Sept. 17, 1957 W. F. COLLINS ET AL 2,806,485

VALVE FOR HYDRAULIC RAM-CONTROL SYSTEM

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FIG. 1

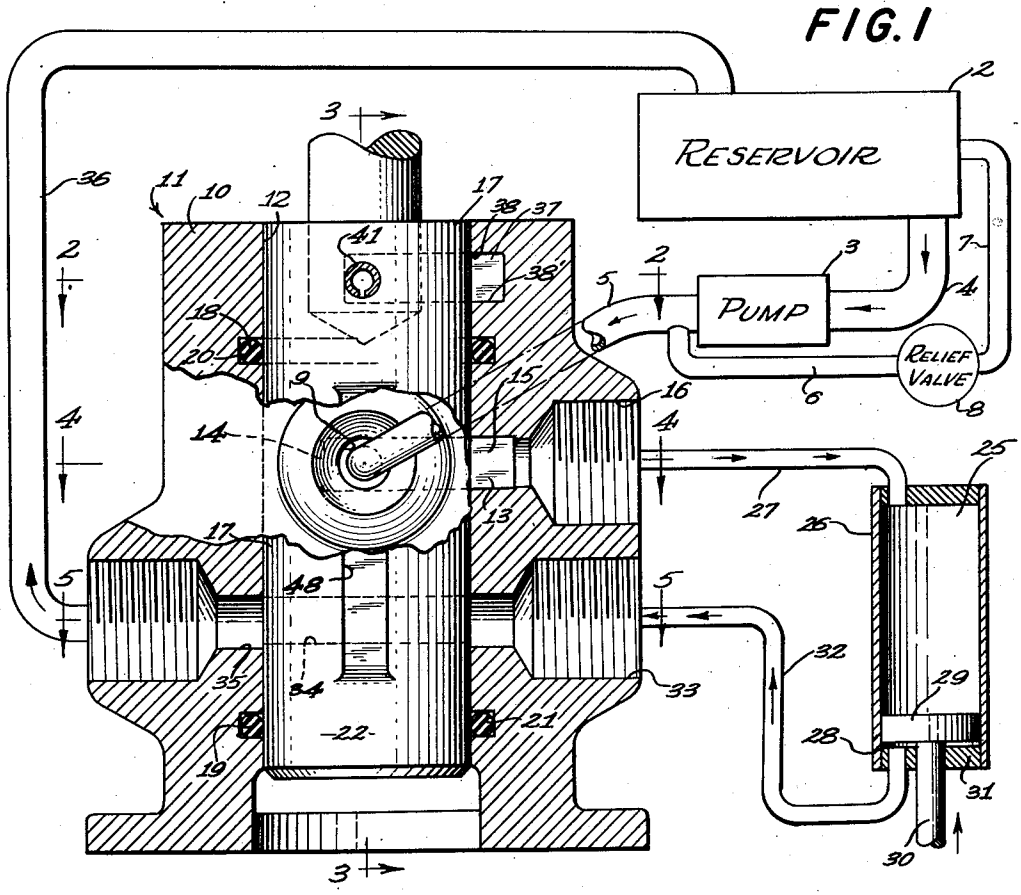
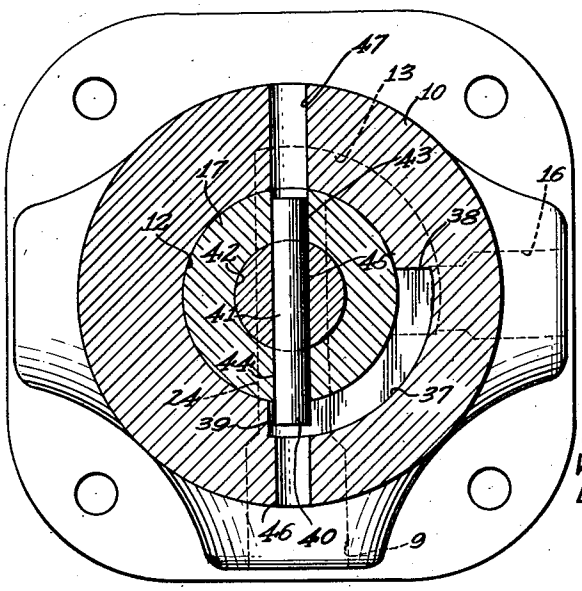


