June 5, 1928. 1,672,561

W. ERNST

HIGH SPEED HYDRAULIC PRESS

Filed Sept. 29, 1926 2 Sheets-Sheet 1

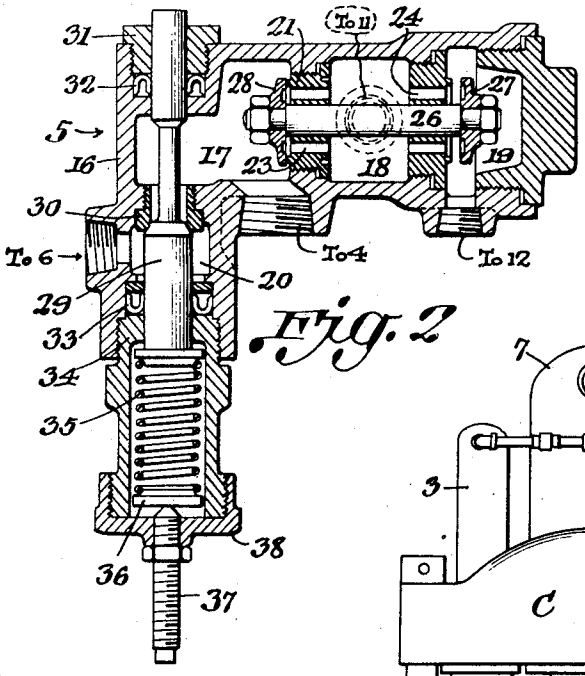


Fig. 2

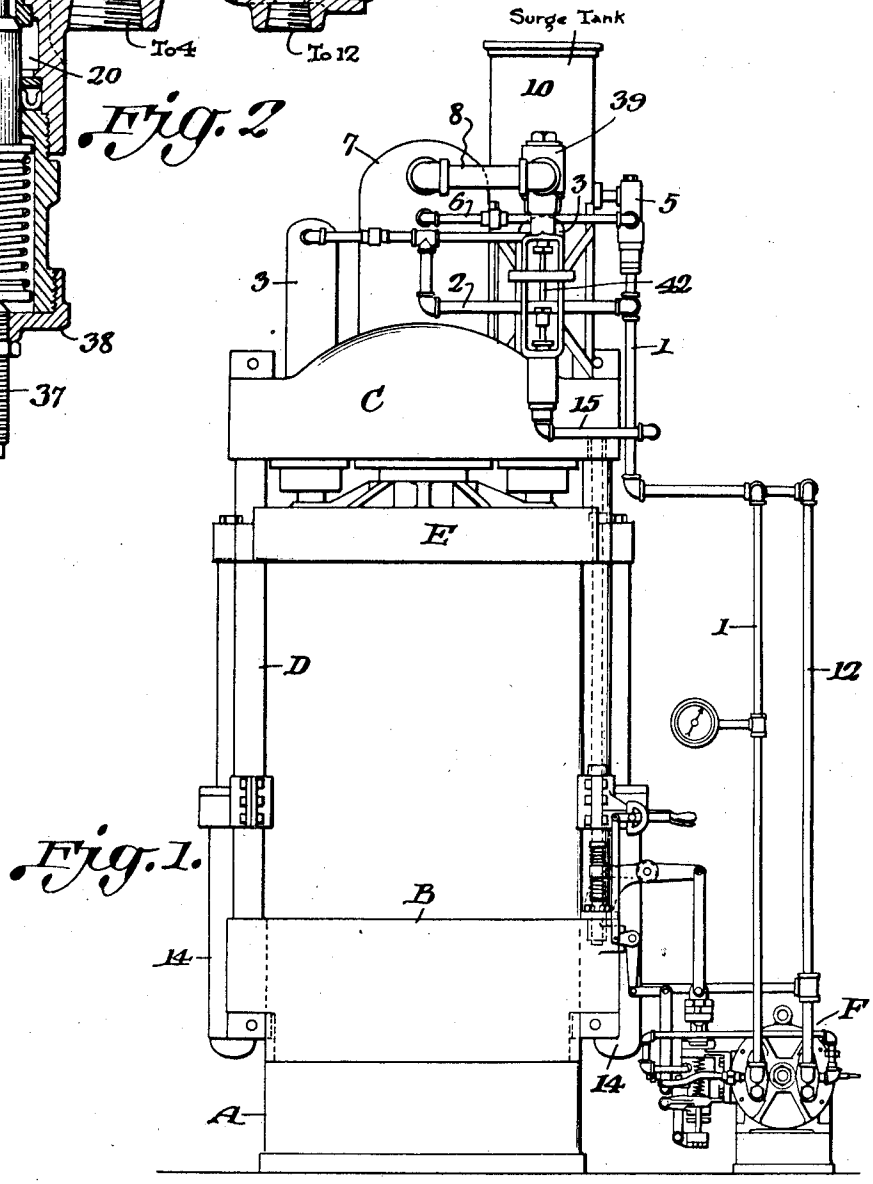


Fig. 1.

