

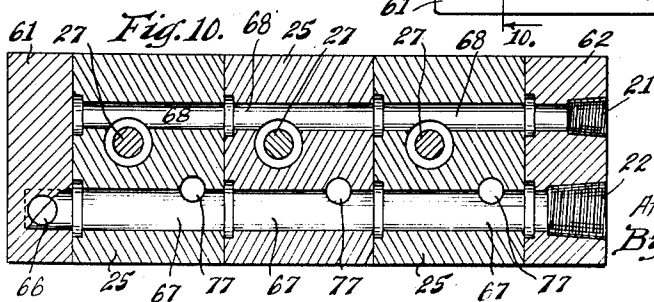
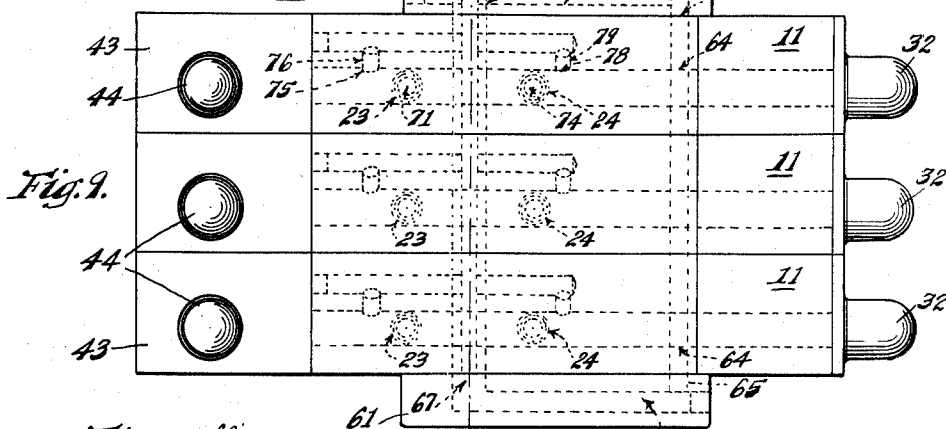
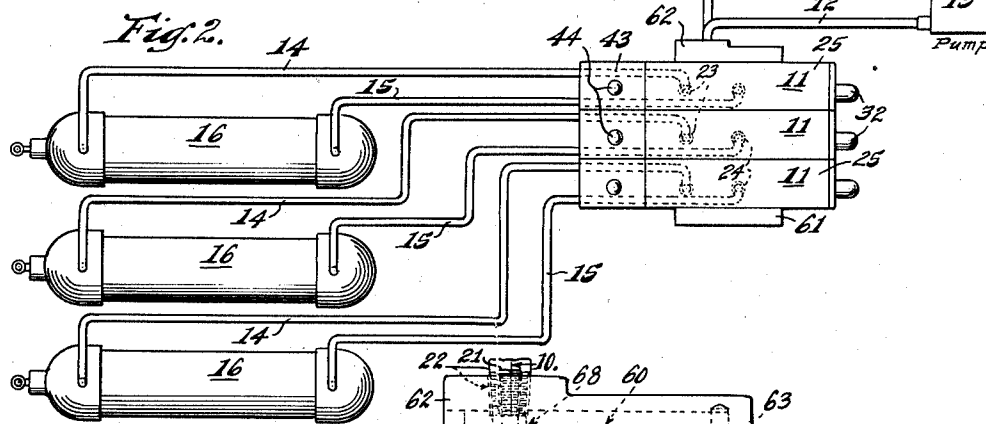
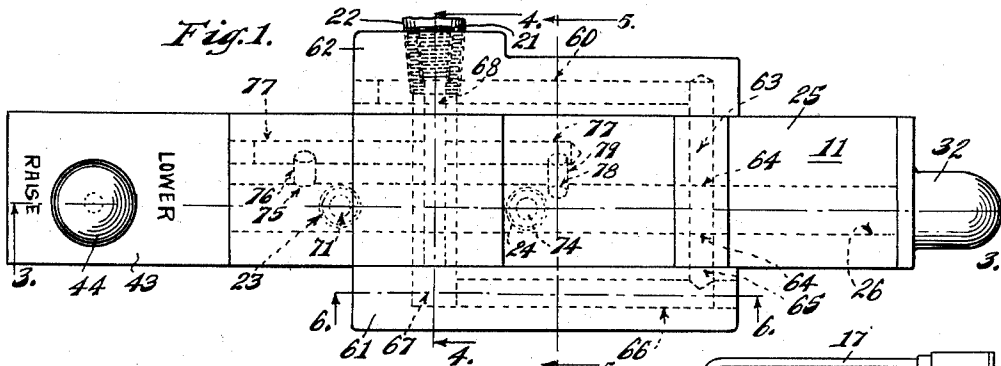
May 15, 1951

