

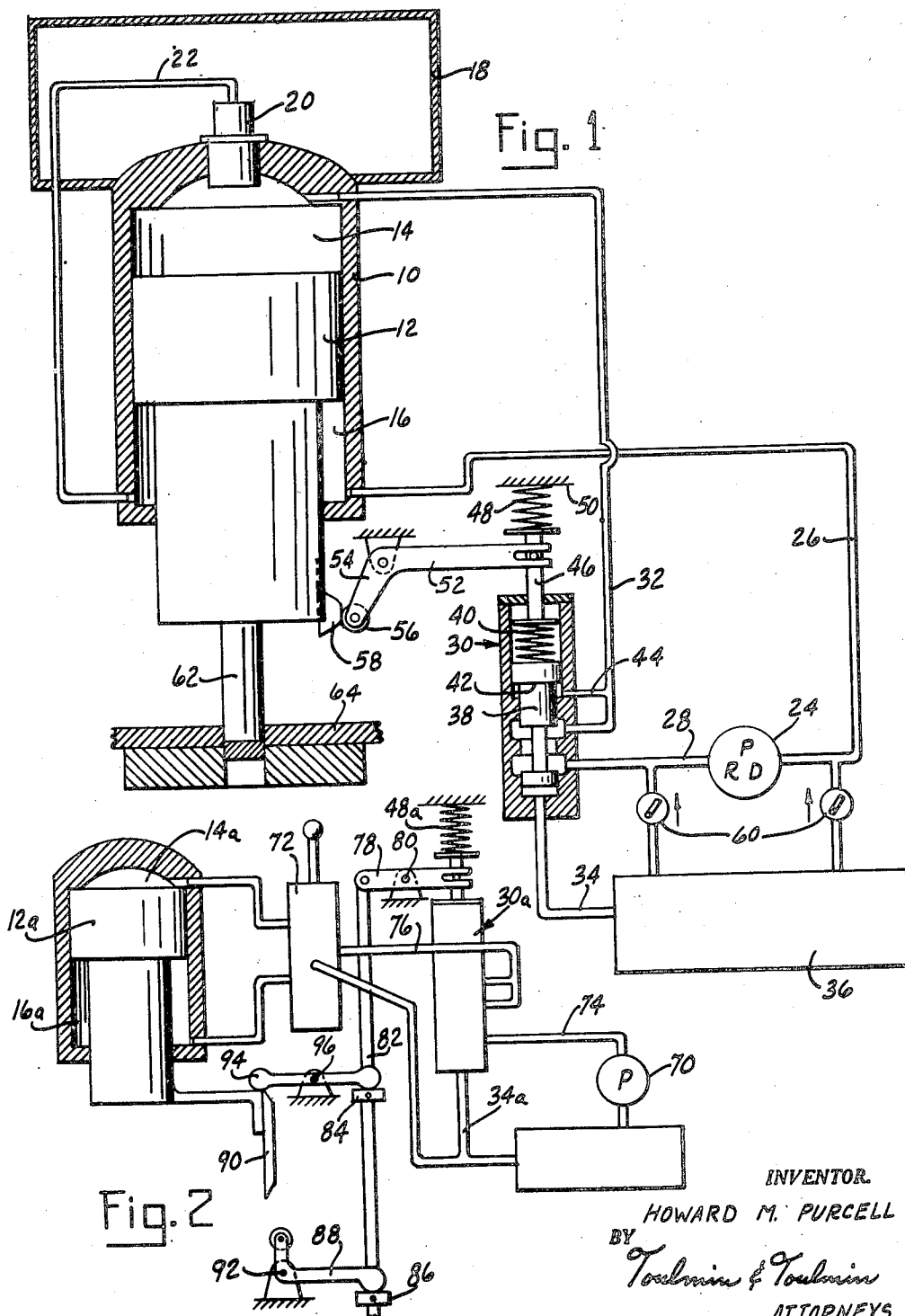
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SLOW DOWN FOR PRESSES

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SLOWDOWN FOR PRESSES

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This invention relates to hydraulic circuits, and particularly to a circuit for a reciprocable ram.

In many work cycles involving the use of a hydraulic press or a moving table or tool driven by a hydraulic ram, there is a tendency for the ram to jump ahead and overshoot when the load thereon is suddenly released. This occurs when a punch breaks through a work piece which is blanking out or when a cutting tool runs off the end or through the work piece which it is operating on.

The particular object of this invention is to provide a simple means for preventing a fluid operable ram from jumping ahead when the load thereon is suddenly released.

Still another object of this invention is to provide an actuating circuit for a hydraulic ram in which the ram can be slowed down at any point in the cycle.

