United States Patent [19]

Jordan

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[54] **LOG GRAPPLE DEVICE**

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[52] **U.S. Cl.** **294/88**

[51] **Int. Cl.** **B66c 3/16**

[58] **Field of Search**..... 294/86 R, 88, 106, 118; 214/147 R, 147 G, 650 R, 652, 653, 654, 656

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Assistant Examiner—Johnny D. Cherry
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[57] **ABSTRACT**

A system for automatically holding and/or restoring pressure to log grapple tongs despite shifting of the logs in the tongs.

2 Claims, 6 Drawing Figures

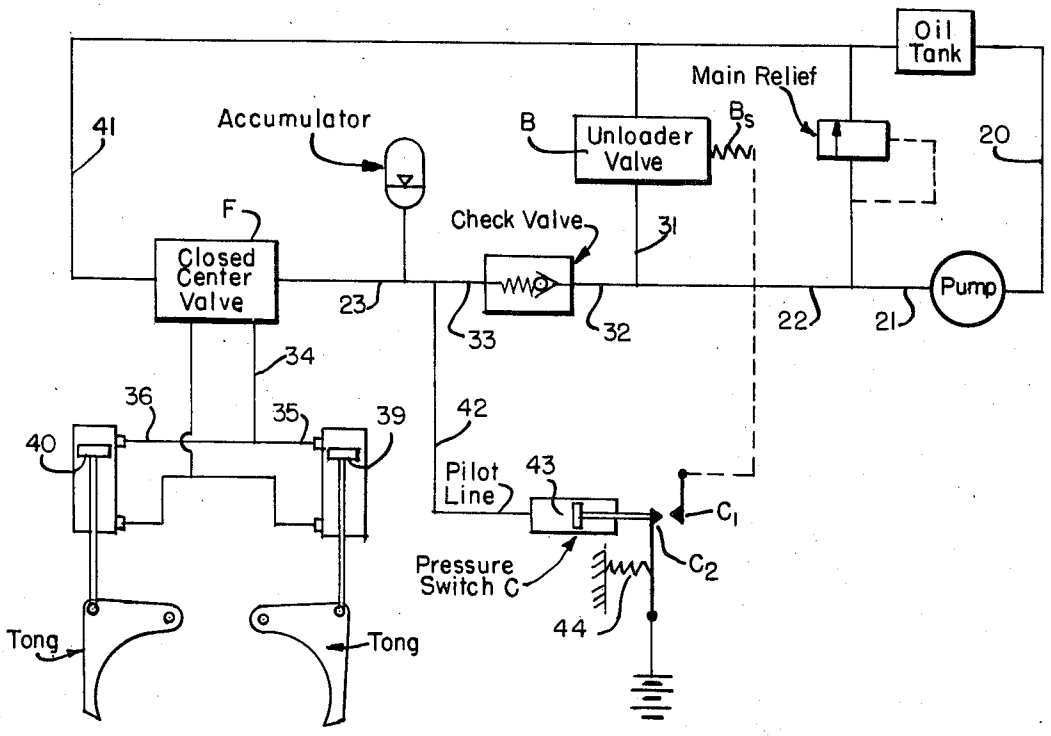


FIG. 1.

