

HYDRAULIC SYSTEM

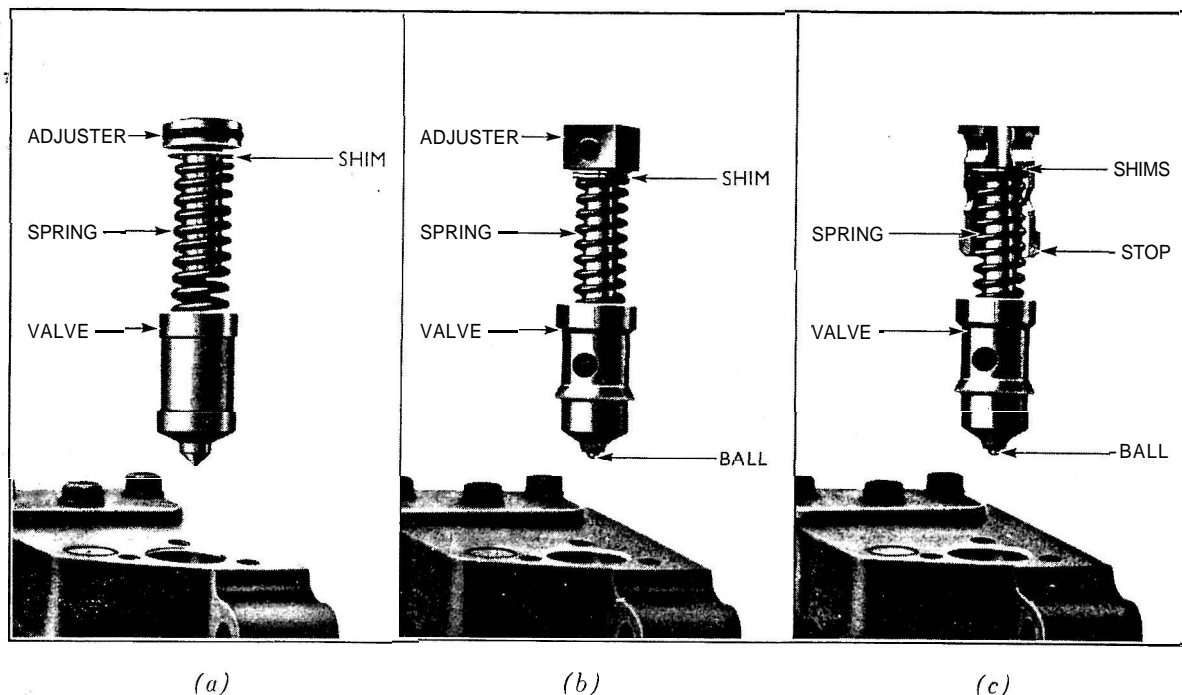


Fig. 1

Hydraulic Power Lift Unloading Valve Assemblies

Only three items on the Hydraulic Power Lift have been affected by changes since the introduction of the Major tractor and details of these modifications together with revised testing instructions are contained in this section.

It is however important to note that the hydraulic unit uses the rear transmission lubricant, the specification of which was changed in January, 1959, to S.A.E. 20 W/30 H.D. for all Major (1952 onwards) tractors.

Unloading Valve and Valve Chest

Effective 100% with the Power Major the unloading valve was redesigned in order to minimise the tendency of the valve to "blow off" under the application of sudden heavy loads.

The change in the valve also involved changes in dimensions of the valve locating bore and oil passages in the valve chest.

Effective with Engine No. 1502511 further changes were made by deleting the square-headed adjuster and introducing a stop sleeve to limit the movement of the valve and obviate the possibility

of the ball becoming displaced and "jamming" under the valve.

Fig. 1 shows the three types of valve which may be encountered and the following points should be noted:—

1. The valve assembly shown at (a) is still serviced for original type hydraulic units, i.e., valve, spring, adjuster and shim are suitable only for the original type unit.

The valve body is no longer serviced and it will be necessary to fit the current type body and valve assembly should the body require replacement.

2. The adjuster shown at (b) is no longer serviced and neither this assembly nor that shown at (c) can be used on a previous type hydraulic unit unless the valve chest is also changed.

This assembly may however be converted to the current type by discarding the adjuster and fitting the current type and shims. The spring, valve and ball are identical on (b) and (c) type assemblies and the shims used at (b) may be modified for use with the (c) assembly providing the outside diameter of the shims is reduced to .68 in. (17.27 mm.).

Testing the H.P.L. Unloading Valve

The unloading valve is set to open at 2000-2200 lbs./sq in. (140.6—154.7 kg./sq. cm.) and care must be taken that this pressure is not exceeded. When fitting new parts or adjusting the opening pressure of the unloading valve it is essential that pressure testing equipment is installed so that accurate adjustment can be made.

Fig. 2 illustrates the installation when using approved testing equipment T.8503 and shows an oil feed being taken from the jack tapping and returned through the rear axle filler plug hole. An adjustable restrictor valve is inserted in the feed line to control the rate of flow and a pressure gauge is fitted to the pressure side of the restrictor valve.

It cannot be too strongly emphasised that absolute cleanliness is essential when carrying out any work on the hydraulic power lift and it is a wise precaution to rinse the parts removed in cleaning fluid to ensure that all traces of swarf and dirt are removed before reassembly and to carry out the assembly operations whilst the parts are still wet.

Before carrying out any checks the tractor should be operated to bring the transmission oil up to its normal operating temperature, after which the following procedure should be adopted.

I. Remove the jack tapping plug and install the "T" piece of the pressure testing equipment. To prevent excessive loss of oil, the lift arms should be lowered before removing the jack tapping plug.

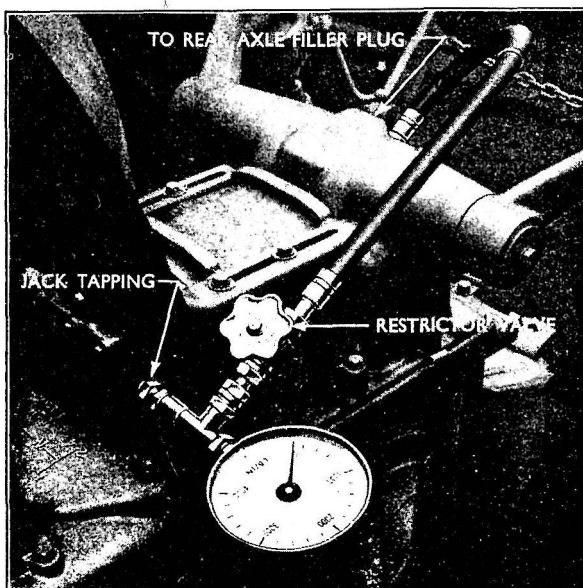


Fig. 2

Hydraulic Power Lift Testing Equipment

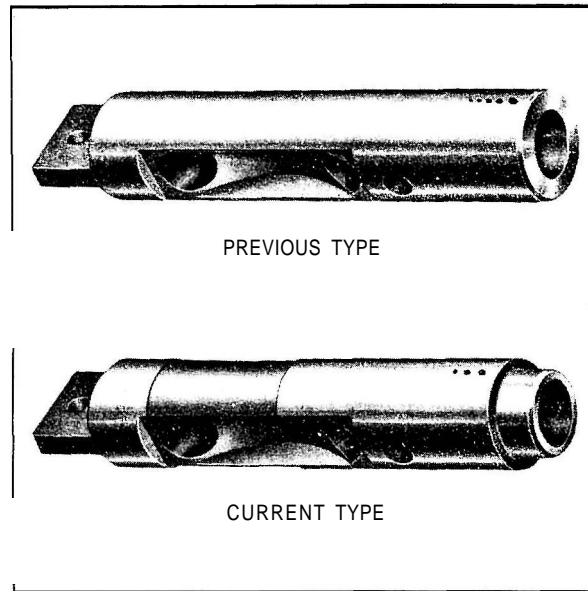


Fig. 3

Control Valve Pistons

2. Mount the pressure gauge in the outer end of the "T" piece and assemble the feed pipe and restrictor valve in the right-angled leg of the "T" piece.
3. Remove the rear transmission filler plug and install the rear end of the feed pipe.
4. Engage the P.T.O.
5. Fully open the restrictor valve.
6. Start the engine and run at a fast idle.
7. Hold the hydraulic lift valve control lever in the "raised" position and gradually close the restrictor valve. If the restrictor valve is progressively closed the pressure will rise until such time as the unloading valve opens when the pressure will immediately drop. "Flick over" of the pressure gauge needle will be very slight, providing the valve is closed **slowly** and an accurate reading will then be possible.

If the pressure is low, shims may be added above the spring, but arbitrary adjustment of this nature should never be carried out in this manner. Increase the pressure gradually by adding a small number of shims each time and always pressure test after each addition is made.

Control Valve Piston

Effective with Engine No. 1384132 the control valve piston was modified to provide quicker lowering of the lift when used with light implements and trailers.

On previous units five graduated holes at the inner end of the valve allowed oil to be returned from the ram cylinder during the lowering cycle, the rate depending on the position of the control lever and in consequence the area of holes uncovered.

The modification consisted of the machining of an annular relief instead of the two inner holes (see Fig. 3) thus allowing a more rapid return of the oil.

The maximum rate of return only was affected by this change, the remaining three holes providing an adjustable rate in accordance with the positioning of the control lever.

Hydraulic Single Acting Valve Coupling Kit

This kit consists of a pipe connected into the jack tapping on the hydraulic power lift valve unit, the other end of the pipe being connected to the male half of a self-sealing coupling mounted on a bracket at the rear of the hydraulic power lift ram cylinder housing. (See Fig. 4.) In this position the rear tapping of the self-sealing coupling is readily accessible, allowing quick and easy connection of hydraulic feed pipes from implements, tipping trailers, etc.

An adaptor is provided so that the jack tapping on the hydraulic power lift valve unit will accept the union nut and ferrule on the pipe assembly, but care must be taken to make certain that the adaptor is fitted the correct way round in the jack tapping, i.e., chamfered inner seat outwards, thus ensuring a good seat for the ferrule on the pipe assembly. The support bracket fits under the head of one of the bolts securing the hydraulic power lift ram cylinder housing to the rear transmission housing. (See Fig. 4.)

Should the self-sealing coupling require attention in service, remove the locking spring and

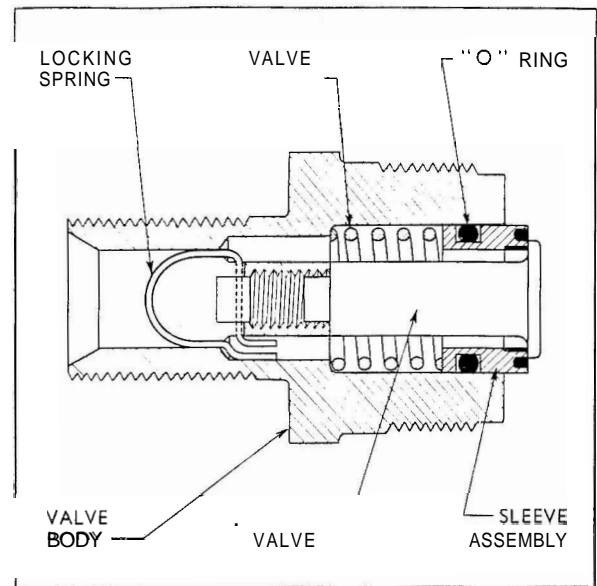


Fig. 5
Self-sealing Coupling

unscrew the valve from the valve body. The sleeve assembly and the valve spring can then be removed for inspection and replacement, if necessary. When re-assembling, always use a new "O" ring on the sleeve assembly and ensure that the valve is fully tightened in the valve body. The valve is retained in the body by means of a locking spring, which must be located in one of the drillings in the body and the slot in the end of the valve (see Fig. 5) to prevent the valve from working loose.

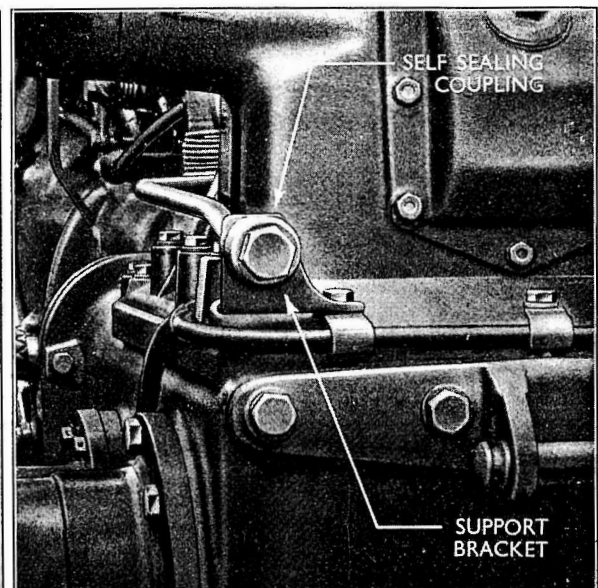
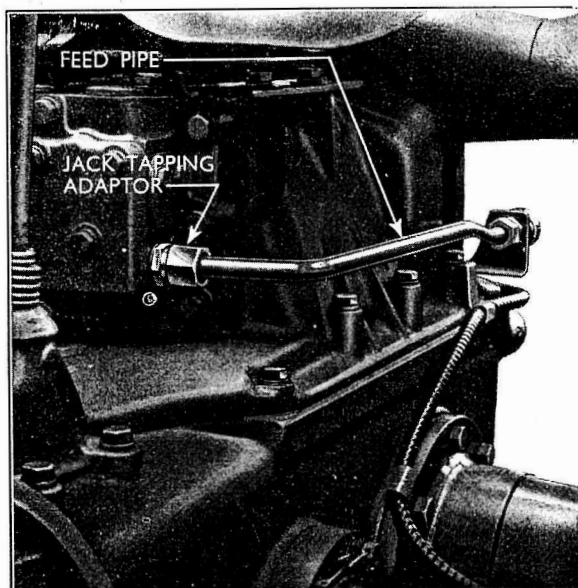


Fig. 4
Hydraulic Single Acting Valve Pipe and Coupling

HYDRAULIC POWER LIFT

GENERAL DESCRIPTION

The hydraulic power lift fitted to the Fordson Super Major offers a choice of operating control enabling either **Qualitrol** (constant draft) or Position Control (constant depth or height) to be selected according to the work being undertaken and the ground conditions encountered.

