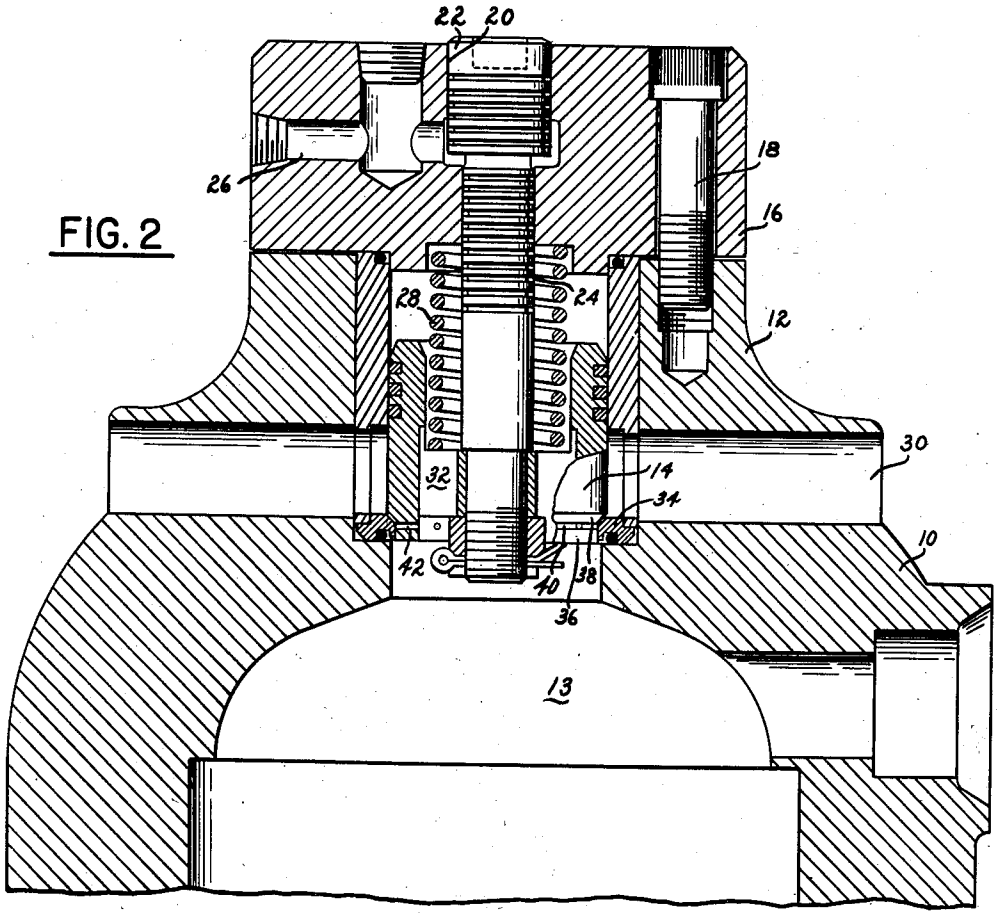
Jan. 1, 1952 H. M. PURCELL 2,581,290

SURGE VALVE

Filed July 8, 1947

FIG. 2



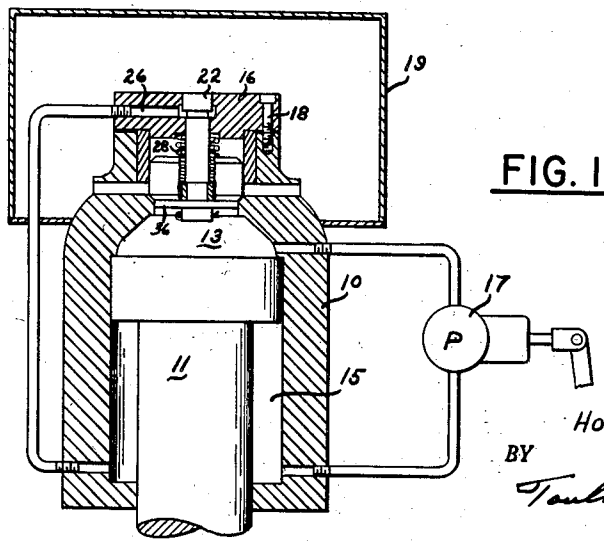


FIG. 1

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SURGE VALVE

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2 Claims. (Cl. 121—38)

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This invention relates to surge valves for use in hydraulic press actuating circuits and the like, and is particularly concerned with a poppet type surge valve.