C. P. GABRIEL ET AL
HYDRAULIC CONTROL VALVE

2,552,848

Filed July 2, 1946

2 Sheets-Sheet 1



INVENTORS.
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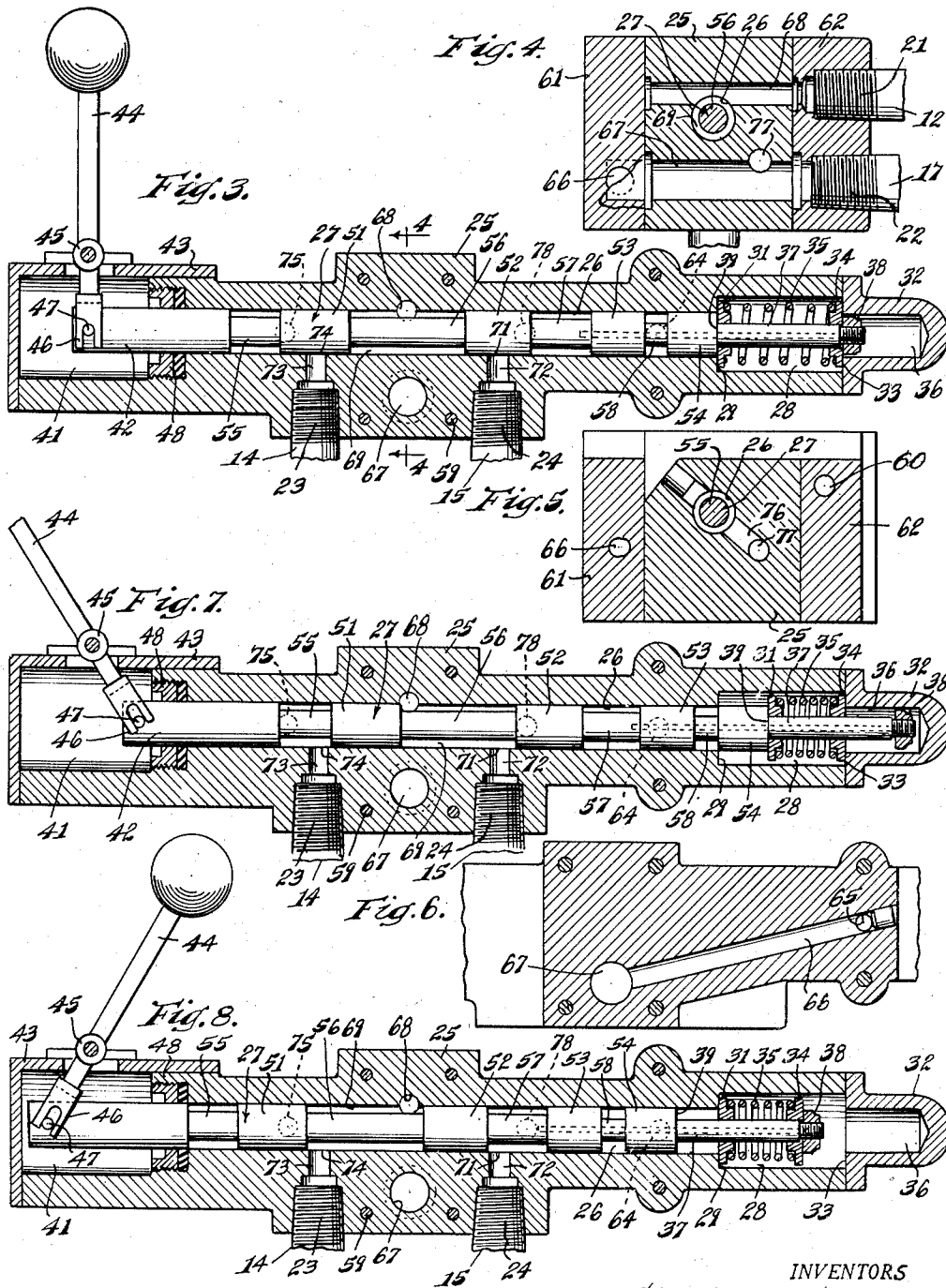
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UNITED STATES PATENT OFFICE

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HYDRAULIC CONTROL VALVE

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This invention relates to a hydraulic control valve and particularly to a hydraulic control valve for a hydraulic system wherein the pump or pressure converter operates continuously, while the motors, cylinders, et cetera, actuated by the hydraulic system operate intermittently and at will.

