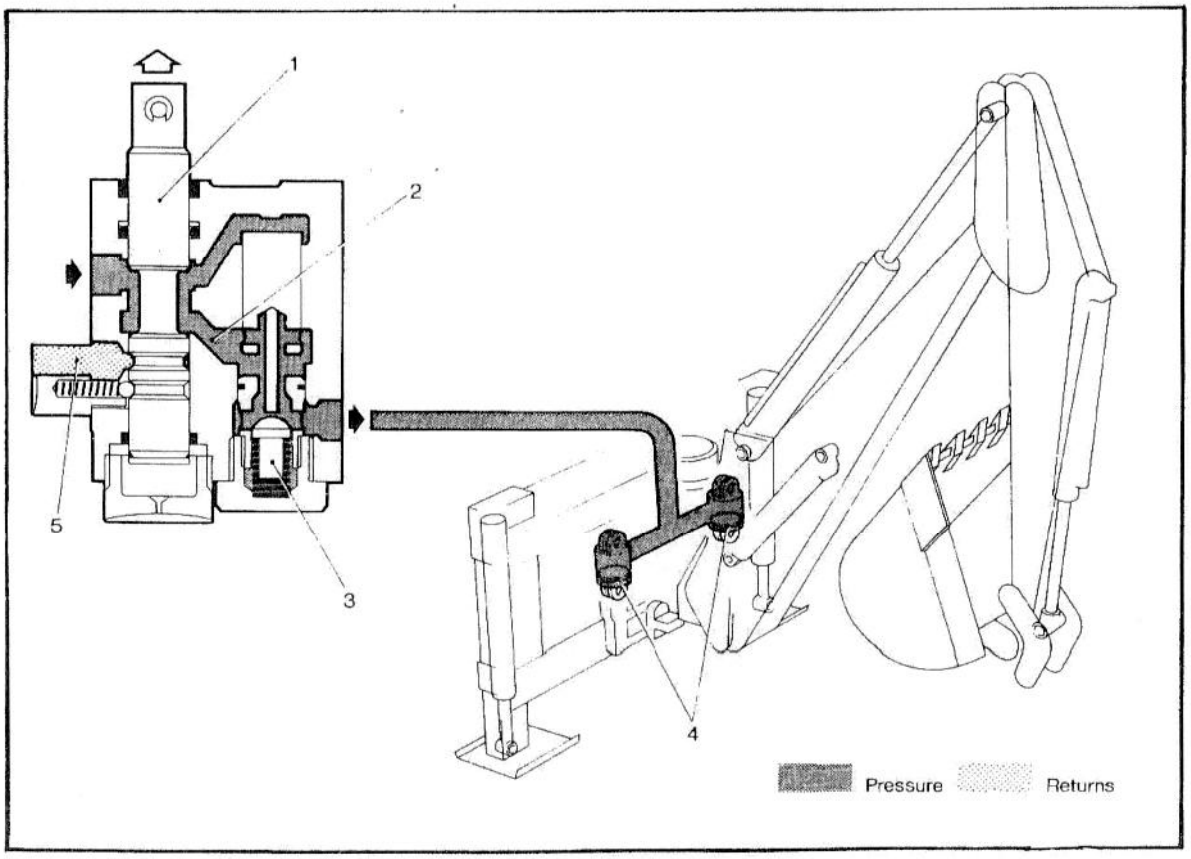
1
2
5
3
4
Pressure
Returns

FIG. 8

KEY TO FIG. 4

1. Open centre gallery
2. Pressure feed gallery
3. Service port
4. Top port
5. Shock valves
6. Service cylinder

(Fig. 5) illustrates the flow of oil through the stabilizer spool then out through the hoses to the rams. When the spool is raised oil is fed to the rod side and the stabilizer retracts. Conversely when the spool is raised oil is fed to the head side and the stabilizer extends.

KEY TO FIG. 5

1. Open Centre gallery
2. Pressure gallery
3. Pressure gallery
4. Check valve
5. Service cylinder
6. Lower service port
7. Upper service port

(Fig. 6). shows the selector spool in an operating position whereby oil flows from the pressure gallery (2) through the lower service port (3) to the left hand vane compartment in the actuator (8). The digger will then rotate to the right. The oil which is discharged from the opposite side of the vane returns via the feed port (4), to the return gallery (5). If the build up of pressure against the actuator vane exceeds 2000 lbs/in^2 (140.6 kg/cm^2), the lower shock valve (7) will relieve the pressure momentarily until movement of the digger is obtained.

Two anti-cavitation valves (6) are situated between the delivery port gallery and the return port gallery. These would come into operation when the actuator over runs after the spool has returned to neutral e.g. when it is impossible to stabilize the machine level and therefore it is necessary to slew "down hill". The momentum of the digger would force more oil from the actuator than the pump could replace. If this happened the valve would be drawn off its seat and oil could then flow from the return gallery to make up the deficiency on the discharge side of the system.

KEY TO FIG. 6

1. Open centre gallery
2. Pressure gallery
3. Feed port
4. Return port
5. Return oil gallery
6. Anti-Cavitation valves
7. Shock valves
8. Rotary actuator

(Fig. 7) illustrates the oil system for the boom. The spool is in a neutral position so the oil will flow through the open centre and not operate the service.

KEY TO FIG. 7

1. Open centre gallery
2. Land
3. Pressure gallery
4. Lower service port
5. Upper service port
6. Return oil gallery
7. Shock valves
8. Boom ram

KEY TO FIGURE 8

1. Selector Spool
2. Gallery
3. Check Valve
4. Clamp Rail Cylinders
5. Return Port

SIX SPOOL VALVE

Removal and Replacement

(9H/1)

1. With the digger bucket resting on the ground, operate the control levers several times to ensure that all hydraulic pressure has been relieved from the digger.
   Remove the spool control lever cover and rubber grommets.
2. Disconnect all hoses from the six spool valve. To make reassembly easier, label or mark all the hoses and their corresponding ports.
3. (Fig 9). Remove the three securing bolts and lift the valve clear.
4. Replacement is a direct reversal of the removal procedure.

SIX SPOOL VALVE

Disassembly

(9H/2)

1. (Fig. 9). Remove the split pins (1) and linch pins (2) which connect the links (3) to the spools.
2. Unfasten and remove the two screws (4) and remove the complete handle assembly from the valve.
3. (Fig. 10). Remove the setscrews (1) and washers (2) which secure the cap (3) and cover spacer (4) then withdraw the spool complete with centering device, retainer (5) and seal ring (6).
4. Remove all other spools as per item 3.

Note

The spools are **NOT** interchangeable. When dismantling the valve, lable the spools and mark the mating bore.

5. Remove the two setscrews (7), washers (8), wiper retainer (9), wiper (10), seal retainer (11) and seal (12) from each bore.
6. Anti-cavitation valves (13) and springs (14) are incorporated in the slew system. These can be removed after the setscrews (1) have been removed from the slew section of the valve, as they are positioned in the block under the setscrews.
7. Remove the seat (15) and extract the overload auxiliary relief valve (16) from its bore. Then remove the lower seat (17) and valve (18).
8. Remove the relief valves from the other services.

SIX SPOOL VALVE

Reassembly

(9H/3)

1. Examine all seal rings and wipers for cuts and scoring, replace if necessary.
2. Check recesses for burrs and dirt, clean up if necessary.
3. Examine housing bore and seal recesses, if scored or damaged; fit new housing together with spools.
4. Lightly oil all components with clean hydraulic oil.
5. (Fig. 10). Replace the cover spacer (4), seal (6) and seal retainer (5) on the spool and replace the spool in the correct bore.
6. Replace the cover (3) and secure with the setscrews (1) and washers (2).
7. Check the spool operation for tendency to stick. Repositioning of the cover will normally cure this.
8. Replace the seal (12), seal retainer (11), wiper (10), wiper retainer (9), washers (8) and setscrews (7).

Note

When replacing setscrews (1) in the slew section of the valve, fit the anti-cavitation valves (12) and springs (13) in their respective bores and secure with the setscrews.

9. Replace all spools in their appropriate bores using the above procedure.
10. Replace the overload relief valves in their respective bores and refit the seat.

