Aug. 28, 1928. 1,682,172

W. ERNST

AUTOMATIC HYDRAULIC PRESS

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Fig. 5.

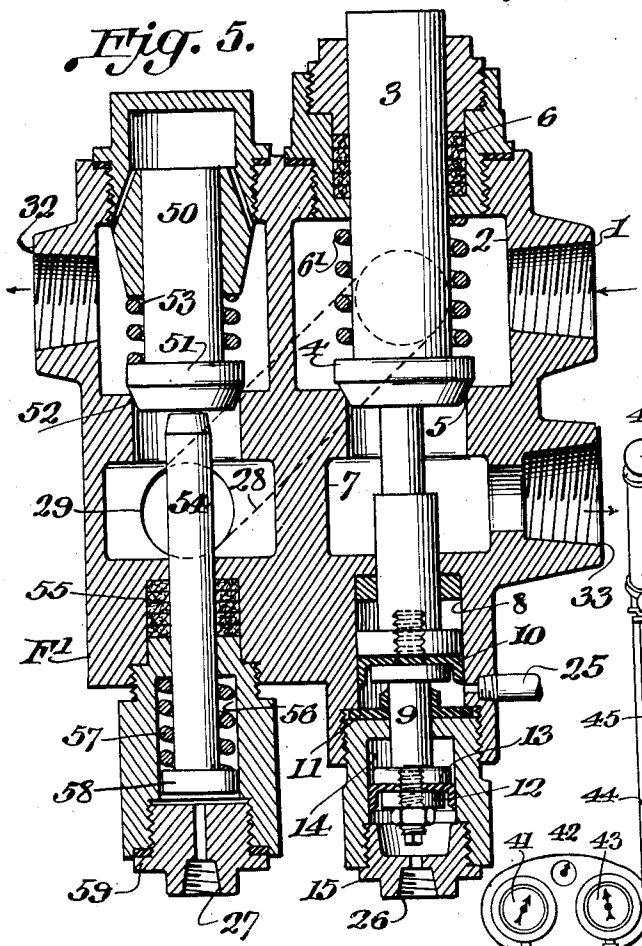
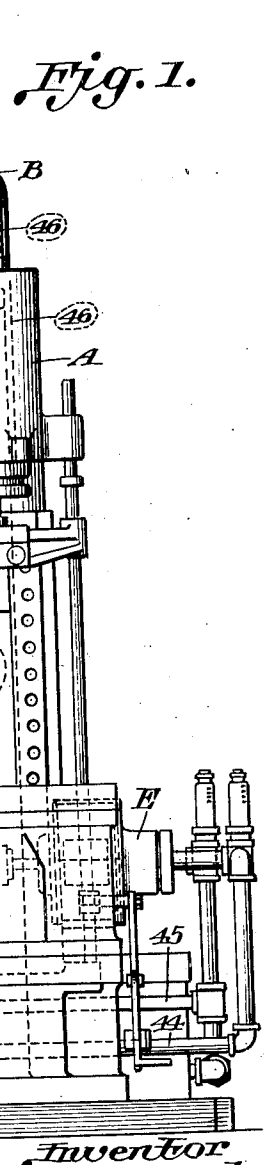


Fig. 1.



Inventor
Walter Ernst
by his Attorneys
Baldwin & Wight

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W. ERNST

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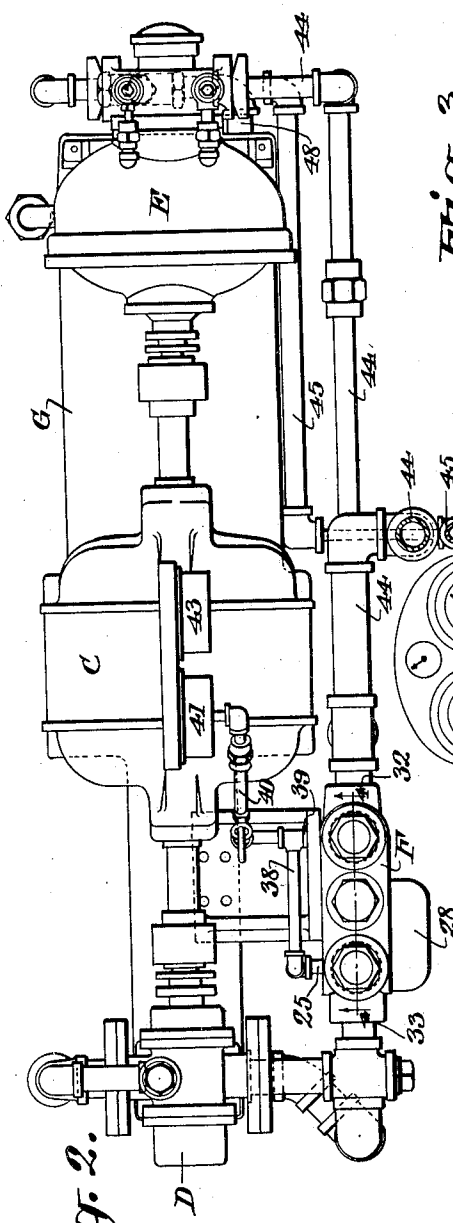


Fig. 2.

