

Ferguson

EXTERNAL HYDRAULIC CONTROL VALVES



Ferguson DIVISION

MASSEY - HARRIS - FERGUSON INC.

RACINE, WISCONSIN

FORM No.199 077 M91

EXTERNAL CONTROL VALVES

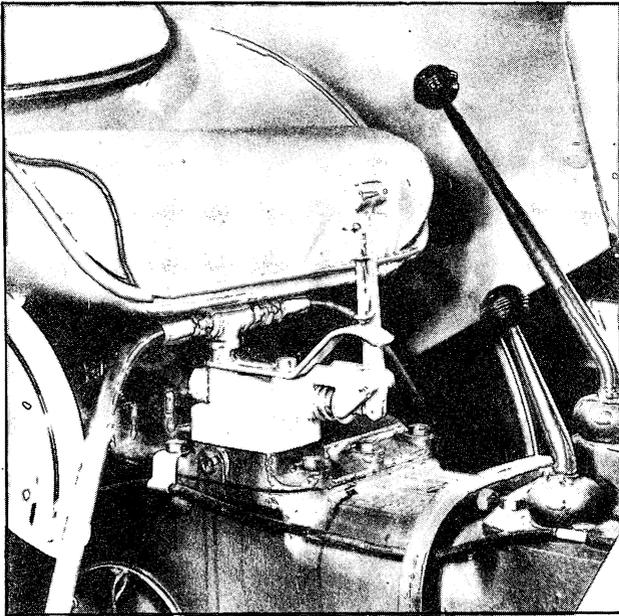


Fig. 1 The Single Spool Control Valve

There are two Ferguson external control valves available which were designed to replace the hydraulic lift cover cap, or transfer plate, on the Ferguson "35" and "40" tractor lift covers. These external control valves were designed specifically to provide open center control of remote hydraulic cylinders used on Ferguson implements. They can however, be adapted and successfully used on a variety of

applications.

When installed on the tractor the valve control lever is conveniently located within easy reach when the operator is in the tractor seat, and in no way interferes with the operation of other tractor controls. The valve outlet and the attached hoses leading to the external cylinders are under the tractor seat out of the way of the operator.

SINGLE SPOOL VALVES

The single spool control valve, shown in Fig. 1, has a single control lever and provides a single outlet to attach an external cylinder or cylinders. A small quadrant attached to the valve body and a latch device on the control lever makes it convenient for the operator to lock the control valve in either the lifting or lowering position.

The single spool valve is composed of a valve body, with the necessary drilled passages, a valve spool, control lever, double acting spring, a spring loaded ball check valve and a check valve plunger.

A sectional view of the single spool control valve is shown in Fig. 2. The land on the