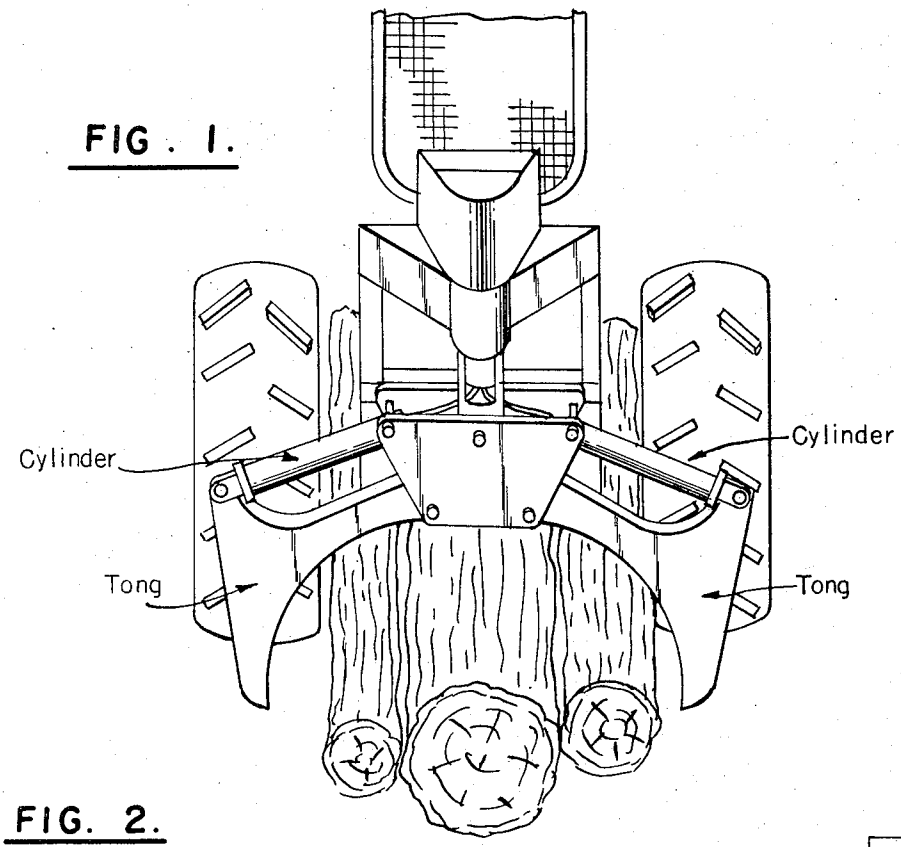
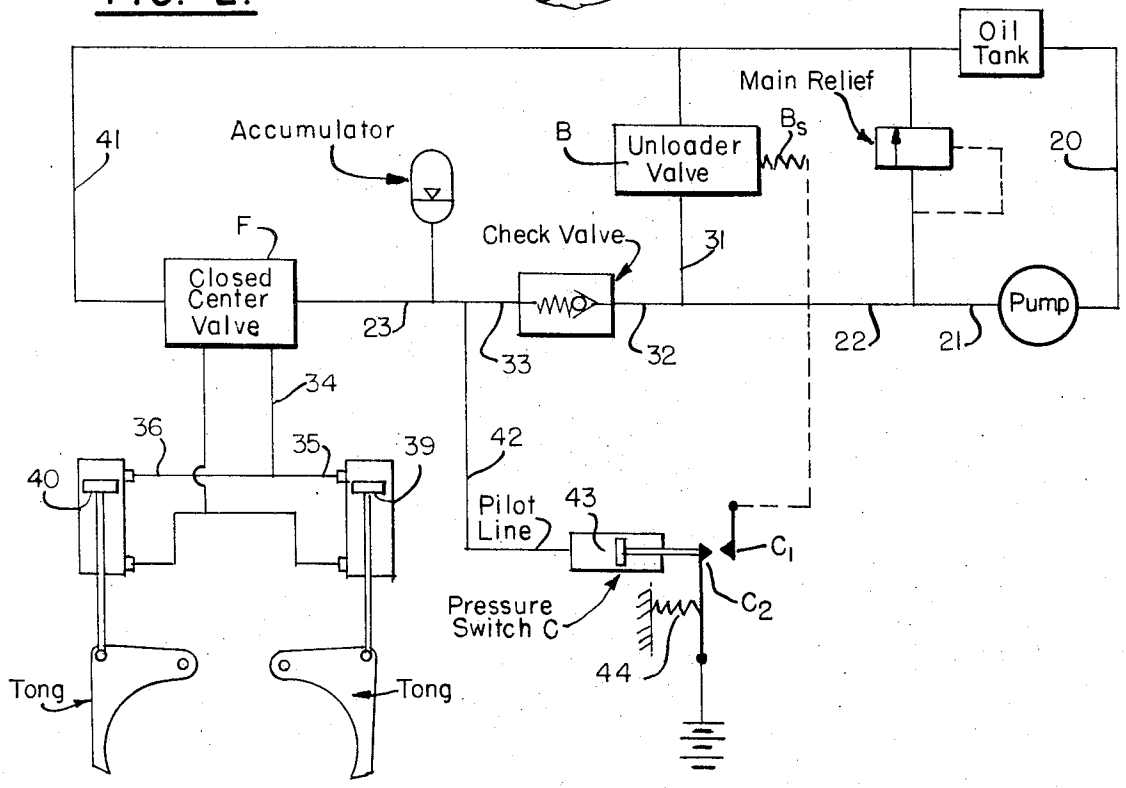

Cylinder
Cylinder
Tong
Tong

FIG. 2.


