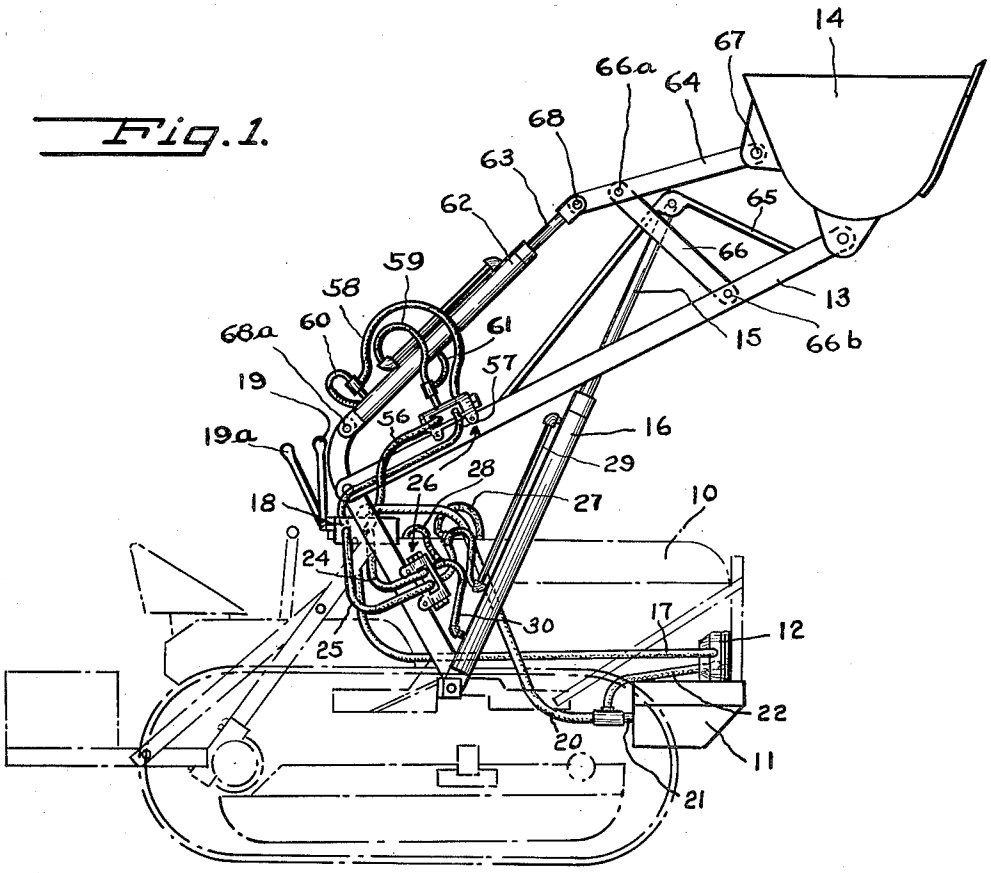
March 25, 1952 J. S. PILCH 2,590,454

HYDRAULIC BY-PASS SYSTEM AND VALVE THEREFOR

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Fig. 1.



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Fig. 2.