Still another object is to provide an actuating circuit for a hydraulic ram which includes the feature of slowing down the travel of the ram at any point in its cycle and which accomplishes this by the use of a relatively simple mechanism.

It is also an object of this invention to provide an actuating circuit for a reciprocable ram wherein a single valve is operable to slow down the movement of the ram in both its advancing and retracting directions.

Another object of this invention is to provide a slow down for a fluid operated ram which may be moved to operate very rapidly whereby the slow down mechanism may be employed for preventing the ram from jumping ahead when it breaks through the work being operated.

These and other objects and advantages will become more apparent upon reference to the following description taken in connection with the accompanying drawing in which:

Figure 1 is a diagrammatic view of a hydraulic press actuating circuit including a slow down arrangement according to this invention; and

Figure 2 is a diagrammatic view showing this invention applied to a press operating circuit in another manner.

General arrangement

According to this invention, a reciprocating ram is supplied with pressure fluid from a source such as a pump. The delivery of the source is selectively directed to one side or the other of the ram whereby it is reciprocated in working and retracting movements. Connected between the source and the advancing side of the said ram according to the preferred embodiment of this

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invention there is a valve which normally provides free communication between the said source and said advancing means.

The aforementioned valve is biased toward position to connect the advancing means with the source by a spring and a fluid operable means is associated with the valve for opposing the action of the spring. This fluid operable means is connected with the advancing means of the ram and in response to a predetermined pressure therein interrupts communication between the source and the advancing means and instead connects the source with exhaust. This slows the ram down and prevents it from jumping ahead at the point of breaking through the work being done.

According to another modification, the aforementioned valve is arranged between the fluid source and the reversing valve which distributes the fluid to the reciprocating ram. The slow down valve is then connected by a linkage with the ram to be operated thereby in both directions of movement of the ram. This provides for a slow down on both the advancing and retracting strokes of the press ram and also may be utilized as a means for bringing the ram to a halt at the end of its retracting movement.

Structural arrangement

Referring to the drawing, there is shown a press cylinder at 10 in which there is reciprocably mounted a press ram 12 which forms with the said cylinder the ram advancing means 14 and the ram retracting means 16. Mounted on top of the cylinder 10 there is a reservoir 18 and carried in the upper end of the cylinder is a surge valve 20. The surge valve is adapted to provide free communication between the reservoir 18 and the advancing means 14 in response to a predetermined suction in the said advancing means, or to a predetermined pressure conveyed to the pilot cylinder of the valve 20 by the conduit 22 which leads to the retracting means 16.

For supplying fluid to the advancing and retracting means of the ram 12 there is a pump 24 which is preferably reversible in delivery. One port of the pump 24 is connected by a conduit 26 with the retracting means 16, while the other port of the pump 24 is connected by a conduit 28 with one port of a valve 30. Another port of the valve 30 is connected by a conduit 32 with the advancing means 14 of the ram 12.

The aforementioned valve 30 also includes an exhaust port which is connected by the conduit 34 with the reservoir 36. Within the valve 30

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there is a valve member 38 which is normally urged by a spring 40 into position to close off the exhaust port of the valve and instead to interconnect the conduits 28 and 32. The valve member 38 is adapted for moving upwardly in the valve 30 to interrupt communication between the conduits 28 and 32 and to connect the conduits 28 and 34. Upward movements of the valve member are accomplished by the area 42 thereon which is connected by a conduit 44 to receive pressure fluid from the conduit 32.

The spring 40 is abutted at its end opposite the valve member 38 by the end of a plunger 46 which, in turn, engages the lower end of a spring 48 which is suitably anchored as by the stationary abutment at 50.

The plunger 46 is engaged by a pivoted lever 52 which includes an arm 54 carrying a roller 56. The ram 12 has a cam 58 positioned to engage the roller 56 during the advancing movement of the said ram whereby the lever 52 is rotated counterclockwise. As will become apparent hereinafter, this slows down the travel of the ram 12.

For supplying makeup fluid to the pump 24 in either direction of delivery thereof there may be provided the check valves 60 which open from the reservoir 36 toward the respective ports of the said pump.

Operation

In operation, a working stroke of the ram 12 is commenced by directing the delivery of the pump 24 to the advancing means 14. During the major part of the stroke of the ram 12, the pump delivers to the said advancing means at full pressure. This pressure fluid is conducted through the valve 30 but the pressure thereof is insufficient to lift the valve member 38 against the thrust of the spring 48.