Oil Tank
Main Relief
41
Accumulator
B
Unloader Valve
Bs
20
F
Check Valve
31
Closed Center Valve
Pump
23
33
32
22
21
34
36
35
39
42
40
Pilot Line
43
C1
Pressure Switch C
C2
44
Tong
Tong

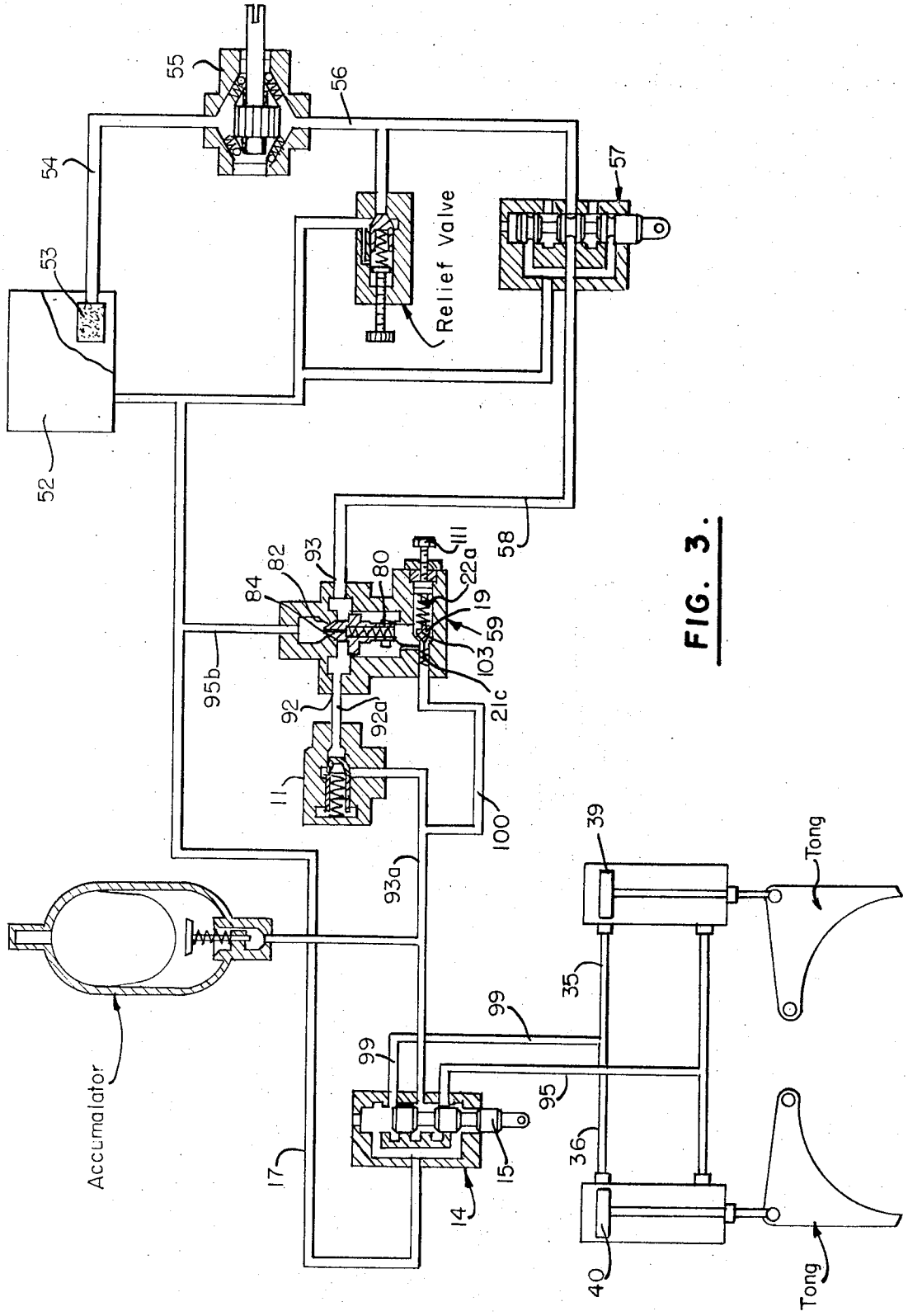

55
56
54
57
Relief Valve
53
52
58
84
82
93
80
111
22a
19
59
103
21c
95b
92
92a
11
100
39
Tong
93a
35
99
99
95
36
Accumulator
17
15
14
40
Tong

FIG. 3.