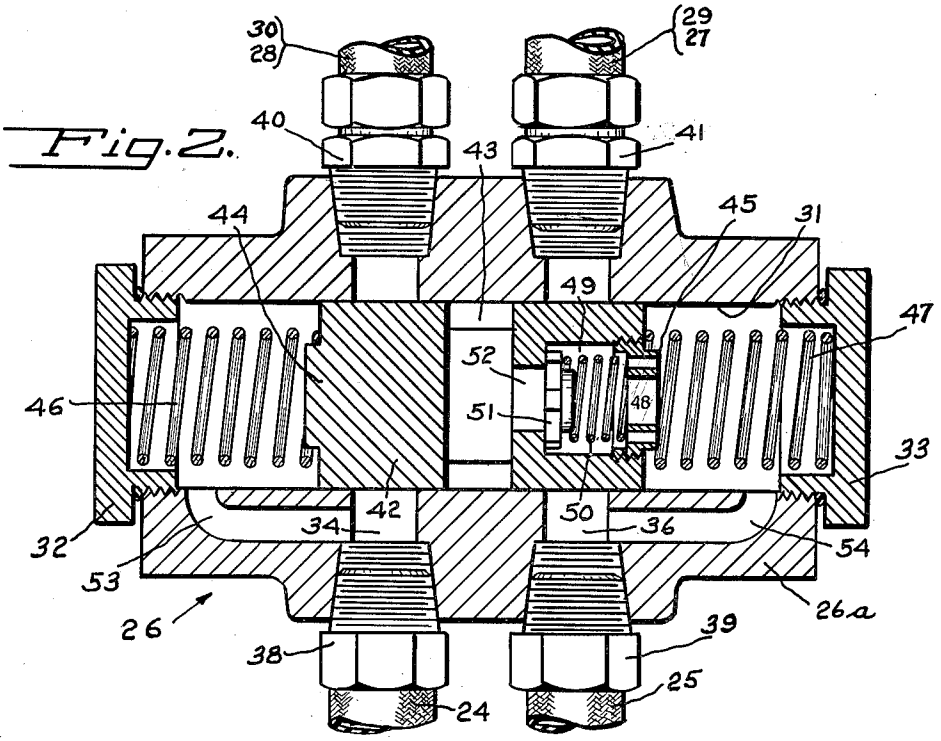
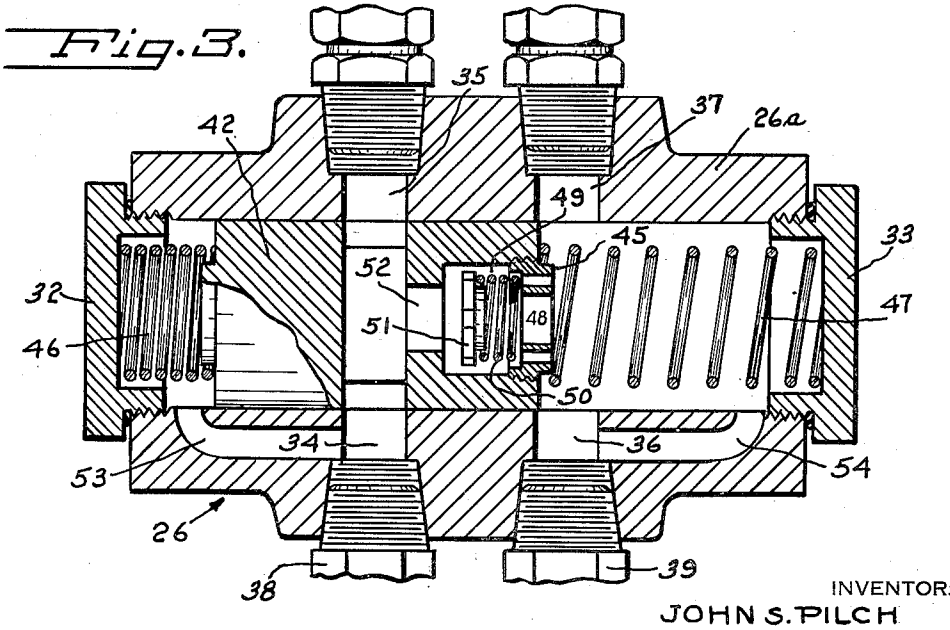


Fig. 3.



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HYDRAULIC BY-PASS SYSTEM AND VALVE THEREFOR

John S. Pilch, Ware, Mass.

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6 Claims. (Cl. 121—38)

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This invention relates to hydraulic systems and a new and improved valve therefor.

An object of the invention is to provide a hydraulic system particularly adapted for use in such devices as hydraulically operated loading buckets carried by tractors or other vehicles and to a new and improved hydraulically operated bucket and flow control valve for such systems which increases the speed of tripping of the bucket and also lowering or return of the bucket for loading, and, therefore, considerably increasing the speed of loading with the device.

Another object of the invention is to provide a hydraulic system and flow control valve therefor which bypasses the hydraulic fluid thus shortening the path of travel of the hydraulic fluid under certain conditions and, therefore, tending to keep such fluid cool and eliminate vacuum created in the system and speeds up the operation of dumping the bucket.

Another object of the invention is to provide a hydraulic system and flow control valve therefor of the type set forth which valve operates automatically during the lowering or return of the bucket and which is relatively simple in construction yet efficient in operation.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings. I, therefore, do not wish to be limited to the details of construction and arrangement of parts shown and described, as the preferred form has been shown by way of illustration only.

