

Feb. 24, 1942.

L. F. BURAN ET AL

2,274,527

HYDRAULIC CONTROL CIRCUIT AND MECHANISM

Filed Aug. 24, 1940

4 Sheets-Sheet 1

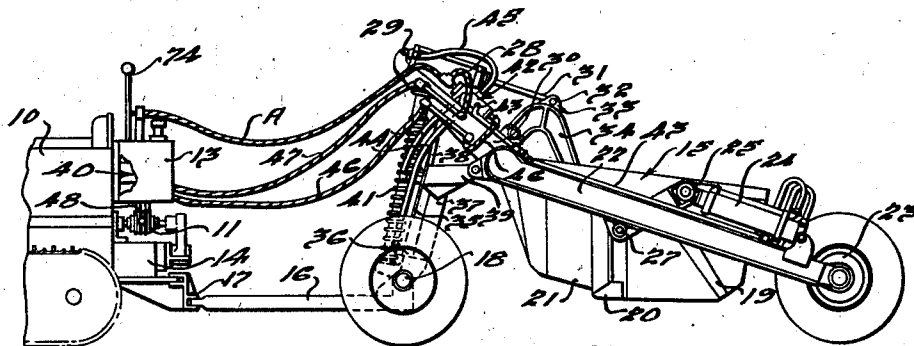


FIG. 1.

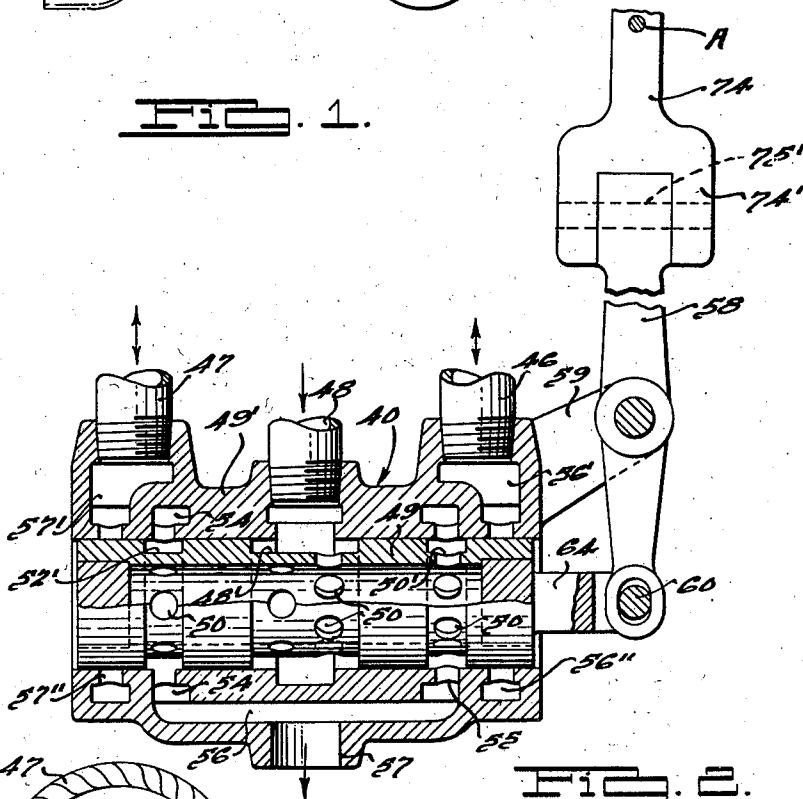


FIG. 2.

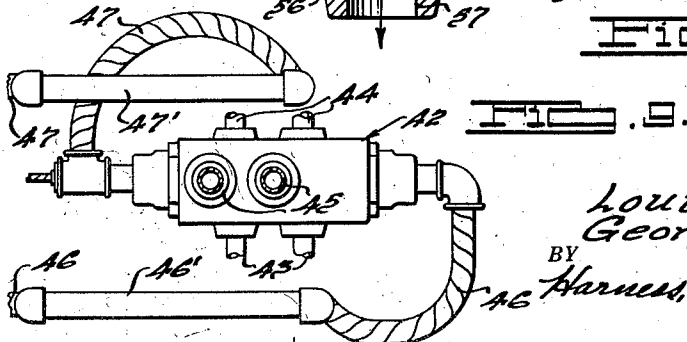


FIG. 3.