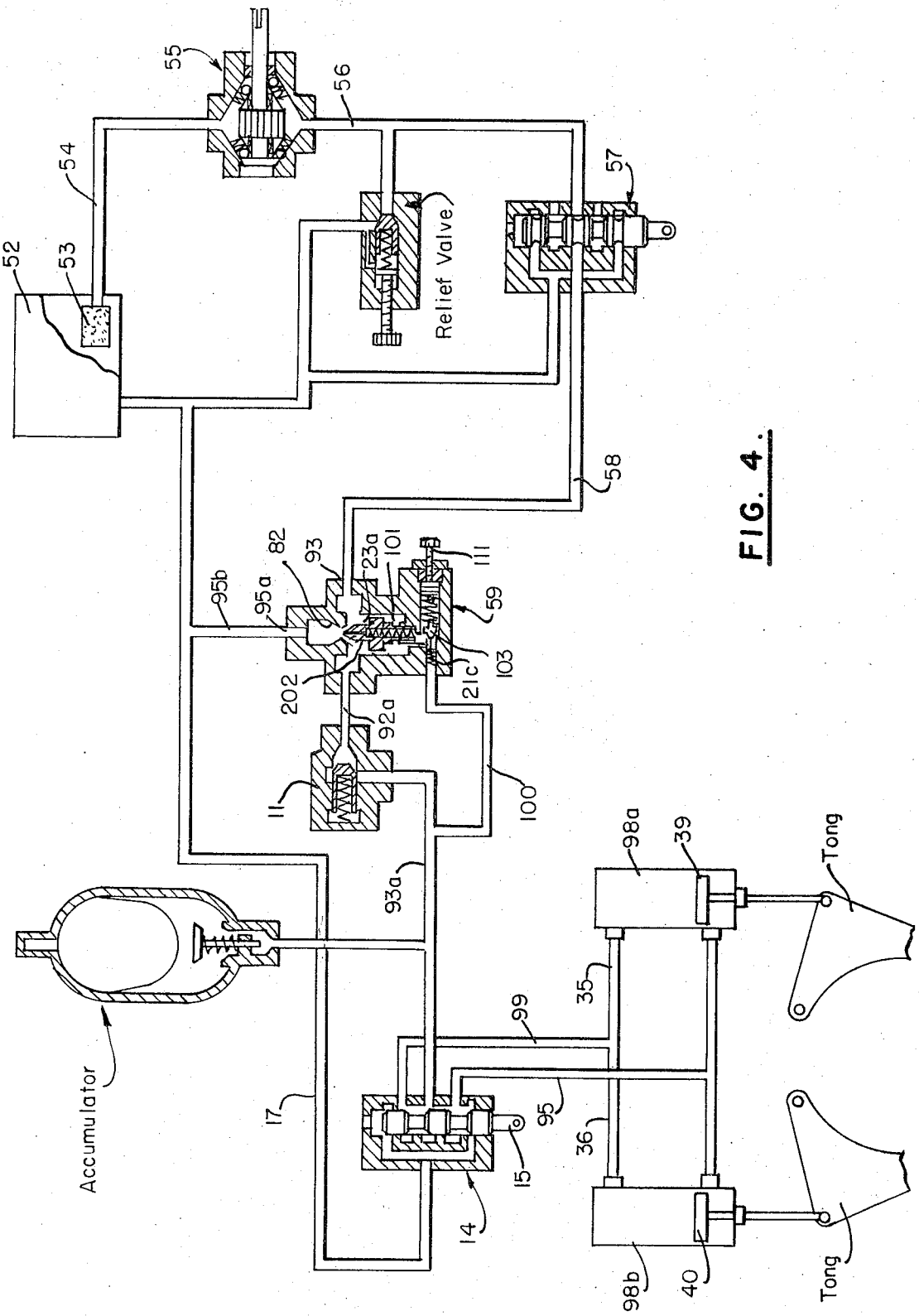

55
56
54
57
52
53
Relief Valve
58
82
93
23a
101
111
95b
95a
59
103
202
21c
92a
11
100
98a
39
Tong
93a
35
99
Accumulator
17
95
36
15
14
98b
40
Tong

FIG. 4.