Referring to the drawings:

Fig. 1 is a side view of a tractor carried, hydraulically operated loading bucket embodying the invention;

Fig. 2 is a sectional view of a flow control valve constructed according to the invention, showing the valve in neutral position; and

Fig. 3 is a view similar to Fig. 2, but showing the valve in operative position during the return or lowering of the bucket.

While the hydraulic system and flow control valve have been shown as applied to a hydraulically operated loading bucket, this has been done by way of illustration only and it will be understood that the system and valve may be employed in other hydraulically operated apparatus in which a similar saving of time is desired.

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout the several views, the hydraulic system is shown in Fig. 1 as applied to a hydraulically operated loading bucket which

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is carried by a tractor 10 of conventional construction.

On the tractor 10 is provided the reservoir tank 11 for the hydraulic fluid for the hydraulic system and the hydraulic pump 12 of conventional type which is mechanically connected to and driven by the engine of the tractor 10 in the usual manner.

The loading arrangement, as shown in Fig. 1, comprises a pair of push arms 13, one on each side of the tractor 10, only one of which push arms is shown. These push arms 13 carry the loading bucket 14 which is actuated by a pair of rams 15, one on each side of the tractor 10, and of which only one is shown, and the rams each have piston portions positioned within cylinders 16 and adapted to be actuated therein by hydraulic force to thereby actuate the rams 15 in the usual manner and said rams 15 are connected at their opposite ends to the supports 65.

The hydraulic pump 12 is adapted to supply fluid through pipe line 17 to the usual four-way hydraulic control valve 18 which is provided with the operating or control lever 19. The return pipe line 20 is provided from said valve 18 and has a branch 21 for returning fluid to the reservoir or tank 11 and a branch 22 for returning fluid directly to pump 12.

Control lever 19a is provided for dumping bucket 14 as hereinafter described.

Control valve 18 is connected by pipe lines 24 and 25, and 56 and 57 to each of the flow control valves 26, one of which is provided for the cylinders 16 and is connected by the two sets of pipe lines 27 and 28; and 29 and 30 to each of the cylinders 16 with each of said pipe lines 27 and 29 connected to each of said cylinders 16 adjacent corresponding ends and said pipe lines 28 and 30 also connected to each of said cylinders adjacent the corresponding ends opposite those at which the lines 27 and 29 are connected so that both of the rams 15 function in a similar direction simultaneously.

The second flow control valve is provided for bypassing the hydraulic fluid and thus speeding up the operation of tipping or dumping the bucket as well as keeping the fluid cool and eliminate vacuums being created in the system. This second flow control valve 26 is connected to control valve 18 by lines 56 and 57.

The hydraulic bucket control system also includes a pair of cylinders 62, one on each side of the tractor 10, only one of which cylinders is shown. These cylinders 62 each are pivotally mounted at their connections 68a with the sup-

porting frame, and each is adapted to receive a ram 63, which rams 63 are pivoted at their outer ends 68 to a link 64 which links are pivotally connected at 67 to the bucket 14.

Each set of push arms 13 and links 64 are connected by links 66 which are pivoted at their ends 66a and 66b to the links 64 and push arms 13 respectively.

The cylinders 62 are each connected adjacent their opposite ends by sets of pipe lines 60 and 61, and 58 and 59 to the flow control valve 26 therefor and control valve 18 is provided with a control or operating lever 19a for controlling the hydraulic system for controlling the tipping or rotation of bucket 14.

Each of the flow control valves 26 comprises a valve body 26a which is provided with a longitudinal opening and slideway 31 extending therethrough and closed at its opposite ends by threaded caps 32 and 33.

Communicating with said longitudinal opening are oppositely disposed sets of openings 34 and 35, and 36 and 37 adapted to communicate with pipe lines 24, 25, 27, 28, 29 and 30 through respective fittings 38, 39, 40 and 41 which connect said pipe lines to said valve body 26a.

Mounted for sliding movement on said slideway 31 is slide 42 which has the transverse passage or slot 43 adapted to align an oppositely disposed set of openings 34 and 35 for the passage of fluid through said slide 42.