Heretofore, in hydraulic systems of this type, it has been customary to allow the pump to operate through a pressure relief valve set at a pressure in excess of that required to operate the cylinders, fluid motors, et cetera. Thus the pump does a considerable amount of wasted work. In cases where cylinder operation occurs only a small fraction of pump operating time, gross inefficiency results in the system.

It is, therefore, an object of the invention to provide a hydraulic control valve having a by-pass therein which is utilized before and after use of the cylinders.

It is another object of the invention to provide a novel hydraulic control valve which is adapted to control the flow of fluid to hydraulically actuated mechanism and also to by-pass hydraulic fluid at will, when the fluid system to the hydraulic mechanism is not operating.

It is also an object of the invention to provide a single pump and a plurality of the aforesaid control valves for a plurality of hydraulic mechanisms and to manifold the control valves so that only one pump inlet and one pump outlet are connected to a plurality of valves.

It is a further object of the invention to considerably reduce the amount of work done by the pump of a hydraulic system containing intermittently operated hydraulic mechanisms.

It is, furthermore, an object of the invention to provide a hydraulic control valve which is inexpensive to manufacture and has a minimum number of parts.

It is another object of the invention to provide a hydraulic control valve having by-pass porting and selective porting for positive operation of hydraulic mechanisms, such as, for example, double-acting hydraulic cylinders, both of which porting arrangements are operated by a single control lever, either manually or automatically.

It is still another object of the invention to provide a hydraulic control valve of the type described which contains a spool type valve construction with pressure-balanced action for ease of operation and control.

It is a further object of the invention to provide a hydraulic control valve of compact, stack-

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type body construction for operation of a plurality of hydraulic mechanisms by manifolded control valves, thus eliminating excessive piping, connectors, and possible leakage of hydraulic fluid.

It is still a further object of the invention to provide integral by-pass porting for a hydraulic control valve which is used when the valve is not in actual operation as a selector valve.

It is still another object of the invention to provide a hydraulic control valve which may be manifolded in as many numbers as desired utilizing only one pair of end blocks for any number of valves.

With these and other objects in view, our invention consists in the construction, arrangement and combination of the various parts of our device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in our claims and illustrated in the accompanying drawings, wherein:

Figure 1 is a top plan view of a hydraulic control valve embodying the invention;

Figure 2 is a diagrammatic view of a hydraulic system showing a plurality of the valves shown in Figure 1 manifolded;

Figure 3 is a vertical sectional view of the control valve taken on line 3-3 of Figure 1, showing the valve in the position for by-passing hydraulic fluid;

Figure 4 is a transverse vertical sectional view taken on line 4-4 of Figs. 1 and 3;

Figure 5 is a sectional view taken on line 5-5 of Figure 1;

Figure 6 is a sectional view of the control valve taken on line 6-6 of Figure 1;

Figure 7 is a sectional view of the control valve similar to Figure 3 showing the valve spool in one of its selector positions;

Figure 8 is a sectional view of the control valve similar to Figures 1 and 7, showing the valve spool in another of its selector positions;

Figure 9 is a top plan view of three of the valves shown in Fig. 1 manifolded, and

Figure 10 is a sectional view taken on line 10-10 of Figure 9.

Referring specifically to the drawing for a detailed description of the invention, and particularly to Figures 1 and 4 to 8 inclusive, numeral 11 designates generally a hydraulic control valve having an inlet conduit 12 which may be connected to the outlet or pressure side of a pump 13, such as shown in Figure 2. Conduits 14 and 15 connect valve 11 to a double acting hydraulic cylinder 16. The outlet of the valve 11 is con-

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nected to the inlet side of a pump 13, such as shown in Figure 2, by a conduit 17. The pressure inlet of the valve is designated at 21, and the outlet at 22. (See Figure 4.) The connections from the valve to the conduits 14 and 15 for the cylinder are designated by numerals 23 and 24, respectively.

It is obvious that a single valve 11 may be used to control a single hydraulic mechanism, such as a cylinder, or a group of cylinders 16, if it is desired that the hydraulic mechanisms operate simultaneously and in the same direction.