An auxiliary control plate is fitted as standard equipment to facilitate operation of remote rams and incorporated in the auxiliary plate assembly is a flow control device enabling the rate of hydraulic work to be adjusted irrespective of engine speed.

"Live" hydraulics are automatically available when a "Live" power take-off (optional equipment) is fitted, and gives the advantage that the tractor may be stopped or gear changes carried out without affecting the operation of the hydraulic system.

Hydraulic Lift Linkage

With the introduction of the new hydraulic system for the Fordson Super Major the layout of the rear linkage has been modified and it is no longer necessary to use the two position lower links to improve weight transference under arduous conditions. This option will, however, continue to be supplied through service for previous production tractors.

The new linkage is readily convertible to suit either Category 1 or Category 2 implements, the necessary conversion parts being supplied as standard equipment with all Super Major tractors. The lower link end swivel balls are removable and the Category 2 balls fitted to the lower links during production can be replaced by the smaller pair supplied with the tractor. Similarly, the top link can be fitted with an alternative rear end piece, again the Category 2 end being fitted in production and the alternative Category 1 part being supplied with the tractor.

A heavy duty check chain bracket is now fitted as standard to all Super Major Tractors, either heavy duty or standard check chains being fitted as requested and the lower links being drilled to take either chain. The check chain shackles incorporate two holes to allow the lift arms to be swung closer or further apart according to the different size of implement in use. Only heavy duty check chain brackets, with either single or double holes, will be supplied in service and can be used for replacement of all previous brackets including heavy duty and standard single hole and heavy duty and standard two position brackets. When replacing a previous type standard bracket (three bolt fixing) with a current heavy duty bracket (four bolt fixing) it will not be necessary to fit the extra bolt.

The automatic clutch release previously used is not suitable for current production tractors mainly due to the changes to the top link pivot bracket. A new installation has been released for use with the

new hydraulic system and details of this will be issued as separate information. This unit is normally only used under arduous conditions and has therefore only been released with Category 2 ball ends in the top **link**.

Top Cover Assembly

Oil is fed, under pressure from the pump, via a feed pipe to a flange at the top of the transmission casing and from here into drillings in the top cover assembly.

The top cover acts as a housing for the control linkage and has attached to it the lift cylinder assembly which acts as a combination of valve chest and ram cylinder housing, and also the auxiliary service and flow control plate assembly.

Fitted in the top cover is a check valve, the purpose of which is to stop the return of oil from the ram cylinder when the implement is in the transport position, and also a pressure relief valve which protects the hydraulic system from damage should an attempt be made to lift an excessive load.

Flow Control Device

Under certain conditions of operation it is preferable to be able to control the rate of flow of oil to the ram cylinder or auxiliaries. When ploughing for instance, only a slow oil feed is required, whereas when using auxiliary equipment such as front end loaders a fast rate is sometimes required. On the Super Major a flow control device is incorporated in the auxiliary service plate assembly which allows such control to be applied. Incorporated in the control unit is a restrictor which locates in the main feed from the pump thus when the control knob is screwed "out" the control unit and hence the restrictor is rotated and greater restriction is applied to the flow of oil, and vice versa. The limiting position either way is indicated by the marking "F" (fast or maximum flow) and "S" (slow or minimum flow) on the auxiliary control housing.

The pump side of the restrictor is connected to the front face of a control valve whilst a branch drilling on the lift (or auxiliary service) side connects with the rear face of the valve. Oil passing the flow control valve restrictor experiences a slight pressure drop due to the restriction to flow, therefore oil at full pressure is fed to the front face of the flow control valve plunger and oil at reduced pressure to the rear face of the plunger. If the pressure difference is sufficient to overcome the pressure of the flow control valve spring, the plunger will move and allow oil from the high pressure side of the restrictor to bleed-off into the transmission. The amount of oil which is bled-off will depend on the pressure difference between the two faces of the flow control valve plunger, this difference being in direct relation to the position of the flow control valve restrictor.

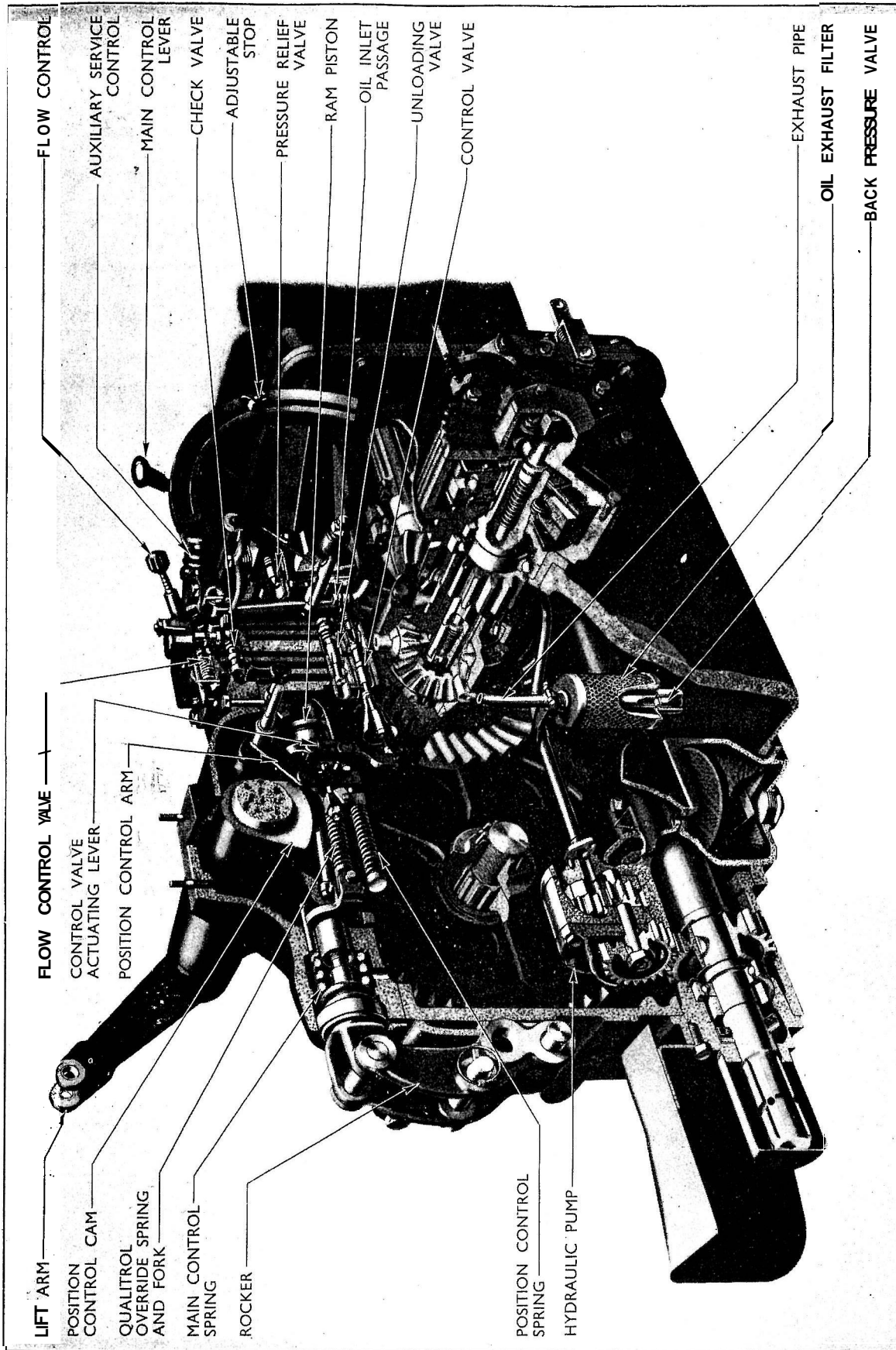


Fig. 6 Sectioned View of Hydraulic System

The rate of oil flow to the ram cylinder or auxiliary service can therefore be controlled by the operator within the design range of the flow control device merely by setting the flow control in the required position.

A further feature of the unit is that regardless of the position at which the flow control is set, when the main control lever is moved to the top of the quadrant the quadrant lever will operate the linkage to the flow control unit, moving it to the "Fast" position so that a quick raise of the implement can be effected.

The correct rate of flow will depend on the implement, speed of operation, operating conditions etc., and the optimum position for any particular unit can only be found under actual operating conditions.

Operating the Auxiliary Service Control

Before operating the auxiliary service control it is recommended that Qualitrol is selected, i.e. the selector lever is placed in the upward position. If the auxiliary service control knob is then pulled out the ram cylinder circuit will be isolated and oil will be directed to the auxiliary ram when the control lever is moved to the top of the quadrant.

As the lever is moved up the quadrant it will move the flow control valve restrictor, via the linkage, to the maximum flow position. If, however, the lift arms are already fully raised the control valve will be held in the neutral position by the ram piston and it will be necessary to move the control lever beyond the top stop in the quadrant to achieve a raise. Before the control lever can be moved to this position it will be necessary to move the spacer from behind the control lever as if the spacer is not moved the flow control valve linkage will prevent the lever being moved beyond the top stop.

Lift Cylinder Assembly

The lift cylinder contains a piston, connected by a connecting rod and ram arm to the cross-shaft, the outer ends of which are splined to the lift arms. A safety valve is located in the front end of the cylinder to obviate damage should shock loads be imposed, as for instance when carrying heavy implements over rough ground.

Control and Unloading Valves

The control and unloading valves operate in bushes in the valve portion of the lift cylinder and control the flow of oil to and from the ram cylinder.

The unloading valve, which is of the shuttle type is operated solely by oil pressure on its front and rear faces, the effective pressure and hence movement of the unloading valve depending on the position of the control valve.

The control valve is connected via an adjustable link and an actuating lever to a cross-shaft to which is attached the main control lever. A spring is located in front of the control valve so that the valve is always held as far to the rear as is permitted by the

valve actuating lever. The valve has three positions, "neutral" at mid-travel, "raise" when pushed forward and "lower" when moved to the rear.

The hydraulic valve action is later described in more detail but briefly when moved forward a small distance, it directs oil to the front of the unloading valve causing the latter to move to the rear thus shutting off the neutral passages. Oil under pressure is then supplied to the ram cylinder (thus raising the lift arms) or to the auxiliary service (to operate auxiliary rams). When moved rearwards the valve allows oil to exhaust from the ram cylinder or auxiliary circuit thus lowering the lift arms or auxiliary equipment at a rate depending jointly on the distance the valve is moved from neutral and the weight being carried.

To study the valve operation under all conditions, it is first necessary to understand the forces that can act on the actuating lever which moves the control valve and this is best dealt with by explaining the operation of the system.

LINKAGE OPERATION UNDER QUALITROL

Qualitrol is designed for use with implements such as ploughs on soils of undulating or variable type. It enables the optimum draft for the implement to be selected and the implement will then continue to operate at a depth corresponding to this draft. If hard soil is encountered, or the implement tends to increase its working depth, the control valve linkage will automatically raise the implements until it is again working at the pre-determined draft. Conversely, if the implement encounters softer soil or tends to rise out of the ground the draft will be decreased and the implement automatically lowered.

Qualitrol is obtained by placing the selector lever in a vertical position, such action making the position control linkage inoperative.

When operating, movement of the actuating lever and consequently the control valve is governed by the position of two pivots.

(a) The top of the actuating lever :—the position of which is controlled by movement of the main control lever within its quadrant.

(b) The qualitrol fork :—the position of which is varied in accordance with the compressive forces on the top link. Soil resistance acting on the implement is transferred through the top link, the rocker and the main spring onto the qualitrol plunger which in turn is connected to the fork. Any compressive force from the implement is resisted by the main spring, the amount of compression being registered as forward movement of the spring plunger. This movement is further transmitted by the qualitrol rod through the qualitrol override spring and fork onto the actuating lever pin. It should be noted that the qualitrol rod is free to slide through the fork, compression of the spring taking place only when :—

(a) The control valve is already fully forward against its end stop, in which case the spring will compress to prevent damage.