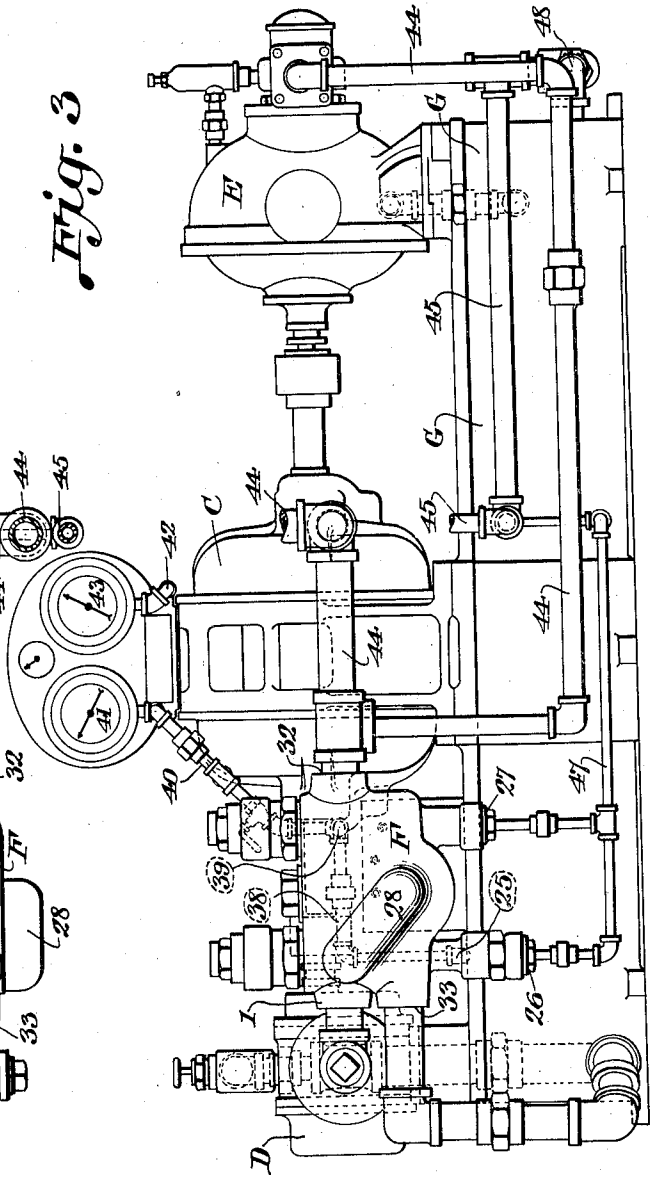


Fig. 3

Inventor
Walter Ernst
by his Attorneys
Baldwin & Wight

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W. ERNST

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Fig. 4.