The slide 42 has spring retainers 44 and 45 at its opposite ends adapted to engage the adjacent ends of coil centering springs 46 and 47 respectively which have their opposite ends engaging threaded caps 32 and 33 and said springs, in the absence of hydraulic force serve to retain the slide in neutral position as shown in Fig. 2.

Spring retainer 45 has an opening 48 therethrough communicating with check valve chamber 49 into which said retainer 45 is threaded and in said chamber 49 is check valve coil spring 50 which is a relatively light coil spring for retaining check valve 51 normally in closed position over opening 52 which communicates with passage or slot 43.

The openings 34 and 36 are each connected by bypass openings 53 and 54 respectively to the opposite ends of slideway 31 whereby pressure through either of said lines 24 or 25 will cause pressure through the respective bypass 53 or 54 and thereby cause movement of slide 42 in slideway 31.

When the fluid is returning from the lower portion of cylinders 16 through lines 30 and 32, that is, when the bucket 14 is being lowered for loading, considerable time elapses for the passage of the fluid through flow control valve 26 to control valve 18 and then through the pressure line to lines 27 and 29 which takes considerable time and correspondingly slows up the loading operation.

In Fig. 2, the slide 42 is shown in neutral position in slideway 31, in which position it is normally retained by springs 46 and 47 and in Fig. 3, slide 42 is shown in operative position for bypassing fluid to speed the lowering or return of the bucket to increase the speed of operation.

When fluid is being forced into the cylinder 29 to raise the bucket, fluid first passes through bypass opening 53 to augment the force of spring 46 against slide 42 and move slide 42 in slideway 31 to such position as to establish communication between lines 24 and 28 which continues as long as hydraulic pressure is applied through

line 24. However, when pressure is shut off through line 24 by valve 18, slide 42 returns to neutral position to prevent passage of fluid in either direction and thus hold the bucket in adjusted position.

When the bucket is to be lowered, valve 18 is so adjusted as to apply pressure through line 25 which through bypass 54 applies pressure against the corresponding end of slide 42, thus augmenting the pressure of spring 47 to effect movement of slide 42 to the position shown in Fig. 3 which establishes communication between openings 34 and 35 through passage 43 and also establishes communication between openings 36 and 37 and lines 25 and 27 and fluid pressure in passage 43 against check valve 51 opens said valve, as shown in Fig. 3 and allows the direct passage of fluid from line 28 through passage 43 and passage 52 and check valve 51 to opening 37 and line 27 without passing through control valve 18 as would otherwise be required.

This bypassing of the fluid path increases considerably the speed of operation of the device.

I have found that by providing passage 52 and check valve 51, that suction or vacuum in the lines to the upper end of cylinder 16 plus oil pressure behind check valve 51 will open said check valve 51 during the lowering of the bucket 14 for loading or tipping of the bucket for unloading and allow hydraulic fluid to pass directly from the return line to the pressure line in flow control valve 26 without the necessity of returning through control valve 18 and then passing from said valve through the lines to the cylinders. This considerably speeds up the time required for the passage of the fluid from the lower end of the cylinders to the upper end thereof and correspondingly increases the speed of lowering the arms and the bucket 14 and thereby speeds up the loading operation and also increases the speed of tipping of the bucket and, therefore, the unloading operation.

From the foregoing it will be seen that I have provided simple, efficient and economical means for obtaining all of the objects and advantages of the invention.

Having described my invention, I claim:

1. In a flow control valve adapted to be interposed in the lines of a hydraulic system having a pressure line and a return line and to be positioned between a hydraulic cylinder and the control valve therefor to increase the speed of operation of the hydraulic system, a valve body communicating with said lines, a slideway in said body adapted to control the passage of fluid through said body, a pressure operated slide in said slideway, said slide having a first fluid passage therethrough and said slide being adapted to be moved by fluid pressure to a position wherein it permits flow from said return line into said first passage in said slide, a second fluid passage in said slide and communicating with said first fluid passage and adapted to establish fluid passage through said slide from said first fluid passage to the pressure line, and valve means in said slide for controlling the passage of fluid through said second passage and allow fluid to pass directly from said return line to said pressure line without passing through the control valve for said hydraulic system.