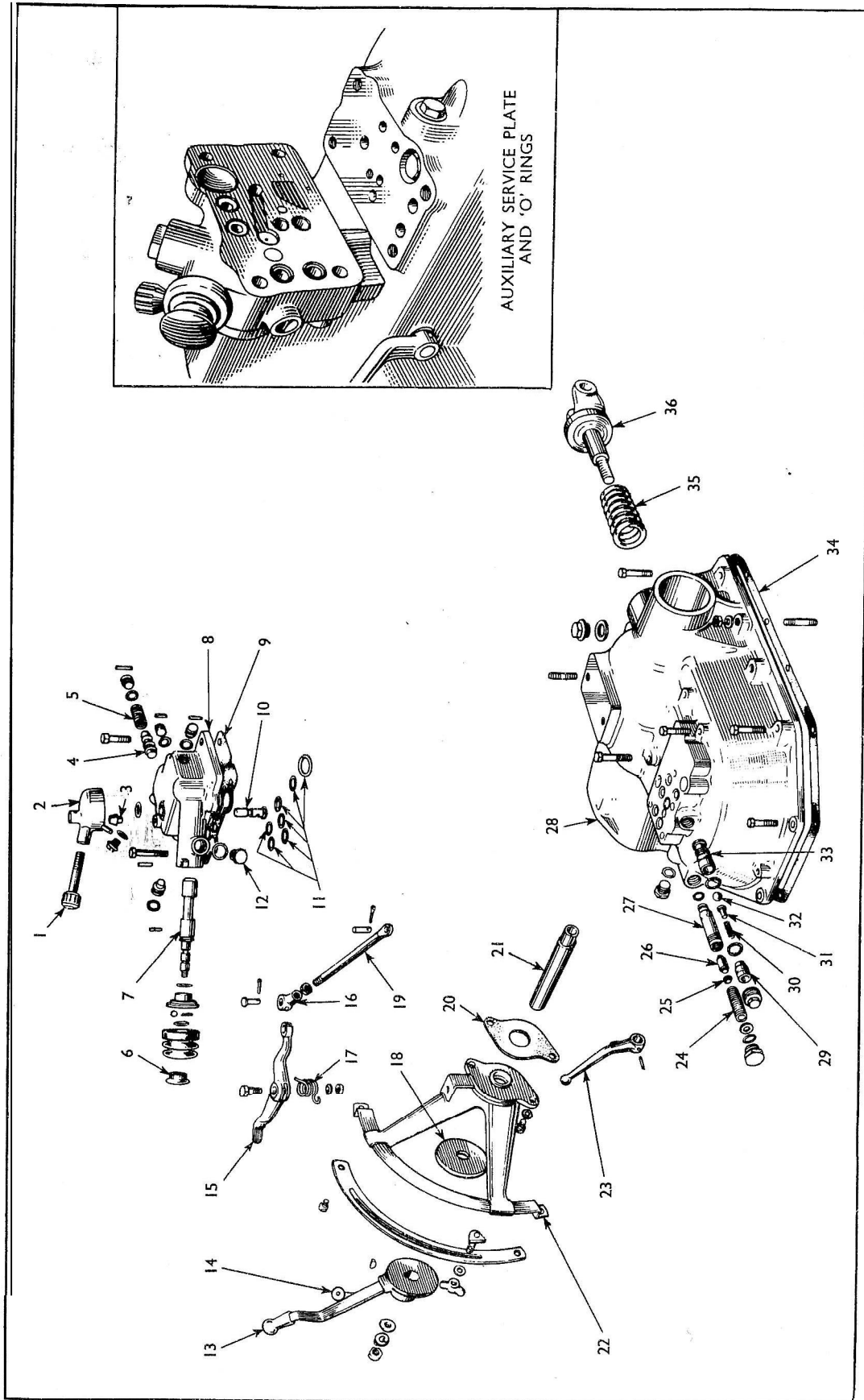


Fig. 7 Hydraulic Lift Cover Assembly, Auxiliary Service and Flow Control Valve Assembly

- | | | | |
|----|--|----|-----------------------------------|
| 1 | Flow Control Valve Restrictor | 28 | Lift Cover |
| 2 | Flow Control Valve Take-off Plug | 29 | Check Valve Pilot |
| 3 | Flow Control Valve Lever | 30 | Check Valve Spring |
| 4 | Flow Control Valve Linkage Spacer | 31 | Check Valve Ball and Spring Guide |
| 5 | Flow Control Valve Crank Lever | 32 | $\frac{1}{4}$ " Diameter Ball |
| 6 | Auxiliary Service Control Valve Spool | 33 | Check Valve Seat |
| 7 | Auxiliary Service and Flow Control Valve Housing | 34 | Lift Cover Gasket |
| 8 | Auxiliary Service Plate Gasket | 35 | Main Control Spring |
| 9 | | 36 | Main Control Spring Yoke |
| 10 | Flow Control Valve Restrictor | | |
| 11 | "O" Rings | | |
| 12 | Auxiliary Service Take-off Plug | | |
| 13 | Flow Control Valve Lever | | |
| 14 | Flow Control Valve Linkage Spacer | | |
| 15 | Flow Control Valve Crank Lever | | |
| 16 | Flow Control Valve Linkage | | |
| 17 | Flow Control Valve Return Spring | | |
| 18 | Friction Disc | | |
| 19 | Flow Control Link | | |
| 20 | Quadrant Gasket | | |
| 21 | Control Lever Shaft Spacer | | |
| 22 | Quadrant Assembly | | |
| 23 | Select Lever | | |
| 24 | Pressure Relief Valve Spring | | |
| 25 | Pressure Relief Valve Spring Seat | | |
| 26 | Pressure Relief Valve | | |
| 27 | Pressure Relief Valve Body | | |

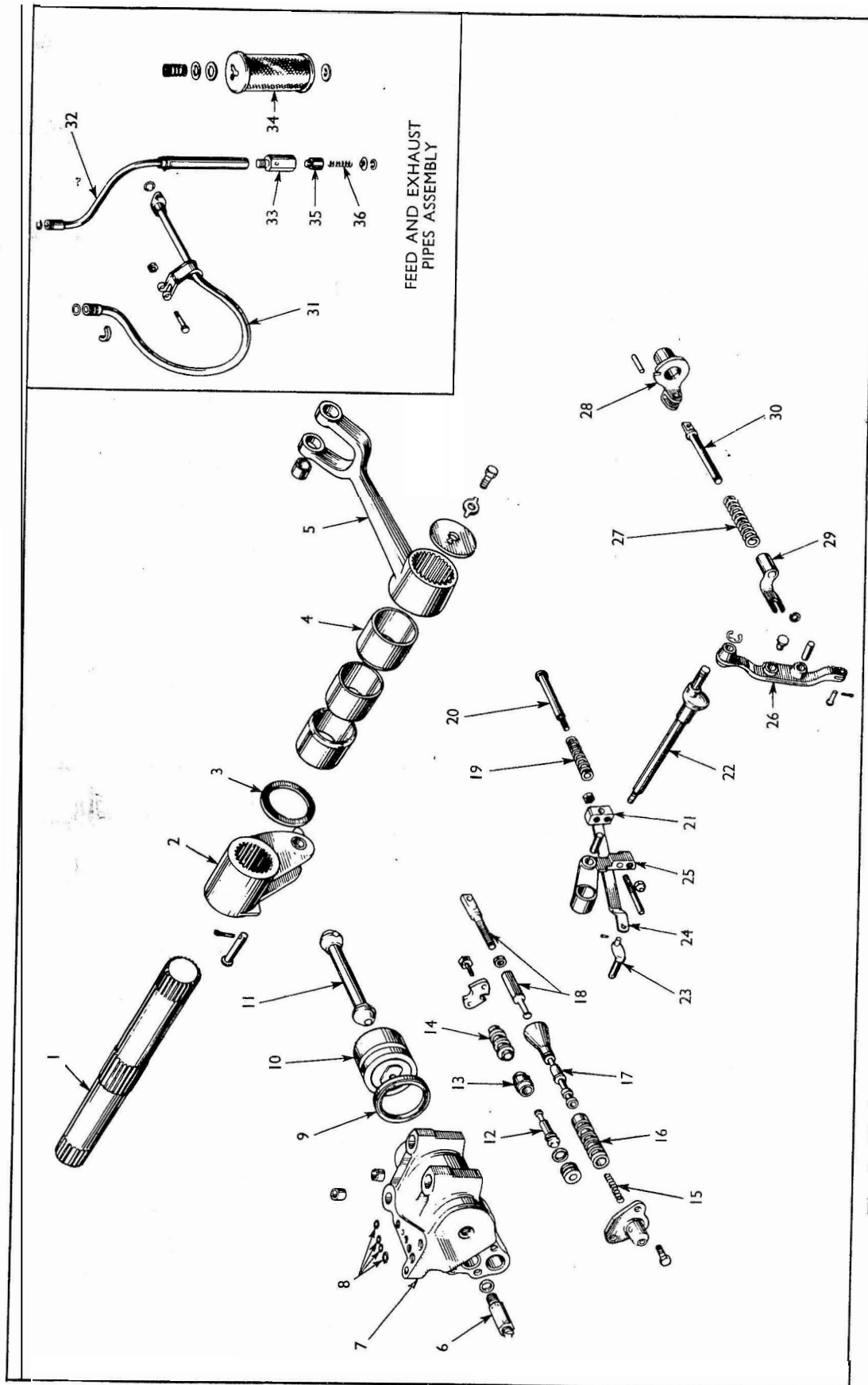


Fig. 8 Hydraulic Lift Cylinder Assembly, Linkage and Lift Arms, Feed Pipe and Exhaust Filter Assembly

- | | | | |
|----|-------------------------------|----|-----------------------------|
| 1 | Lift Cross-shaft | 28 | Main Control Spring Plunger |
| 2 | Ram Arm Thrust Washer | 29 | Qualitrol Fork |
| 3 | Ram Arm Thrust Washers | 30 | Qualitrol Link |
| 4 | Lift Arm | 31 | Main Oil Feed Pipe |
| 5 | Ram Arm Cross-shaft Bushes | 32 | Exhaust Oil Pipe |
| 6 | Ram Cylinder Safety Valve | 33 | Back Pressure Valve Body |
| 7 | Ram Cylinder | 34 | Exhaust Oil Filter |
| 8 | "O" Rings | 35 | Back Pressure Valve |
| 9 | Piston Gland | 36 | Back Pressure Valve Spring |
| 10 | Ram Piston | | |
| 11 | Ram Piston Connecting Rod | | |
| 12 | Unloading Valve | | |
| 13 | Unloading Valve Bush (Front) | | |
| 14 | Unloading Valve Bush (Rear) | | |
| 15 | Control Valve Spring | | |
| 16 | Control Valve | | |
| 17 | Turnbuckle | | |
| 18 | | | |
| 19 | Position Control Spring Guide | | |
| 20 | Position Control Spring Block | | |
| 21 | Control Lever Shaft | | |
| 22 | Selector Control Arm | | |
| 23 | Position Control Link | | |
| 24 | Position Control Arm | | |
| 25 | Control Valve Actuating Lever | | |
| 26 | Qualitrol Override Spring | | |
| 27 | | | |

(b) The lift arms are in the fully raised position and the ram piston emerges from the ram cylinder forcing the actuating lever rearwards and thus placing the main control valve in neutral.

Lowering into Work under Qualitrol

When the quadrant lever is pushed down the quadrant² the top of the actuating lever is moved forward. The lever will pivot about the qualitrol fork and the bottom end will in consequence move rearwards placing the control valve in the lowering position.

The implement will then drop into work and continue to drop until a sufficiently high force operates through the top link to push the qualitrol fork and actuating lever forward and place the control valve in neutral. The lower the lever is placed in the quadrant the greater the depth at which the implement will work.

Operation in Work in Qualitrol

Assuming that the implement has now reached the required depth corresponding to the required draft, the main control spring will be partially compressed, and as long as the implement draft remains constant the control valve will remain in neutral and no further change in depth will take place.

As soon as an increase in draft occurs a resultant increase in compression of the main control spring takes place, the effect of which is transferred through the qualitrol linkage to move the control valve into the raising position. Oil then flows to the ram cylinder and the implement rises until the draft decreases to the amount previously obtained, thus allowing the main control spring to expand to its former position and the control valve to be moved back to the neutral position.

Conversely, a decrease in draft allows the main control spring to expand and the control valve to move to the lowering position, whereupon the weight and suck of the implement carries it to a greater depth. The draft is thus increased to that previously obtained and the control valve again moves back to the neutral position.

By making these slight corrections, therefore, the hydraulic system automatically adjusts itself to maintain a constant draft at the implement.

Raising under Qualitrol

Raising the main control lever will move the top end of the valve actuating lever rearwards and the lever will pivot around the qualitrol fork, moving the control valve forward into the "raising" position.

When the lift arms reach the fully raised position the ram piston skirt will contact the actuating lever pin and automatically move the control valve into neutral.

Raising can be stopped at any intermediate position by moving the control lever downwards slightly, from the top of the quadrant thus allowing the control valve to move to the neutral position.

LINKAGE OPERATION UNDER POSITION CONTROL

Position control, which is selected by placing the selector lever in the horizontal position, is designed for use on fairly level ground, with no wide variations in soil resistance, and enables the working depth of the implement to be pre-set. For all practical purposes, accurate work at constant depth can be achieved and position control is, therefore, particularly suited to implements such as weeders, steerage hoes, down the row thinners etc. It is also suitable for implements such as sprayers which require to be worked at a fixed height above the ground.

Placing the selector lever in the horizontal position brings the special position control linkage, between the servo cam on the ram arm and the control valve actuating lever, into operation. Under these conditions the qualitrol fork no longer acts as a pivot point for the actuating lever but is replaced by the machined pad, adjacent to the qualitrol fork, on the rear face of the actuating lever.

Lowering into Work

Lowering of the lift arms is effected by moving the control lever down the quadrant. Whereas in Qualitrol the implement is lowered to the ground almost as soon as the control lever is moved away from the fixed stop at the upper end of the quadrant, in position control the implement is lowered an amount directly proportional to the movement of the control lever.

As the control lever is moved down the quadrant the top end of the actuating lever will be moved forward, pivoting around the position control rod, so that the bottom end moves rearwards and allows the control valve to move into the lowering position.

As the lift arms drop the servo cam will move the position control arm roller, spring and rod forward until the control valve spring is compressed and the control valve is moved into neutral. The final position of the implement will depend upon the positioning of the control lever, this setting the pivot point for the actuating lever—the lower the control lever is placed in the quadrant the greater the distance the lift arms will drop before the servo cam moves the control valve into neutral.

Operation in Work

If a soil-engaging implement tends to be forced out of the ground by an obstruction the weight and suck of the implement will cause it to return to its pre-set depth as soon as the obstruction is passed.

If the lift arms fall, due for instance to oil leakage from the ram cylinder, the servo cam is rotated and, as the cam is in contact with the position control roller such movement is transmitted via the position control spring and guide to the position control block and rod. As the rod moves forward it also moves forward the valve actuating lever and places the control valve in the raising position. An automatic correction is therefore made.