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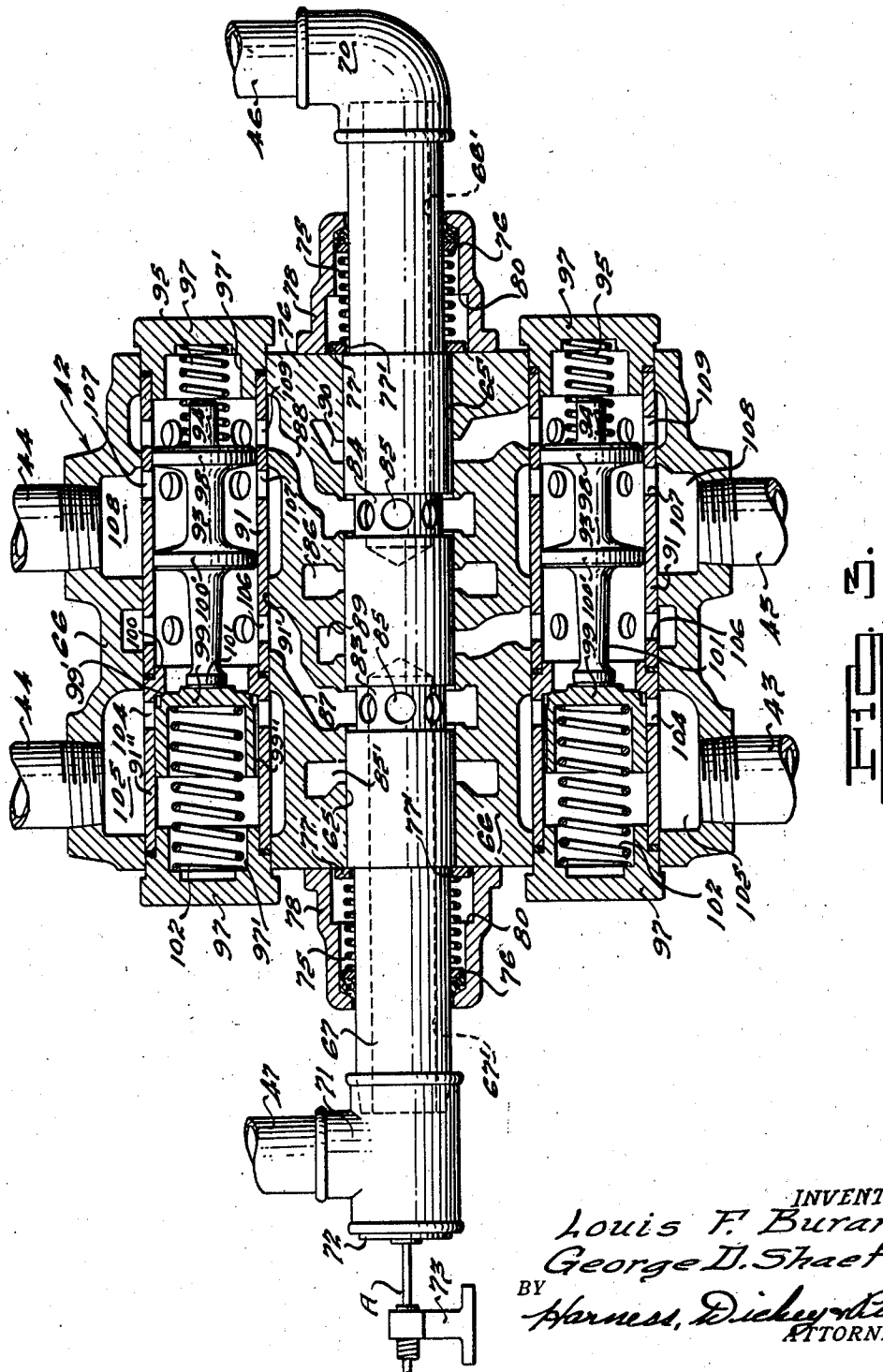
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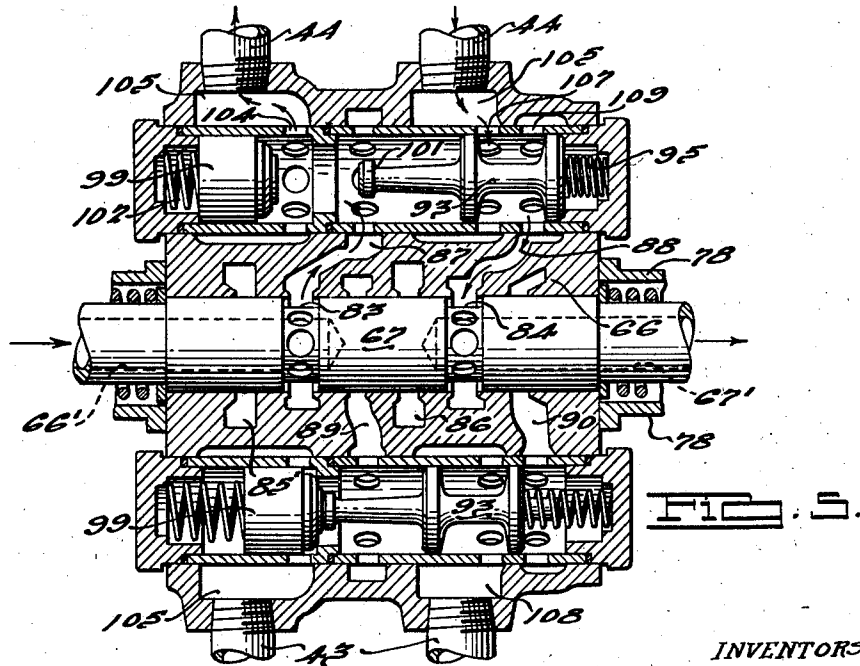
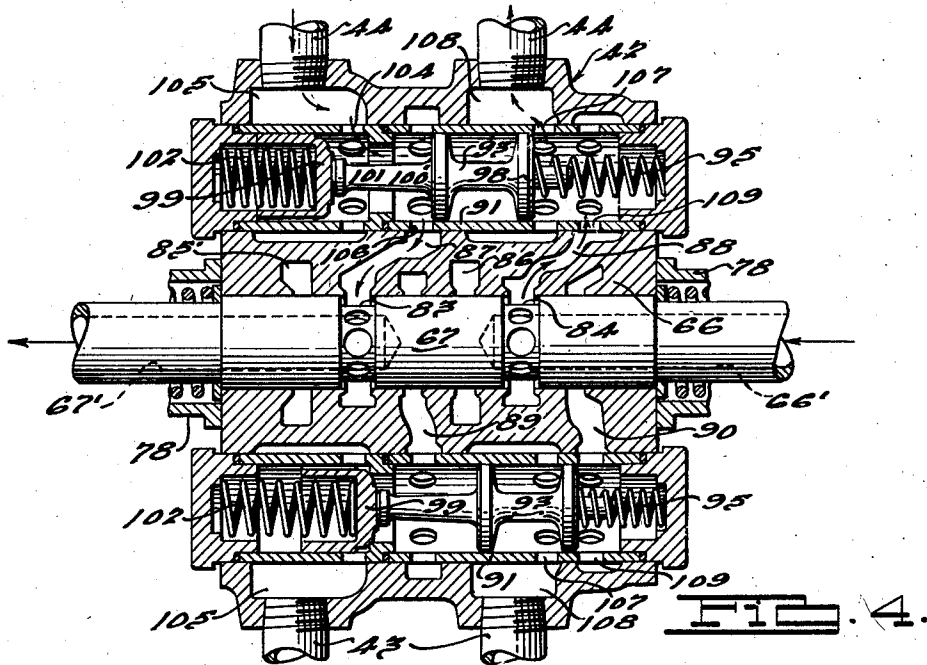
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HYDRAULIC CONTROL CIRCUIT AND MECHANISM