FIG. 5.

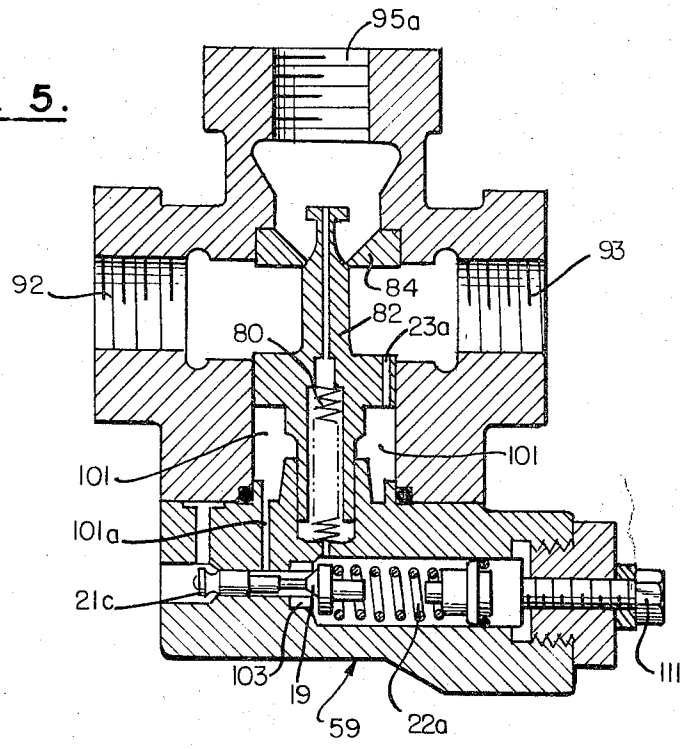
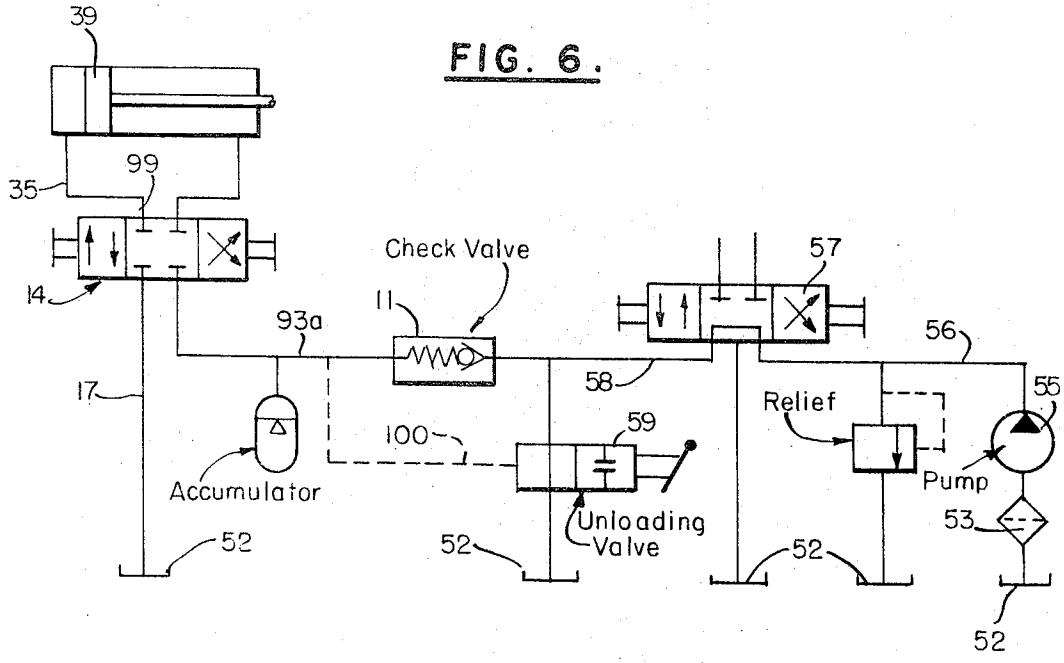

95a
92
93
84
82
23a
80
101
101
101a
21c
103
19
59
22a
111

FIG. 6.