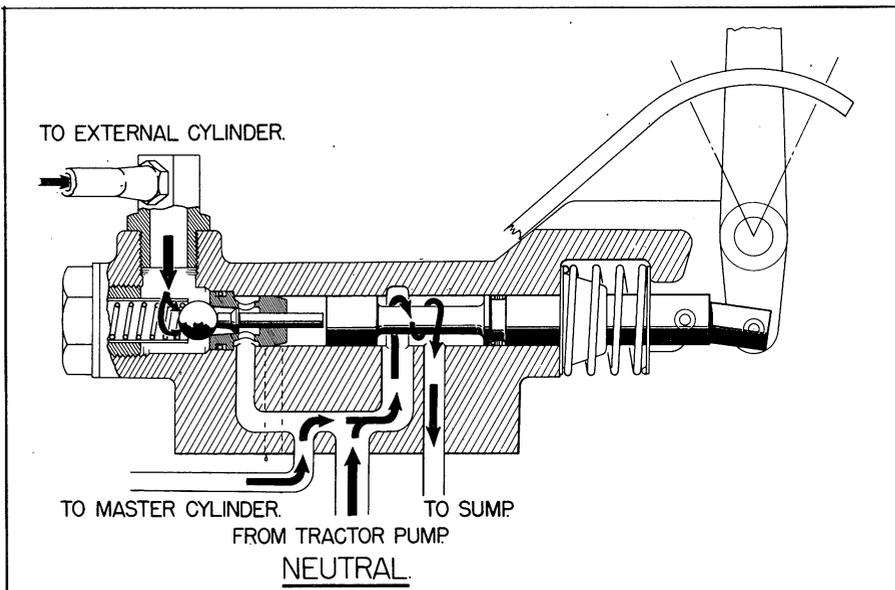


Fig. 2 The Single Spool Valve in Neutral

valve spool is closely fitted to the bore in the valve body and directs the flow of oil. Fig. 2 shows the flow of oil through the control valve when the control lever is in the neutral position. Note the clearance between the end of the valve spool and the check valve plunger; this allows the check valve spring to properly seat the check valve ball on its seat. The check valve prevents the oil from flowing from the external hydraulic cylinder.

The standpipe from the tractor hydraulic pump is sealed in the valve body at the point which is labeled "from tractor pump" in Fig. 2. The oil is pumped through the standpipe into the valve body where it circulates around the relieved section of the valve spool and returns through another passage to the tractor sump. The oil has an unrestricted path through the valve, in the neutral position, so it is pumped under very low pressure through the valve and back to the sump.

This is the open center control feature.

The oil from the tractor master cylinder, which controls the tractor lift links, is allowed to flow out and return to the sump. This is an important characteristic of the single spool valve which should be kept in mind when selecting a control valve for a specific job.

Oil is shown flowing in three passages which must be sealed between the valve body and the tractor lift cover. Note the fourth passage which is shown by dotted lines in Fig. 3.

This passage also returns to the tractor sump and is a bleed passage to take care of any leakage between the land on the valve spool and the valve body or leakage by the check valve plunger.

The single spool control valve is shown in the lifting position in Fig. 3. The valve spool has moved forward in the valve body and the land of the spool now seals the passage which returns the oil to the sump. This forces the oil to flow either to the tractor master cylinder, or to un-

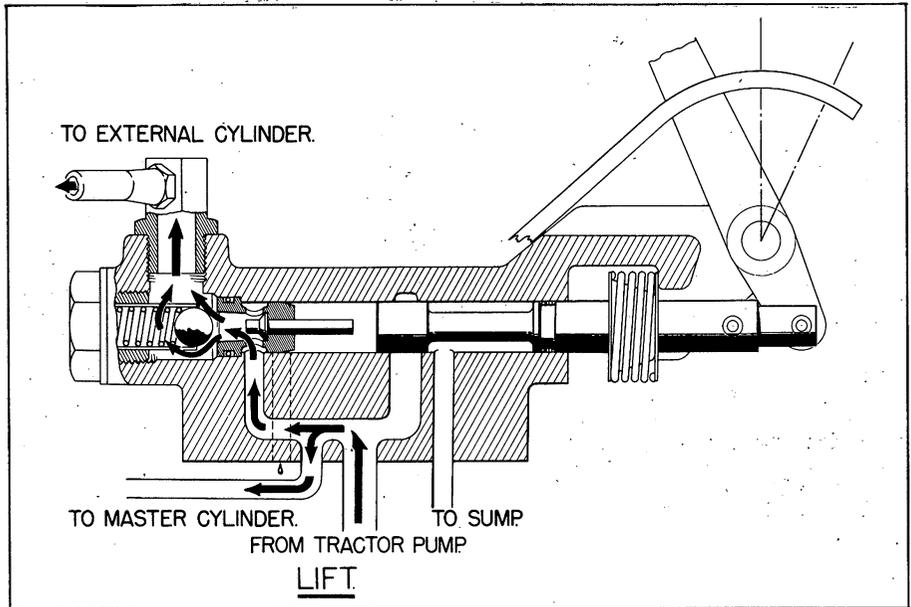


Fig. 3 The Single Spool Valve in the Lifting Position

seat the ball check valve and flow to the external cylinder, which ever offers the least resistance. For this reason it is imperative that the lower links be prevented from raising by the stay links when operating an external cylinder with the single spool valve.

Note also that the double acting return spring on the valve spool is compressed in the forward direction. When the valve control lever is released the spring automatically returns the valve spool to neutral.