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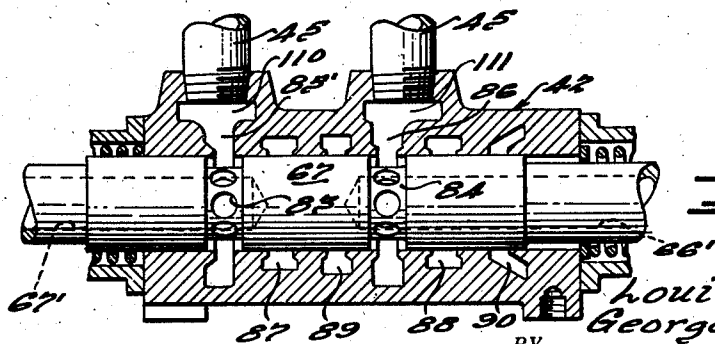
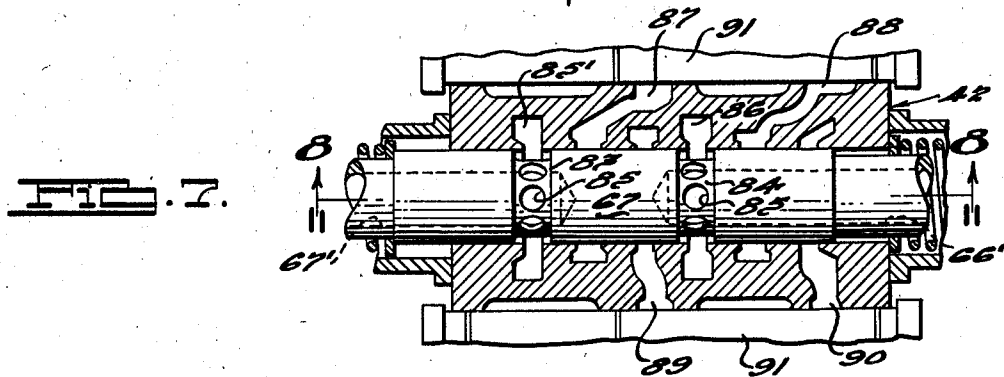
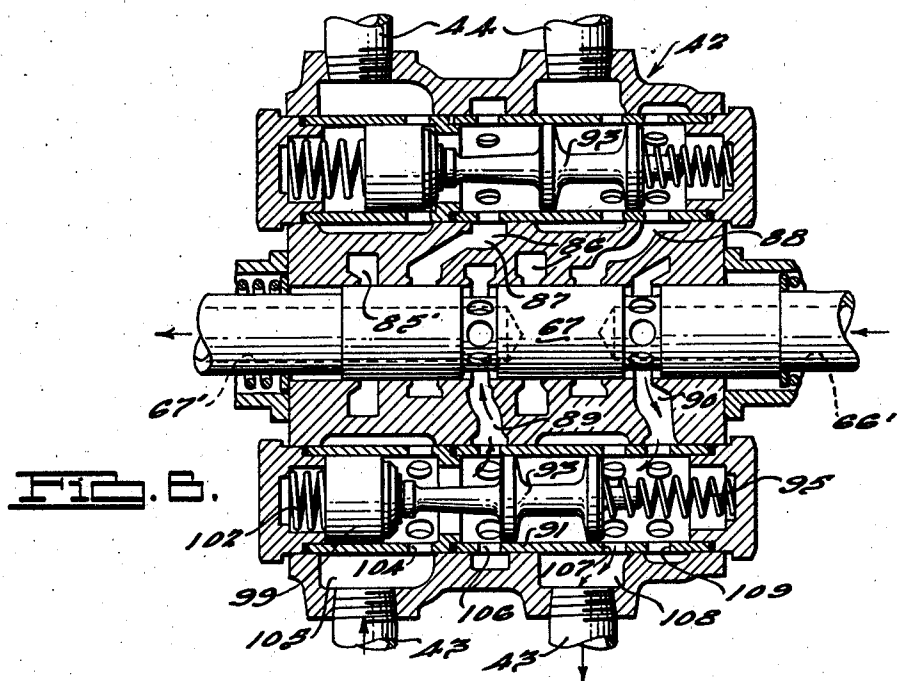
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HYDRAULIC CONTROL CIRCUIT AND MECHANISM