FIG. 2



INVENTORS
WILLIAM F. COLLINS
WILLIAM F. SCHMIED
EVERETT M. SANDAHL
Paul O. Pippel
ATTORNEY

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FIG. 3

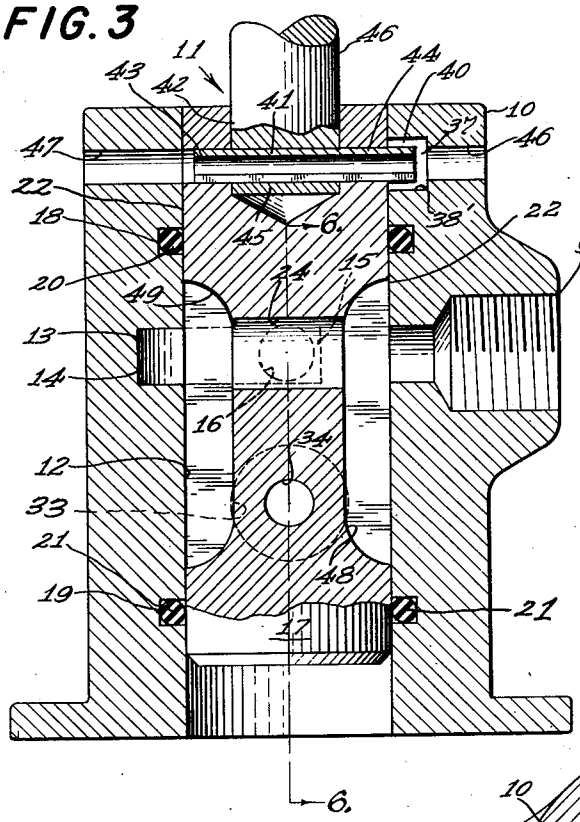


FIG. 6

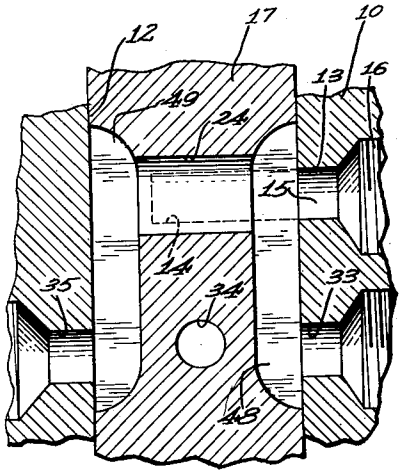


FIG. 4

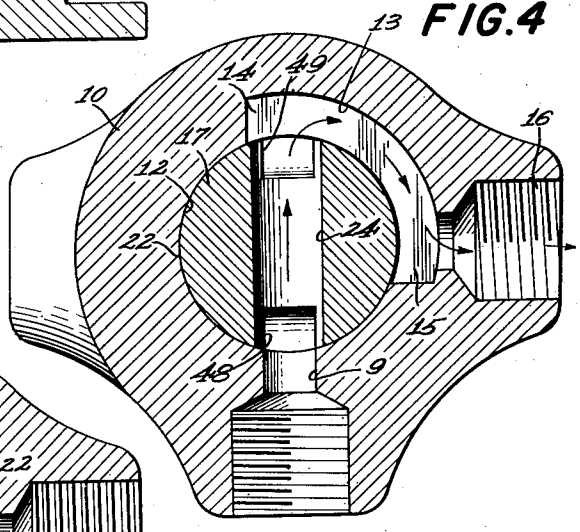
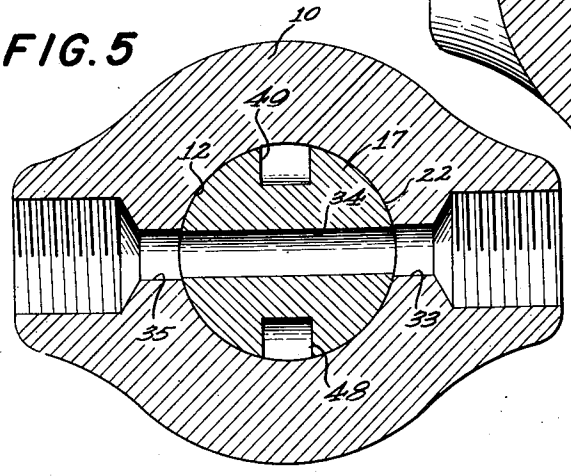