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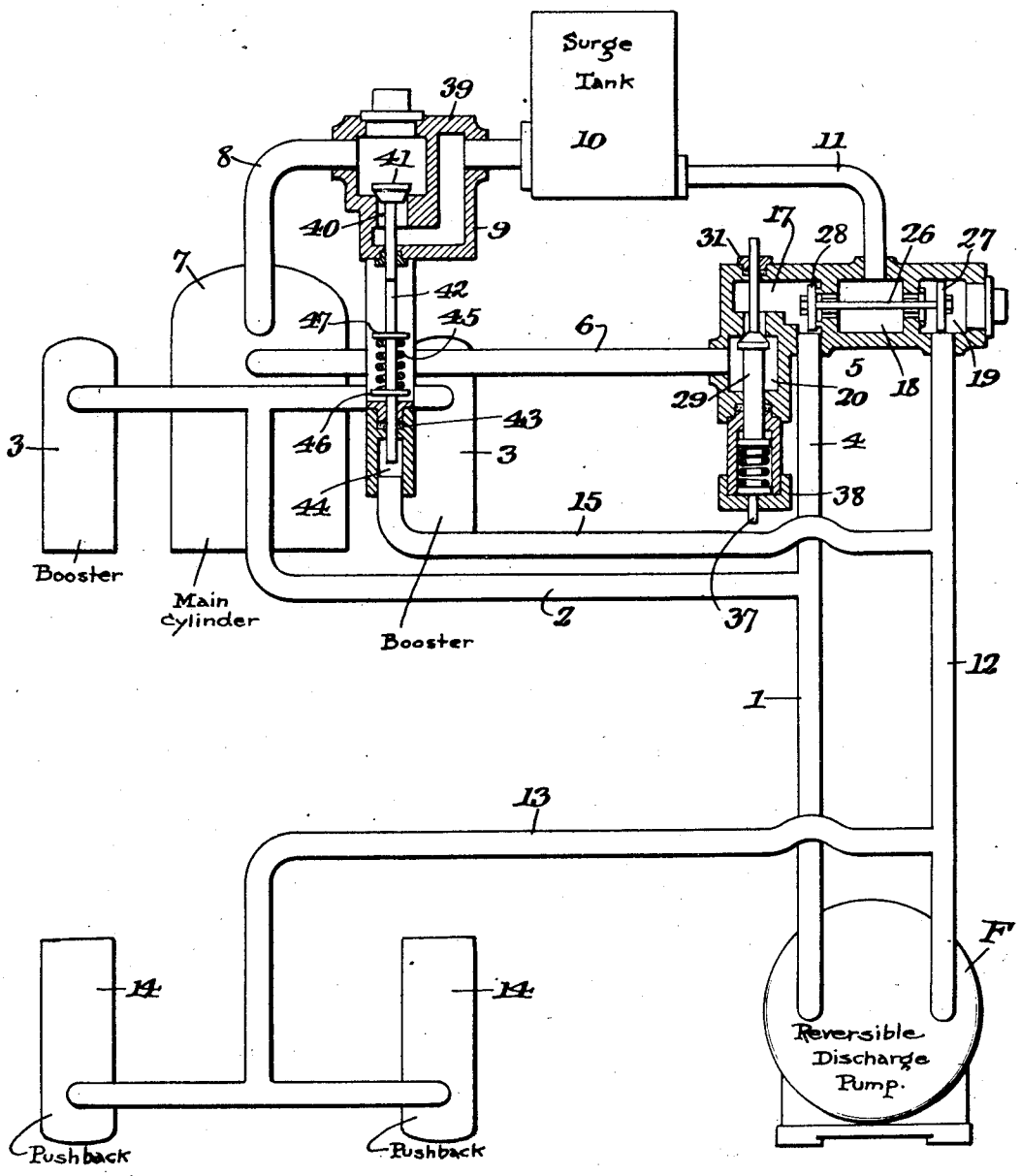


Fig. 3.