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,274,527

HYDRAULIC CONTROL CIRCUIT AND MECHANISM

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Application August 24, 1940, Serial No. 354,020

15 Claims. (Cl. 37—126)

This invention relates to improvements in fluid control devices and particularly to improvements in fluid control devices for controlling and operating an earth working machine drawn by a tractor.

The main object of this invention is to provide a fluid control system which is simple to construct, easy to adjust, and economical to manufacture.

Other objects of this invention are to provide a fluid reversing valve mounted on a tractor, or like pulling means, which is connected to an earth working machine by means of a pair of flexible hose lines and a Bowden wire which take the place of four, six, or more, hose lines previously used for transporting the fluid from its reservoir to a hydraulic mechanism on the earth working machine; to provide an improved construction of the type mentioned in which the fluid is returned to the reversing valve under pressure, thereby providing efficient operation; to provide a fluid reversing valve mounted on a tractor, or the like, which has a simple valve system for determining the direction of flow through the hose lines; to provide a fluid distributing valve mounted on the earth working machine comprising a valve system for operating an hydraulic mechanism; to provide a Bowden wire connection which shifts positions of a longitudinally extending plunger valve inserted in a distribution bore of the unit on the earth working machine so as to determine through which set of valves and to what hydraulic mechanism the fluid will travel; to provide valve chambers in the fluid distributing valve of the earth working machine through which the fluid must pass in order to reach the destination of the hydraulic mechanism, each valve chamber being provided with a spool valve and a check valve for operating and controlling the flow of the fluid.

Other objects and advantages of this invention will become more apparent after the following detailed description, reference being had to the accompanying drawings in which:

Figure 1 is a side elevational view of a tractor and earth working machine having the control means of the present invention associated therewith.

Fig. 2 is a cross-sectional view of the fluid reversing valve mounted on the tractor, certain conduits being shown in side elevation.

Fig. 3 is an enlarged horizontal sectional view of the distributing valve secured to the earth working machine, certain parts being shown in side elevation.

Fig. 4 is a horizontal sectional view of the distributing valve shown in Fig. 3, the position of parts being shown when a fluid is entered through the hose line on the right side of the fluid control valve and passed through the upper section of the valve and then out through the hose line on the left side.

Fig. 5 is a horizontal sectional view of the distributing valve of the earth working machine, the position of parts being shown when the fluid is entered on the left side through the hose line and passed through the upper section of the valve and then out through the hose line on the right side.

Fig. 6 is a horizontal sectional view of the distributing valve of the earth working machine, the position of parts being shown when the fluid has entered the hose line on the right side and passed through the lower valve and out through the valve on the left side.

Fig. 7 is a horizontal sectional view showing the distributing valve of the earth working machine positioned for operating the gate.

Fig. 8 is a vertical, longitudinal, sectional view taken along the line 8—8 of Fig. 7 showing the connection for the gate mechanism.

Fig. 9 is a top plan view of the distributing valve and its associated conduits.

A tractor generally designated at 10 has the usual fluid control system mounted at its rear end comprising a pump 11, reservoir 13, a power take off 14, and the other essential parts not shown herein in detail which comprise the fluid control system used on present day tractors. An earth working machine generally designated as 15 is secured to the tractor 10 by means of a draw bar 16 which is attached to the tractor with a draw bar attachment 17 and to the earth working machine 15 at the front axle 18.