The valve 11 comprises a main substantially rectangular elongated body portion 25 having a generally uniform central cylindrical bore 26 extending longitudinally therethrough for the reception of a spool type valve 27. The right-hand end of the bore 26 as seen in Figure 3, for example, is enlarged to provide a recess at 28 forming a shoulder 29, against which a ring 31 sometimes abuts, as shown in Figs. 3 and 8. The other end of the recess 28 is closed by a cap 32 which forms a shoulder 33 against which a second ring 34 sometimes abuts, as shown in Figures 3 and 7. A coil spring 35 is disposed between the rings 31 and 34 and a recess 36 in cap 32 receives an extension 37 on valve spool 27 under some conditions, such as shown in Figure 7. The extension 37 is provided with a nut 38 which at times engages ring 34, as shown in Figure 8, to compress spring 35. Likewise, a shoulder 39 on end of valve spool 27 at times engages ring 31, as shown in Figure 7, to compress spring 35. The cap 32 is secured to the valve body 25 by any suitable means.

The opposite end of the valve body 25 is cut away, as shown at 41, and end 42 of valve spool 27 extends into the cut-away portion. A casing 43 is preferably screwed to this portion of the valve body and an operating handle 44 extends through the casing 43, being pivotally mounted thereon at 45. The lower end of the handle 44 is provided with forked extremities 46 pivotally engaging a transverse pin 47 on end 42 of valve spool 27. A suitable fluid tight packing gland 48 surrounds the end 42 of valve spool 27.

The valve spool 27 is enlarged adjacent its end 42 and also at 51, 52, 53 and 54 to snugly fit and slide in the bore 26. The valve spool 27 is reduced at 55, 56, 57 and 58.

Secured to the central portion of the main body portion 25 at opposite sides thereof, preferably by bolts 59, are by-pass or end blocks 61 and 62, respectively. The inlet and outlet connections 21 and 22, respectively, are contained in the by-pass block 62, as shown in Figure 4.

Assuming that the valve spool 27 is in the position shown in Figure 3, which is the by-pass position, hydraulic fluid from the pump outlet enters the valve through inlet 21 (Figure 1) and is conveyed through a by-pass passage 60 in end or by-pass block 62, then through cross passage 63, through port 64, around reduced portion 58 of spool 27, through cross-passage 65, thence to diagonal passage 66 in end or by-pass block 61, to passage 67 connecting with outlet 22. Fluid also enters a passage 68 and passes into reservoir chamber 69 surrounding reduced portion 56 through the passage 68. However, it is obvious that no fluid may escape from reservoir 69 when the valve spool 27 is in the position shown in Figure 3. Since no appreciable resistance to the flow of fluid occurs in the by-pass

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passages and ports, the fluid, naturally, follows the course of least resistance.

Assuming now that the valve spool 27 is moved to the position shown in Figure 7 by moving the handle 44, as shown in that figure, to the left, the valve spool 27 is moved to the right and it is first noted that the large portion 53 of the spool blocks the by-pass port 64, so that no fluid may pass through the by-pass passages to the outlet 22. Fluid under pressure does, however, enter passage 68 and reservoir 69. A port 71, communicating with a passage 72 and thence with outlet 24, is opened by large portion 52 of the spool 27 and fluid is pumped to the cylinder 16 through conduit 15 (Figure 2). Fluid is returned from the cylinder 16 through conduit 14 to the inlet 23, thence through a passage 73 to port 74, around reduced portion 55 of valve spool 27, thence to a port 75 which is now completely uncovered. Fluid from the port 75 passes through a diagonal passageway 76 (Figure 5), thence to a cross passageway 77, which connects with passageway 67, which in turn connects to outlet 22.

A port 78 communicating also with passageways 77 and 67 through a passage 79 (Figure 1) is blocked at this time by enlarged portion 52 of the valve spool 27.

Assuming now that the valve spool 27 is moved to the left to the position shown in Figure 8, by moving the handle 44 to the right, the outlet 24 becomes the inlet and inlet 23 the outlet, in the following manner, thereby reversing the movement of a double acting cylinder 16.

Fluid under pressure enters the same inlet 21 as before and enters pressure reservoir chamber 69 through passage 68. The fluid passes through port 74 into passage 73 and outlet 23 to conduit 14 and returns through conduit 15, it being noted that ports 75 and 64 are blocked by the enlarged portions 51 and 54, respectively, of the valve spool 27. Fluid enters inlet 24 from conduit 15 and passes through conduit 72 and port 71. Fluid then passes around reduced portion 57 of valve spool 27 and enters port 78, from whence it passes through passage 79, as shown in Figure 1, enters passage 77 and is exhausted to conduit 17 leading to the low pressure side of pump 13 through passage 67 and outlet 22. The passages 76 and 79 are identical and a section taken through passage 79 would be exactly like Figure 5.