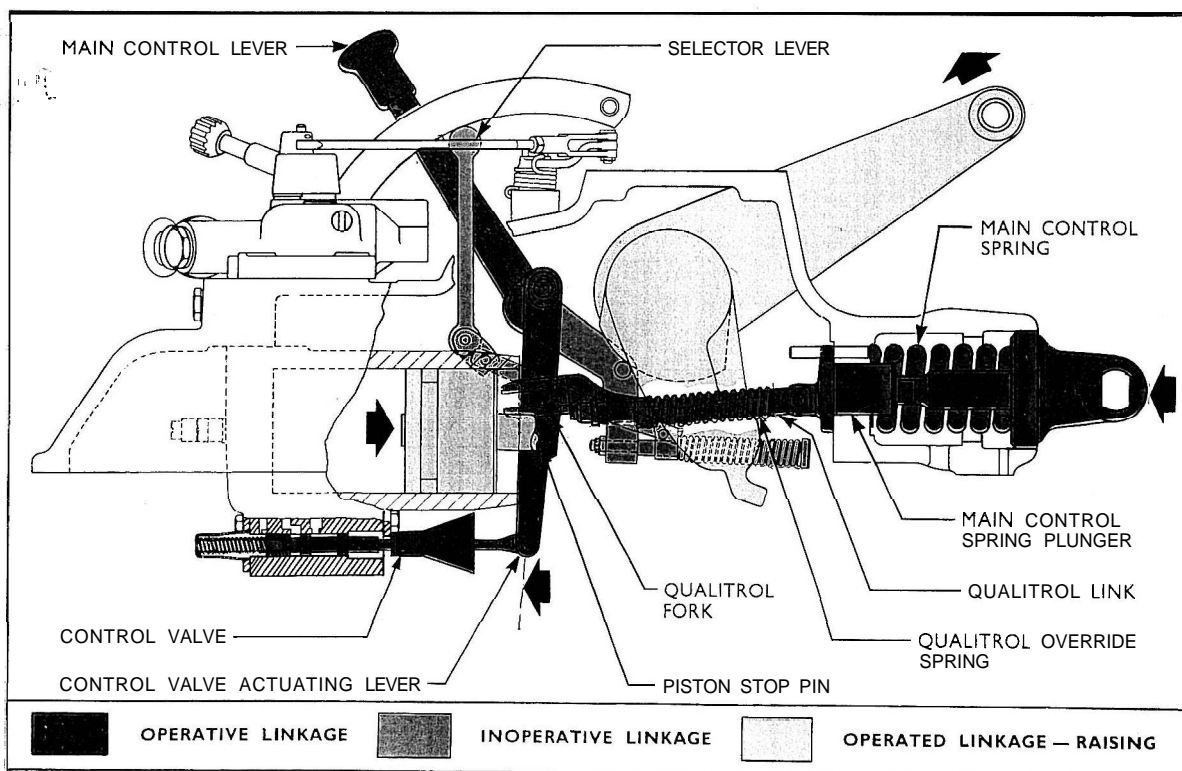
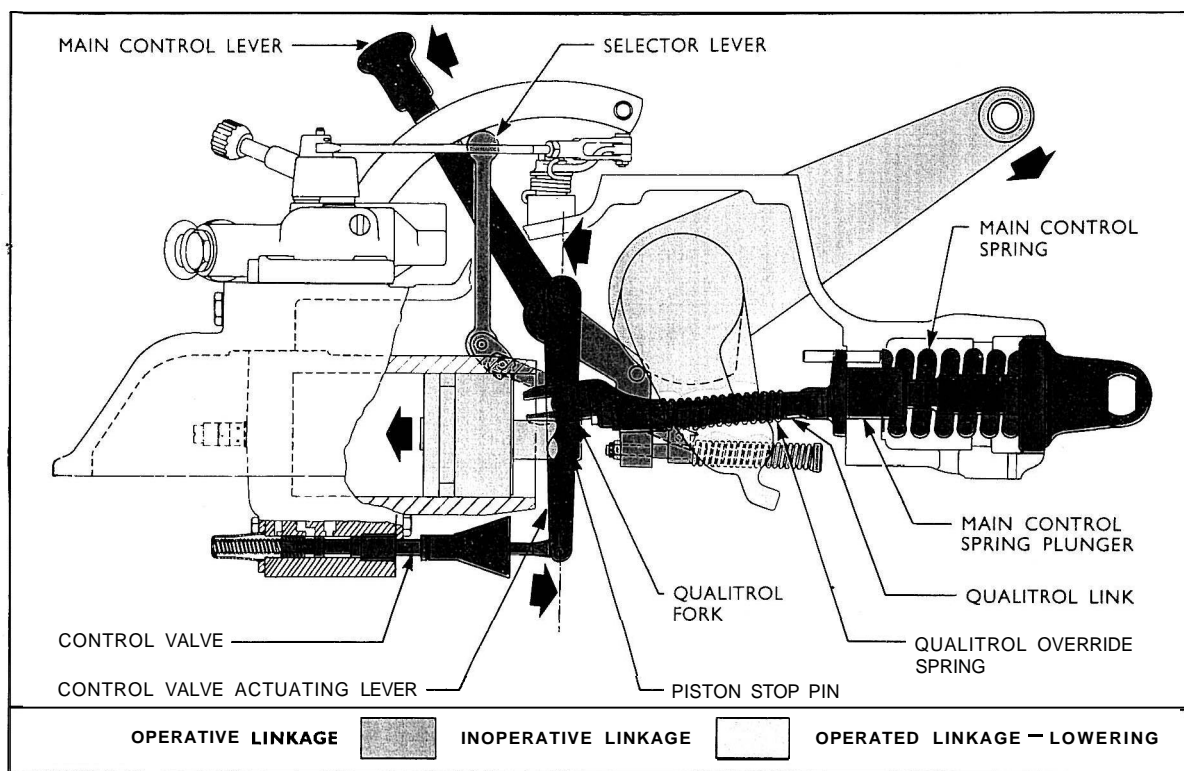


Fig. 10 Qualitrol Linkage—Raising in Work

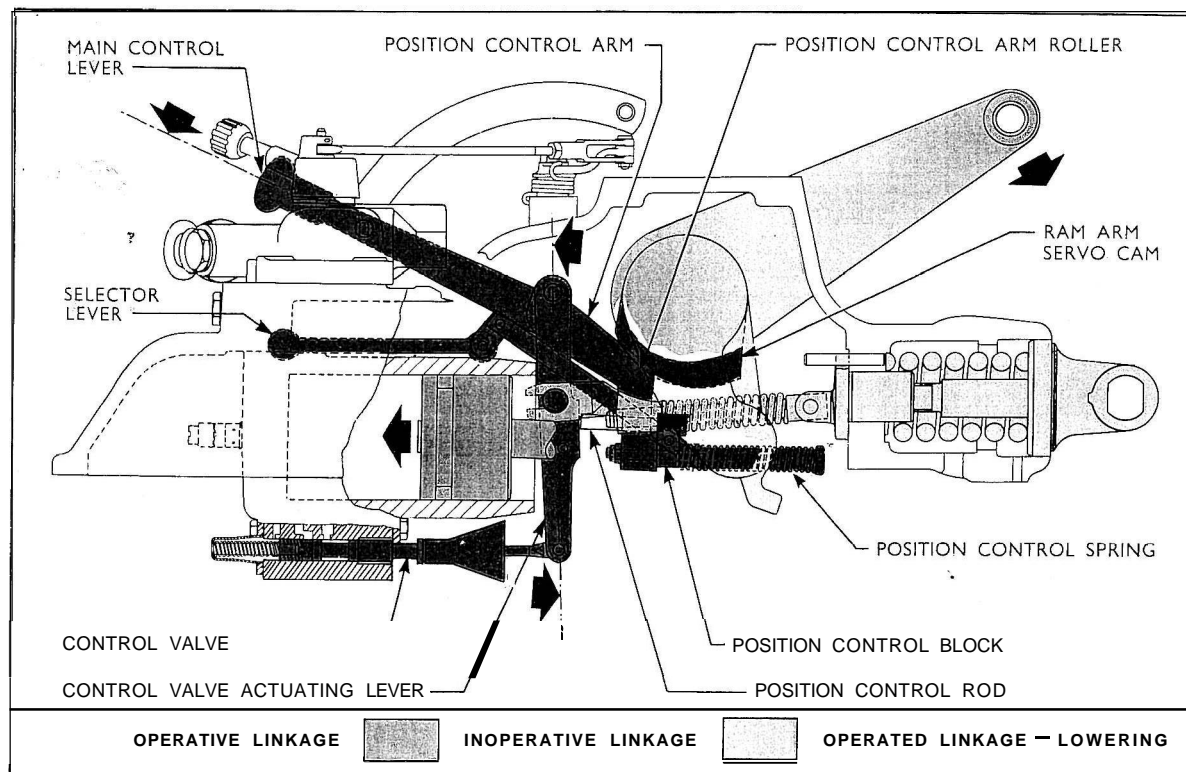


Fig. 11 Position Control Linkage—Lowering

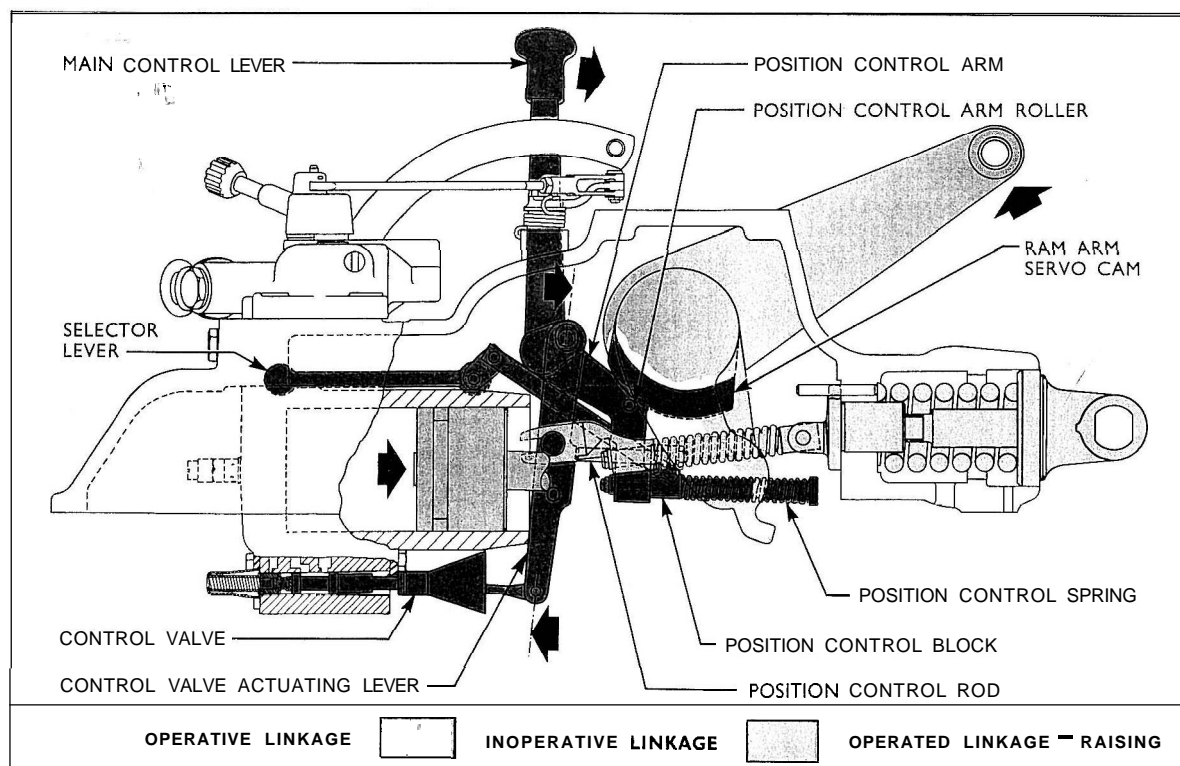


Fig. 12 Position Control Linkage—Raising

Raising

Raising the main control lever will move the top of the actuating lever rearwards, pivoting it about the position control rod and moving the lower end forward and the control valve into the raising position.

As the lift arms raise the servo cam will rotate, presenting a lower point on the cam to the position control linkage. When the required height is reached, as set by the positioning of the main control lever, the servo cam will have reached a position where it allows the position control linkage to move rearwards sufficiently for the control valve to be moved into the neutral position.

If the main control lever is moved up to the fixed stop at the upper end of the quadrant the lift arms will continue to raise until the ram piston skirt emerges from the cylinder, contacts the actuating lever pin, and automatically moves the lever rearwards, so allowing the control valve spring to move the control valve into neutral.

HYDRAULIC LIFT OIL FLOW

The oil flow diagrams, Figs. 13, 14 and 15, show schematically the oil flow through the system, the oil flow being identical whether Qualitrol or Position Control is in operation.

Oil Flow in the Neutral Position

The control valve is returned automatically to the neutral position after the desired depth or height is reached and also after a correction is made in operation.

The hydraulic pump supplies oil to the lift cover where it passes through drillings to the pressure relief valve chamber and then to the flow control restrictor. Oil is therefore being fed at pump pressure to the front face of the flow control valve and at slightly reduced pressure, due to the pressure drop across the restrictor, to the rear face of the flow control valve via a small drilling. Due to the difference in pressure, which will be in relation to the position of the restrictor, the flow control valve will move and allow oil to bleed off from the high pressure side and exhaust via the exhaust oil pipe and filter.

The oil then flows via the check valve passage into passage 'A', passes around an annular groove in the unloading valve bush and enters the unloading valve chamber where it acts on the rear face of the unloading valve, moving the valve forward. Any oil in front of the valve is forced by this movement through passage 'D' and drillings in the control valve to the control valve spring chamber 'G,' from where it leaks away into the transmission housing.