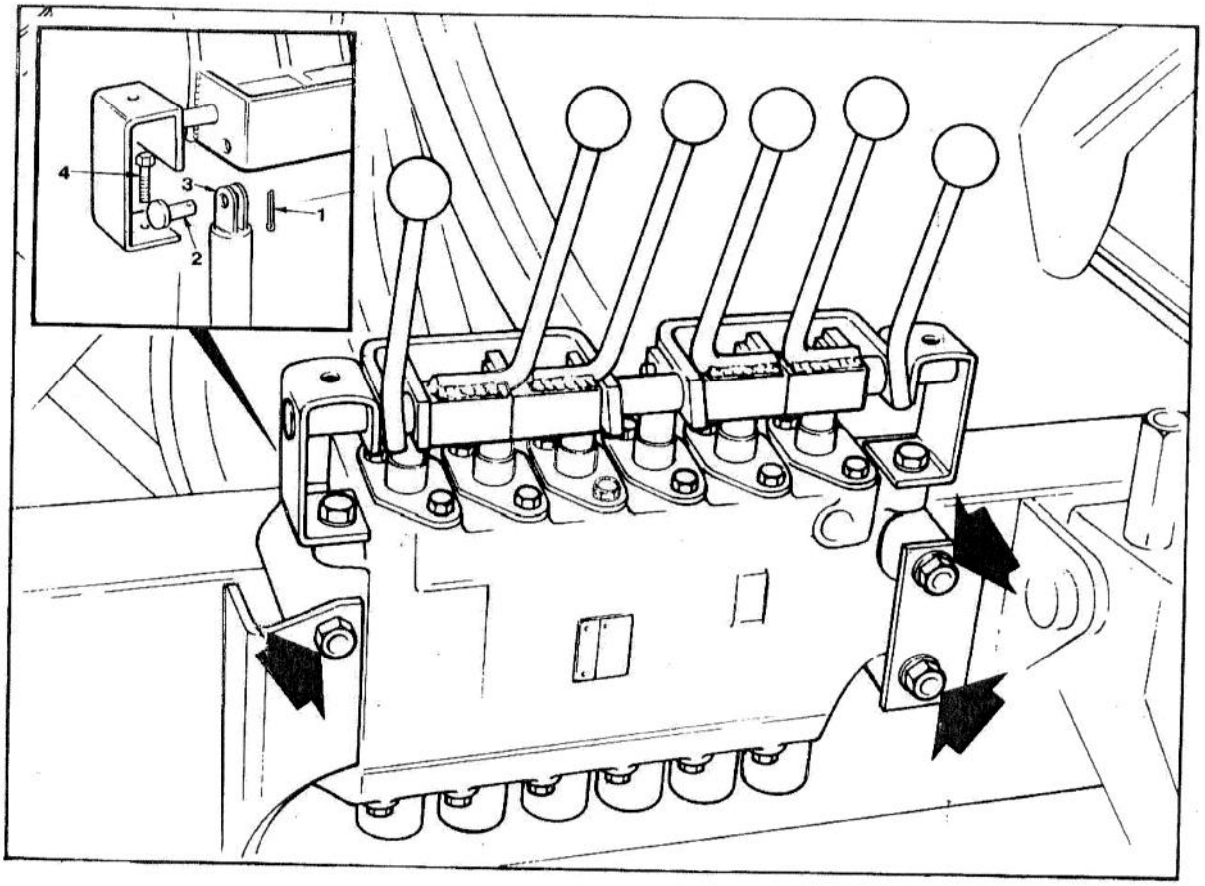

FIG. 9

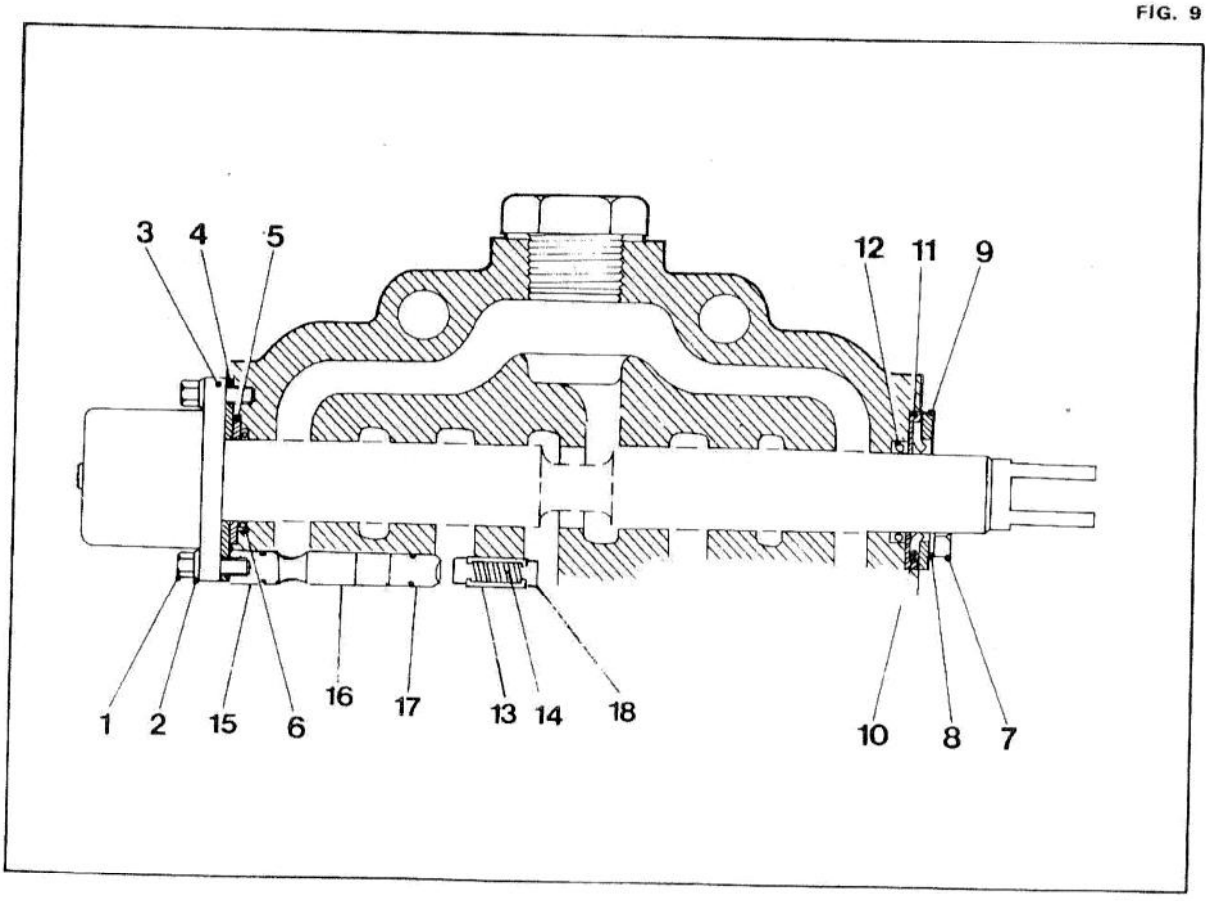

FIG. 10

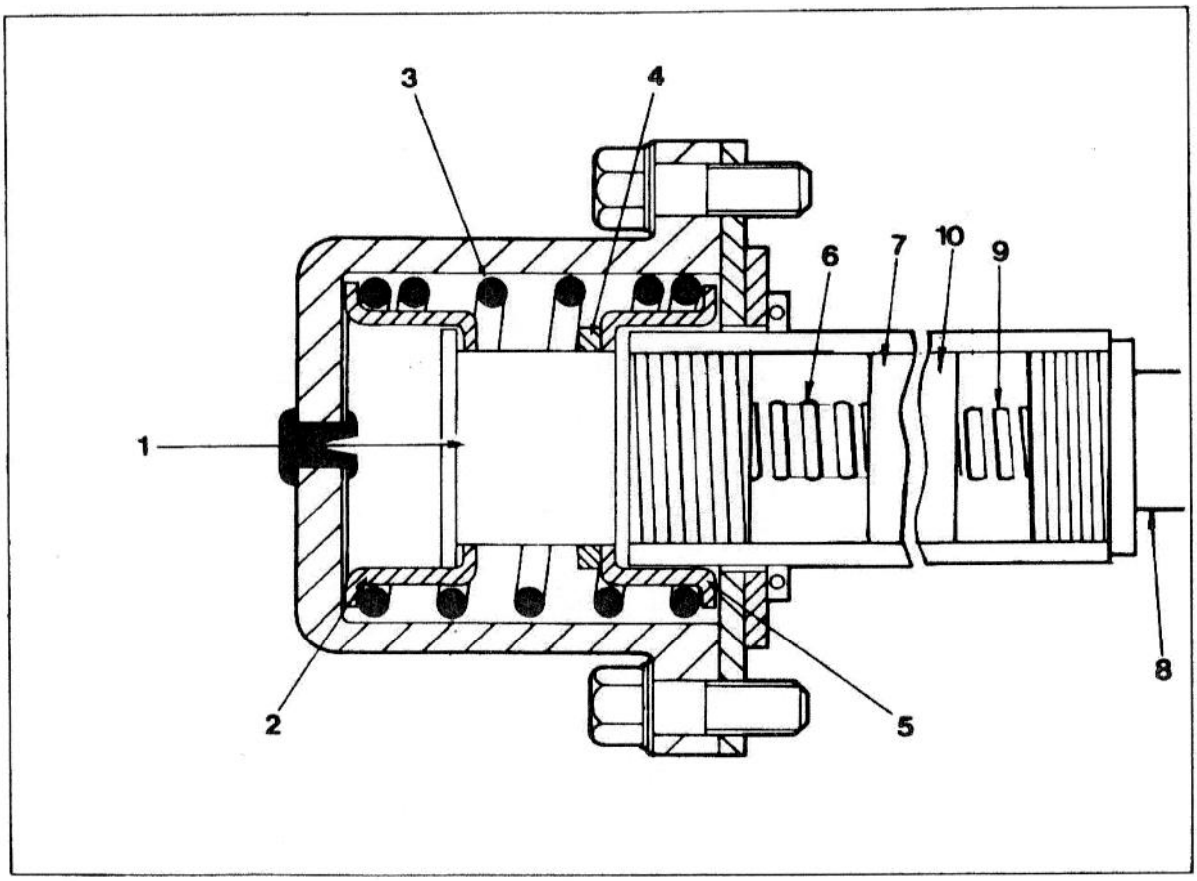

FIG. 11

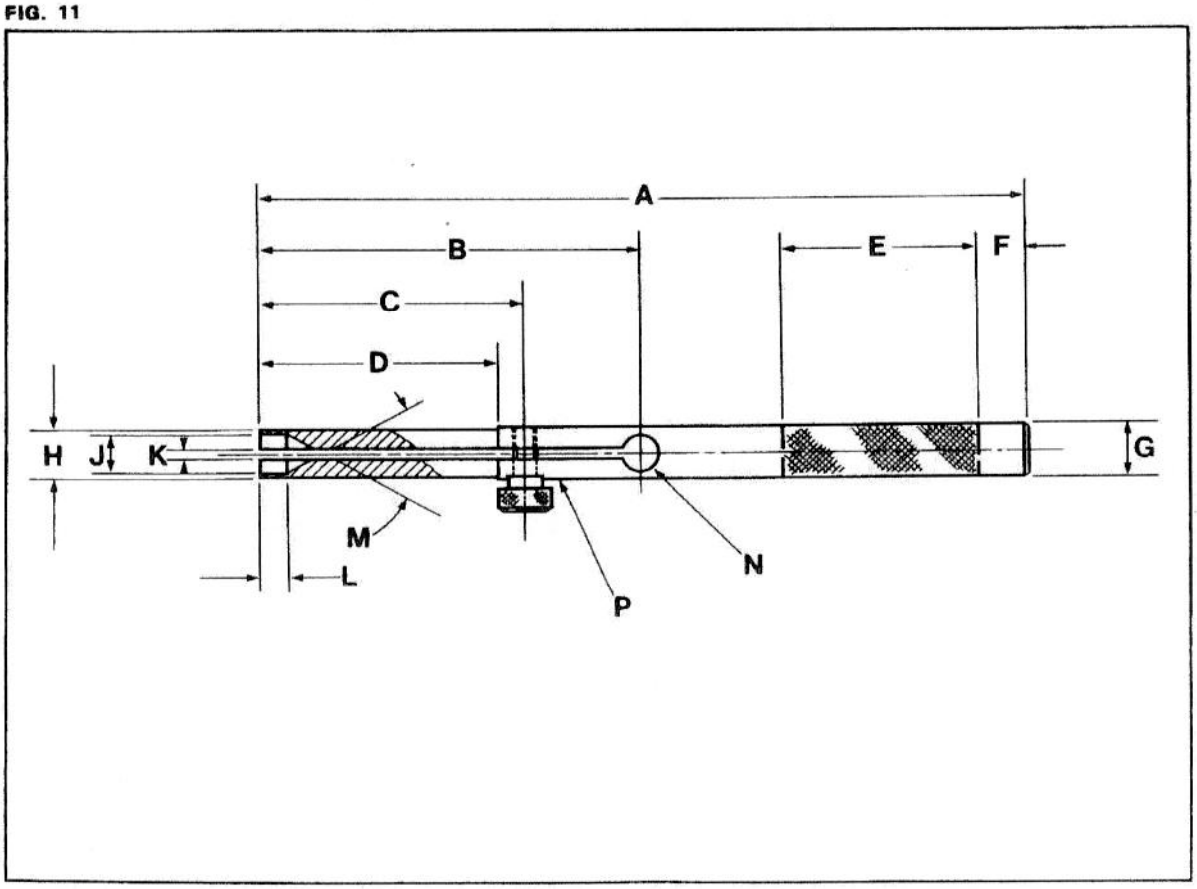

FIG. 12

9H6A

SPOOL

Disassembly

(9H/4)

1. (Fig. 11). Place the spool in a vice which is equipped with soft jaws and unscrew the cap (1).
2. Remove the retainer (2), spring (3), spacer (4) and retainer (5).
3. Extract the spring (6) and check valve (7) from the inside of the spool. Mark the spring and its respective bore.
4. Remove the spool eye (8) from the other end of the spool and extract the spring (9) and check valve (10) from inside the spool. Mark the spring and its respective bore.

SPOOL

Reassembly

(9H/5)

1. Ensure that all items are clean and lightly oiled with clean hydraulic oil.
2. (Fig. 11). Replace the check valve (10) and spring (9). Ensure that they are in their correct bore, then replace the spool eye (8).
3. Replace the check valve (7) and spring (6) in the other bore.
4. Fit the retainer (5), spacer (4), spring (3) and retainer (2) to the spool.
5. Secure the centering device assembly with the cap (1).

SHOCK RELIEF VALVES

Removal and Replacement

(9H/6)

1. Remove the valve seat to expose the valve cartridge.
2. Place extractor tool over the end of the valve cartridge, tighten the screw on the tool and lift the cartridge clear.

Note

The extractor tool which can be made locally is shown in Fig. 12.