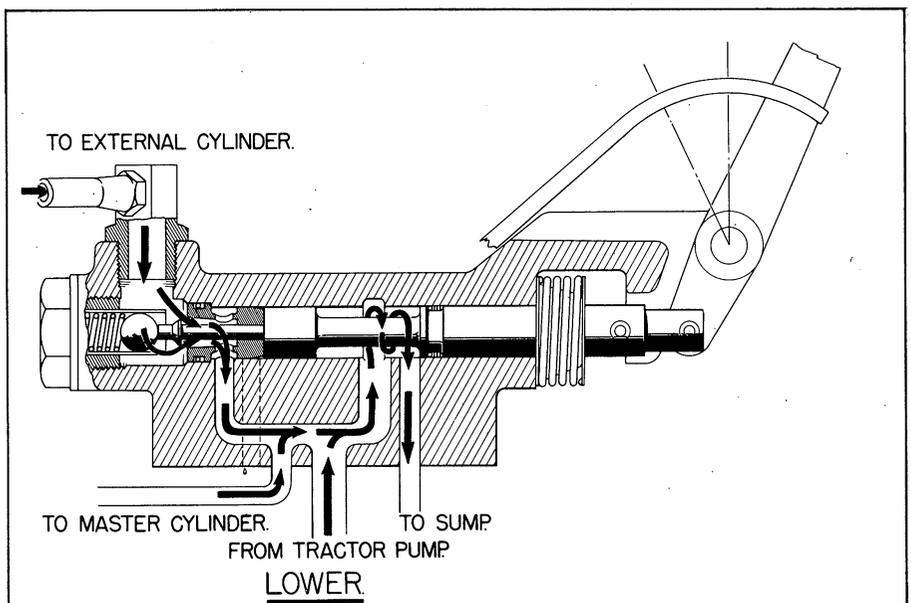


Fig. 4 The Single Spool Valve in the Lowering Position

When the control lever is moved forward to the lowering position, as shown in Fig. 4, the valve spool is moved rearwardly and contacts the ball check valve plunger which moves the ball check valve off its seat and allows the oil to flow out of the external cylinder as shown. The oil from the master cylinder is also free to flow out through the valve to the tractor sump. The oil being delivered by the hydraulic pump through the standpipe flows into the valve body, joins with the oil returning from the external cylinder and flows around the relieved section of the valve spool to the tractor sump.

Note that the double acting return spring on the valve spool is now compressed in a rearward direction. When the control lever is released the spring will automatically return the valve spool to neutral.

DOUBLE SPOOL VALVE

The double spool control valve, shown in Fig. 5, has two control levers and provides two outlets for attaching external cylinders. The left hand control lever is equipped with a small quadrant and latch device making it convenient for the operator to lock the control

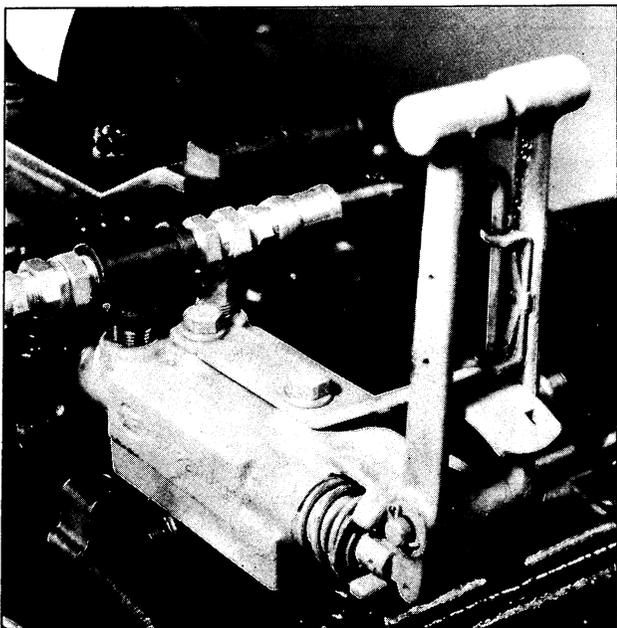


Fig. 5 The Double Spool Control Valve

lever in either the lifting or lowering position.