Oil from passage 'B' passes into, and is trapped in, the unloading valve rear bushing until, as the un-

loading valve moves forward, passage 'C' is opened and the oil passes along it, by-passing the check valve. It is then directed through the auxiliary service plate back to the lift cover and then, via the exhaust pipe and filter, into the main rear transmission lubricant.

Oil Flow in the Raising Position

Oil passes from the pump through the lift cover and flow control device to the check valve chamber as before.

As the control lever is moved to the raise position and the control valve moves forward, a passage is opened leading from the rear to the front face of the unloading valve. The same movement seals off the spring chamber in front of the control valve and prevents oil being exhausted from this point.

Oil therefore flows through passage 'A' into the rear of the unloading valve chamber and is then able to pass to the front face of the unloading valve. As the front face of the unloading valve is larger than the rear face, the total pressure exerted by the oil will be higher on the front face than on the rear face and the valve will move rearwards thus sealing off passages 'B' and 'C.'

Pressure will then build up in the system until the check valve is lifted off its seat and, as the lower end of passage 'E' is sealed by the control valve at 'F,' oil passes either to the ram cylinder or auxiliary service depending on the position of the auxiliary control valve spool.

Oil Flow in the Lowering Position

When the control valve is moved to the lowering position, passage 'D' is shut off from the pump and the oil in front of the unloading valve is free to exhaust through the control valve into the transmission casing.

Oil from the pump follows the usual channels to the check valve chamber and then through passage 'A' to the rear of the unloading valve. Since the passage to the front of the unloading valve is shut off and the oil in front of the unloading valve is free to exhaust, the pressure on the rear of the valve will cause it to move forward. This opens passage 'C' to oil from passage 'B' and oil will flow back to the transmission housing via the exhaust oil filter. Thus no pressure can build up and the check valve will return to its seat.

The weight of the implement will cause the lift arms to lower, forcing the ram piston forward and oil will exhaust, via drillings in the top cover to passage 'E.' This passage by-passes the check valve and connects with an annular groove in the unloading valve plug. The oil therefore passes around the unloading valve plug and flows via a drilling to an annulus in the front of the control valve bush, passes through into the bush and exhausts into the transmission casing via the front of the control valve and the control valve spring chamber 'G.'

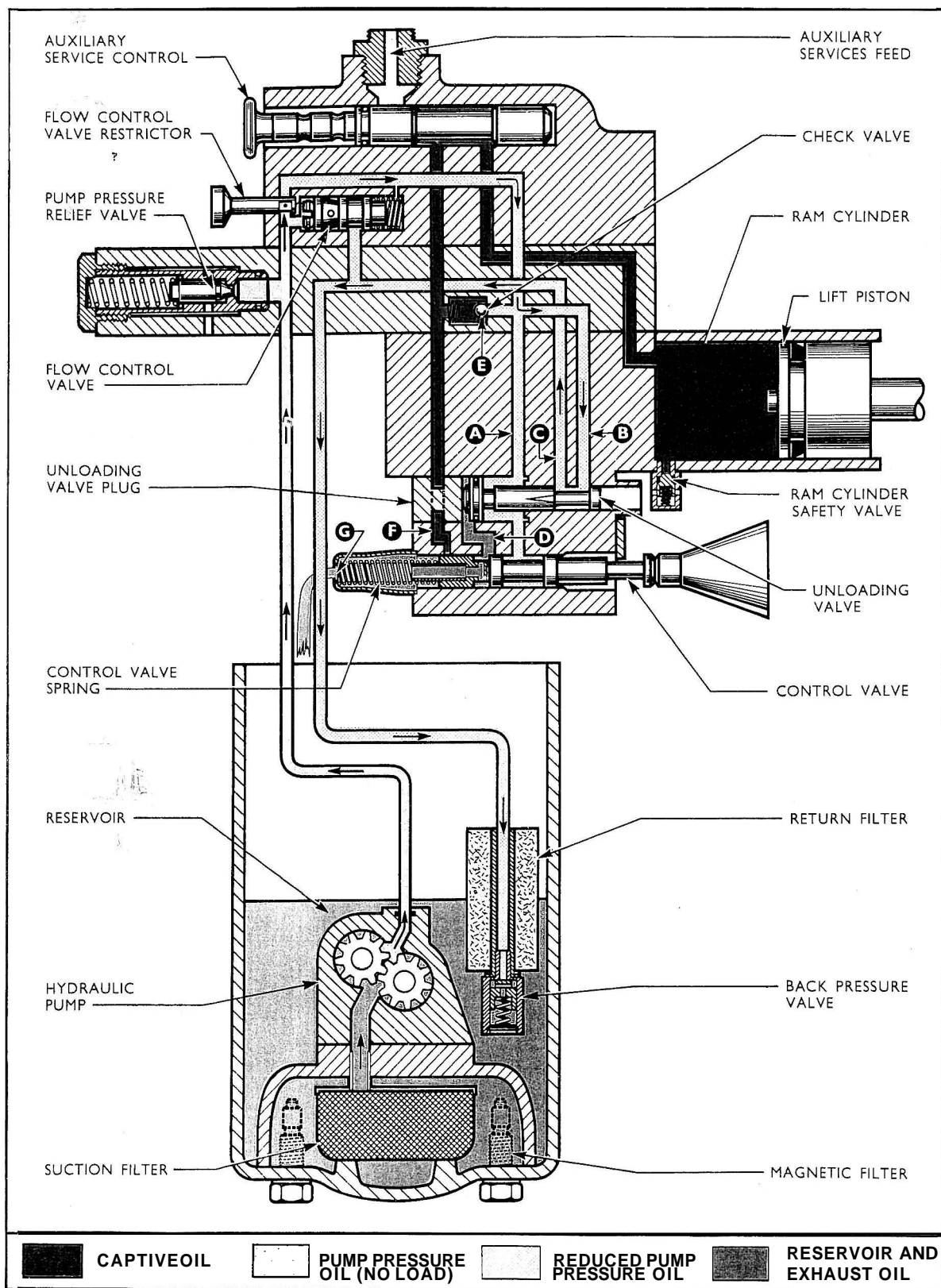


Fig. 13 Hydraulic Oil Flow—Neutral

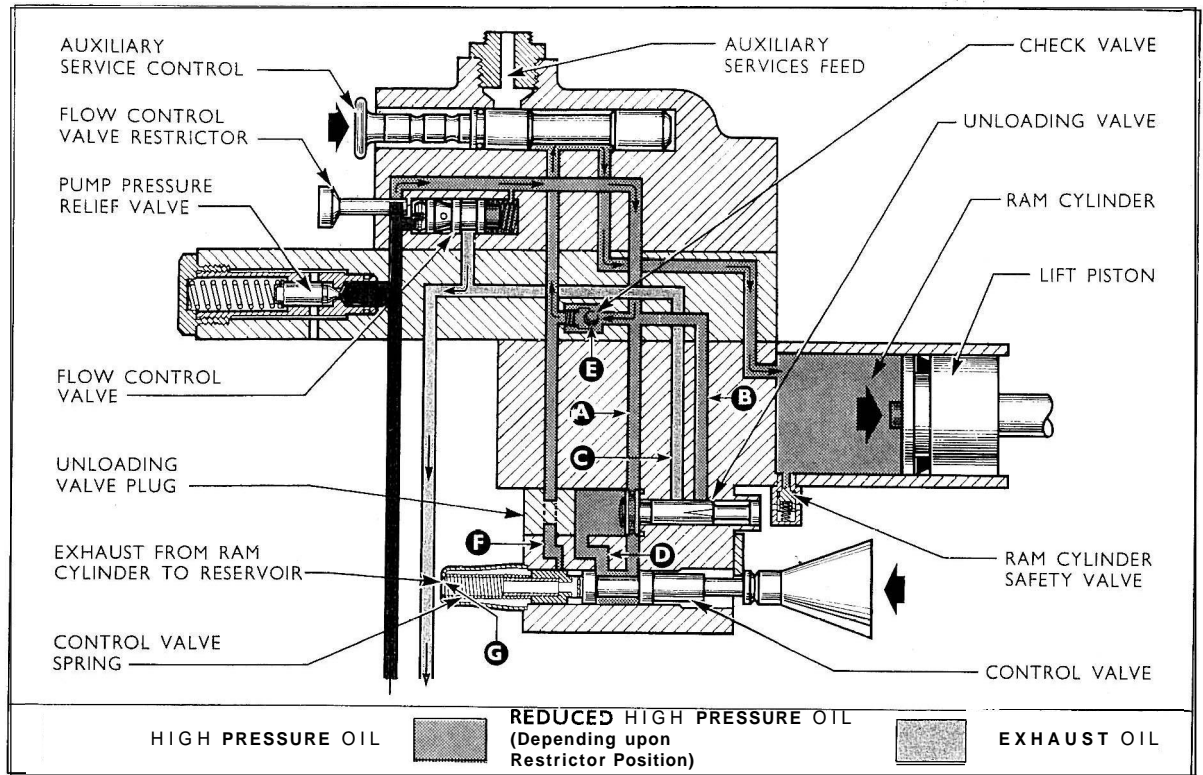


Fig. 14 Hydraulic Oil Flow—Raising

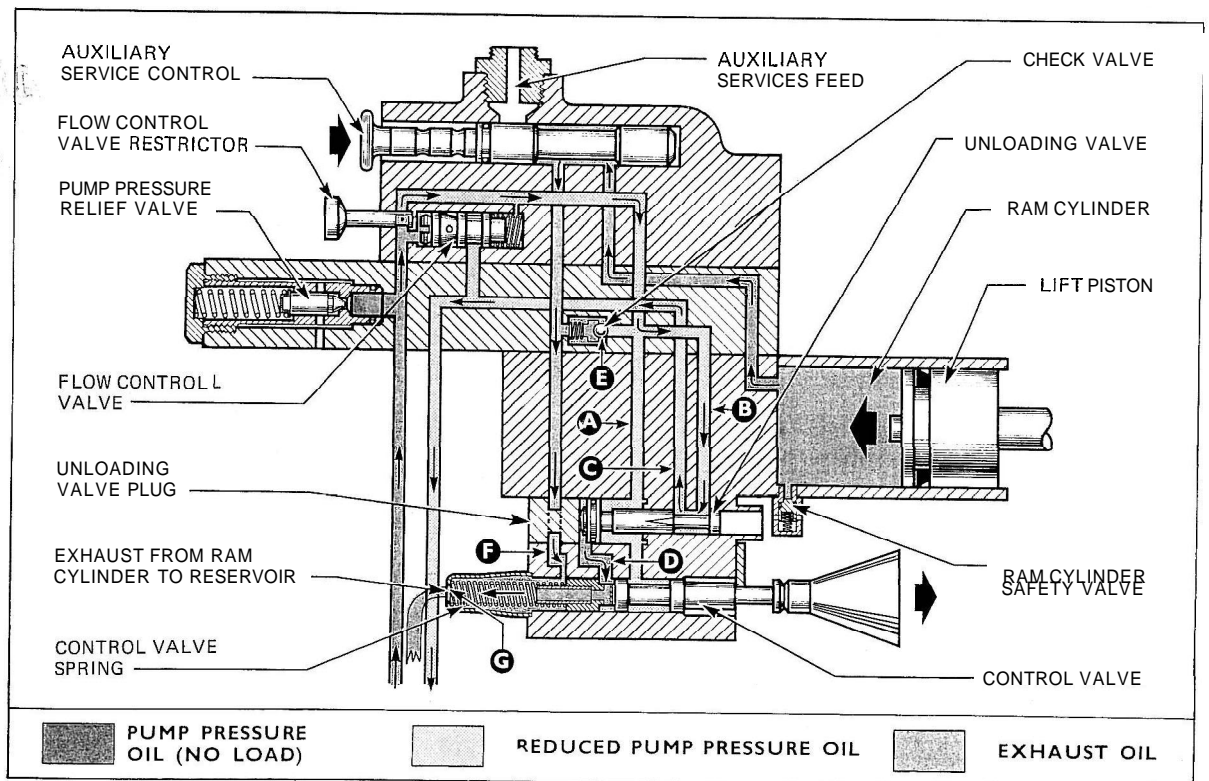


Fig. 15 Hydraulic Oil Flow—Lowering

HYDRAULIC CONTROL ADJUSTMENTS

Main Control Lever

The nut securing the control lever friction plate to the quadrant should be tightened so that an effort of 10 lbs. (4.536 kg.) measured at the outer end of the lever, with a spring balance, is required to move the lever.

This adjustment is only likely to be necessary after a long period of operation, resulting in wear of the friction plate and friction disc, has taken place.

Main Control Spring

The main control spring is correctly set for normal operation when the rear face of the yoke is flush with the housing face. If it is not correctly set it can be adjusted by disconnecting the yoke from the rocker and screwing the yoke into (clockwise), or out of (anti-clockwise), the housing.

Whilst the above setting is correct for all normal usage it may be advantageous to screw the yoke further in, increasing the spring compression, when it is required to obtain abnormal penetration from earth-moving equipment operating in Qualitrol. Before this adjustment is made, however, care should be taken to ensure that the implement is correctly set and that the required operating depth cannot be obtained without this increase in spring compression.

This setting will increase the depth at which the implement can be operated but will decrease the sensitivity of the system and the spring setting should therefore be corrected before resuming normal operations.