The spring 35 serves the dual function of balancing the valve spool 27 in the by-pass position shown in Figure 3 and biasing the valve spool toward the by-pass position at other times. When the valve spool 27 is in the position shown in Figure 7, the ring 31 compresses spring 35 and tends to move the valve spool 27 and handle 44 back to the by-pass position. Likewise, when the valve spool is in the position shown in Figure 8, the ring 34 compresses the spring 35 and tends to move the valve spool toward the by-pass position. In both the positions shown in Figures 7 and 8, it is, therefore, necessary to hold the handle 44 in the desired position while operating a cylinder 16.

Referring now to Figures 2, 9 and 10 for a description of the manifolding of a plurality of valves 11, it will be noted that a number of valve bodies 25 are placed adjacent to each other with the passages 67 and 68, respectively in each valve body 25 communicating with each other. Only one valve block 62 is utilized for conveying liquid to and from the pump 13 through conduits 12 and 17 to all the valve bodies 25. Further-

more, only one by-pass valve block 61 is utilized. While the drawings show three valves manifolded, it will be apparent that any number of valves from two up may be manifolded in the same manner. Obviously, the valve bodies 25 and valve blocks 61 and 62 are held together by any suitable means, such as screws or bolts (not shown).

Liquid from pump 13 is conveyed through conduit 12 to the valve inlet 21 and then passes through each valve in the same manner as described with respect to Figures 1 and 4 to 3. Since the passages 57 and 68, respectively are always in open communication with each other, flow through each valve to and from conduits 14 and 15 may be controlled by operation of the levers 44, or by-passing may be effected when all valves are in the neutral position through by-pass passage 66. If the lever 44 is in either the raised or lowered position, the fluid flows through conduits 14 and 15 to and from the respective valve bodies 25 from passages 23, 73 and 24, 72 to operate respective hydraulic mechanisms in two directions, such as the hydraulic jacks 16.

It will be obvious from the above description and the diagrammatic conduit system of Figure 2 that any one or more valves may be in the by-pass position without affecting any other valve. Therefore, the pump 13 is only under load when one or more of the cylinders 16 is to be operated.

Some changes may be made in the construction and arrangement of the parts of our hydraulic control valve without departing from the real spirit and purpose of our invention, and it is our intention to cover by our claims any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope without sacrificing any of the advantages thereof.

We claim as our invention:

1. A fluid flow valve comprising a valve block having first and second parallel bores therein, an inlet bore extending through said block and intersecting said first bore at right angles, an outlet bore extending through said block parallel to said inlet bore and intersecting said second bore, a by-pass bore through said block parallel to said inlet bore and intersecting said first bore, a pair of spaced connecting bores interconnecting said first and second parallel bores, a pair of spaced delivery-return bores extending from the face of said valve block to the first bore and disposed transversely to the plane of the first bore and the inlet bore, a valve spool in said first bore adapted to be reciprocated to three positions, the first position with the by-pass bore unblocked and the delivery-return bores blocked, the other two positions with the by-pass bore blocked and the pair of delivery-return bores unblocked and selectively in communication with the inlet bore, all of said bores being straight, fluid flow means communicating the inlet bore to the by-pass bore,

means for supplying fluid to the inlet bore and by-pass bore, fluid flow means communicating the by-pass bore to the outlet bore, and means for receiving fluid from the outlet bore.

2. A valve block as described in claim 1 wherein said fluid flow means communicating the inlet bore to the by-pass bore, and said fluid flow means communicating the by-pass bore to the outlet bore, comprises a pair of end blocks, the first of said end blocks having an end inlet bore and an end by-pass bore adapted to register with said inlet bore and said by-pass bore in the valve block, and a connecting bore between said end inlet bore and said end by-pass bore, the second of said end blocks having a second end by-pass bore and an end outlet bore adapted to register with said by-pass bore and outlet bore in the valve block, and a connecting bore in said second block between said second end by-pass bore and said end outlet bore.

3. A valve block as described in claim 1 wherein said fluid flow means communicating the inlet bore to the by-pass bore, said means for supplying fluid to the inlet bore and by-pass bore, said fluid flow means communicating the by-pass bore to the outlet bore, and said means for receiving fluid from the outlet bore comprises a pair of end blocks, the first of said end blocks having an end inlet bore and an end by-pass bore adapted to register with said inlet bore and said by-pass bore in the valve block, and a connecting bore between said end inlet bore and said end by-pass bore, the second of said end blocks having a second end by-pass bore and an end outlet bore adapted to register with said by-pass bore and outlet bore in the valve block, and a connecting bore in said second block between said second end by-pass bore and said end outlet bore, an inlet port in the first of said end blocks communicating with the end inlet bore therein and an outlet port in one of said end blocks communicating with the outlet bore.

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RALPH THOMAS MARETTE.

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