The double spool control valve is composed of a valve body, with the necessary drilled passages, two valve spools, control levers, return springs, spring loaded ball check valves and check valve plungers.

A sectional view of the double spool control valve is shown in Fig. 6. Note the difference in the location of the lands on the valve spools as opposed to the valve spool in the single spool valve. There are two control lands and two relieved areas on each of the valve spools. Both valve spools are shown in the neutral position in Fig. 6 and the flow of oil is shown by the arrows in the diagram. A passage is provided so that the oil can flow around the wide land on the left valve spool. However the land does seal the passage to the tractor master cylinder and the left valve outlet. The oil flows from the pump through the standpipe to the center of the valve, where it is directed through drilled passages to the relieved area of the right hand spool and to the tractor sump. With both valve levers in the neutral position the ball check valves seal the oil in both external cylinders. The oil is also sealed in the tractor master cylinder by the wide land on the left valve spool.

In the neutral position the oil has an unrestricted path through the valve so it is pumped under very low pressure through the valve and back to the sump. This is the open center control feature.

Fig. 7 shows the double spool valve with the left valve spool in the lift position and the right valve spool in neutral. Observe that the return passage to the sump is sealed by the wide land on the left valve spool and the passage to the right outlet is sealed by the wide land on the right valve spool. The oil is forced to flow from the standpipe into the valve body where it is directed around the relieved area of the left valve spool through the passage to the tractor master cylinder or to the left external cylinder, whichever offers the least resistance.