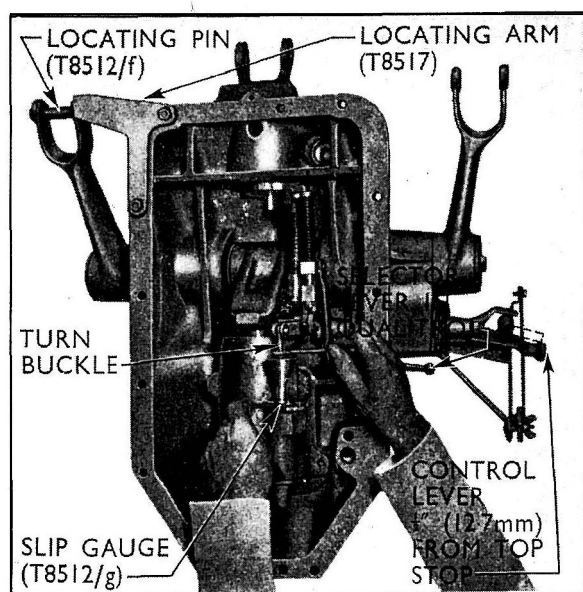


Fig. 16

Qualitrol Linkage Adjustment

Qualitrol Linkage Adjustment

1. Remove the lift assembly from the tractor (see section headed "To Remove the Lift Cover Assembly").

2. Ensure that the main control spring is correctly adjusted with the yoke and housing faces flush.

3. Fit the locating arm, Tool No. T.8517, to the underside of the lift cover flange, attaching it to the two rear holes on the left-hand side. Insert the locating pin T.8512/f through the arm and left-hand lift arm bush.

4. Place the selector lever in the upward position i.e., at right angles to the lift cover.

5. Raise the main control lever to within 0.5 in. (12.7 mm.) of the fixed stop. The slip gauge T.8512/g is the correct width for this setting and can be used to gauge the correct dimension.

6. Remove the slip gauge from the quadrant, loosen the control valve turnbuckle locknut and adjust the turnbuckle until the Qualitrol end of the slip gauge can just be inserted between the control valve and rear face of the control valve bush. After adjustment tighten the turnbuckle locknut and re-check the setting.

Position Control Adjustment

This operation should only be carried out after the setting of the main control spring has been checked and the qualitrol adjustment carried out.

1. Set the selector lever in the horizontal position, i.e. level with the lift cover face.

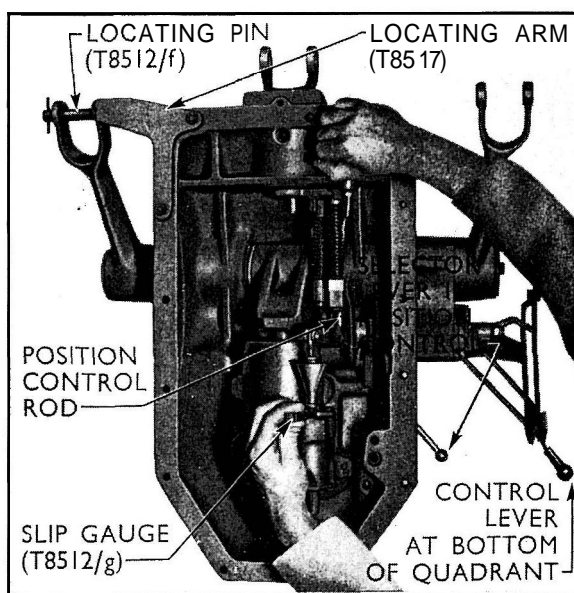


Fig. 17

Position Control Linkage Adjustment

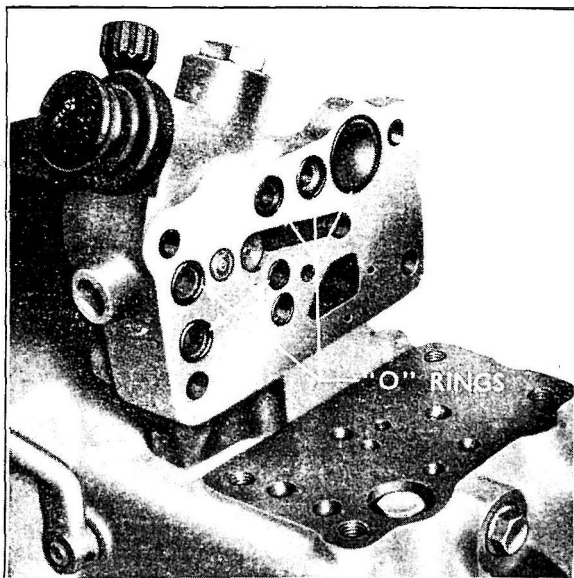


Fig. 18
Auxiliary Service Control Plate

2. Move the main control lever to the bottom end of the quadrant.
3. Hold the position control rod locknut and adjust the position control rod until the position control end of the slip gauge, T.8512/g, can just be slipped between the control valve and the rear face of the control valve bush.
4. Retighten the position control rod locknut.

To Adjust Flow Control Valve Linkage

Move the spacer from behind the quadrant lever, so that the flow control valve crank lever contacts the rear face of the control lever and place the lever against the top stop in the quadrant.

Screw the flow control valve restrictor spindle and knob fully out and turn the lever fully against the 'S' stop. Gradually screw the spindle and knob until the lever **just** moves. It is important that the knob is not screwed in beyond this point.

Remove the split pin and clevis pin securing the flow control rod to the crank lever, slacken the locknut and adjust the clevis so that the crank lever just contacts the main control lever. Tighten the locknut and reconnect the rod to the crank lever.

Replace the spacer behind the main control lever and check the operation of the linkage.

TO DISMANTLE THE HYDRAULIC LIFT ASSEMBLY

Absolute cleanliness is essential in dealing with repairs or internal adjustments to the hydraulic system. It is recommended that all mud and dirt is removed from the tractor before removal of any hydraulic components. Clean receptacles should be

provided for small components and highly finished parts should be placed on soft material. All parts should be cleaned and adequately lubricated before replacement.

To Remove the Auxiliary Service Control Plate Assembly

1. Remove the split pin and clevis pin securing the flow control linkage to the flow control valve restrictor lever and move the rod away from the housing.
2. Remove the set-screws securing the auxiliary service plate to the lift cover.

NOTE.—The screws used are of varying length and care should be taken to note from which locations the various screws are removed.

To Dismantle the Auxiliary Service Control Plate and Flow Control Device Assembly

1. Remove and discard the "O" rings fitted between the plate and the lift cover.
2. Drive out the tension pin securing the auxiliary service spool cap and withdraw the spool, together with the knob and rubber cover.
3. Unscrew the knob from the spool and remove the cover and the flat washer fitted inside it. Withdraw the cap from the spool, taking care not to lose the spring and locating ball fitted in the internal recess. Remove and discard the "O" ring fitted to the valve spool.
4. Drive out the pin securing the flow control knob to the restrictor, remove the knob and push the restrictor downwards out of the housing. Remove and discard the "O" ring fitted in the upper recess of the restrictor bore.

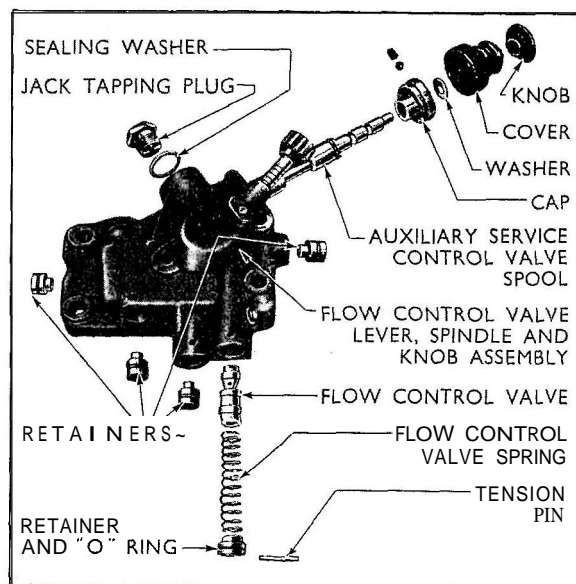


Fig. 19
Auxiliary Service Control Plate and Flow Control Valve

5. Drive out the pin in the end of the flow control valve chamber and withdraw the retainer, spring and valve plunger. Remove and discard the "O" ring fitted to the retainer.

6. Similarly drive out the remaining four tension pins and remove the retainers and "O" rings fitted in the other oil passages in the housing.

To Rebuild the Auxiliary Service Control Plate and Flow Control Device Assembly

1. Fit new "O" rings to the retainers, press into position in their bores and secure with tension pins.

2. Place the flow control valve plunger in its bore. This valve is a selective fit and the largest valve should be fitted which will operate without binding in the bore. Replace the flow control valve spring followed by the retainer, using a new "O" ring on the retainer, and secure by driving in the tension pin.

3. Insert the restrictor in its bore in the plate, keeping the large end to the lower face of the plate. Fit a new "O" ring over the top of the restrictor into the counterbore in the housing. Place the control knob in position over the restrictor and secure with a tension pin, it should be noted that the holes in the restrictor and knob are bored off centre to ensure that the parts are located correctly in relation to one another.

4. The auxiliary service spool is a selective fit in its bore and the largest spool which will operate without binding should be fitted. Place the spring and ball in the internal recess of the auxiliary service spool cap. Depress the ball into the recess and slide the cap on to the spool. Place the flat washer on the end of the spool, followed by the rubber cover and operating knob.

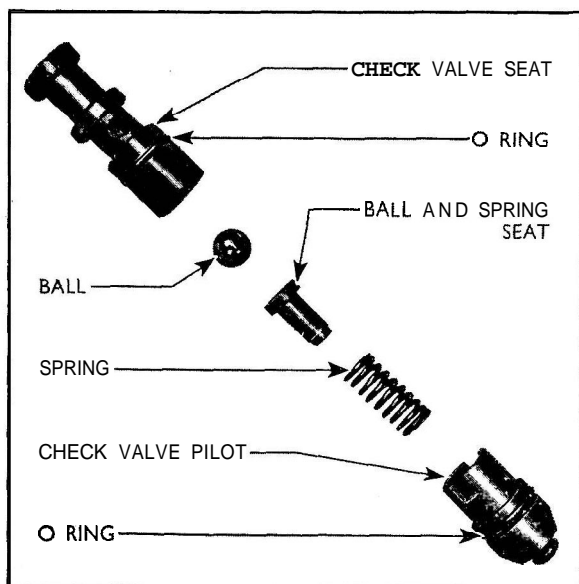


Fig. 20

Check Valve Assembly

5. Fit a new "O" ring to the auxiliary service valve spool and fit the spool to the auxiliary service plate locating the cap in the entrance to the bore and securing with a tension pin.

To Replace the Auxiliary Service Control Plate Assembly

1. Ensure that the mating faces of the plate and lift cover are clean, fit new "O" rings to the oil passage counterbores in the lower surface of the plate and locate the plate (with a new gasket between plate and lift cover) on the cover.

2. Insert and fully tighten the retaining screws.

3. Connect the flow control link to the flow control by means of a clevis pin and split pin.

4. Check the operation of the auxiliary service control and of the flow control device, if necessary, adjusting the flow control linkage as previously described.

To Remove the Lift Cover Assembly

1. Remove the seat and place the control lever at the bottom of the quadrant to allow oil to exhaust from the ram cylinder.

2. Remove the upper link and disconnect the right- and left-hand lifting rods from their respective lift arms.

3. Remove the clevis pin securing the main control spring plunger yoke to the rocker and swing the rocker away from the yoke.

4. Remove the ten bolts and two nuts located around the periphery of the cover which retain it to the rear transmission housing. These bolts are of varying lengths and note should be made from which location the various bolts are removed.

5. Remove the lift cover assembly complete with lift cylinder and control linkage, using lifting bracket Tool No. T.8518, located on the seat mounting studs to facilitate removal.

To Replace the Lift Cover Assembly

1. Fit new 'O' rings at the top of the inlet pipe and exhaust oil passage in the rear transmission housing and locate a new gasket on the top face of the housing.

2. Carefully replace the lift cover, locating it on the dowels at the front and rear of the transmission housing top face and insert and fully tighten the retaining screws and nuts.

3. Adjust the main control spring as previously described, then connect the yoke to the rocker and secure with a clevis pin.

4. Replace the upper link and connect the lifting rods to the lift arms.

5. Replace the seat.

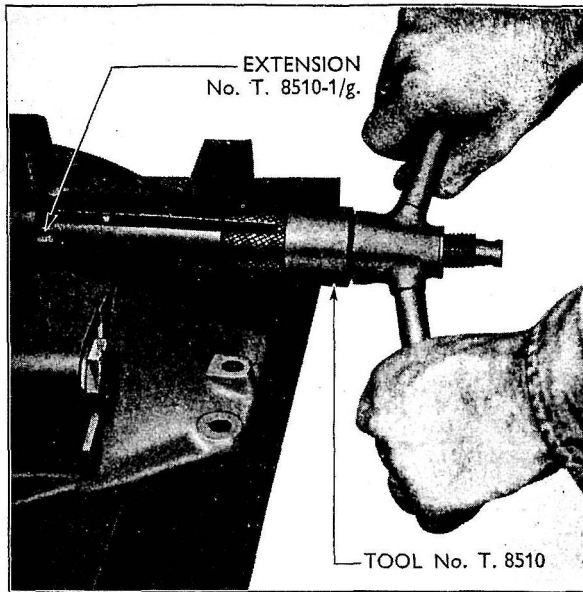


Fig. 21

Removing Check Valve Seat

To Remove the Check Valve

Remove the lift cover as previously described and place the lift cover on a bench, suitably supported to prevent damage to the machined surfaces and internal components.

1. Unscrew the check valve plug and, using a pair of sharp-nosed pliers, extract the valve pilot, spring, spring guide and ball from the check valve passage.