FIG. 5



INVENTORS
WILLIAM F. COLLINS
WILLIAM F. SCHMIED
EVERETT M. SANDAHL
Paul O. Pippel
ATTORNEY

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VALVE FOR HYDRAULIC RAM-CONTROL SYSTEM

William F. Collins, Downers Grove, William F. Schmied, Blue Island, and Everett M. Sandahl, Brookfield, Ill., assignors to International Harvester Company, a corporation of New Jersey

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4 Claims. (Cl. 137—624)

This invention relates to an hydraulic ram-control system, and more specifically to a novel valve arrangement in said system.

A general object of the invention is to provide a novel hydraulic control system incorporating such a valve which in one position is adapted to port hydraulic fluid under pressure into the high-pressure chamber of an hydraulic cylinder, and in another position affording communication between the upper and lower ends or the high and low-pressure chambers of the hydraulic cylinder.

A more specific object of the invention is to provide such a novel hydraulic system wherein the valve in one position thereof connects the hydraulic pump with the advance chamber of the hydraulic ram, and at the same time connects the return chamber with the reservoir, said valve in another position thereof connecting the advance and return chambers with each other and with the discharge to the reservoir while closing of the high-pressure line from the hydraulic pump.

These and other objects of the invention will become more apparent from the specification and the drawings wherein:

Figure 1 is a vertical sectional view through the novel valve and hydraulic ram in association with the remainder of the system diagrammatically shown;

Figure 2 is a cross-sectional view of the valve taken substantially on the line 2—2 of Figure 1;

Figure 3 is a vertical section taken substantially on the line 3—3 of Figure 1;

Figure 4 is a cross section taken substantially on the line 4—4 of Figure 1;

Figure 5 is a cross section taken substantially on the line 5—5 of Figure 1; and

Figure 6 is a longitudinal section taken substantially on the line 6—6 of Figure 3 with the valve rotated to a retract position, that is 90° with respect to that shown in Figure 3.

Describing the invention in detail, a reservoir 2 may be of the known type associated with a conventional tractor which also carries a pump 3 having a suction inlet 4 connected to the reservoir 2, and having a discharge outlet or conduit 5. The discharge conduit 5 is connected to the reservoir through conduits 6 and 7 which are interconnected through a relief valve 8 which affords a bypass and is set for a predetermined pressure value.

The discharge side 5 of the pump is connected to an inlet port 9 formed in a valve body 10 of a valve, generally designated 11, said pressure port 9 extending radially of a central longitudinal bore 12 in the valve body. The cylindrical bore 12 is interrupted in an area in transverse radial alignment with the port 9 with a groove or arcuate notch 13 which has one inlet end 14 in diametric alignment with the port 9, said channel 13 extending approximately 90° and having an outlet end 15 communicating with an outlet port 16 which is in the same radial plane as the port 9 but spaced at 90° therefrom.

The bore 12 receives a valve stem 17 therein, and the bore is provided with a pair of axially spaced circular

grooves 18 and 19, within which are disposed sealing rings 20 and 21 in fluid-tight engagement with the cylindrical periphery 22 of the valve stem 17 adjacent to opposite ends thereof. The valve stem is provided intermediate its ends with a transverse opening or passage 24, which in the advance position of the stem is disposed in axial alignment with the inlet port 9 and the inlet end 14 of the arcuate slot 13, whereby affording communication from the inlet port 9, through the passageway 13, and out the outlet port 16, the port 16 being connected to one end or advance high-pressure chamber 25 of an hydraulic cylinder 26 by means of a conduit 27. The cylinder 26 is divided into the before-mentioned advance chamber 25 and a retract chamber 28 by means of a piston head 29 which is slidable within the cylinder 26 in fluid-tight engagement therewith, the piston head 29 being connected to a stem 30 which extends through an end member 31 in fluid-tight engagement therewith, the stem member 30 continuously supporting a load, as indicated by the arrow.