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Patented June 5, 1928. 1,672,561

UNITED STATES PATENT OFFICE.

WALTER ERNST, OF MOUNT GILEAD, OHIO, ASSIGNOR TO THE HYDRAULIC PRESS MANUFACTURING COMPANY, OF MOUNT GILEAD, OHIO.

HIGH-SPEED HYDRAULIC PRESS.

Application filed September 29, 1926. Serial No. 138,416.

This invention relates to hydraulic presses which are intended to be operated by fluid supplied under pressure from a reversible variable delivery pump and has for an object the provision of simple and efficient valve mechanism by which the proper sequence of operations will be carried out automatically or semi-automatically. Detail features of the invention will be apparent from the following description and the appended claims.

This invention relates to certain improvements on applicant's Patent 1,653,350, of December 20, 1927.

In the drawings:

Figure 1 is a side elevation of one type of press having embodied therein the present invention.

Figure 2 is a vertical section through a valve mechanism constituting a part of the invention.

Figure 3 is a diagrammatic view with two valve mechanisms shown in section showing the various connections from the pump to the operating mechanism of the press.

The invention may be embodied in various types of presses employed for various purposes, but is illustrated in connection with a press of the four column downward pressure type. There is shown a base A which may be formed of cast iron for the purpose of bringing the working surface to a convenient height. Above this is a heavy cast steel base B which receives the strains from the press. A press head C is connected to the base by four strain rods D. The main downwardly movable platen E is guided on the strain rods in the usual manner. There is also illustrated in Figure 1 a variable delivery reversible pump F and connections for operating the same which form no part of the present invention.

A pipe line 1 is shown as leading from the pump and has a branch 2 which communicates with two booster cylinders 3 which are intended to initiate the movement of the press ram. This line also has a connection 4 leading to a valve mechanism generally indicated at 5. From this valve mechanism a pipe 6 communicates with the main cylinder 7 above the press ram. From the upper part of this cylinder a pipe 8 communicates by the way of a valve mechanism indicated generally at 9 with a surge tank 10, which has a pipe 11 communicating with the valve mechanism 5.

A second pipe 12 leads from the pump F and has a separate branch 13 communicating with the two push back cylinders 14 which return the platen to its upper position. This line 12 also has a line 15 which communicates with a small chamber underlying the stem of the valve mounted in the valve mechanism 9 above mentioned. The pipe 12 also communicates with the valve mechanism 5.

The valve mechanism 5 is particularly illustrated in Figure 2 but comprises a main casting 16 which is divided into four chambers 17, 18, 19, and 20. A partition 21 between the chambers 17 and 18 is provided with a plurality of passages 23 and the partition 22 between the chambers 18 and 19 is provided with similar passages 24. A valve stem 26 is slidably mounted in the partitions 21 and 22 and carries at one end a head 27 lying in the chamber 19 and is adapted to close the openings 24 and at its other end a head 28 lying in the chamber 17 is adapted to close the openings 23. The valve stem is of such length that when one set of openings is closed the other is opened.

Also slidably mounted in the casing is a valve 29 which coacts with a valve seat 30 to control communication between the chambers 17 and 20. The upper end of this valve stem is guided in a bushing 31 set in the casing 16 and acting to retain a packing 32. The lower end of the valve stem has a packing 33 held in place by a cylindrical member 34 which is screwed into the casing 16. This member 34 has mounted therein a coil spring 35, and bears at one end against the valve stem and at its other end against a plate 36, the position of which may be adjusted by a screw 37 adjustably mounted in a cap 38 which is screw threaded on the open end of the member 34. In this manner the tension of the spring may be varied and the valve set to open at differing pressures.

The valve mechanism 9 comprises a casing 39 having therein a passage 40 which is controlled by a valve 41. The stem 42 of this valve is separate and fits slidably in a short tubular member which is connected to the

end of the pipe 15. Suitable packing 43 is provided and a small chamber 44 is formed in the tubular member just mentioned. A coil spring 45 surrounds the valve stem 42 and bears at its lower end against a collar 46 carried by said valve stem and at its upper end against a fixed collar through which the valve stem 42 slides so that this spring tends to hold the stem 42 in its lower position.