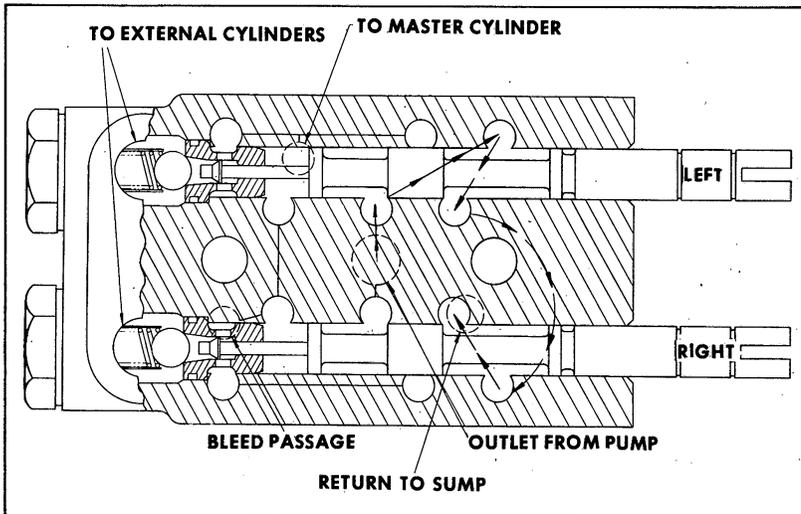


Fig. 6 Both Spools in the Neutral Position

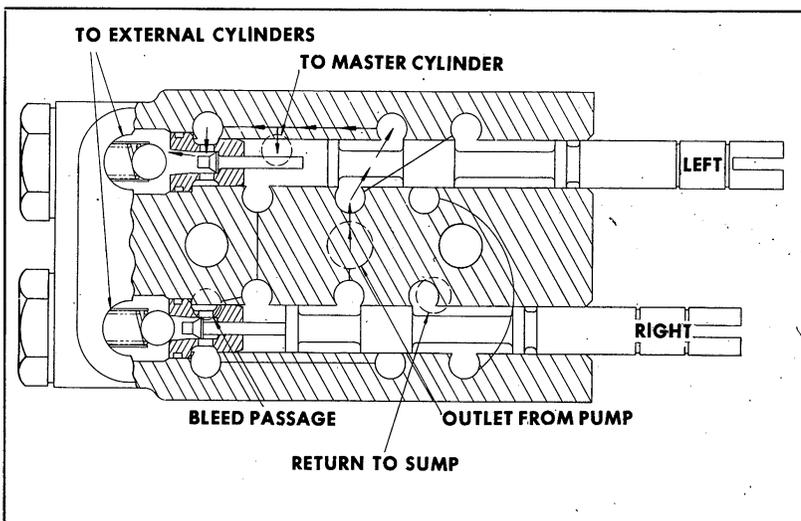


Fig. 7 Left Spool Lifting, Right Spool in Neutral

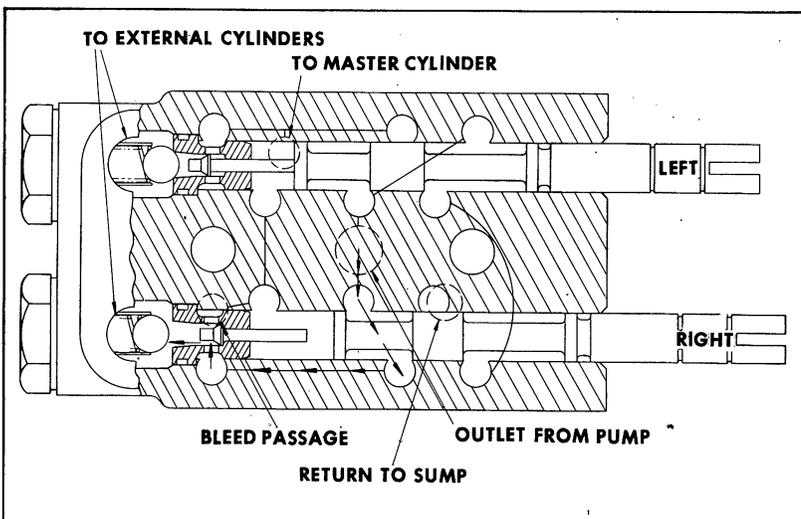


Fig. 8 Left Spool in Neutral, Right Spool Lifting

In Fig. 8 the double spool valve is shown with the left spool in the neutral position and the right spool in the lifting position. The oil is trapped in the left external cylinder by the ball check valve and the passage from the tractor master cylinder is sealed by the wide land on the left valve spool. The return to the sump is sealed by the wide land on the right valve spool. When the right valve spool is moved forward it not only seals the return to sump passage but also opens the passage to the right external cylinder. Oil is then forced to flow from the standpipe through the valve body, around the relieved section of the right valve spool through the passage to the ball check valve and to the external cylinder. It can be clearly seen in Fig. 8 that the right valve of the double spool valve has nothing to do with the flow of oil to and from the tractor master cylinder.

The path of oil through the double spool valve when both spools are in the lifting position is shown in Fig. 9. As before, the return to the tractor sump is sealed by the wide land on the right valve spool. In this position the oil can flow to either of the external cylinders or the tractor master cylinder, whichever presents the least resistance. Therefore, if both control levers are held in the lifting position, both outlets attached to weighted cylinders and the tractor lower links are free with no implement attached, the tractor links will raise to their maximum height before either of the cylinders begin to move. It follows then that the external cylinder with the least load will then complete its stroke before the se-