39
99
35
14
Check Valve
11
93a
57
56
58
55
17
Relief
100
59
Accumulator
Pump
53
Unloading Valve
52
52
52
52

LOG GRAPPLE DEVICE

BACKGROUND

Most of the log grapples in use in the logging industry today are mounted on a boom located at the back end of a skidder, half-track or tractor. Hydraulic circuitry and hydraulic controls permit the operator to raise and lower the grapple, rotate the grapple about its axis of mounting, and to actuate the tongs of the grapple between "hold" and "release" positions.

A problem with many log grapples is that although they may initially pick up several logs without difficulty, once the operator begins to drag the logs through a forest, the tongs of the grapple may lose their grip on the logs for one reason or another. For instance, if the logs are wet they may easily slip with respect to each other. The mere weight of the logs and the fact that they are being dragged over very uneven ground nearly always is enough to cause shifting of the logs within the grapple.

Since logs can easily shift enough in the grapple to become loose and fall out, grapple operators have usually tried to avoid loss of logs by continuously applying hydraulic pressure to the tongs of the grapple. Whereas this technique does serve to cause the tongs of the grapple to take up any slack caused by shifting of the logs, it has the disadvantage that the pump in the circuit has to be continuously pumping oil through the system, which leads to overheating of the oil, undue wear of the pump, etc.

THE PRESENT INVENTION

The present invention relates to a log grapple having tongs that are actuated by at least one hydraulic cylinder, said at least one hydraulic cylinder being included in a hydraulic circuit that is designed so that the tongs can grasp a group of logs at an initial holding pressure and thereafter automatically maintain the initial holding pressure regardless of any change in the relative positional relationship of the logs within the tongs and regardless of any forces which are applied to the logs in the course of their being moved from one location to another. Basically my hydraulic circuit senses a drop in pressure of the grapple cylinder circuit and automatically restores the desired holding pressure to the grapple cylinder.

My disclosed hydraulic circuit arrangement can be used in its extirety by manufacturers of log grapples, or existing log grapple circuits may be modified so that the resulting circuit conforms with my invention.

My invention will be better understood by referring to the following description taken in conjunction with the attached drawings wherein:

FIG. **1** shows a log grapple with cylinder actuated tongs;

FIG. **2** is a sketch illustrating one embodiment of my invention;

FIGS. **3** and **4** are sketches illustrating a second embodiment of my invention;

FIG. **5** is an enlarged view of the unloader valve **59** used in FIGS. **3** and **4** when the pump is in its "loaded" condition;

FIG. **6** is a simplified hydraulic diagram of an embodiment of my invention using a single tong cylinder.

FIG. **1** illustrates a log grapple containing tongs that are moved relative to each other by hydraulic cylinders.

FIG. **2** illustrates one embodiment of my invention. Here it will be seen that a pump withdraws oil from a tank of hydraulic oil through line **20** and out through line **21.** The fluid then passes through line **22** to point X, where it has the possibility of flowing through line **31** or line **32.** Whether the oil will flow through line **31** or line **32** primarily depends upon the pressure of the oil in the system and the position of the tongs. For instance, if the tongs are initially in the "open" position (as shown) and it is desired to close the tongs, the pump will force the hydraulic fluid through line **32,** through the check valve, through lines **33** and **23,** through closed center valve F, and then through lines **34, 35** and **36** so as to apply pressure against pistons **39** and **40.** Such applied pressure will cause the piston rods to move downwardly so as to "close" or bring together the tongs around a group of logs. In order to insure that the fluid will flow in this manner the unloaded valve B is maintained in a "closed" position so that there will not be any flow through line **31.** Unloader valve B is preferably a two-way unloader valve. Pressure switch C is designed so that its contacts C_1 and C_2 will remain in the "open" position (as shown) during the time that the fluid pressure is moving pistons **39** and **40** toward their downward or "closing" position.