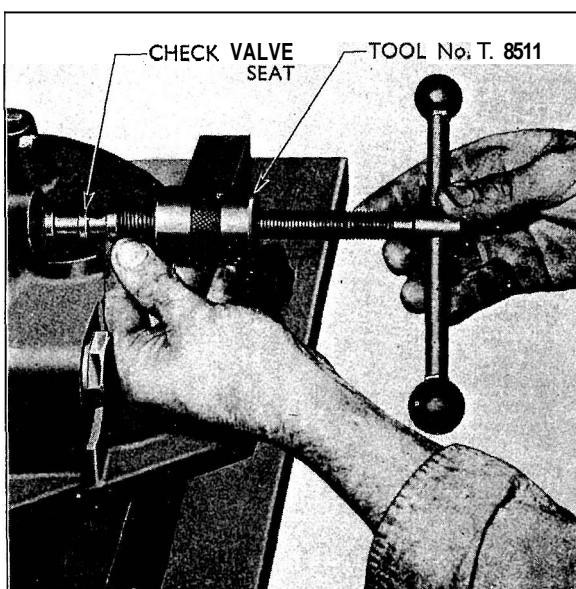


Fig. 22

Replacing Check Valve Seat

2. The check valve seat is a press fit in the housing but is threaded at its front end to accept the thread of the remover extension T.8510-1/g which is used with Main Tool No. T.8510. The shorter threaded end of the extension screws into the tool and the longer end into the valve seat. Operate the wing nut on the tool to withdraw the seat.

NOTE.—It is most important that the hollow outer tube of the withdrawal tool seats squarely against the lift cover during this operation, as excessive misalignment may result in breakage of the seat which will then be extremely difficult to remove. If the face of the lift cover appears rough, or out of square with the check valve drilling it is advisable to correct this before attempting to remove the valve seat.

To Replace the Check Valve

1. Examine the seat and renew if scored, damaged or chipped on either the outer surface or on the ball seat.
2. Fit a new 'O' ring to the check valve seat, locate the seat in the pilot of Tool No. T.8511, and enter the seat into the check valve passage. Screw the body of the tool into the threaded. outer end of the check valve passage and operate the centre screw of the tool to press the valve seat into position.
3. Remove the tool, fit a new 'O' ring to the check valve pilot and assemble the check valve ball, spring guide, spring and pilot to the cover. Replace the check valve plug and tighten to a torque of 45 to 55 lbs/ft. (6.219 to 7.601 kg.m.).

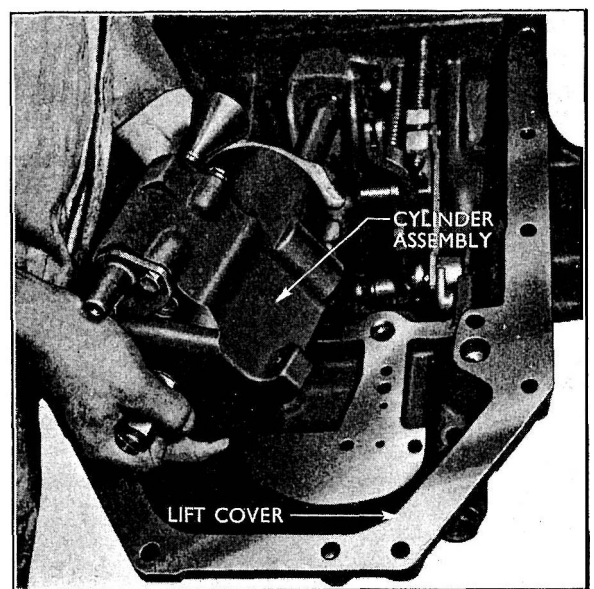


Fig. 23

Removing Lift Cylinder from Cover

To Remove the Ram Cylinder Assembly

1. Remove the lift cover as previously described, then remove the auxiliary service plate and flow control valve assembly from the cover assembly.
2. Disconnect the control valve linkage by removing the pin securing the turnbuckle assembly to the actuating lever and remove the turnbuckle.
3. Remove the four screws securing the ram cylinder to the lift cover (one of these is recessed into the cover in the area covered by the auxiliary service control plate) and withdraw the cylinder from its locating dowels in the cover.

To Dismantle the Ram Cylinder Assembly

1. Remove the ram cylinder safety valve by turning it anti-clockwise, using a spanner on the hexagon head of the body. Do not attempt to dismantle the safety valve assembly; the slot in the centre portion is for adjustment during initial assembly, after which the valve is sealed and should not be disturbed. It is set to open at 2,750 to 2,850 lbs/sq. in. (193.35 to 200.38 kg/sq. cm.) and if the valve is suspected of being faulty it should be removed and replaced with a new one.
2. If necessary, remove the two ring dowels from the top face of the cylinder assembly.
3. Remove and discard the 'O' rings fitted in the counterbores of the various oil passages in the ram cylinder.
4. Ensure that the bench surface is clean and turn the ram cylinder onto its top face or, if preferred, secure it in a soft-jawed vice.
5. Remove the two screws securing the front cover plate to the lift cylinder and remove the plate and control valve spring.

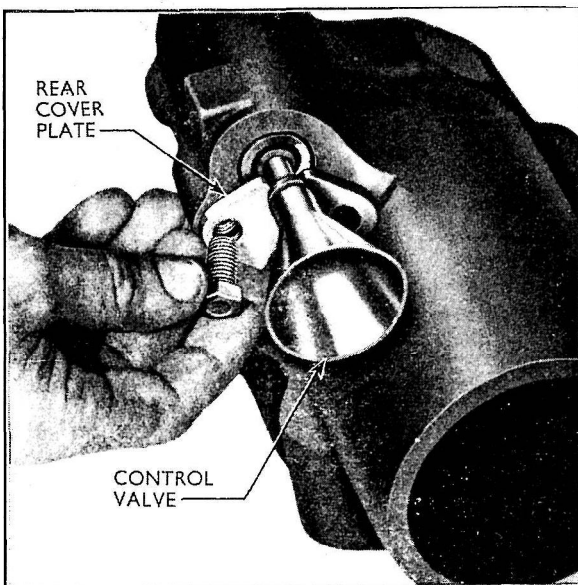


Fig. 24

Removing Rear Cover Plate from Cylinder

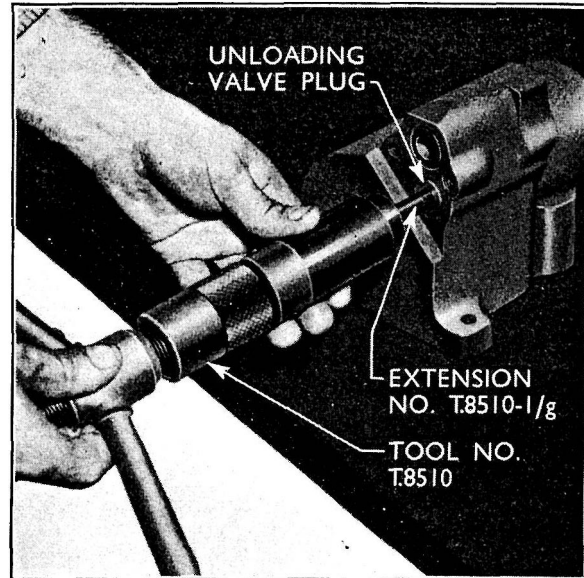


Fig. 25

Removing Unloading Valve Plug

6. Remove the two set screws securing the rear cover plate to the lift cylinder and remove the rear cover plate.
7. Remove the control valve, withdrawing it from the rear of the cylinder. Care should be taken in handling the valve to avoid damage or scoring to the lands of the valve or distortion of the valve as a whole.
8. Attach remover adaptor T.8510/g to Main Tool No. T.8510 and screw the outer end of the adaptor

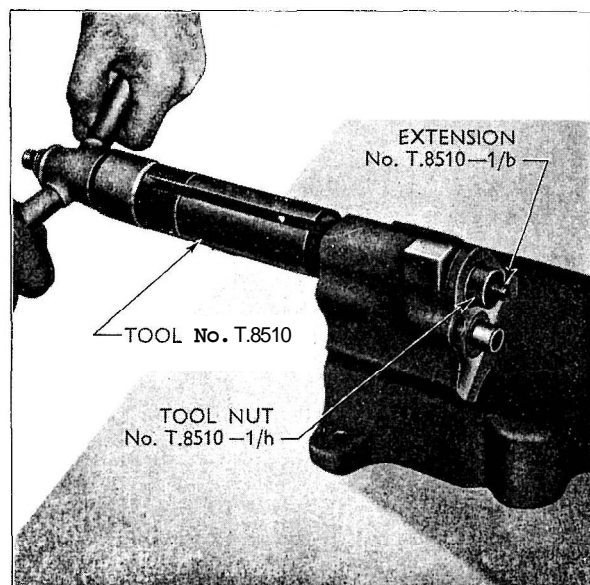


Fig. 26

Removing the Control Valve Bush

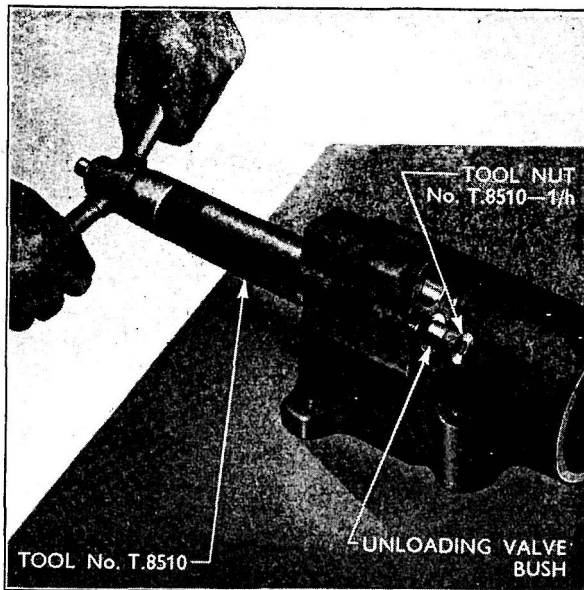


Fig. 27

Removing the Unloading Valve Bushes

into the unloading valve plug (at the front end of the unloading valve chamber) and remove the unloading valve plug.

Care should be taken to avoid damage to the lands of the plug as leakage at this point will affect the operation of the unloading valve.

9. Remove the unloading valve from its chamber and discard the 'Q' ring fitted to the large end of the valve.

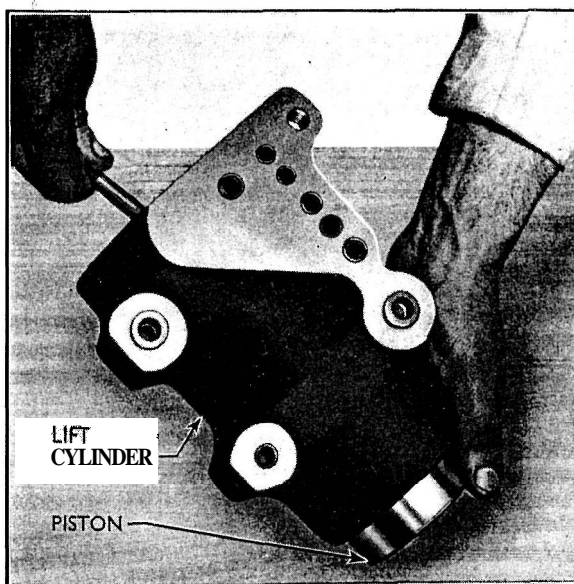


Fig. 28

Removing Ram Cylinder Piston

10. Attach the short threaded end of extension T.8510-1/b to Main Tool No. T.8510 and pass the extension through the control valve bush with the main tool at the front end of the cylinder. Screw the special nut, Tool No. T.8510-1/h onto the rear end of the extension until it locates squarely against the rear face of the bush with the small tapered portion of the nut located inside the bush for centralisation. Operate the wing nut of the main tool and withdraw the bush, then remove the special nut and bush from the main tool.

11. Repeat this operation for the unloading valve bushes, seating the nut against the rear face of the rear bush, i.e. with the main tool at the front of the cylinder, and withdrawing both bushes at the same time.

12. Insert a suitably sized rod through the safety valve locating hole and push the piston out of the ram cylinder. Care must be taken to avoid damage to the threads in the locating hole and to avoid scoring of the ram cylinder walls.

13. Unless the piston gland is known to be giving an absolutely perfect seal it is recommended that the gland is discarded and a new one fitted on reassembly.

To Rebuild the Ram Cylinder Assembly

The valves, bushes and sealing plugs used on the ram cylinder are machined to extremely accurate limits and it is important that any part which is worn, scratched or damaged in any way is discarded and only perfect parts fitted on reassembly. Each bush is a press fit in its respective bore in the cylinder and the control valve is a selective fit in its bush. *All* 'O' rings and sealing gaskets should be discarded and replaced by new parts on reassembly.

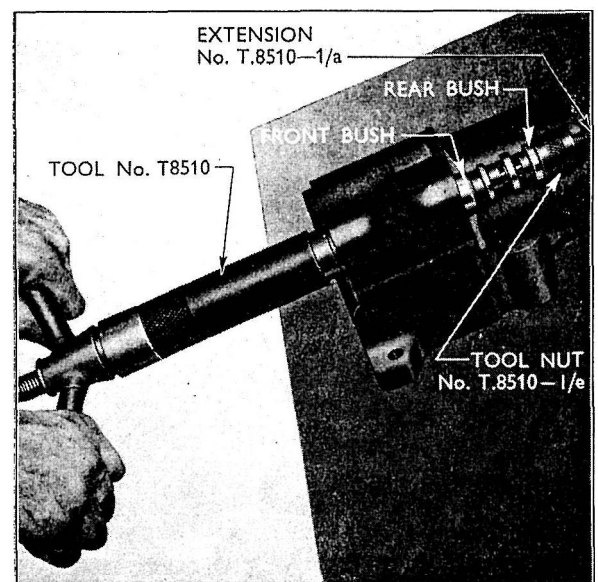


Fig. 29

Replacing the Unloading Valve Bushes

The outside of the lift cylinder bears colour spots, adjacent to the unloading valve and control valve bores, for identification of the bore sizes. The unloading valve bushes, unloading valve plug and control valve bush are marked with similar colours.