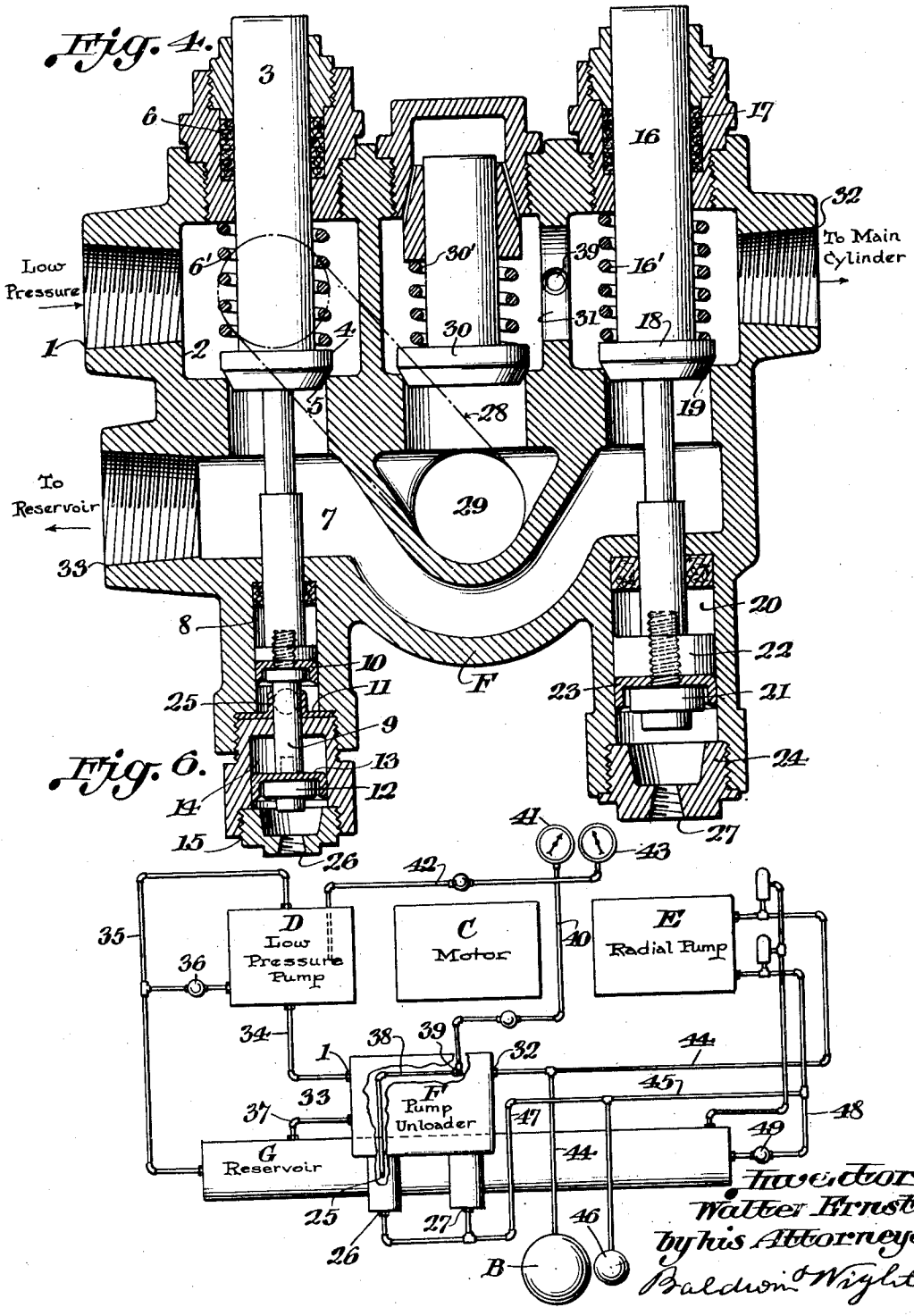


Fig. 6.

Inventor
Walter Ernst
by his Attorneys
Baldwin & Wright

Patented Aug. 28, 1928.

1,682,172

UNITED STATES PATENT OFFICE.

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

AUTOMATIC HYDRAULIC PRESS.

Application filed September 8, 1927. Serial No. 218,189.

This invention relates to improvements in press construction, and primarily in a pump unloader and in main cylinder discharge valves. This is particularly adapted for use with hydraulic press mechanism employing a radial reversible discharge variable delivery pump such as shown in Patent No. 1,250,170 of Hele-Shaw. This pump is driven preferably by an electric motor, and the same motor is connected to drive a booster pump which may be any type of pump of conventional design which will deliver a large volume of liquid at a low pressure of from 100 to 300 pounds per square inch.

The invention consists primarily in an automatic by-pass and unloading valve construction which will allow fluid to pass from the low pressure pump to the press cylinder, but when a predetermined pressure has been reached will automatically by-pass the fluid from the low pressure pump and allow the radial or high pressure pump to take up the work, while, at the same time, the by-pass is closed against the fluid from the high pressure pump.

The radial pump, which in itself forms no part of this invention, has associated with it a pressure operated control mechanism adapted to reverse the discharge of the pump when the platen is in pressing position, and the pressure has built up to a predetermined value; and a mechanically operated control mechanism, cooperating with the moving platen to throw the pump discharge valve into a neutral position when the platen has reached the upper limit of its travel.

In the operation of the invention embodied in the present application, when the discharge from the radial pump has been reversed, the automatic by-pass valve will then permit the fluid from the main cylinder to escape through the by-pass to the reservoir.

In the drawings:

Figure 1 is a side elevation of a conventional form of press equipped with the mechanism above described.

Figure 2 is a top plan view showing the relation of the motor, the two pumps, and the by-pass and unloading valve or pump unloader.

Figure 3 is a side elevation of the construction shown in Figure 2,

Figure 4 is a vertical section through the pump unloader.

Figure 5 is a similar vertical section through a modified form of pump unloader.