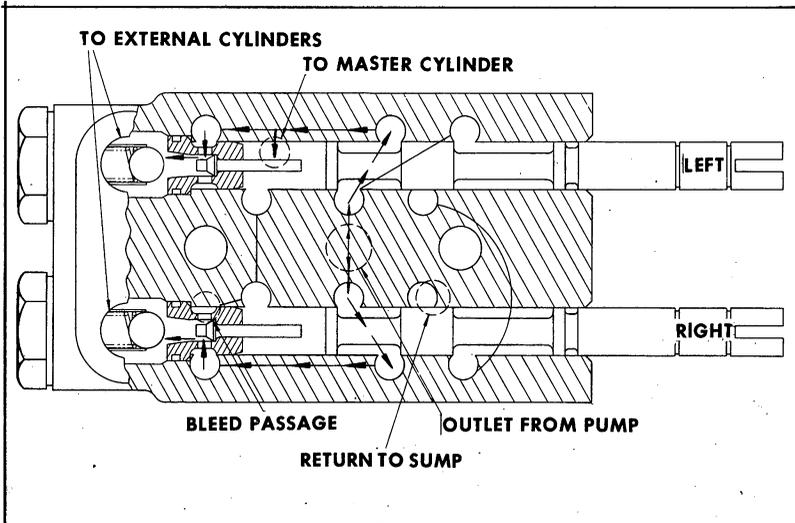


Fig. 9 Both Spools in the Lifting Position

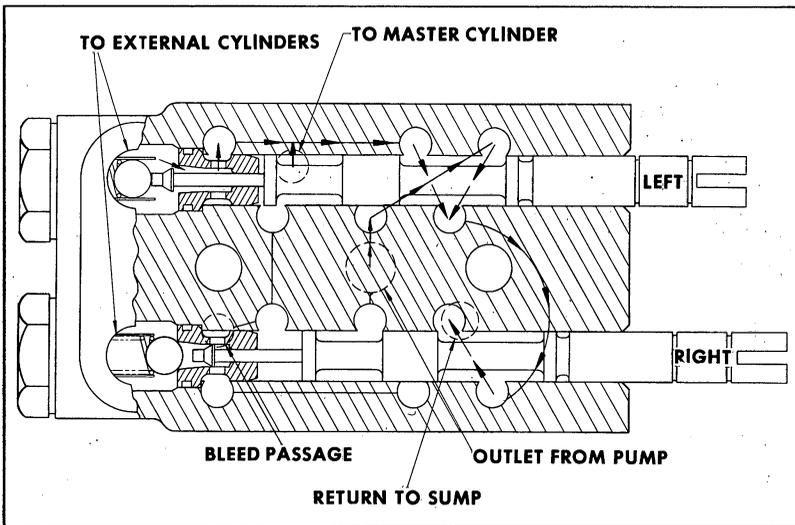


Fig. 10 Left Spool Lowering, Right Spool in Neutral

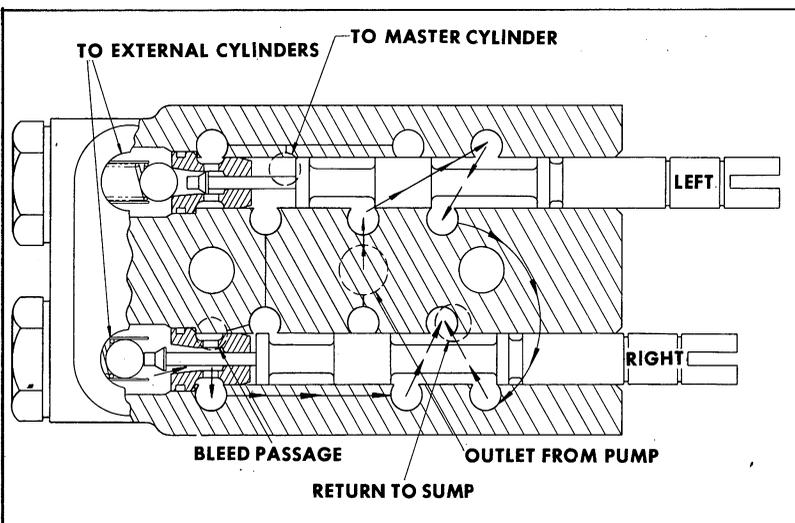


Fig. 11 Left Spool in Neutral, Right Spool Lowering

cond, or heavier weighted, cylinder begins to move.

In Fig. 10 the path of oil flow is shown when the left spool is in the lowering position and the right spool is in neutral. When the left valve spool is moved rearward it contacts the check valve plunger which moves the check valve ball off its seat and allows the oil to flow from the external cylinder to the tractor sump. The oil can also flow from the tractor master cylinder to the sump. The oil which is being supplied by the pump joins with the oil returning from the external cylinder, and tractor master cylinder, and returns to the sump.

Fig. 11 shows the path of oil flow when the right spool is in the lowering position and the left spool is in neutral. Observe again that the oil is sealed in the tractor master cylinder by the wide land on the left valve spool and that the right valve spool has no connection with the tractor master cylinder. As before, the oil from the standpipe is directed through the valve body and returned directly to the tractor sump.

In Fig. 12 the path of oil flow is shown; when both valve spools are in the lowering position. Observe that the oil is permitted to return from both external cylinders and the tractor master cylinder. The oil from the standpipe joins the returning oil and all of it is returned to the tractor sump.