The earth working machine 15 here illustrated is an hydraulically operated scraper and comprises a bowl 19 having a scraper blade 20 positioned along the forward edge, a gate between side wings 21 secured to beams 22 extending from the rear wheel 23 to the forward portion of the gate at both sides thereof. The bowl 19 is operated by means of hydraulic jacks 24, each of which has a piston rod 25 pivotally secured to the bowl, which has a piston rod 25 pivotally connected to a bracket 26, which is secured to the upper edge of bowl 19. The gate is operated by means of an hydraulic jack 28 pivotally mounted at 29 to a forward extension 30 which is rigidly connected to beams 22 by a cross member. The piston rod 31 of the jack 28 is pivotally con-

nected at 32 to a bracket 33 of the crank lever 34 which has one end of the arm pivotally connected to the gate by a link and the other end of the arm pivotally connected to the extension 30. The entire structure can then be raised or lowered by means of an hydraulic mechanism 35 which is pivotally mounted on a cross pin 36 which extends through a fitting welded into the lower end of the post 37. The piston rod 38 of the jack 35 is pivotally secured to the forward extension 30. Springs 41 embrace telescopic members and are disposed at each side of the forward extension 30.

The scraper so far described is illustrated in greater detail in the application of Jack B. Haile, Serial No. 224,131, filed August 10, 1938, now Patent No. 2,256,051; and reference may be had to this application for a detailed description of the scraper here illustrated.

A fluid distributing valve, according to the present invention, is generally indicated at 42 and is mounted on the forward extension 30. It has conduits 43 extending rearwardly and connected to opposite ends of hydraulic cylinder 24, conduits 44 connecting it with opposite ends of hydraulic cylinder 35 and conduits 45 connecting it with opposite ends of hydraulic cylinder 28. The conduits 43 and 44 extend from the sides of the distributing valve 42 while the conduits 45 extend from the top of the valve 42.

Also extending from the distributing valve 42 are conduits 46 and 47 which lead to and communicate with the reversing valve 40 located on the tractor. The conduits 46 and 47 have rigid pipe sections 46' and 47' of equal length interposed between the ends thereof which are rigidly attached to the extension 30. Flexible portions of the conduits connect the sections 45' and 47' with the valve 42 and with the elements on the tractor. Without such fixed sections 46' and 47', a movable element, on the valve 42, to which conduits 46 and 47 are connected might be moved on relative movement between the tractor and scraper due to the pulling action of those flexible parts between the tractor and the scraper.

A fluid reversing valve generally indicated at 40 is mounted on the tractor 10 within housing 13, and is shown in Fig. 2 in a neutral or center position. In this position, the oil is introduced into the valve from the pump through conduit 48, through an opening in valve casing 49' and into the interior of the valve. A hollow valve plunger 49, closed at its ends, is slidably disposed within a longitudinal bore in the casing 49'. The plunger 49 is formed with reduced diameter portions 48', 50', and 52', each provided with spaced openings 50 therearound. An annular inlet chamber surrounds reduced portions 48', and annular chambers 54 and 55 surround reduced portions 52', respectively, when the valve is in its neutral position.

When the plunger 49 is in its neutral or central position, as shown in Fig. 2, the oil is introduced into the casing 49' through conduit 48 from the pump and enters the annular chamber surrounding reduced portion 48'. The fluid then passes through the adjacent openings 50 into the interior of the hollow plunger and passes outwardly through the openings 50 into the chambers 54 and 55 surrounding the reduced portions 52' and 50', respectively. Openings are provided in the casing which communicate the chambers 54 and 55 with a longitudinally extending channel 56, which communicates through an opening 57 exteriorly of the casing. The oil thus flows through

the opening 57 back into the reservoir, so that when the valve is in the neutral position shown, the fluid flows freely through the valve while the pump is being operated.

Annular chambers 56' and 57' are formed in the casing 49' adjacent the ends thereof, and are adapted to communicate with the hollow bore of casing 49' through openings 56'' and 57'', respectively. The conduits 46 and 47 communicate through openings in the casing 49' with chambers 56' and 57', respectively.

The valve plunger 49 is adapted to be slid longitudinally of the bore in order to communicate the reduced portion 52' with chamber 57', when it is slid to the left viewing Fig. 2; and to communicate reduced portion 50' with chamber 56' when the valve plunger is slid to the right viewing Fig. 2.

In order to shift the plunger 49 from its neutral position to the positions at the right or left, as mentioned above, a handle 58 is provided which is pivotally mounted on a bracket 59 formed integral with the valve casing. The pivotal connection for the handle is intermediate its ends and the lower end of the handle is provided with an elongated slot through which a pin 60 passes. The pin 60 is rigidly connected to a projection 64 which, in turn, is connected to the valve plunger 49, so that when the handle 58 is moved about its pivot, the plunger 49 is correspondingly shifted within the bore.