It is advisable that the valve seat and valve cartridge, when removed from the six spool block, should be kept together to prevent any errors when refitting them.

Note

ON NO ACCOUNT MUST THE SIZE OF THE VALVE SEAT BE CHANGED AS THE PRESSURE SETTINGS VARY WITH THE SIZE OF THE SEAT.

KEY TO FIG. 12

A	8.00 in (203.2 mm)
B	4.25 in (107.95 mm)
C	3.00 in (76.2 mm)
D	2.75 in (69.85 mm)
E	2.00 in (50.8 mm)
F	0.5 in (12.7 mm)
G	0.563 in (14.287 mm) 0.557 in (14.1478 mm)
H	0.555 in (14.097 mm)
J	0.515 in (13.081 mm) 0.516 in (13.1064 mm)
K	0.062 in (1.5748 mm)
L	0.313 in (7.9375 mm)
M	60°
N	1 Hole drill through 0.375 in (9.525 mm)
P	1 Hole drill through 0.094 in (2.381 mm) C'Bore 0.188 in (4.762 mm) x 0.281 in (7.143 mm) deep. Spot face 0.438 in (11.112 mm) to clean up and tap 2BA.

Material: EN 24 Harden and Temper to 30-35 Rockwell C.

SHOCK RELIEF VALVES

Pressure Checking

(9H/7)

1. (Fig. 13). Fit the adaptor MF348 to a Lere hand pump.
2. Secure the relief valve into the adaptor.
3. Pressurise the relief valve and note from the gauge the pressure at which the pilot valve cracks.
4. If the pressure differs from the list given below, the valve can be stripped and cleaned as stated in operation 9H/8
5. If, after cleaning, the valve is still faulty, scrap the valve and replace with a new one.

There are two seat diameters for the slew circuit relief valve, the old 0.197" (5.0038 mm) and the new 0.312" (7.9248 mm).