2. In a flow control valve adapted to be interposed in the lines of a hydraulic system having a pressure line and a return line and to be positioned between a hydraulic cylinder and the control valve therefor to increase the speed of

operation of the hydraulic system, a valve body communicating with said lines, a slideway in said body adapted to control the passage of fluid through said body, a pressure operated slide in said slideway, said slide having a first fluid passage therethrough and said slide being adapted to be moved by fluid pressure to a position wherein it permits flow from said return line into said first passage in said slide, a second fluid passage in said slide and communicating with said first fluid passage and adapted to establish fluid passage through said slide from said first fluid passage to the pressure line, and a check valve in said second fluid passage in said slide for controlling the passage of fluid through said second passage and allow fluid to pass directly from said return line to said pressure line without passing through the control valve for said hydraulic system.

3. In a flow control valve adapted to be interposed in the lines of a hydraulic system having a pressure line and a return line and to be positioned between a hydraulic cylinder and the control valve therefor to increase the speed of operation of the hydraulic system, a valve body communicating with said lines, a slideway in said body adapted to control the passage of fluid through said body, a pressure operated slide in said slideway, said slide having a first fluid passage therethrough and said slide being adapted to be moved by fluid pressure to a position wherein it permits flow from said return line into said first passage in said slide, a second fluid passage in said slide and communicating with said first fluid passage and adapted to establish fluid passage through said slide from said first fluid passage to the pressure line, and valve means in said slide for controlling the passage of fluid through said second passage and allow fluid to pass directly from said return line to said pressure line without passing through the control valve for said hydraulic system and means for normally retaining said slide in neutral position in said body.

4. In a flow control valve adapted to be interposed in the lines of a hydraulic system having a pressure line and a return line and to be positioned between a hydraulic cylinder and the control valve therefor to increase the speed of operation of the hydraulic system, a valve body communicating with said lines, a slideway in said body adapted to control the passage of fluid through said body, a pressure operated slide in said slideway, said slide having a first fluid passage therethrough and said slide being adapted to be moved by fluid pressure to a position wherein it permits flow from said return line into said first passage in said slide, a second fluid passage in said slide and communicating with said first fluid passage and adapted to establish fluid passage through said slide from said first fluid passage to the pressure line, and a check valve in said second fluid passage in said slide for controlling the passage of fluid through said second passage and allow fluid to pass directly from said return line to said pressure line without passing through the control valve for said hydraulic system, and means for normally retaining said slide in neutral position in said body.

5. In a flow control valve adapted to be interposed in the lines of a hydraulic system having a pressure line and a return line and to be positioned between a hydraulic cylinder and the control valve therefor to increase the speed of operation of the hydraulic system, a valve body communicating with said lines, a slideway in said body adapted to control the passage of fluid through said body, a pressure operated slide in said slideway, said slide having a first fluid passage therethrough and said slide being adapted to be moved by fluid pressure to a position wherein it permits flow from said return line into said first passage in said slide, a second fluid passage in said slide and communicating with said first fluid passage and adapted to establish fluid passage through said slide from said first fluid passage to the pressure line, and valve means in said slide for controlling the passage of fluid through said second passage and allow fluid to pass directly from said return line to said pressure line without passing through the control valve for said hydraulic system and spring members in said valve body adjacent the opposite sides of said slideway for normally retaining said slide in desired position in said valve body.

6. In a flow control valve adapted to be interposed in the lines of a hydraulic system having a pressure line and a return line and to be positioned between a hydraulic cylinder and the control valve therefor to increase the speed of operation of the hydraulic system, a valve body communicating with said lines, a slideway in said body adapted to control the passage of fluid through said body, a pressure operated slide in said slideway, said slide having a first fluid passage therethrough and said slide being adapted to be moved by fluid pressure to a position wherein it permits flow from said return line into said first passage in said slide, a second fluid passage in said slide and communicating with said first fluid passage and adapted to establish fluid passage through said slide from said first fluid passage to the pressure line, and a check valve in said second fluid passage in said slide for controlling the passage of fluid through said second passage and allow fluid to pass directly from said return line to said pressure line without passing through the control valve for said hydraulic system, and spring members in said valve body adjacent the opposite sides of said slideway for normally retaining said slide in desired position in said valve body.

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