When the plunger 49 is moved to the left, viewed in Fig. 2, oil passes into the valve housing through conduit 48, through openings 50 adjacent the reduced portion 48', and then passes out through opening 50 adjacent reduced portion 52' into annular chamber 57' and into conduit 47. The fluid then passes to the distribution valve 42 and is distributed in a manner that will be described in detail hereinafter. The fluid returns through conduit 46; and as the valve 49 is shifted toward the left, the opening 56'' is uncovered so that the fluid may flow out of chamber 56' through the annular opening 56'' and out through the open end of the bore.

When the valve is shifted to the right, viewing Fig. 2, the action is the reverse of that described above, namely, the fluid flows into chamber 56' and out through conduit 46. The return is through conduit 47 into chamber 57', out through annular opening 57'', through that open end of the bore which has been uncovered when the valve is shifted to the right.

Referring to Figs. 3 through 7, the distributing valve 42 is illustrated in detail. Such valve 42 comprises a casting 66 formed with a central, longitudinally disposed bore 65 therein. A distributing valve plunger 67 is slidably disposed within the bore; and longitudinal bores 66' and 67' are formed through the ends of the plunger providing oil conduits or passages. Such bores terminate short of the center of the plunger. At the right end of the plunger 67 (viewing Fig. 3) conduit 46 communicates with conduit 66' through an elbow 70 which is secured to the end of the plunger. The conduit 67' communicates with conduit 47 through a T-joint 71 which is fixedly secured to the left end of plunger 67 (viewing Fig. 3).

A plug 72 is fixed into the end of the joint 71, and a Bowden wire A is fixedly secured to the plug 72. The Bowden wire is supported by means of a bracket 73 mounted to the forward extension 30. The forward end of the Bowden wire A is secured to a handle 74 (Figs. 1 and 2)

which is used for controlling and moving the Bowden wire to thereby shift the plunger 67. Such handle 74 has a depending yoke portion 74' which is pivotally attached to lever 58 by a pin 75' on a pivot axis transverse to the pivot axis of the member 58. It will thus be seen that by the single handle, the plungers 49 and 67 may be shifted independently of each other or together.

The plunger 67 is normally urged to its central position by means of compression springs which embrace the plunger at opposite ends thereof. The casting has aligned housings 78 forming extensions fixed thereto which embrace the plunger and the springs, such extensions being provided with seals having washers 76 associated therewith adjacent the open ends thereof. The outer ends of the springs abut against the washers 76 and the inner ends abut against washers 77, which in turn bear against shoulder 77' formed on plunger 67. Such washers 77 are of greater diameter than that of the bore 65 so that the casting 66 around the bore limits movement of washers 77 inwardly. The extensions 78 are formed with internal shoulders 80 which limit the outward movement of washers 77, and therefore outward movement of plunger 67, in both directions of its movement. With this arrangement at both ends, the plunger 67 is limited in its movement and the operator of the tractor 10 can readily operate the handle 74 to move the wire A and shift the plunger 67 to its proper positions within the valve housing.

The spring at one end is compressed when the plunger is moved, and when the driver releases the handle 74, the plunger is returned to its normal position due to the action of the compressed spring thereagainst.

The plunger 67 is provided with spaced reduced diameter portions or sections 83 and 84 having apertures 85 therearound communicating with passages 67' and 66', respectively, for distributing fluid into and through the valve. Distribution chambers are provided in the casting 66 which lead to the different conduits for the different operating mechanisms. The sections 83 and 84 are so spaced that they coincide with any pairs of these chambers to which they are shifted. One pair of chambers 85' and 86 lead to the conduits 45 for operating the gate 21; another pair of chambers 87 and 88 lead to the conduits 44 for operating the master jack 35; and a third pair of chambers 89 and 90 lead to the conduits 43 for operating the jacks 24 which operate the bowl 19.

Chambers 87 and 88 extend above the plunger 67 and communicate with a bore 91' which is parallel to bore 65, through apertures 106 and 109, respectively, in a casing means 91 which is fixed in bore 91'. A spool valve 93, having end projections 94 and 101, is slidably disposed within casing 91. The ends of casing 91 are closed by plugs 97 having inwardly disposed axial recesses 97' formed therein. A check valve 99 is slidably disposed within a cage or casing 91''. The valve 99 has a conical shoulder 99' which is adapted to seat against a conical shoulder formed on casing 91'', as shown in Fig. 2. The valve 99 is formed with longitudinally extending grooves 99'', so that oil may flow from chamber 105 through the longitudinal passageways formed by grooves 99'' to a position behind valve 99 to permit the use of a relatively small spring 102. The chamber 105 communicates with one

of the conduits 44 leading to the top end of cylinder 35.

The end 101 of the spool valve abuts against valve 99, and a compression spring 102 which bears against the left (viewing Fig. 3) plug 97 and against the valve 99 urges the valve and spool valve toward the right. Another compression spring 95 abuts against the right plug 97, embraces portion 84 of the spool valve and abuts against the adjacent portion 98 to urge the spool valve to the left.

Another annular chamber 108 is provided in the casting and communicates with the interior of the housing 91 through openings 107. Other openings 106 and 109 are provided in the housing 91 for communicating the interior of the housing with chambers 87 and 88, respectively. Chamber 108 communicates with conduit 44 leading to the upper end of hydraulic mechanism 35 for lowering the master jack.