In hydraulic presses it is customary to have a large main area on a ram and a smaller retracting area. This is due to the fact that the ram generally works in only its advancing direction and it is desired to have a large working area to develop high thrusts and a small retracting area in order to develop high retracting speeds. The differential resulting between the areas requires a surge valve for pre-filling and for exhausting the main area when a reversible pump is employed for powering the press.

During the working stroke of the press ram high pressures are developed on the advancing area thereof and when the press is reversed this pressure must be dissipated at a more or less gradual rate in order to prevent shock, vibration and noise. This is usually accomplished by an independent and special valve means connected in the press system.

A preferred type of surge valve to employ is a poppet type valve in which the valve member is urged in its opening direction by pressure standing on the advancing area of the press ram. A valve of this type will open wide and quickly and permit relatively free flow of fluid to and from the advancing area.

Also, a valve of this type has an advantage over a surge valve which opens against the pressure on the main area because it may be moved towards its open position with a much smaller force. However, poppet type surge valves have a tendency to relieve the pressure on the main area of the press ram so rapidly that shock, vibration and noise result. This is commonly overcome by damping the action of the valve member of the surge valve in a suitable manner so that it opens at a slow rate of speed and thus gives time for the excessive pressure on the advancing area to bleed off to a value where the aforementioned shock and vibration are greatly reduced or even entirely eliminated. This treatment of the problem results in slowing down the opening of the surge valve to such an extent that in many cases it is undesirable. In presses operating on a very fast cycle the loss of production over a period of time is appreciable.

The present invention is concerned with an improvement in a poppet type surge valve such that the shock and vibration referred to above are eliminated but in which the surge valve opens in the shortest possible time thereby creating no

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unnecessary delay in the operating cycle of the press.

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

Figure 1 is a diagrammatic view of a press operating circuit adapted for employing the surge valve of this invention; and

Figure 2 is an enlarged view through the surge valve showing more in detail the construction thereof.

Referring to the drawings, there is a press cylinder 10 within which is reciprocably mounted a press ram 11 which forms with the said cylinder the ram advancing area 13 and the ram retracting area 15.

Connected between the said advancing and retracting areas is a pump 17 which is preferably reversible in operation for selectively supplying the said areas with pressure fluid.

As will be best seen in Figure 2, the press cylinder 10 is extended as at 12 to provide a housing for the surge valve member 14. A closure cap 16 is bolted to the upper end of the cylinder by the bolts 18 and has a shouldered bore 20 therethrough into which extends the valve member actuating piston 22 and piston rod 24, the latter being secured to the valve member 14.

Retraction pressure is admitted to beneath the piston 22 by a passage 26 which is connected by a conduit with the ram retracting area 15, and a spring 28 normally holds the valve member closed until pressure beneath the piston reaches a predetermined amount.

The reservoir 19 is communicated with the bore in the cylinder 10 through the transverse passages 30 which open beneath the surge valve when the latter raises from its seat. The space above the valve member is communicated with the main advancing area of the cylinder through a plurality of circumferentially spaced bores 32 passing through the said valve member. The larger upper area of the valve member 14 maintains the surge valve closed until there is a predetermined pressure established under the piston 22.

A seat ring 34 is mounted on the bottom of the bore in the upper end of the cylinder 10 and is arranged to receive the lower end of the valve member 14. This lower end of the valve member 14 includes a cylindrical projection 36 at the upper edge of which, and beneath the chamfered edge 38 of the valve member, there is a groove 40. The groove 40 is communicated

with the main cylinder cavity by a plurality of drilled holes 42.