Circuit Relief Valve Setting P.S.I.	Pilot Setting for 0.312" (7.9248 mm) Seat P.S.I.	Pilot Setting for 0.197" (5.0038 mm) Seat P.S.I.
1200	750	980
1500	980	1240
2000	1325	1680
2500		2120
2800		2380
3000		2560
3500		3000

SHOCK RELIEF VALVE

(9H/8)

Setting

1. (Fig. 14). Remove the pilot seat locknut and spring (1).
2. Unscrew and remove the pilot seat (2) complete with 'O' Ring (3).
3. Extract the pilot valve (4) and spring (5) from the body (6).
4. Examine the pilot valve and seat for wear or damage. If any wear or damage is found the complete shock valve must be discarded.
5. Reassemble all the components in a reverse order of the above procedure, then re-set the pilot valve by screwing the pilot valve seat in until it just comes into contact with the pilot valve.
6. Test the pilot valve cracking pressure as described in operation 9H/7.
7. The pilot valve pressure should then be adjusted to the required setting as shown in the table in operation 9H/7.

Note

If the valve is to be stored for future use then it must be clearly indicated by means of a label and placed in a box also clearly marked.

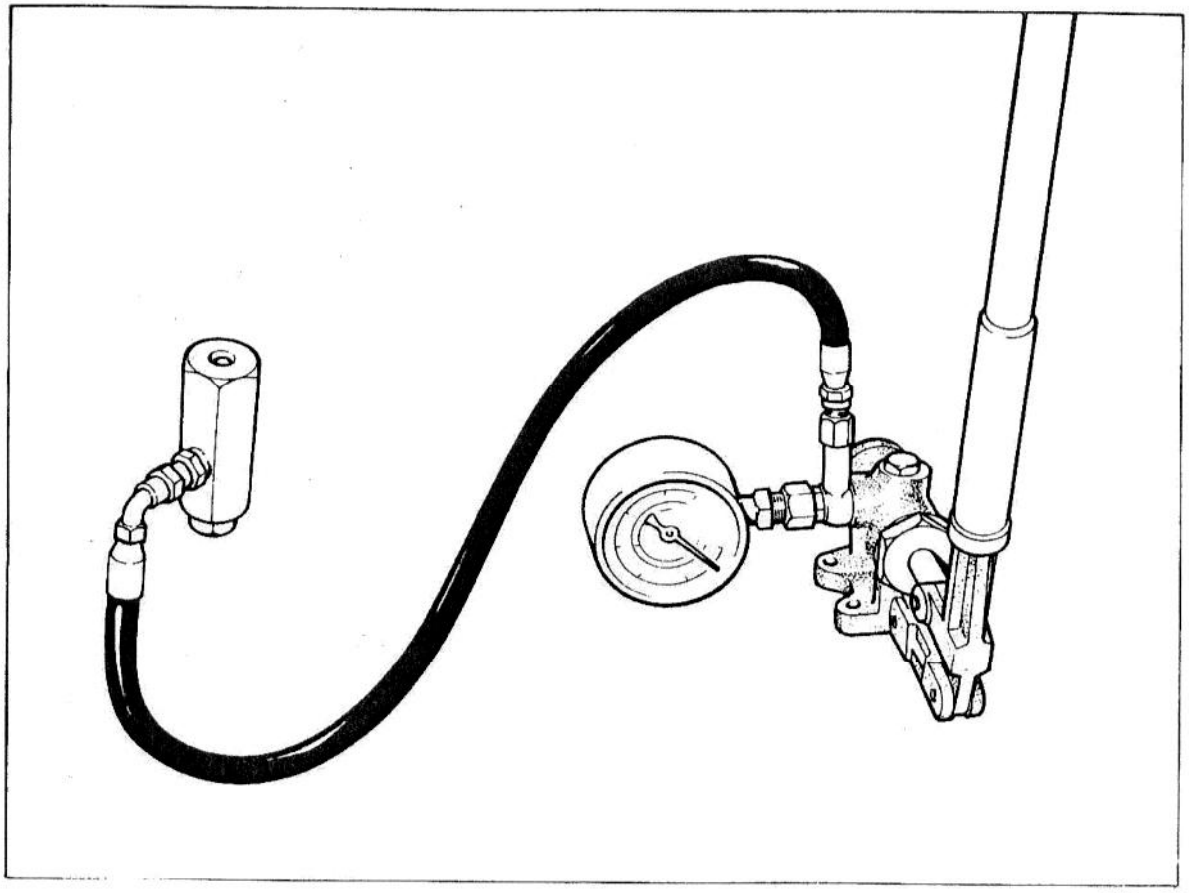

FIG. 13

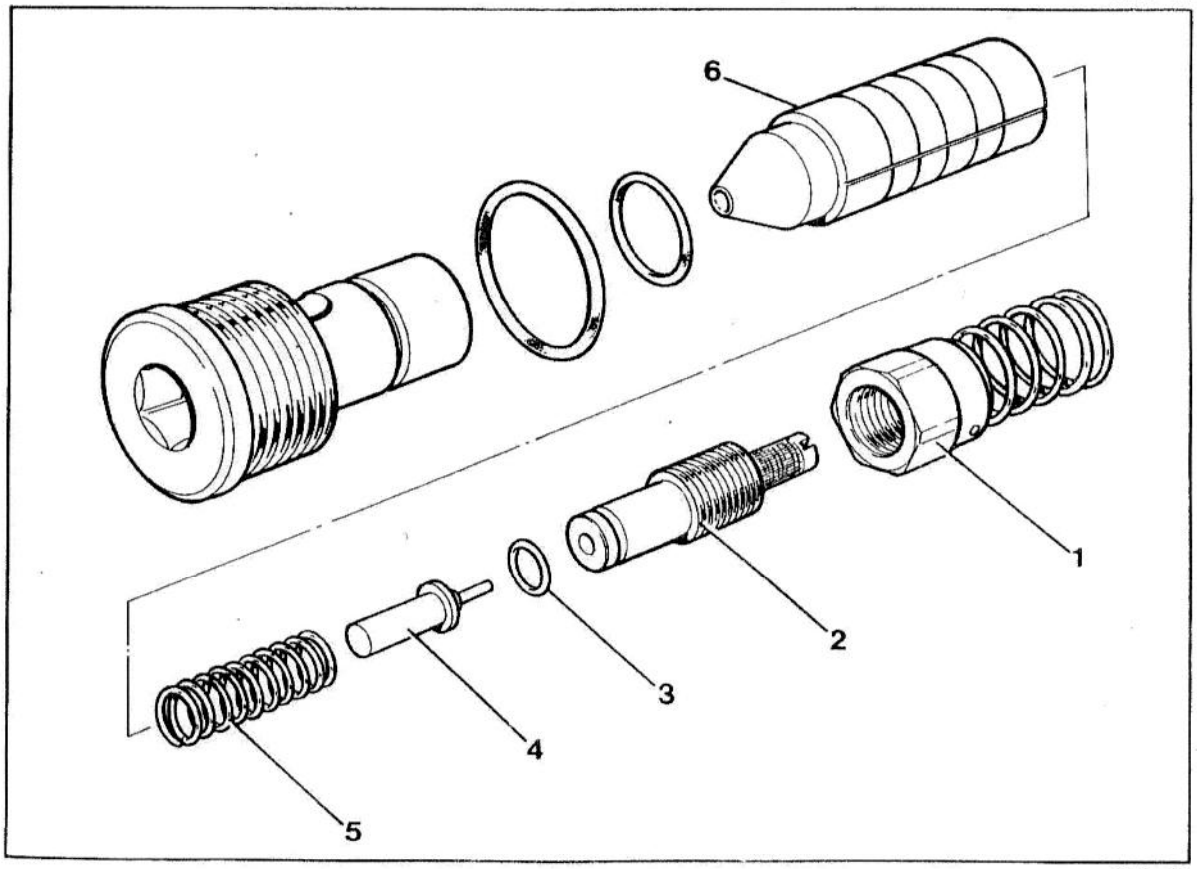

FIG. 14

ATTACHMENTS

CONTENTS

LIST OF ILLUSTRATIONS

ATTACHMENTS

General

LOADER

General Purpose 1 Cu. yd. (0·765 cu. m.) Bucket

This bucket has a replaceable blade and is fitted with eight replaceable teeth. The SAE Capacity is as follows:—

Struck volume .778 cu. yd.
Heaped volume 1.000 cu. yd.
Weight of empty bucket 650 lbs.

Drott 4 in 1 Bucket

This bucket can be used as either bulldozer, scraper, loader or clamshell.

DIGGER

Trench Bucket

Various widths are available for this bucket 12 in, 18 in, 24 in, 30 in, 36 in, and 42 in (30, 45, 60, 76, 91, and 106 cm respectively).
Each bucket has a replaceable cutting edge, side cutters and teeth.
On the 50B machine the 24 in (60 cm) bucket is fitted as standard.