The low-pressure chamber 28 is connected through a conduit 32 to a utilization or connection port 33 which is in alignment axially of the valve body 10 with the outlet port 16 and spaced axially thereof, the port 33 being formed in the valve body 10 and extending radially of the bore 12 and communicating therewith, and in the advance position of the stem 17 communicating with a transverse passage or opening 34 through the stem, said passage being disposed at right angles to the passage 24; and, as just stated, in the advance position of the stem 17, communicating at one end with the utilization port 33, and at the other end communicating with a discharge port 35 formed in the valve body directly opposite to, that is 180° away from, and in axial alignment with the utilization port 33; whereby in the advance position of the stem, and the fluid from the low-pressure chamber 28 is forced out of the same through the conduit 32, through the utilization port 33, the passageway 34 in valve stem 17, through the outlet port 35, and through the outlet conduit 36 which is connected to the port 35, the conduit 36 being connected to the reservoir 2.

It will be observed that the stem 17 is rotatable within the limits of the slot or arcuate groove 37 which is open to the bore 12, said slot having an arcuate extent of approximately 90° terminating in abutment stops 38 and 39 (Figure 2) for abutment with one end 40 of a rolled pin 41 which is formed of resilient spring steel and C-shaped in cross section, said pin extending through a counterbore 42 in one end of the stem 17 and through a pair of registering openings 43 and 44 in the stem which extend radially of the stem in intersecting relationship to the axial counter-bore 42, and also through a radially aligned aperture 45 in the inner end portion of an operating member 46, said inner end of said member 46 being received within said counter-bore 42. It will be noticed that the valve body is provided with access openings 46 and 47, through which the pin 41 is applied to connect the members 46 and 17 when the stem 17 is in position within the bore 12. It will be noted from a consideration of Figure 3 that the pin has its end 40 so positioned that it extends into the slot 37, and thus the pin not only holds the pin 17 against axial displacement within the bore by abutment with edges 38, 38' of the slot, but also limits the circumferential displacement, the end 40 being abuttable with the shoulder 39 in the advance position of the valve and against a shoulder 38 in the retract position.

Referring now to Figure 6, the stem is shown in the retract position that is rotated 90° from the position shown in Figures 1 through 5. In the position shown in Figure 6, the transverse opening 24 in the stem 17 is disposed in axial registry with the outlet port 16. It will be seen

that the stem is provided at diametrically opposite sides with axially elongated grooves, slots, or channels **48** and **49**, and that the slot **48** communicates adjacent to one end with the opening **24**, and that similarly the slot **49** has a corresponding end communicating with the opposite end of the opening **24**. In the position shown in Figure 3, these slots or passage means **48** and **49** serve as hydraulic balancers for maintaining identical pressures at opposite sides of the stem so that it may be readily rotated. It will be seen from a consideration of Figure 6 that the slots **48** and **49** extend past the opening **34** at their other ends, and that the slot **48** communicates with the utilization port **33** of Figure 6, whereby establishing communication from port **16** to port **33** so that a load acting on the stem **30** discharges the hydraulic fluid from the high-pressure chamber **25**, through the port **16**, through the slot **48**, into the utilization port **33**, and into the low-pressure chamber **28**. Some of the fluid will flow from the port **16**, through the passageway **24**, and through the slot **49**, into the outlet or return port **35**, and through the conduit **36**, into the reservoir, and thus a balanced pressure at opposite sides of the stem is again maintained.

From the foregoing description, it will be apparent that an inexpensive and highly efficient valve and hydraulic system has been developed. This valve has been actually tested, and has been found to operate as heretofore described.