A similar construction is provided on the opposite side of plunger 67 for communicating the chambers 89 and 90 with their respective conduits 43 which lead to the bowl operating mechanism. Similar reference numerals are used on corresponding elements for the purpose of clarity, and it will be understood that the elements operate in the same manner as those described above.

When it is desired to raise or lower the master jack 35, the plunger 67 is held in position through the action of springs 75, so that the sections 83 and 84 are in registry with the chambers 87 and 88 as shown in Fig. 3. The handle 74 is also operated to shift lever 58 to thereby shift plunger 49 to introduce fluid to conduits 46 or 47. To lower the jack, the plunger 49 is shifted to introduce fluid into conduit 46. The fluid then enters conduit 66' of plunger 67, passes out through openings 85 of section 84 and into chamber 88, as shown in Fig. 4. From the chamber 88 the fluid passes through the passageways 109 to the right of spool portion 98. The fluid is under pressure, which is greater than that exerted by spring 102, and thereby shifts the spool valve to the left, as shown in Fig. 4. Such fluid then passes through apertures 107 into chamber 108, and thence the upper end of the jack 35. The return fluid passes through openings 104 and past the conical seat which has been uncovered by movement of valve 99 to the left, by the action of spool valve portion 101 thereagainst, then through openings 106 into chamber 87, through openings 85 in section 83, into conduit 67' and returns through conduit 47 to valve 40.

In order to raise the master jack 35, the reversing valve 40 on the tractor is shifted so that the fluid passes into conduit 67' of plunger 67, as shown in Fig. 5. The fluid then passes through openings 85 of section 83 into chamber 87, and through openings 106 into casing 91. Such fluid is under pressure and overcomes the resistance of springs 95 and 102 to shift the spool valve 93 to the right and shift the valve 99 to the left. The latter uncovers the conical valve seat, so that the fluid passes into chamber 105 and thence through the conduit 44 which leads to the lower end of the jack 35. The fluid from the jack returns through the other conduit 44 into chamber 108, through openings 107, and into chamber 88. The fluid then passes through openings 85 in section 84, into conduit 66', and returns to the valve 40 through conduit 46.

To raise or lower the bowl 19, the Bowden

wire A is shifted by means of handle 74 to shift the plunger 69 to the position shown in Fig. 6. The sections 83 and 84 are then in registry with chambers 89 and 90. To raise the bowl, the plunger 49 of valve 40 is shifted so that the fluid enters chamber 90 through conduit 66', thereby shifting the lower spool valve (referring to Fig. 6) so that the fluid passes into the lower chamber 108 through openings 109. The fluid then passes into conduit 43 leading to the rear end of cylinder 24. The return is through the other conduit 43 into lower chamber 105, through chamber 89, through conduit 67', and returns through conduit 47 to valve 40. To lower the bowl, the valve plunger 49 is reversed so that the fluid enters through conduit 47, conduit 67', and into chamber 89. The action of the spool valve and safety valve is similar to that shown in Fig. 5, and the flow will be obvious from the above description.

Referring to Figs. 7 and 8, when it is desired to operate the gate 21, the plunger 67 is shifted through the Bowden wire A so that the sections 83 and 84 are in registry with chambers 85' and 86. Such chambers 85' and 86 communicate respectively with chambers 110 and 111 with which the conduits 45 are respectively in communication.

The use of the spool valve and check valve, as used in operating the master jack 35 and bowl jack 24, is not necessary for operating the gate jack 28, but such means could be incorporated in the valve if desired.

In order to raise the gate, the reversing valve 40 is shifted so that the fluid is introduced into conduit 47, into conduit 67', through openings 85 of section 83, and into chamber 85'. The fluid then passes into chamber 110 and through conduit 45 leading to the lower end of cylinder 28. The return is through the other conduit 45, into chambers 111 and 86, through openings in section 84, through conduit 66', and back to the valve 40 through conduit 46.

In order to lower the gate, the valve plunger 49 is reversed so that the fluid enters the distribution chamber 42 through conduit 66' and returns through conduit 67'.

From the above description, it will be evident that the present invention provides a structure in which, by the operation of a single lever located on the tractor, a plurality of hydraulic mechanisms located on another vehicle, such as a scraper, may be operated to produce a number of different functions.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit of the invention, the scope of which is commensurate with the appended claims.

What is claimed is:

1. A tractor and vehicle having fluid operated mechanisms thereon attached thereto, a fluid diverting valve on said tractor, a fluid distributing valve on said vehicle, a fluid conductor connecting said valves, a pump for supplying fluid under pressure to said diverting valve, and means for operating both said diverting valve and said distributing valve.

2. A tractor and vehicle having fluid operated mechanisms thereon attached thereto, a fluid diverting valve on said tractor, a fluid distributing valve on said vehicle, a fluid conductor connecting said valves, a pump for supplying fluid under pressure to said diverting valve, manual means operable from said tractor for operating

said diverting valve and said distributing valve.