Note that the bleed return passage is connected to both bores in the valve body and returns to the sump any oil which may leak by the lands on the valve spools or by the check valve plunger. The two solid circles in the center of the valve

body represent the cap screw holes for mounting the valve on the tractor lift cover.

It is recommended that the operator not attempt to operate the double spool valve with one control lever in intake and the other in exhaust. The passages in the valve body are so arranged that when one lever is held in lowering and the other in lifting, oil is pumped under pressure through the valve spool which is lifting to the one which should be lowering and causes it to lift.

INSTALLATION

As received the valve has a protective masonite cover secured to the underside of the valve by the attaching cap screws. To install the valve on the tractor:

1. Clean the area around the transfer plate and remove the attaching cap screws.
2. Remove the cap and standpipe and pull the standpipe from the seat in the cap. Note that the standpipe has an "O" ring fitted in a groove at each end.
3. Remove the protective cover from the underside of the valve. The three "O" rings seal the two passages returning to the sump and the passage to the tractor master cylinder.
4. Clean the underside of the valve, check the "O" rings on the standpipe and install the standpipe in position in the valve.
5. Carefully insert the standpipe through the port in the lift cover and center the lower end in the tapered hole in the top of the pump body. Install the two cap screws and tighten them to 40-45 ft. lbs. torque.

OPERATION

After the valve is installed on the tractor, raise both control valves to the top of the quadrant, this will hold the tractor hydraulic pump control valve in the intake position and result in a constant supply of oil from the pump.

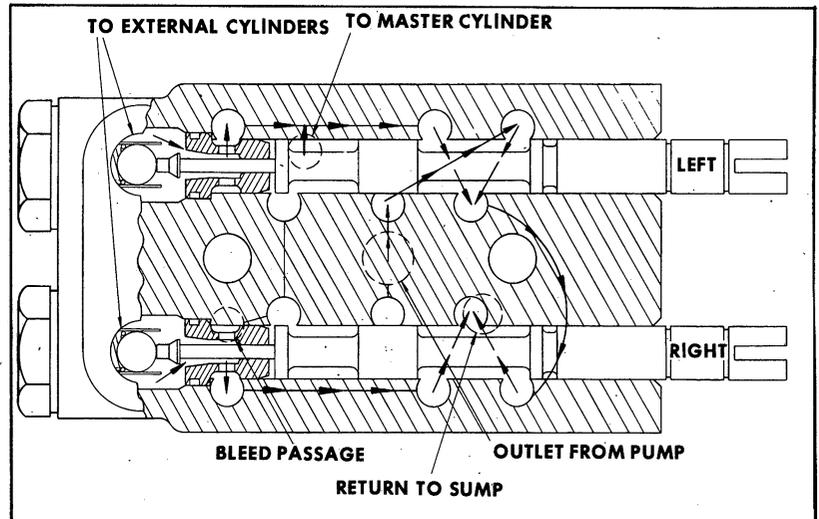


Fig. 12 Both Spools in the Lowering Position

Once either of the valves have been installed on the tractor they need not be removed. When the hoses have been disconnected from the valve the outlets can be closed with pipe plugs. Then place the tractor quadrant levers in the desired position and lock the external valve control lever in the lift position. This restores the conventional Ferguson System, draft control and position control implements can then be operated in the usual manner.

Refer again to Figs. 2, 3 and 4 and note that in the lifting position the single spool valve delivers oil to the external cylinder and to the tractor master cylinder at the same time. Also note that the single spool valve provides no means of sealing oil in the tractor master cylinder. With the single spool control valve it will be necessary to tie the tractor lower links down to prevent them from raising and delaying the action of the external cylinder. This is accomplished by installing the drawbar and drawbar stays, as shown in Fig. 13. Even with the stays installed there will be a slight delay in the action of the external cylinder until all the slack is removed from the lower links and the master cylinder stopped from further movement. This will occur each time the valve lever is moved to the lift position since the oil is allowed to drain from the master cylinder when the valve is in the neutral position. If