Ditch Cleaning Bucket

Width 48 in. (121.9 cm). Cubic Capacity (liquid level) of 4 cu. ft. (0.1132 cu.m) An extension can be fitted which increases the width to 72 in. (182.9 cm) and the cubic capacity to 6 cu. ft. (10.170 cu m).

Ditch Digging Bucket

The standard bucket is 48 in. (121.9 cm) wide at the top, 15 in. (38 cm) at the base, 30 in. (76 cm) in depth. With the extension fitted the depth is 42 in. (106 cm) and the top width is 60 in. (152.4 cm).
Hardened steel reversible blades are fitted.

CUTTING BLADE

Renewal 10A/1

1. Break the old weld and remove the cutting blade. Clean up the edges on the bucket.
2. Pre heat the new blade to a temperature of 250°–300°C.
3. (Fig. 1) Whilst the blade is still hot position it on the bucket and secure it with six bolts.
4. Tack weld the blade into position using Armoid No. 1 welding rods.

Note

The welding rods should be pre-heated to a temperature of 160°C to ensure that no dampness is present in the rod at the time of welding.

5. (Fig. 2) Complete the welds marked A before welds marked B to avoid distortion.
6. Remove the 6 bolts.

If required a further run of weld using Duroid No. 3 rods can be put over the top of the new weld. This gives a hard wearing surface.

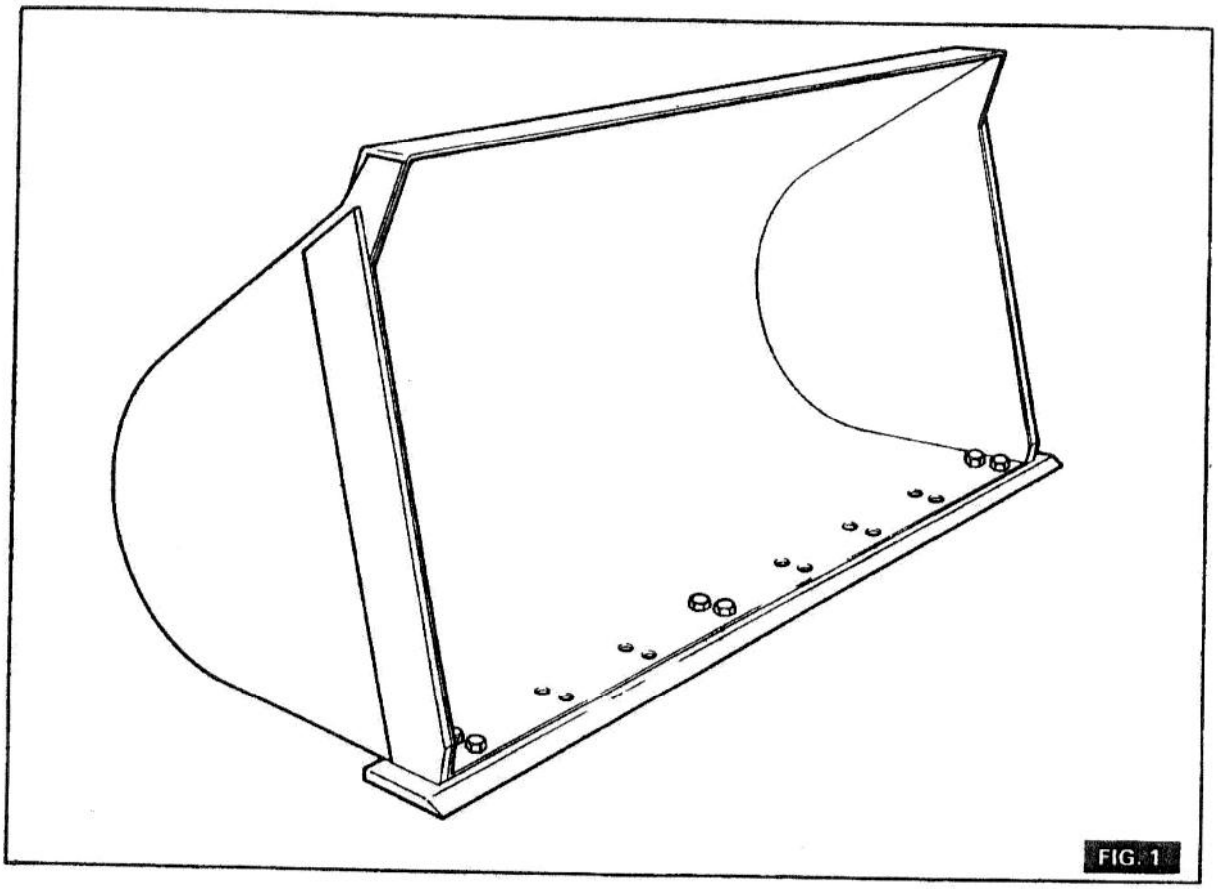

FIG. 1

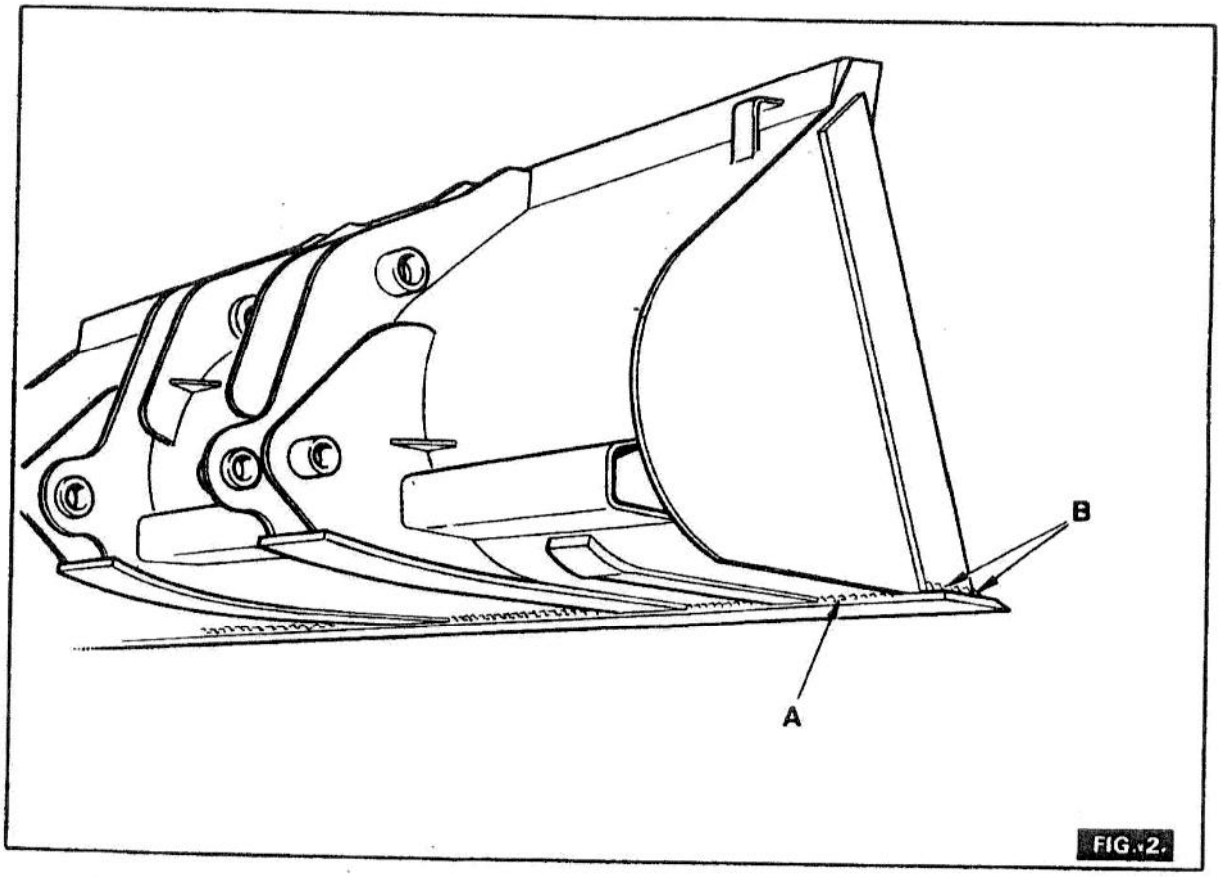

FIG. 2.

DIGGER
MECHANICAL COMPONENTS

CONTENTS

LIST OF ILLUSTRATIONS

DIGGER FRAME

The digger is attached to the machine at four points by means of hook type linkages and is easily removed. An attaching sill is fitted to the rear of each loader side frame, the lower attaching points on the digger are hooked over the attaching sills and the upper part of the frame is then connected by two box section links. The links are pivoted near the base of the vertical pivot post.