After the ram has advanced into the work as, for example, when the punch 62 has reached a point where it has substantially broken through the workpiece 64, the cam 58 engages the roller 56 and rotates the lever 52 counterclockwise. This moves the plunger 46 upwardly thereby completely counteracting the thrust of the spring 48 and substantially reducing the thrust of the spring 40. The reduction in thrust of the spring 40 permits the pressure standing on the area 42 to raise the valve member 38 thereby to interconnect the conduit 28 with the exhaust conduit 34. This diverts at least a portion of the pump delivery to exhaust and reduces the supply of fluid to the ram advancing means 14. The ram 12 therefore slows down and does not jump ahead upon finally breaking through the workpiece 64.

It will be apparent that the cam 58 could be so formed that the ram 12 would come to a complete halt if desired. This could be accomplished by substantially nullifying the effects of both of the springs 40 and 48.

It will also be apparent that this arrangement could be employed for slowing down the press ram immediately before it engaged the work or for any other purpose desired.

Embodiment of Figure 2

In Figure 2 the arrangement of this invention is illustrated in a circuit wherein the valve is operated by the ram in both directions of movement thereof. The parts in Figure 2 which are similar to those in Figure 1 are correspondingly numbered with the addition of a subscript *a*.

In Figure 2 the valve 30_a is positioned between the pump 70 which is a one way delivery pump

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and the reversing valve 72 which selectively directs fluid to the advancing means 14_a of the ram 12_a, or to the retracting means 16_a thereof. A conduit 74 connects the discharge side of the pump 70 with the inlet of the valve 30_a while a conduit 76 connects the outlet of the said valve with the inlet of the reversing valve 72.

The valve 30_a is similarly provided with a spring inside the valve casing and the spring 48_a outside the valve casing and between which there extends a lever 78 whose function is the same as that of the lever 52 in Figure 1.

The lever 78 is pivoted at 80 and the end opposite its engagement with the springs of the valve 30_a is connected with a rod 82 which has thereon the collars 84 and 86. It will be apparent that downward movement of the rod 82 will operate in exactly the same manner as the lever 52 in Figure 1 and bring about bypassing of the pump delivery to exhaust at a reduced pressure.

For so moving the rod 82 there is a lever 88 positioned to be engaged by the cam 90 carried by the ram 12_a so that during the advancing stroke of the said ram the lever 88 will be rotated clockwise about its pivot 92 and thus move the rod 82 downwardly and cause bypassing of at least a part of the delivery of the pump 70. Similarly there is a lever 94 pivoted at 96 and having one end positioned to be engaged by an arm carried by the ram 12_a during its retracting movement, and having its other end positioned to engage the collar 84. It will be apparent that the lever 94 will rotate in a clockwise direction during the retracting movement of the ram 12_a and move the rod 82 downwardly thereby to counteract the effect of the springs on the valve 30_a and bring about the bypassing to exhaust of substantially the entire discharge of the pump 70.

The arrangement in Figure 2 thus provides for a controlled slowdown of the ram 12_a during its advancing stroke and a halting thereof during its retracting stroke and accomplishes this through the medium of one and same valve mechanism and actuating linkage therefor.

It will be seen from the foregoing descriptions of the modifications of this invention shown in Figures 1 and 2 that a relatively and effective circuit arrangement has been devised for selectively slowing down a ram at any point in either its advancing or retracting directions of movement, and may be employed for bringing the ram to a complete halt. The arrangement is simple and inexpensive and is positive in action at all times. Furthermore, the foregoing selective control of the movement of the press ram may be had without the use of an expensive variable delivery pump. Instead, either a simple reversible delivery pump or a one way pump with a reversing valve may be employed. In either case all of the desirable control features usually found in connection with pumps of infinitely variable delivery may be had by the inclusion in the circuit of the valve and operating mechanism therefor of this invention.

It will be understood that this invention is susceptible to modification in order to adopt it to different usages and conditions and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. In a hydraulic system; a reciprocable ram having advancing and retracting means; a source of pressure fluid for selectively supplying said means; a valve having a first port connected with

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said source, a second port connected with said advancing means, and a third port connected with exhaust; a valve member in said valve movable into a first position to interconnect said first and second ports, and into a second position to interconnect said first and third ports; yielding means continuously urging said valve member toward its first position; fluid-pressure-responsive means on said valve member connected with said second port for moving said valve member to its second position; and means operated by said ram during the advancing movement thereof for at least partially counteracting said yielding means.

2. In a hydraulic system; a reciprocable ram having advancing and retracting means; a source of pressure fluid for selectively supplying said means; a valve normally connecting said source with said advancing means and also having an exhaust port; a valve member in said valve movable to connect said source with said exhaust port; yielding means continuously urging said valve member toward its normal position; a fluid-pressure-responsive area on said valve member connected with the ram side of said valve for moving said valve member toward its second mentioned position; and means operable during the advancing movement of said ram for at least partially counteracting the effect of said yielding means whereby said valve member moves toward said second mentioned position and brings about the bypassing of at least part of the delivery of said source.