3. A tractor and a vehicle having fluid operated mechanisms thereon attached thereto, two conductor lines providing a fluid circuit between said tractor and said vehicle, a fluid distributing valve in said circuit and located on said vehicle, a fluid diverting valve in said circuit and located on said tractor for controlling the direction of fluid travel in said circuit, a pump for supplying fluid under pressure to said diverting valve and means for operating both said diverting valve and said distributing valve.

4. A tractor and a vehicle having fluid operated mechanisms thereon attached thereto, two conductor lines providing a fluid circuit between said tractor and said vehicle, a fluid distributing valve in said circuit and located on said vehicle, a fluid diverting valve in said circuit and located on said tractor for controlling the direction of fluid travel in said circuit, a pump for supplying fluid under pressure to said diverting valve, and means for operating both said diverting valve and said distributing valve, said last named means including manual means operable from the tractor.

5. A tractor and a vehicle having fluid operated mechanisms thereon attached thereto, a fluid distributing valve on said vehicle connected to said fluid operated mechanisms, two conductor lines providing a fluid circuit connected to said distributing valve, a pump connected to said circuit for supplying fluid under pressure thereto, a diverting valve located on said tractor and connected to both of said conductors for controlling the direction of fluid travel in said circuit, said fluid operated mechanism valves and conductors being so arranged as to constitute a fluid filled circuit whereby fluid introduced into one of said conductors displaces a substantially equal volume of fluid through the other of said conductors, and means for operating both said diverting valve and said distributing valve.

6. A tractor and a vehicle having fluid operated mechanisms thereon attached thereto, a fluid distributing valve on said vehicle connected to said fluid operated mechanisms, two conductor lines providing a fluid circuit connected to said distributing valve, a pump connected to said circuit for supplying fluid under pressure thereto, a diverting valve located on said tractor and connected to both of said conductors for controlling the direction of fluid travel in said circuit, said fluid operated mechanism valves and conductors being so arranged as to constitute a fluid filled circuit whereby fluid introduced into one of said conductors displaces a substantially equal volume of fluid through the other of said conductors, and means operable from a single operator's position for controlling both of said valves.

7. A tractor and vehicle having fluid operated mechanisms thereon attached thereto, a fluid diverting valve on said tractor, a fluid distributing valve on said vehicle, a fluid conductor connecting said valves, a pump for supplying fluid under pressure to said diverting valve, and means for operating both said diverting valve and said distributing valve, said last named means including a single manual control means for operating said valves.

8. A tractor and vehicle having fluid operated mechanisms thereon attached thereto, a fluid diverting valve on said tractor, a fluid distributing valve on said vehicle, a fluid conductor connecting said valves, a pump for supplying fluid under

pressure to said diverting valve, and means for operating both said diverting valve and said distributing valve, said last named means including a single manual control means for independently operating said valves.

9. A tractor and vehicle having fluid operated mechanisms thereon attached thereto, a fluid diverting valve on said tractor, a fluid distributing valve on said vehicle, a fluid conductor connecting said valves, a pump for supplying fluid under pressure to said diverting valve, and means for operating both said diverting valve and said distributing valve, said last named means including a control lever rockable in two directions, the rocking movement in one direction controlling one valve and a rocking movement in another direction controlling the other of said valves.

10. A tractor and vehicle having fluid operated mechanisms thereon attached thereto, a fluid diverting valve on said tractor, a fluid distributing valve on said vehicle, a fluid conductor connecting said valves, a pump for supplying fluid under pressure to said diverting valve, and means for operating both said diverting valve and said distributing valve, said last named means including a control lever having a plurality of movements, one of said movements controlling one of said valves, and another of said movements controlling the other of said valves.

11. In an organization as defined in claim 1, said fluid distributing valve characterized by having the conductor lines connected to and communicating with a movable valve core.

12. In an organization as defined in claim 1, said fluid distributing valve characterized by

having the conductor lines connected to and communicating with an axially movable valve core.

13. An organization as defined in claim 1, in which the fluid distributing valve is provided with a movable core and in which said operating means includes a flexible member and a manual control means located on said tractor, said flexible member having one end connected to said core and the other end thereof connected to said manual control means.

14. An organization as defined in claim 1, in which the fluid distributing valve is provided with an axially movable core and in which said operating means includes a flexible member and a manual control means located on said tractor, said flexible member having one end connected to said core and the other end thereof connected to said manual control means.

15. A tractor and a vehicle having fluid operated mechanisms thereon attached thereto, each of said mechanisms having two movements thereof, one the reverse of the other, a distributing valve connected to said fluid operated mechanisms, said valve being located on said vehicle, a remote control operable from said tractor for positioning said distributing valve, conductors forming a fluid circuit connected to said distributing valve, a diverting valve connected to said conductors for controlling the direction of fluid travel in said circuit, said diverting valve being located on said tractor and a pump for supplying fluid under pressure to said circuit.

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