When the fluid pressure has closed the tongs around a group of logs so that the tongs are holding the logs with the desired pressure, it is not desirable for the pump to have to continue to pump fluid thru line **21,** and then through the main relief valve and back to the tank through line **41** because this can lead to overheating of the oil and undue wear upon the pump. With my arrangement, when the pressure in the system builds up by virtue of the tongs having exerted their optimum holding pressure on a group of logs, the back pressure developed through lines **35, 36, 34** and **23** will be sensed through pilot line **42** and the piston **43** of the pressure switch is designed to move to the right under such build up pressure. As the piston **43** moves to the right it will close contacts C_1 and C_2, thus energizing the solenoid B_s and opening the unloader valve B. With unloader valve open the fluid flow from the pump will be through lines **21, 22** and **31** (rather than to line **32**).

Now, should the logs shift in the tongs with the result that the pistons **39** and **40** are able to move, then the pressure within the lines **35** and **36** will drop and in turn the pressure in lines **34, 23, 33** and **42** will likewise drop. The drop in pressure in pilot line **42** will cause the force of tension spring **44** to move the piston **43** to the left, which opens contacts C_1 and C_2. The opening of C_1 and C_2 and deenergizes solenoid B_s, which in turn closes the unloader valve B so that there will no longer be any flow through line **31.** The fluid from the pump will then resume its flow through lines **32, 33, 23, 34, 35** and **36** until the pressure in the system again builds up to the point where the piston **43** will be moved to the right closing contacts C_1 and C_2.

FIGS. **3, 4** and **5** illustrate another embodiment of my invention. In FIG. **3** the tongs are shown in the "open" or "retract" position. Oil is drawn from a reservoir **52** (after passing through filter **53**) via line **54** by means of a pump **55** and pumped into line **56** until it reaches open center control valve **57.** With open center valve

57 in the position shown the fluid will flow through the line 58 to the inlet 93 of unloading valve 59. The unloader valve 59 is closed by virtue of the fact that spring 80 is exerting sufficient upward pressure against valve stem 82 that it abuts against seat 84, whereby fluid entering through inlet 93 flows around the valve stem 82 and then flows outwardly through outlet 92 and line 92a. A check valve 11 is interposed in the line 92a - 92a so as to restrict flow to the right-to-left direction. The fluid passing through line 93a flows into the closed center valve 14, and (with the spool 15 in the position shown) out through line 95 and thence to the rod ends of the tong cylinders. This causes the pistons 39 and 40 to move upwardly, which is the "retract" postion of the tongs of the grapple. There is an exit flow of hydraulic fluid through lines 35, 36, and 99, then through valve 14, through line 17 and back to the oil reservoir 52.

Now when the operator wishes to activate the tongs so that they will grasp a group of logs he merely moves the spool 15 so that the fluid flow coming through line 93*a* will pass through valve 14 and into line 99 (rather than into line 95). The fluid going from line 99 to lines 35 and 36 will then push the pistons 39 and 40 down so that the tongs will come toward each other, which achieves the "grasp" or "hold" position of the tongs. The fluid below the pistons 39 and 40 will be forced out line 95, through valve 14, through line 17 and back to the oil reservoir 52.

As noted previously, when the fluid pressure has closed the tongs around a group of logs so that the tongs are holding the logs with the desired pressure, it is not desirable for the pump to have to continue to pump fluid thru the relief valve because this can lead to overheating of the oil, undue wear on the pump, and other problems. With my arrangement (see FIG. 4) when the pressure in the system builds up by virtue of the tongs having exerted their optimum holding pressure on a group of logs, the back pressure developed through lines 35, 36, 99 and 93*a* will be sensed through pilot line 100 and the back pressure developed in line 100 will press against pilot piston 21c and move it to the right against the spring 22*a* (see also FIG. 5). When member 21*c* is moved to the right (from the position shown) it will move valve 19 away from valve seat 103, which will permit fluid to flow from inlet 93, down through passageway 23*a* into chamber 101, down through passageway 101*a*, past valve seat 103, upwardly through the interior of valve stem 82 and out through outlet 95*a* and line 95*b* and back to the tank 52. When this happens there will be a pressure drop across valve stem 82 by virtue of fluid flow downwardly through the passageway 23*a*, this pressure drop allowing the valve stem 82 to move downwardly against the force of the spring 80, and as valve stem 82 moves downwardly fluid flow coming in through inlet 93 will be diverted past valve seat 84, outlet 95*a*, out line 95*b*, and then to tank 52 at nearly zero pressure. This "unloads" the pump. The diversion of flow will continue so long as there is no change in the pressure in chambers 98*a* and 98*b*.