3. In a hydraulic system; a reciprocable ram having advancing and retracting means; a source of pressure fluid for selectively supplying said means; a valve having a first port connected with said source, a second port connected with said advancing means and a third port connected with exhaust; a valve member in said valve movable into a first position to interconnect said first and second ports, and into a second position to interconnect said first and third ports; yielding means continuously urging said valve member toward its first position; fluid operable means adapted for moving said valve member toward its second position and connected with said advancing means; cam means carried by said ram; and a lever system positioned to vary the thrust of said yielding means on said valve member and operable by said cam during the advancing movement of said ram to reduce the said thrust.

4. In a hydraulic system; a reciprocable ram having advancing and retracting means; a pump for selectively supplying said means; a valve having a first port connected with said pump, a second port connected with said advancing means, and a third port connected with exhaust; a valve member in said valve movable into a first position to interconnect said first and second ports, and into a second position to interconnect said first and third ports; a pair of serially arranged springs biasing said member toward its first position; fluid operable means connected with said advancing means for urging said member toward its second position; a lever having one end between said springs; and cam means carried by said ram and operable during the advancing movement thereof to actuate said lever for reducing the thrust of said spring means on said valve member whereby said valve member moves toward its second position at a reduced pressure and operates to slow down said ram.

5. In a hydraulic system; a reciprocable ram; a pump for supplying actuating fluid to said ram;

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a valve connected between said ram and pump and having an exhaust port; a valve member in said valve movable to a first position connecting said pump with said ram and closing said exhaust port and a second position connecting said pump with said exhaust port; yielding means continuously biasing said valve member toward its first position; fluid operable means connected to receive pressure fluid from the ram side of said valve for moving said valve member toward its second position; and means operated in both directions of movement of said ram and by said ram, for decreasing the bias of said yielding means on said valve member.

6. In a hydraulic circuit; a reciprocable ram; a pump for supplying fluid to said ram; a reversing valve between said ram and pump; a valve between said pump and reversing valve and having a port to exhaust; a valve member in said valve movable into a first position to close said exhaust port and into a second position to connect said exhaust port with said pump; yielding means continuously urging said valve member toward its first position; fluid pressure responsive means connected to receive pressure fluid from the reversing valve side of said last-named valve for moving said valve member from its first position toward its second position; and means operated by said ram in both directions of movement thereof for decreasing the force exerted upon said valve member by said yielding means.

7. In a hydraulic system; a ram; a pump; a reversing valve connecting said pump with said ram; a control valve connected between said pump and reversing valve and having an exhaust port; a valve member in said control valve having a first position wherein said exhaust port is closed and a second position wherein said pump is connected with said exhaust port; yielding means continuously urging said valve member toward its first position; fluid operable means connected with the inlet of said reversing valve for moving said valve member toward its second position; and means operable by said ram in both directions of movement thereof for at least partially counteracting the thrust of said yielding means on said valve member for bypassing said pump to exhaust at a predetermined pressure.

8. In a hydraulic system; a ram; a pump; a reversing valve connecting said pump with said ram; a control valve between said pump and reversing valve and having an exhaust port; a valve member in said control valve movable into a first position to close said exhaust port and into a second position to connect said pump with said exhaust port; serially arranged springs biasing said valve member toward its first position; fluid operable means connected with the inlet of said reversing valve for moving said valve member toward its second position; means operated by said ram during its movement in one direction for reducing the bias of said springs on said valve member for slowing down the said ram; and means operated by said ram in the other direction of movement for reducing the bias of said springs on said valve member for bringing said ram to a complete halt.

9. In a hydraulic system; a ram; a pump; a reversing valve connecting said pump with said ram; a control valve between said pump and reversing valve and having an exhaust port; a valve member in said control valve having a first position wherein said exhaust port is closed and a second position wherein said exhaust port is con-

nected with said pump; serially arranged spring means biasing said valve member toward its first position; fluid operable means connected with the inlet of said reversing valve for urging said valve member toward its second position; a lever having its end positioned between said spring means; and cam means carried by said ram and operable in one direction of movement thereof for actuating said lever to partially counteract said spring means whereby a portion of the delivery of said pump is bypassed to exhaust and said ram slows down, and operable in the other direction of movement of said ram for substantially completely counteracting said spring means whereby substantially the entire delivery of said pump is bypassed to exhaust and said ram comes to a halt.

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