FRAME

Removal and Replacement

11A/1

1. (Fig. 1) Remove the rear panel (1) from the cab.
2. Extend the stabilizer legs far enough to take the weight of the digger rear frame.
3. Centralise the digger unit on the frame and position the bucket centrally on the ground.
4. (Fig. 2) Unscrew the nuts (1) from the tie links (2) and lift the arms (3) from off the pin (4).
5. Carefully raise the frame by using the stabilizers until it is clear of the lower link (5) then move the tractor a few inches forward to clear the frame.
6. Lower the frame far enough to allow the seven spool valve control levers to come clear of the cab frame.
7. Disconnect the oil return pipe from the seven spool valve.
8. Disconnect the oil pressure pipe at the union under the left hand wheel arch then quickly connect the return pipe to the pressure pipe thus isolating the digger.
9. To replace the digger reverse the above procedure.

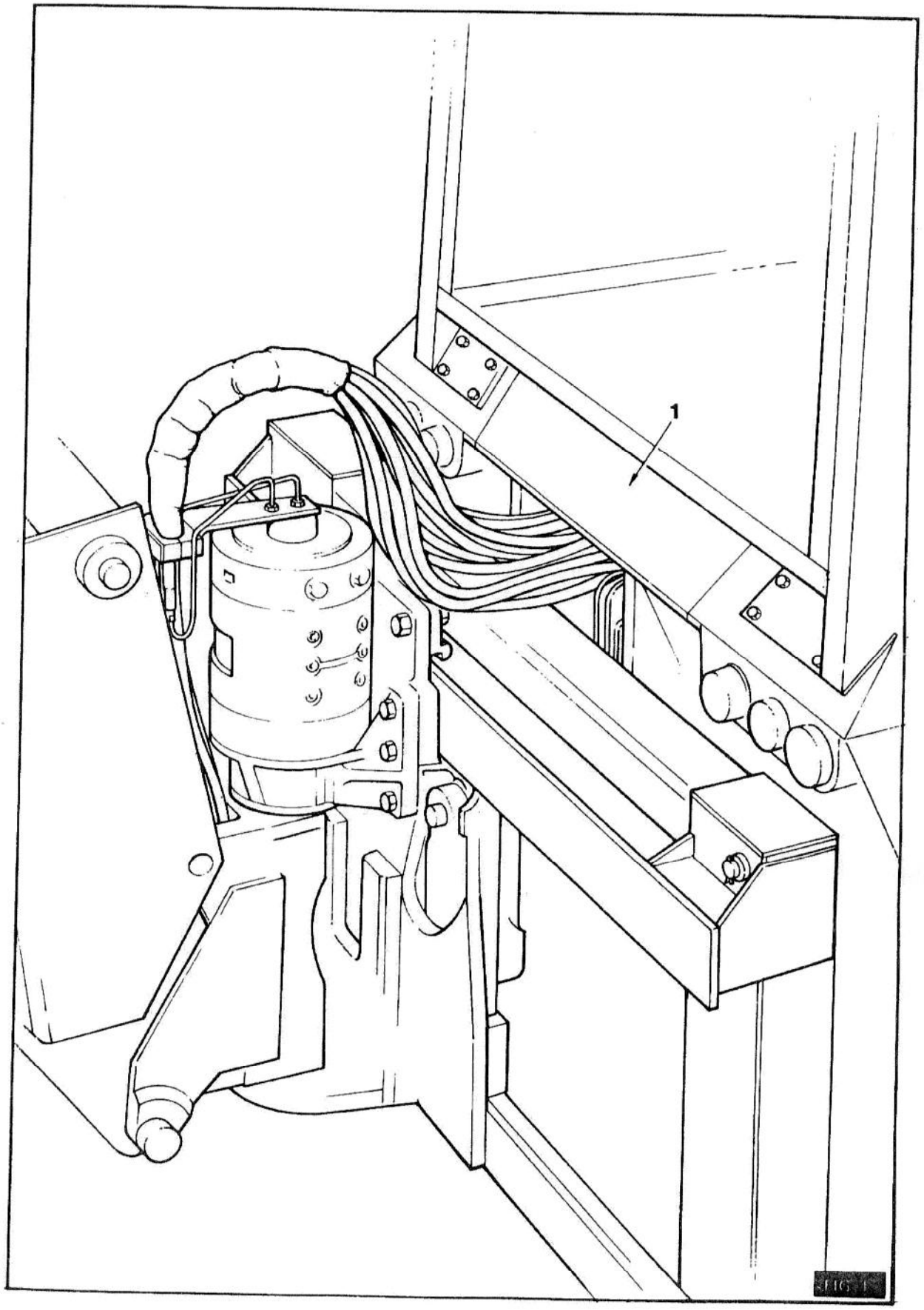
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FIG. 1

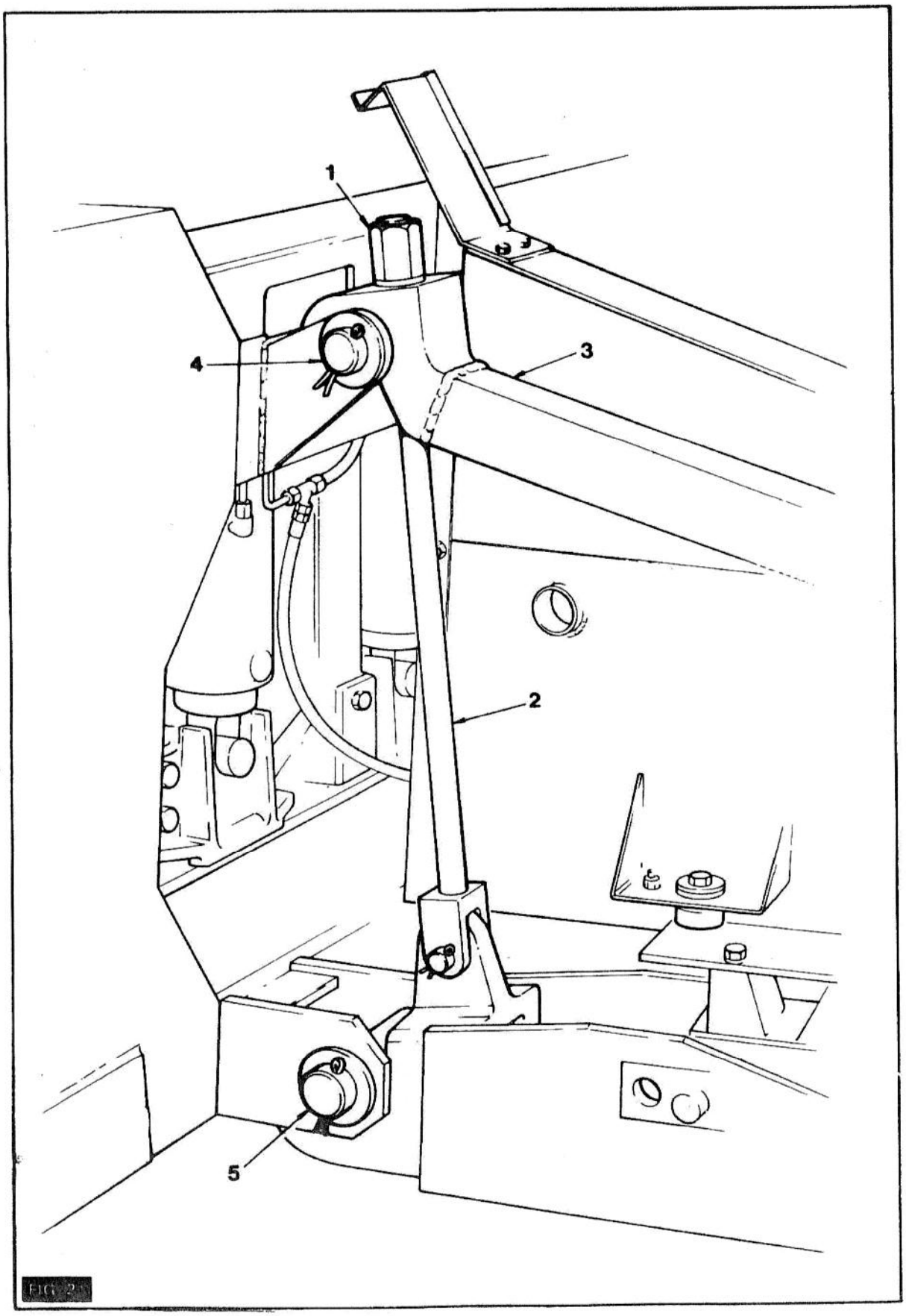

FIG 2

LOADER
MECHANICAL COMPONENTS

CONTENTS

LIST OF ILLUSTRATIONS

LOADER FRAME AND LIFT ARMS

GENERAL

The main movable component of the loader is the lift arms which, pivoted from the vertical pivot posts, is actuated by a pair of hydraulic rams and carries the bucket and its associated linkage.