What is claimed is:

1. A valve having a body with a cylindrical bore, a valve stem rotatively mounted in said bore, sealing means in said bore between said body and opposite ends of said stem, said body having a pressure port extending radially of said bore and open thereto, said body having a groove open to said bore in alignment with said pressure port transversely of said bore and having an inlet end diametrically opposite said pressure port and having an outlet end spaced substantially 90° from said pressure port, said body having an outlet port in substantially the radial plane of said pressure port and said groove and spaced 90° from said pressure port and communicative with said outlet end of said groove, said valve body having a connection port and a discharge port disposed at diametrically opposite sides of said bore and communicating therewith, said connection and discharge ports being axially aligned and the axes thereof and of said outlet port lying in a common medial axial plane of said bore, said outlet port and said connection port disposed on the same side of said valve body, said stem having first and second transverse passages therethrough disposed at right angles to each other, said first passage lying in the beforementioned plane of said pressure and outlet ports and said groove and in one position of said stem axially aligned with said pressure port and said inlet end of said groove and affording fluid communication from said pressure to said outlet port, said second passage in said one position of the stem axially aligned with said connection and discharge ports and affording fluid communication therebetween, a pair of diametrically opposed peripheral channels in said stem extending lengthwise thereof and having one of their ends intersecting respective ends of said first passage and having opposite ends extending beyond the transverse plane of said second passage, said stem rotatable to a second position with said first passage out of registry with said pressure port and in alignment with said outlet port whereat one of said channels is aligned and open to said outlet and connection ports affording fluid communication therebetween and said other channel is aligned with said discharge port and affording fluid communication between said outlet and discharge ports via said first passage and between said outlet and connection ports via the other of said channels.

2. An hydraulic valve comprising a body having a cylindrical bore and inlet, outlet, connection and discharge ports intersecting said bore, said connection and discharge ports disposed in axial alignment at diametrically opposite sides of said bore, and said outlet and inlet ports spaced longitudinally of the bore from said connection and discharge ports and disposed in a common plane extending transversely of said bore and angularly related to each other, said body having an arcuate groove interrupting said bore and disposed in said plane and having an outlet end communicating with the outlet port and having an inlet end in alignment with said inlet port diametrically with respect to said bore, a valve stem rotatively mounted within said bore and having first and second transverse passages therethrough spaced longitudinally thereof on the order of the spacing of said discharge and connection ports from said inlet and outlet ports, said first and second passages angularly disposed with reference to each to respectively connect in one position of said stem, said inlet port with said inlet end of said groove and said connection and discharge ports, said stem having a pair of longitudinal peripheral pressure-balancing channels of a length greater than the spacing between said passages and disposed at diametrically opposite sides of said stem and intersecting said first passage and disposed to simultaneously afford fluid communication between said outlet and connection and discharge ports in a second position of the stem and affording a two path flow for fluid from said connection to said exhaust port and simultaneously from said connection to said outlet port.

3. A valve comprising a body with a bore, a stem rotatively mounted in the bore, an operating element, said element and stem having axially overlapped portions, pin openings in said valve body and in said stem and element portions alignable transaxially of the stem, said body having an arcuate slot open to said bore and intersecting a pin opening in said body, a pin interconnecting said stem and element extending through said openings in said portions thereof and insertable therein through said openings in the aligned portion thereof, said pin having an end projecting outwardly from said stem into said slot and abuttable with margins thereof to limit endwise and rotary movement of said stem.

4. An hydraulic valve comprising a body having a cylindrically bore and intersecting pressure, discharge utilization and connection ports therein, said discharge and connection ports coaxially arranged at diametrically opposite sides of said bore and said pressure and utilization ports spaced from said connection and discharge ports lengthwise of said bore and spaced substantially 90° apart from each other, said body having a groove interrupting said bore with an end disposed diametrically opposite to said pressure port, said groove connected to said utilization port, a valve stem rotatively mounted in said bore and having first and second transverse passages disposed at right angles to each other and spaced lengthwise of each other on the order of the spacing between said connection and said utilization ports, said first passage alignable with said pressure port and said one end of said groove in one position of the stem to afford fluid flow from said pressure port to said utilization port and simultaneously said other passage being aligned with said connection and discharge ports, said stem having a pair of longitudinal peripheral channels at opposite sides thereof intersecting respectively opposite ends of said first passage and extending therefrom in a direction toward the second passage and of a length at least slightly in excess of the distance between said utilization and connection ports lengthwise of said body and located substantially at right angles to said second passage, said stem having a second position displaced 90° from the first whereat said stem closes said pressure port and said first passage is aligned with said utilization port and one of said channels is aligned and communicates with said connection port and the other is aligned and communicates with said discharge port and thereby providing a substan-

tially larger passage area for the reverse flow of fluid that is, from said utilization port than thereto.

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