The colour **spots** on the housing should not be confused with a colour **streak** adjacent to the control valve bore.⁷ This streak is used to indicate the **internal** diameter of the control valve bush during initial assembly of the unit at the factory and bears no relation to the size of a new bush assembled in service.

1. Observe the colour spot on the outside of the cylinder adjacent to the unloading valve chamber and select a front and rear unloading valve bush with the same colour marking.

Attach the short threaded end of extension T.8510-1/a to Main Tool No. T.8510 and, working from the front of the cylinder pass the extension through the unloading valve bushing bore, using guide adaptor T.8510-1/k to centralise the tool in the bore.

Place the unloading valve front bush over the extension and locate it at the entrance of the bore. The bush has small notches in its end periphery, one small notch at one end and two larger notches at the other. The bush should be fitted to the housing with the small, single notched end to the front. Place the rear bush over the extension with the long spigot end away from the front bush and screw the special guide nut T.8510-1/e onto the extension, locating the spigot end of the rear bush in the nut. Lubricate the outsides of the bushes and draw them into the bore until the back face of the rear land on the rear bush is flush with the rear face of the housing,

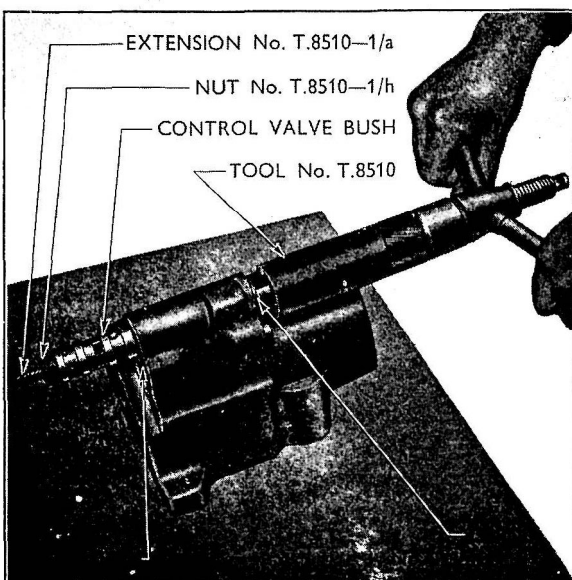


Fig. 30

Replacing the Control Valve Bush

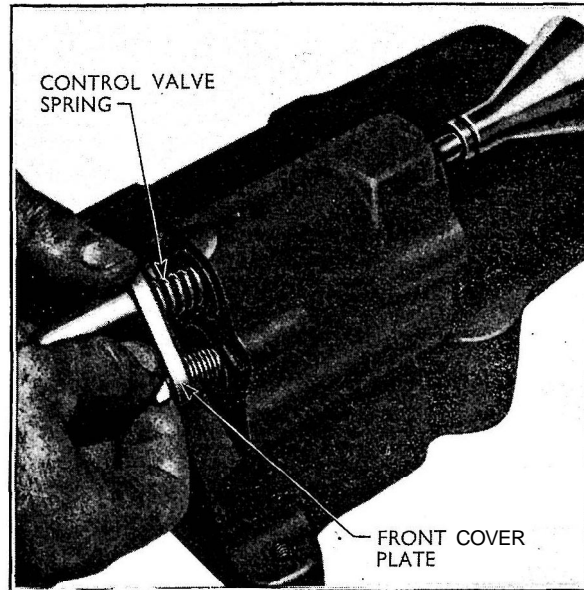


Fig. 31

Replacing Cylinder Front Cover Plate

the bushes being correctly located when the front face of the guide nut is in contact with the housing. Care should be taken to ensure that the rear bush is accurately centralised when making the assembly, otherwise difficulty may be experienced in obtaining entry into the bore.

It is important to the correct functioning of the lift that the bushes be correctly located.

2. Release the nut and withdraw the tool from the unloading valve bushes.

3. Observe the colour spot on the outside of the cylinder adjacent to the control valve bushing bore and select a control valve bush with the same colour marking. Insert guide and stop adaptor T.8510-1/k (spigot end foremost) into the rear of the control valve bushing bore and working from the rear of the cylinder, pass extension T.8510-1/a, fitted to Tool No. T.8510, through the guide and locate the control valve bush over the extension. The lands of the bush vary in width, and assembly should be made with the longest annular recess to the rear of the cylinder.

Lubricate the bush and, using nut T.8510-1/h to retain the bush and centralise the extension, pull the bush into the bore until the rear face contacts the guide.

Slacken the wing nut of the tool and reverse the guide, passing the spigot into the body of the tool, so that the larger face of the guide is against the rear face of the cylinder. Retighten the wing nut and draw the bush fully into the bore.

The position of this bush is important for correct operation of the valve gear and its front face should be flush with the front face of the cylinder.

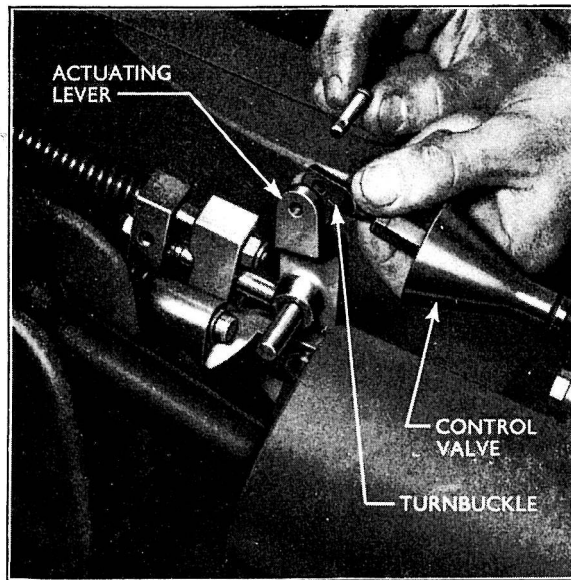


Fig. 32

Replacing Control Valve Turnbuckle

4. Fit a new 'O' ring in the recess at the large end of the unloading valve, lubricate the valve and 'O' ring and insert the valve in its bushes in the lift cylinder, small end to the rear.
5. Select an unloading valve plug of the same colour marking as the unloading valve bush and press this plug into the unloading valve bore, with the threaded central hole in the plug facing outwards, until it is flush with the front face of the cylinder.
6. The control valve is colour marked to assist identification, this should not, however, be used as a means of selecting a valve to match the bush. The internal diameter of the bush will vary according to the interference fit between the bush and the bore and the control valve selected should be the largest size which will operate without binding in the bush. It is essential that the internal bore of the bush and the lands of the valve are completely free from burrs as these could give a false impression of the fit of the valve.
7. Having selected a suitable valve, retain it in the bush by assembling the rear retaining plate, securing the plate with two set screws.
8. Replace the control valve spring in the front cover plate and secure the plate to the housing with two set screws.
9. If removed, replace the two ring dowels in the appropriate diagonally opposite counterbored holes in the top face of the ram cylinder.
10. Fit a new gland to the piston using the tapered replacer, Tool No. T.8519-a. Lubricate the gland and press the gland over the taper until it locates on the parallel portion of the tool.

Locate the gland and replacer on the closed end of the piston and slide the gland off the tool so that it locates in its groove in the piston.

11. Lubricate the outer face of the piston and, after allowing the gland to contract to its original size, insert the open end of the piston into the replacer guide, T.8519-b, so that the gland is compressed into its groove.

Fit the piston to the ram cylinder by inserting the front end of the piston into the ram cylinder until the replacer guide contacts the rear end of the ram cylinder; slide the piston from the replacer into the ram cylinder.

12. Replace the ram cylinder safety valve assembly using a new sealing washer between the valve and the cylinder.

To Replace the Ram Cylinder

1. Ensure that the mating faces of the ram cylinder housing and lift cover are clean and free from burrs.
2. Fit new 'O' rings to the counterbores in the oil passages, fit the cylinder assembly to the lift cover, entering the piston rod into the cylinder bore and secure with the retaining screws.
3. Replace the control valve turnbuckle assembly, inserting the ball end in the control valve sleeve and securing the rear end to the valve actuating lever with a cotter pin and split pin.
4. Carry out the Qualitrol and Position Control adjustments as previously described.
5. Refit the auxiliary service and flow control plate assembly, assemble the lift cover assembly to the tractor and replace the driver's seat.

To Dismantle the Lift Cover Assembly

1. Remove the scat, disconnect the lift arms and main control spring yoke and remove the lift cover from the tractor as previously described.
2. Remove the auxiliary service plate and ram cylinder.
3. Remove the quadrant retainer.
4. Remove the self-locking nut, double coil spring washer and flat washer securing the friction plate to the lift control lever shaft and withdraw the friction plate, woodruff key and friction disc.
5. Remove the two screws and spring washers securing the quadrant assembly to the lift cover and slide the quadrant assembly off the control lever cross-shaft.
6. Remove the locating spacer tube situated within the control lever cross-shaft housing.
7. Turn the lift cover on the bench, so that it rests on its top face, suitably supported to protect the machined faces.

8. Straighten the lockwasher tab and remove the screw and flat washer securing each lift arm to the cross-shaft. Remove the lift arms.

9. Remove the cross-shaft together with the two supporting bushes and spacer from one side of the housing.

10. Unscrew the main control spring plunger yoke and remove the main control spring.

11. Remove the Qualitrol plunger, link and spring assembly, sliding the fork off the pin in the actuating lever. The link and spring can be removed from the plunger by removing the clevis pin and split pin.

12. Remove the snap ring securing the valve actuating lever to the control lever shaft and remove the actuating lever.

13. Remove the split pin retaining the position control link to the selector arm.

14. Remove the position control assembly and control lever cross-shaft from the lift cover and slide the position control assembly from the cross-shaft.

The position control assembly can, if required, be further dismantled by removing the self-locking nut securing the spring guide to the position control arm. The position control rod can be removed by removing the locknut and unscrewing the rod from the block. The position control link is secured to the block by a pin which is a press fit and can be removed by carefully pressing out this pin. A washer is fitted between the link and the block and care should be taken not to lose it. The position control arm roller

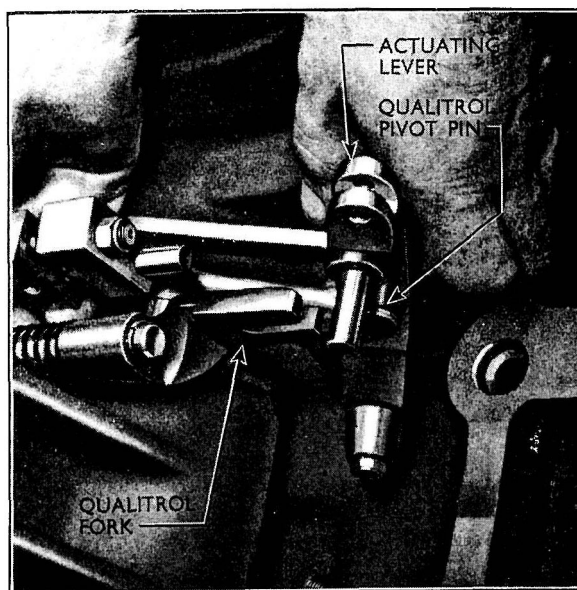


Fig. 33

Removing Control Valve Actuating Lever

can be removed by carefully pressing out the pin from the arm.

15. Remove the ram arm, piston rod and thrust washer from the lift cover. Remove the remaining cross-shaft bushes and spacer.

16. Remove the pin securing the selector lever to the selector control arm and remove the selector control arm.

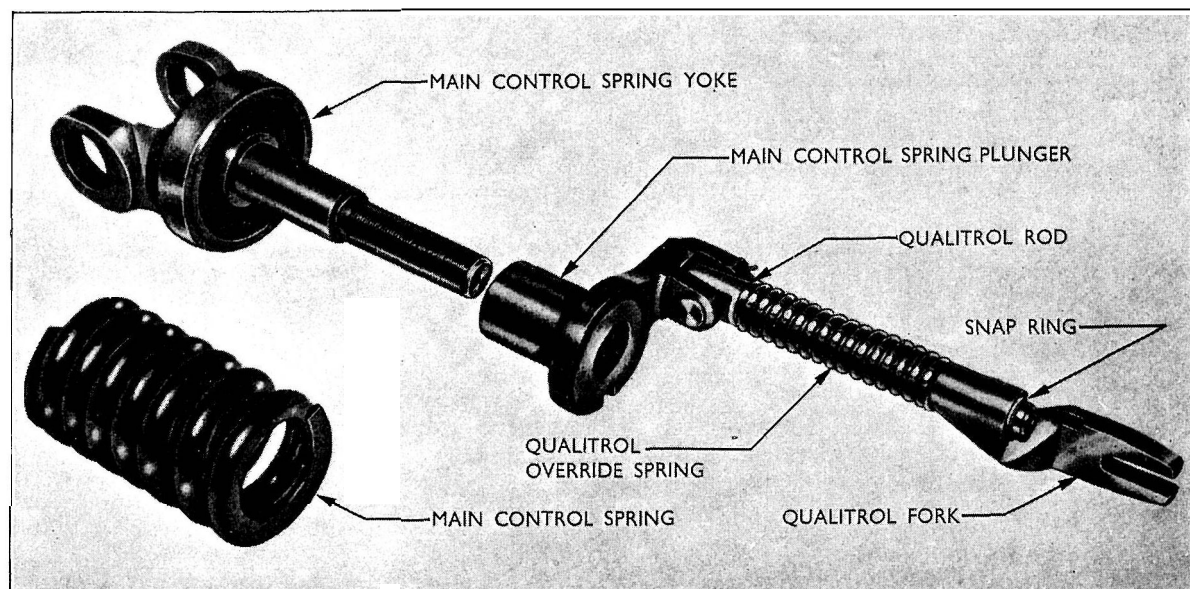


Fig. 34 Qualitrol Link, Spring and Plunger Assembly