BUCKET

Removal and Replacement 12A/1

1. Lower the bucket to the floor and switch off the engine.
2. Disconnect the loader lift arms and the bucket arms from the bucket by removing the split pins and pivot pins from each lift arm and bucket arm attachment points.
3. The bucket can now be moved clear.
4. Replace in reverse order of the above procedure.

LIFT ARMS

Removal and Replacement 12A/2

1. Remove the bucket as stated in operation 12A/1.
2. (Fig. 1) Remove the split pins and pivot pins (1) which secure the short transfer arms (2) to the counter arms (3) and remove the transfer arms.
3. Remove the split pins and pivot pins (4) securing the long transfer arms (5) to the counter arms and remove the transfer arms.
4. Remove the split pins and pivot pins (6) which secure the front counter lever (3) to the lift arms and remove the levers.
5. Remove the pivot pins and split pins (7) securing the bucket rams to the counter levers.
6. Remove the split pins and pivot pins (8) securing the rear counter levers to the lift arms and remove the levers.
7. Disconnect the lift rams from the lift arms.
8. Start the engine and fully contract the bucket and lift rams.
9. Support the loader lift arms on a suitable gantry and remove the split pins and pivot pins (9) which secure the loader arms to the side frames.
10. Reverse the machine from the loader lift arms and lower the arms to the ground.
11. Replace in reverse order of the above procedure.

SIDE FRAMES

Removal and Replacement 12A/3

The following instructions assume that the cab and digger unit have been removed.

1. Completely drain the hydraulic system.
2. Remove the lift arms as stated in operation 12A/2
3. Remove the lift rams as stated in operation 9G/1.
4. Remove the bucket ram as stated in operation 9G/4.
5. Disconnect all hydraulic pipes from the two spool valve (L.H. frame only).