In operation, when the press is reversed at the end of a working stroke and the delivery of the pump is initially directed to the retracting area, the surge valve member commences to move upwardly and the groove 40 opens into the bores 38. This immediately establishes a restricted passage to exhaust for the pressure fluid in the advancing area of the cylinder 10 with a continued build-up in pressure within the retracting area of the cylinder, the valve member continues to move upwardly far enough to withdraw the cylindrical skirt 36 from the ring 34 and free comunication between the reservoir and the main cylinder is established. At this time the retracting speed of the ram increases and substantially no time is lost during the retracting stroke.

In the advancing stroke of the ram, it is necessary to prefill the advancing area due to the differential in areas between the advancing and retracting sides of the ram. Such prefilling is accomplished by movement of the valve member 14 to an unseated position. Such movement takes place due to the pressure within the retracting area of the ram caused by the weight of the ram 11 when the latter occupies an upward position within the cylinder 10. Generally, there is a back pressure within the retracting area of approximately 50 pounds per square inch when the ram is conditioned for advancing movement, and this pressure is transferred to the valve-actuating piston 22 to move the same upwardly and to unseat the valve member 14, thus providing for full communication between the reservoir and the advancing area of the ram. As the ram continues to advance and eventually engages the work, or when resistance is encountered, the back pressure within the retracting area 15, and consequently the pressure acting on the piston 22, disappears, permitting the valve member 14 to close under action of the spring 28. Closing movement of the valve member 14 thus disconnects the advancing area from the reservoir and permits a high pressure build-up within the advancing area for the continuation of the working stroke of the ram.

By this invention shock at the time of reversal is eliminated in the hydraulic system by giving a controlled bleed off of the main cylinder pressure for a short time before the surge valve fully opens. This eliminates auxiliary choke and check valves and does not interfere with the speed of opening the surge valve after the aforementioned bleed off of pressure is accomplished.

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. A combination surge and prefill valve for a hydraulic ram having a ram-advancing pressure area, a ram-retracting pressure area, and means to introduce fluid under pressure to either of said areas, comprising means defining a vertically arranged valve chamber communicating at one end with the ram-advancing area and an exhaust port intersecting the valve chamber intermediate the ends thereof; a valve member movable in said chamber between positions opening and closing communication between the ram-advancing area and said exhaust port, said valve member having a passage extending longitudinally therethrough and being formed with a plurality of restricted radially disposed orifices extending from said passage to the outer surface of said valve member and arranged a distance inwardly from one end of said valve member, said restricted orifices being arranged to provide restricted communication between the ram-advancing area and said exhaust port upon initial movement of said valve member toward its open position and prior to movement of said valve member to a position providing for unrestricted communication between the ram-advancing area and said exhaust port; spring means engaging said valve member and resiliently urging the same to a closed position; and fluid-pressure-responsive means connected with said valve member and responsive to the pressure of fluids within the ram-retracting area for moving said valve member to an open position in opposition to said spring means.

2. A combination surge and prefill valve for hydraulic rams having a ram-advancing pressure area, a ram-retracting pressure area, and means to introduce fluid under pressure to either of said areas, comprising a valve chamber freely communicating at one end with the ram-advancing area; an annular valve seat arranged intermediate the ends of said chamber; exhaust passage means intersecting said chamber intermediate the ends thereof and above said valve seat; a valve member movable within said chamber into and out of engagement with said valve seat and between positions providing for open or closed communication between the ram-advancing area and said exhaust passage means, said valve member being formed at one end with a reduced diameter skirt arranged to telescope within said valve seat and a longitudinal passage extending through said valve member; restricted channel means extending radially through the skirt of said valve member for establishing restricted communication between the ram-advancing area and said exhaust passage means upon initial opening movement of said valve member; spring means engaging said valve member and urging the latter into seating engagement with said valve seat; and a fluid-pressure-responsive plunger connected with said valve member and communicating with the ram-retracting area, and operable, in response to fluid pressure within the ram-retracting area, for moving said valve member out of engagement with said valve seat.

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