However, should the pressure in 98*a* or 98*b* drop, as for instance because of a shifting of the log within the grasp of the tongs, the pressure of the fluid in pilot line 100 would also be reduced, causing piston member 21c to return toward the left, reseating valve 19 on seat 103, thus terminating flow downwardly through passageway 23*a*, which in turn causes spring 80 to close the valve 82 open valve seat 84. Fluid will come again pass through line 93*a*, through valve 14, through line 99 and then to chambers 98*a* and 98*b*, as discussed previously, and this flow will continue until enough pressure has built up behind the pistons 39 and 40 so that they will exert the desired log holding pressure. Once the desired pressure is once again achieved, then the sequence of "pump unloading" operations set forth above (relative to diverting the pump flow past valve seat 84 and into line 95*b*) will start.

The point at which the pump will be unloaded can be controlled by adjusting the force which the spring 22*a* exerts upon valve 19, for instance by means of a threaded bolt 111.

FIG. 4 shows the position that the closed center valve 14 will be in when the tongs are to be actuated to the closed position, and it will remain in this position after the operator has clamped the tongs around a group of logs. The accumulator makes up for seepage, takes care of pressure surges, etc. For instance, when the grapple operator is dragging a bunch of logs thru the woods, one thing that can happen is that the logs will twist in such a way that a force will be exerted against piston 39 or 40. When this happens the pistons will move to compress the fluid in the cylinder, which will increase its pressure. This increased pressure will be transmitted backwardly through the closed center valve and then into the accumulator where the increased pressure of the fluid will cause the gas in the accumulator to be compressed. The accumulator therefore acts as a cushion against encountering such conditions which might otherwise result in the breakage of lines or valves.

FIG. 6 is a hydraulic flow diagram for the case where only a single tong cylinder would be used and which would otherwise be substantially identical to the arrangement of FIGS. 3, 4 and 5 (and therefore the same numerals have been used) except that a tandem center valve has replaced the open center valve (57).

The closed center valve 14 in FIGS. 3 and 4 may be a single closed center valve or a plurality of closed center valves, each closed center valve being connected to a different hydraulic cylinder. All of the closed center valves could operate at the same time, or each could operate separately or several could operate at the same time. Closed center valves are in parallel.

Whereas FIGS. 3 and 4 show the use of an open center valve 57, I have found that a tandem center valve will serve just as well, and in some cases better.

It is thus seen that I have provided a log grapple that will grasp logs and hold them tightly under all conditions.

A few of the advantages of my log grapple are as follows:

1. A constant holding pressure on the logs that will allow the tongs to tighten automatically around shifting logs and prevent slippage of wet or slick logs.

2. Longer hydraulic pump life due to automatic cycling of the pressure rather than constant loading of the pump by the operator to hold the tongs tight.

3. Ease of operation for the operator because of automatic monitoring and restoration of the holding pressure.

4. Safer log grapple operation between the grapple operator does not have to be looking back to monitor the condition of the logs in the grapple.

In accordance with my invention the main relief valve should always be set to "unload" at a pressure which is above the "unloading" pressure of my unloader valves (B or **59**) and this can be easily arranged (e.g., by adjustment of the spring **22***a*). If this is not done then when the pressure builds up in the system the oil will go back to the tank through the main relief valve in preference to going through my unloader valves, which would cause an undesired amount of heat.

What I claim is:

1. A log grapple mounted on a vehicle, said log grapple comprising two tongs that are mounted on said vehicle so as to be movable toward and away from each other, at least one hydraulic cylinder for moving said tongs toward and away from each other, a hydraulic circuit including a hydraulic pump for supplying hydraulic power to said at least one hydraulic cylinder,

said hydraulic circuit including:

a. unloader valve means for unloading the hydraulic pump after the tongs have initially obtained a firm grip on a group of logs,

b. means for thereafter sensing any pressure drop in said at least one cylinder that may be due to a slippage or shifting of the logs within the grasp of the grapple,

c. means for automatically and substantially instantaneously restoring the pressure in said at least one hydraulic cylinder to the pressure which existed in said at least one hydraulic cylinder at the time that it attained its initial firm grip on said group of logs.

2. A log grapple device according to claim **1** wherein said pressure restoring means include a closer center valve in combination with an unloader valve.

* * * * *