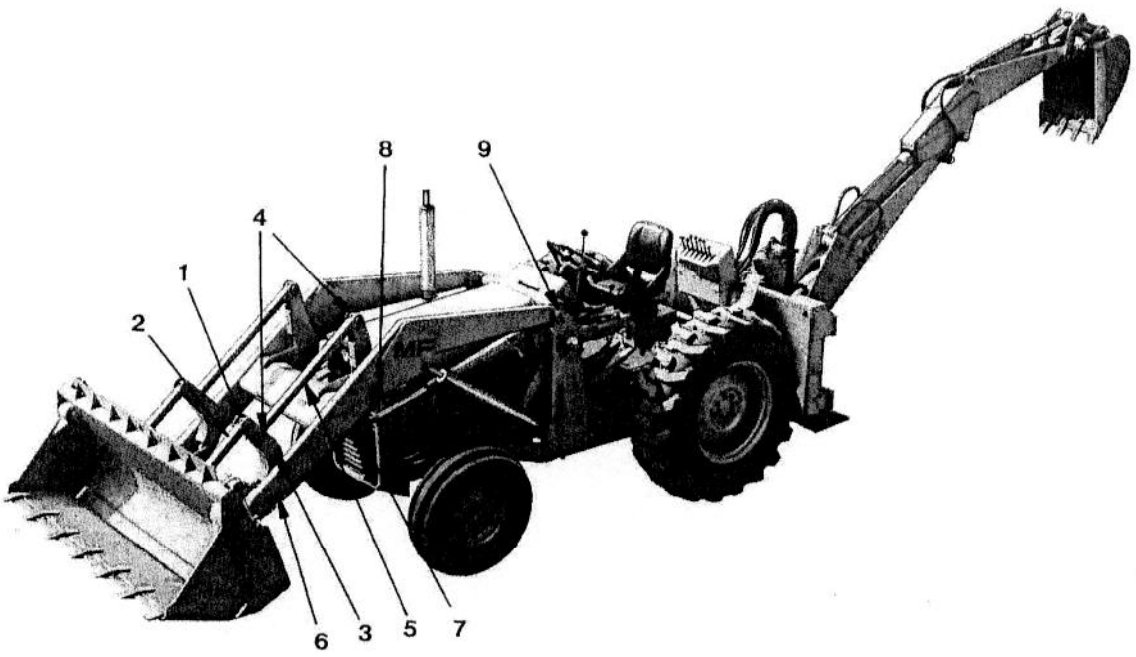

FIG. 1

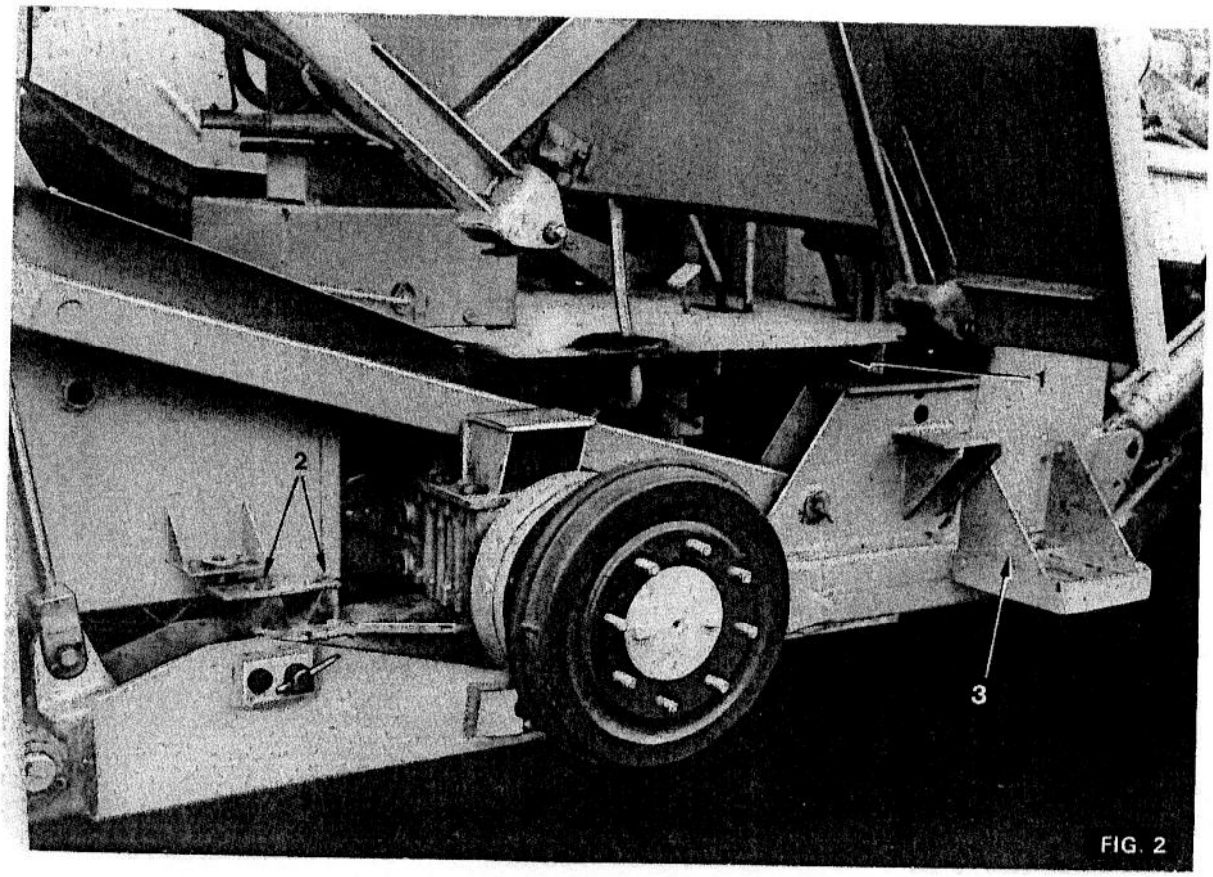

FIG. 2

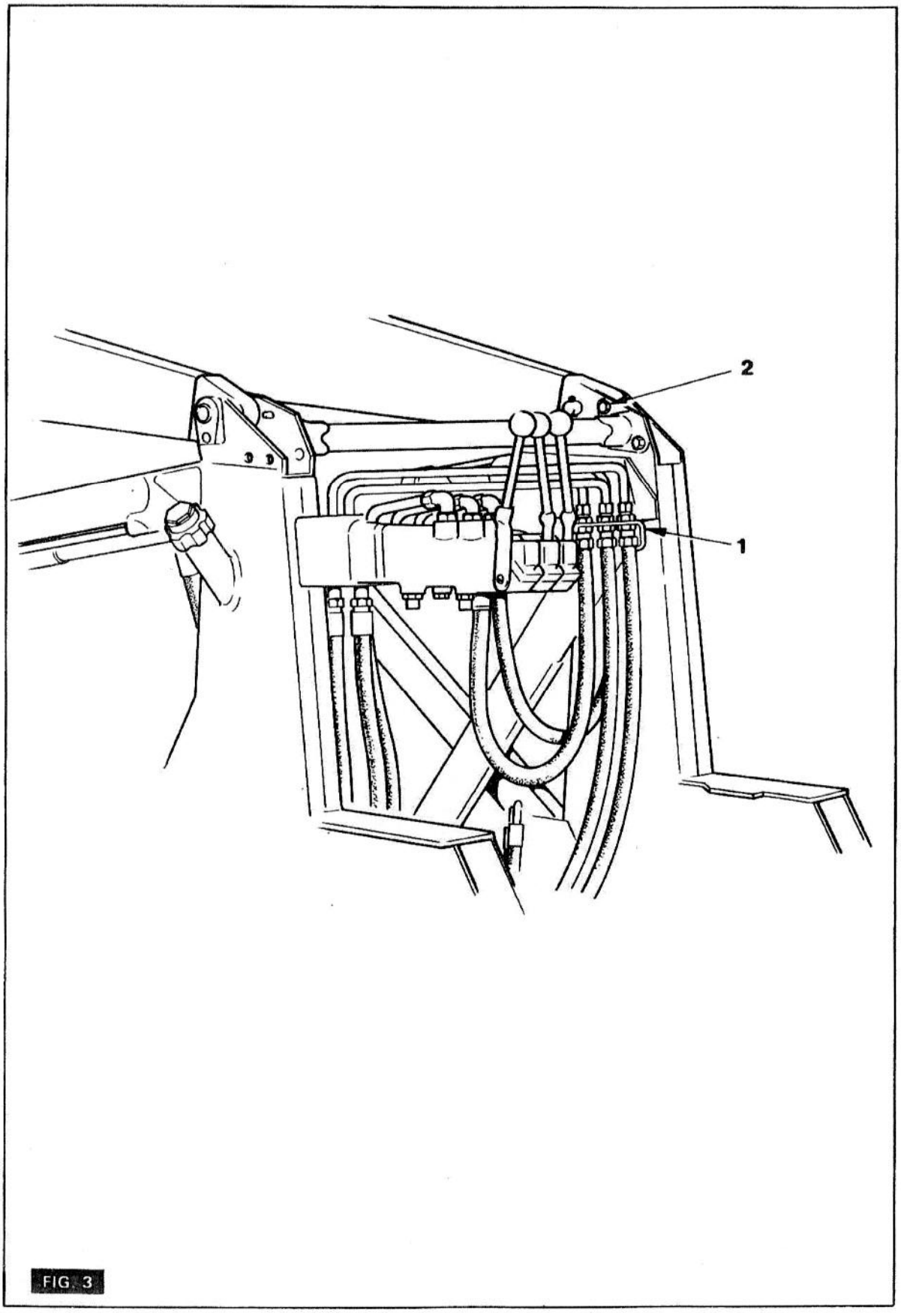

FIG. 3

SIDE FRAMES

Removal and Replacement . . . . Cont'd

6. Remove the oil filter and main hydraulic hoses from the side frame (L.H. frame only).
7. (Fig. 2) Remove the bolt (1) which secures the platform to the side frame.
8. Remove the two bolts (2) which secure the rear well to the side frame.
9. Remove the footstep unit (3) by unscrewing the four securing bolts (R.H. frame only).
10. (Fig. 3) Release the cross pipe securing bracket (1) from the inside face of the side frame.
11. Remove the cross member retaining bolts (2).
12. Place a trolley jack under the centre of the side frame and set the jack just in tension.
13. Remove the four frame/rear axle retaining bolts
14. Remove the three front retaining bolts.
15. Lower the frame and remove it from under the machine.
16. Replacement is a reversal of the above procedure.

TOOLS

CONTENTS

TOOLS

APPROVED SERVICE TOOLS

ENGINE

38 UX	Piston Ring Compressor
PD 42 B	Gudgeon Pin Bush Remover
PD 42 B/4	Adaptor
PD 137	Valve Guide Reamer
PD 138	Valve Guide Reamer
PD 150	Cylinder Liner Remover/Replacer
PD 150/2	Cylinder Liner Remover/Replacer Adaptor
MF 155	Small Adjustable Puller
MF 200	Hand Press
MF 200/4	Hand Press Adaptor
316 X	Valve Seat Cutter Handle
316/12	Valve Seat Cutter Pilot
316/13	Valve Seat Cutter Pilot +.030 in.
316/125	Valve Seat Cutter Pilot +.015 in.
317/30	Inlet Valve Seat Cutter
335	Con. Rod Alignment Jig
336	Multi-Purpose Arbor
6118 A	Valve Spring Compressor
6118/4	Valve Spring Adaptor
6200	Reaming Fixture
PD 6200/3	Reamer Set

COOLING SYSTEM

MF 155	Small Adjustable Puller
MF 200	Hand Press
MF 200/4	Hand Press Adaptor

FRONT AXLE

MF 263/3	King Pin Bush Remover
MF 264/7	King Pin Bush Reamer

POWER STEERING

MF 148	Hydraulic Pressure Test Equipment
MF 148/7	Power Steering Adaptor
MF 203 A/1	Oil Seal Driver Adaptor
MF 263	Front Axle and Steering Bush Remover
MF 263/2	Front Axle and Steering Bush Remover/ Replacer Adaptor
MF 264	Front Axle and Steering Bush Reamer
MF 264/2	Reamer and Pilot
MF 550	Driver Handle

STANDARD TRANSMISSION

MF 177	Transmission Main Drive Shaft Oil Seal Pilot
MF 179	Transmission Pinion Oil Seal Replacer
MF 220/25	Multi Purpose Bearing Remover/Replacer

CLUTCH

MF 159 A	Clutch Centraliser
MF 314	Lever Fulcrum Height Setting

REVERSOMATIC TRANSMISSION

MF 244	Instant Reverse Clutch Spring Compressor

TORQUE CONVERTER

MF 246	Torque Converter Checking Gauge
MF 260	Low Pressure Hydraulic Test Set
MF 260/2	Hydraulic Test Adaptor

REAR AXLE WET BRAKES

MF 197	Wheel Axle Outer Bearing Cone and Differential Cone Replacer
MF 197/2	Differential Carrier Plate Bearing Cone Replacer Adaptor
MF 200	Hand Press
MF 200/3	Differential Carrier Plate Bearing Cone Remover Adaptor
MF 200/23	Drive Pinion Bearing and Pilot Bearing Remover/Replacer Adaptor
MF 200/24	Epicyclic Hub Inner Bearing Cone Remover Adaptor
MF 200/25	Multi Purpose Bearing Remover
MF 245 D	Rear Axle Pre Load Gauge
MF 257	Differential Bearing Cone Replacer
MF 265 A	Planetary Carrier Remover
MF 266	Planetary Carrier Bush Inner Oil Seal Bearing Cone and Unit Replacer
MF 550	Handle
MF 555	Three-Legged Adjustable Puller
MF 555–2 A	Differential Coupling Bearing
MF 1105	Cone Remover
MF 1105/1	Adaptor
MF 1105/2 A/1	Adaptor
MF 1105/2 A/4	Adaptor
MF 1105/7A/1	Differential Bearing Cup Remover/ Replacer Adaptor
MF 1105/7A/2	Differential Bearing Cup Removal/ Replacer Adaptor
MF 1105/7A/3	Differential Bearing Cup Removal/ Replacer Adaptor
MF 1105/8	Epicyclic Hub Inner Bearing Cup Remover/Replacer Adaptor
CP 4030	Drive Pinion Pre-Load Gauge

HYDRAULIC PUMP

MF 341	Drive Shaft Extracter

TWO SPOOL VALVE

MF 148	Hudraulic Pressure Test Equipment

ROTARY ACTUATOR

MF 342	Peening Punch—Rotary Actuator Locking Column
MF 343	Peening Punch—Rotary Actuator Sleeve Retainer
MF 344	Tee Wrench—Rotary Actuator Sleeve Retainer and Locking Column