The operation of the device may be described as follows. It is assumed that it is desired to operate the press. The pump is set to deliver fluid under pressure through the line 1. The branch 4 of this line which communicates with the chamber 17 will thus receive fluid under pressure and the valve stem 26 will slide to the right in Figure 3 so that the valve head 28 closes communication between the chambers 17 and 18 as shown in this figure. At the same time, fluid under pressure will pass through the branch pipe line 2 to the booster cylinders 3 and thus start the movement of the press ram downwardly. This, of course, tends to produce a vacuum in the upper portion of the main cylinder 7, but the suction exerted through the pipe 8 will lift the valve 41 off its seat against the force of gravity and permit liquid to flow from the surge tank 10 through the valve casing 9 and pipe 8 into the upper portion of the main cylinder 7 behind the press ram. This action will continue until the ram meets sufficient resistance to build up the pressure in the pipe line 1 to a point where it is sufficient to overcome the force of the spring 35. The valve 29 will then be moved downwardly away from the valve seat 30, opening communication between the chambers 17 and 20 and the fluid will pass from the pipe 4 through the chamber 17, chamber 20, and pipe 6 into the main cylinder 7. As soon as the fluid under high pressure enters the main cylinder 7, the back pressure exerted through the pipe 8 will close the valve 41 and prevent this fluid from returning to the surge tank at this time. The parts will remain in this position until the pressing operation is completed.

Thereafter, either automatically or manually, the pump will be reversed and discharge fluid under pressure into the pipe line 12. The branch 13 of this line will conduct fluid to the push back cylinders 14 and immediately begin returning the ram to its normal upper position. At the same time the fluid entering the chamber 19 will move the valve stem 26 to the left so that the head 27 will close communication between the chambers 19 and 18. At this time the fluid under pressure will also pass through the branch 15 to the under side of the valve stem 42 and exert sufficient pressure thereon to lift the valve 41 off of its seat and permit the fluid behind the press ram, which is now moving upwardly, to be forced through the pipe 8 and valve chamber 9 into the surge tank 10. As soon as the press ram reaches its upper normal position, the pump may be stopped manually or automatically or reversed to begin a new pressing operation.

It is to be noted that during this return movement, the booster rams will also be moving upward in the booster cylinders 3 and the fluid contained in these cylinders will be forced through the pipe line 2 and branch 4 into the chamber 17 and thence into chamber 18 and through the pipe 11 to the surge tank.

It is obvious that the invention is independent of any specific type of pump so long as it is adapted to be reversed and afford a variable delivery. While especially adapted to a high speed press, the invention may be applied to presses of many kinds without departing from the spirit thereof. It is obvious that features of the invention may be modified as regards their specific embodiment and it is to be remembered that the invention is limited only by the scope of the appended claims.

I claim as my invention:

1. In a hydraulic press mechanism having main, booster, and push back cylinders, a press ram operated thereby and a surge tank; operating means which comprises a pipe line for conducting fluid under pressure to the booster cylinders, connections from the main cylinder to the surge tank including a valve which automatically opens when the fluid enters the booster cylinders, and connections from said pipe line to the main cylinder including a second valve which opens when the pressure in said pipe line reaches a predetermined point and admits fluid under pressure from said pipe line directly to the main cylinder.

2. In a hydraulic press mechanism having main, booster, and push back cylinders, a press ram operated thereby and a surge tank; operating means which comprises a pipe line for conducting fluid under pressure to the booster cylinders, connections from the main cylinder to the surge tank including a valve which automatically opens when the fluid enters the booster cylinders, and connections from said pipe line to the main cylinder including a second valve which opens when the pressure in said pipe line reaches a predetermined point and admits fluid under pressure from said pipe line directly to the main cylinder.

3. In a hydraulic press mechanism having main, booster, and push back cylinders, a press ram operated thereby and a surge tank; operating means which comprises a pipe line for conducting fluid under pressure to the booster cylinders, connections from the main cylinder to the surge tank in-

cluding a valve which automatically opens when the fluid enters the booster cylinders, connections from said pipe line to the main cylinder including a second valve which opens when the pressure in said pipe line reaches a predetermined point and admits fluid under pressure from said pipe line directly to the main cylinder, a pipe line for admitting fluid under pressure to the push back cylinders to return the press ram, means operated by the fluid under pressure in the second pipe line for opening the first named valve and permitting fluid to return from the main cylinder to the surge tank, and another valve opened by pressure in said second pipe line and interposed in connections between the booster cylinders and the surge tank which permits fluid to return to the surge tank from the booster cylinders at this time.

In testimony whereof, I have hereunto subscribed my name.

WALTER ERNST.