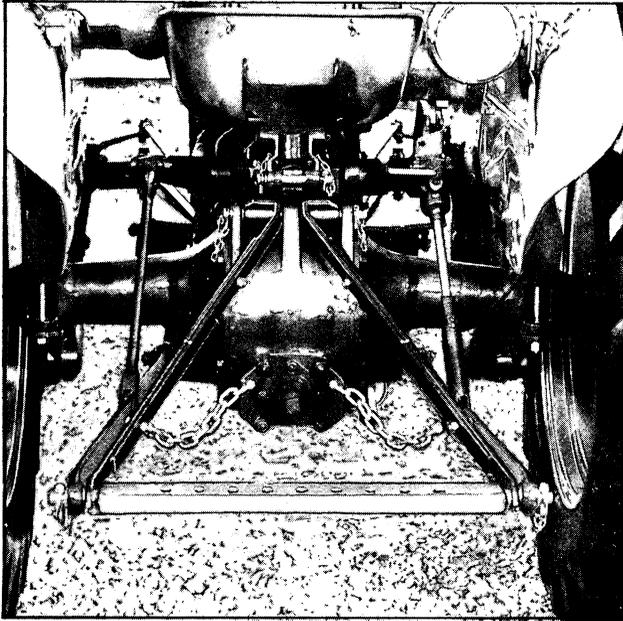


Fig. 13 Restraining Tractor Lift Links

this slight delay is undesirable it is recommended that the double spool valve be used as outlined below.

The double spool valve was designed specifically to control the two single acting hydraulic cylinders on the Side Mounted Highway Mower. Since one cylinder of the Highway Mower is attached to each side of the double spool valve, it is necessary to again restrain the tractor lower links with the drawbar stays, as shown in Fig. 13.

The double spool valve can also be used to control one external cylinder and the tractor master cylinder. To accomplish this the external cylinder should be attached to the right valve outlet and the left valve outlet closed with a pipe plug. The right control lever is then used to control the external cylinder and the left control lever to raise and lower the tractor lower links. A typical example of this is shown in Fig. 14. A tee has been installed

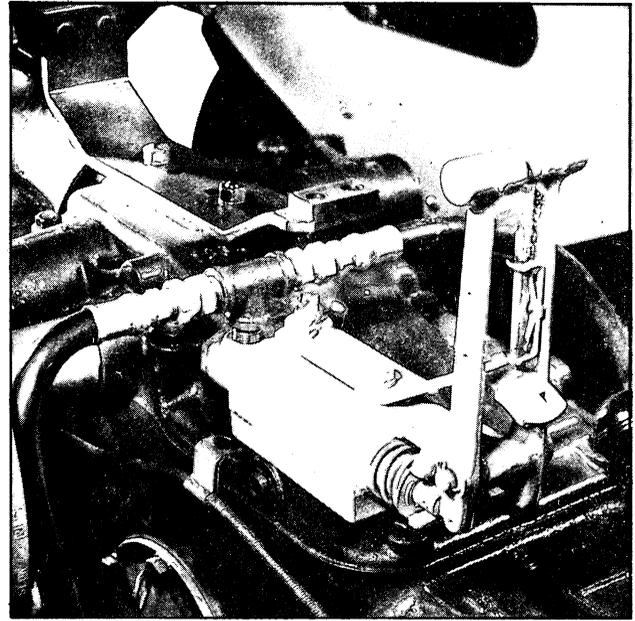


Fig. 14 Typical Installation

in the right valve outlet and the two hoses for the F-32 Loader attached. The left valve can then be used to control the tractor lower links if a blade is used with the loader.

The double spool valve is also very convenient to use to control one single acting external hydraulic cylinder such as with the Agricultural Side Mounted Mower or Forage Harvester. If the hose to the single cylinder is attached to the right outlet of the double spool valve, and the left outlet is plugged, the undesirable delay, present in single spool valve operation, is completely eliminated. Using the double spool valve in this manner also eliminates the necessity of tying down the tractor lower links with the drawbar and stays.

The double spool control valve is not designed to control the flow of oil to a double acting hydraulic cylinder and there is no way in which it can be successfully adapted to this application.

PREPARED BY THE SERVICE DEPARTMENT
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