Figure 6 is a diagrammatic view showing the elements of the press mechanism and the various piping connections therebetween.

The press itself may be of any conventional construction having a main cylinder, which is preferably downward acting, and a return cylinder. It may be of strain-rod construction or of the C-frame type. The power unit is connected to the main cylinder by means of one pipe line, and to the return cylinder by a second pipe line. The return cylinder may be a differential cylinder of conventional construction.

The press is indicated generally at A, and there is shown the motor C, low pressure pump D, radial pump E, the pump unloader unit F, and reservoir G. The general operative relationship of these parts is shown in the drawings, but of course they may be arranged in various forms as desired, so long as they are connected in accordance with the diagram shown in Figure 6. Since the press, its control mechanism, the pumps, and motor are of themselves conventional in form or operation, no detailed description of the same is necessary.

Referring particularly to Figure 4, which shows a section through the pump unloader or the automatic by-pass, this casing F is provided with an inlet opening 1 for fluid under low pressure which communicates with a chamber 2 in which is positioned a valve stem 3 provided with a valve 4 resting upon a valve seat 5 of any desired construction. This valve stem is guided at its upper end in packing 6, and the valve is urged against its side by a spring 6'. This valve stem extends downwardly through a chamber 7 into a chamber 8, and has a tapped opening in its lower end into which is screw-threaded a plunger 9 which holds in position a cup shaped packing 10 on the stem 3. The plunger 9 passes through a flange packing 11 and has in its lower end a tapped opening into which is screwed a plug 12 which holds in position a cup shaped packing 13 slidably mounted in a small cylinder 14 carried by the casing F and closed at its lower end by a plug 15.

The valve casing is also provided with a valve stem 16 slidably mounted in packing 17 and provided with a valve 18 which is normally urged against a valve seat 19 by means of a spring 16'. This valve stem extends downwardly into a chamber 20, and has a tapped opening in its lower end into which screws a plunger 21, thus securing it to a washer 22 and a cup shaped packing 23. The lower end of the chamber 20 is closed by a plug 24. An opening 25 is provided in the chamber 8 beneath the packing 10 for a purpose hereinafter set forth, and the plug 15 is provided with a tapped opening 26, and the plug 24 with a similar opening 27, both of which are connected to the return line, as will be described hereinafter.

A passage or pipe 28 affords communication between the chamber 2 and a chamber 29 on the under side of a check valve 30 which is normally forced against its seat by a spring 30'. The valve 18 and the check valve 30 both control passageways into a chamber 31 provided with an outlet 32 communicating with the pipe line to the main cylinder. The chamber 7 communicates with the chamber 31 when the valve 18 is open, and has an outlet opening 33 connected to a pipe leading back to the reservoir.

Referring particularly to the diagram of Figure 6, it will be noted that a pipe 34 leads from the low pressure pump to the inlet opening 1 of the pump unloader F. The suction line of the low pressure pump is indicated at 35, and a by-pass valve 36 may be employed as a safety device if desired. A pipe 37 connects the outlet opening 33 with the reservoir G. A pipe 38 is tapped into the chamber 31 at the point 39 shown in Figure 4, and has a branch communicating with the opening 25 beneath the valve 10. This line may also have a branch 40 which communicates with the high pressure gauge 41, while a line 42 leads direct from the low pressure pump to the low pressure gauge 43. The radial pump E is connected by a pipe line 44 with the main cylinder B, this pipe line also connecting with the outlet opening 32 from the control mechanism described. The radial pump also has a line 45 which communicates with the push back cylinder 46, and has a branch 47 which connects to both of the openings 26 and 27 of the pump unloader. This line 45 also has a branch 48 controlled by a check valve 49 communicating with the cylinder G.

The operation of the mechanism thus far described may be set forth as follows:

When the pressing operation is started, the fluid under low pressure passes from the low pressure pump through the pipe 34 into the chamber 2 of the unloader, and through the diagonal pipe 28 into the chamber 29 beneath the check valve 30 which it lifts from its seat, and thence through the chamber 31, outlet opening 32, and pipe 44 into the main cylinder B. It will be observed that at this same time fluid under low pressure is in the pipe 38 which communicates with the chamber 8 beneath the packing 10. When the pressure builds up to the neighborhood of the maximum low pressure, this packing 10 and the valve stem 3 will be moved upward by fluid entering at 25, and lift the valve stem 3 and valve 5 against the pressure of the spring 6', thus opening this valve. The fluid under low pressure will therefore pass idly from the chamber 2 into the chamber 7, and back to the reservoir, while the high pressure pump, which also communicates with the line 44, will take up the load and build up the high pressure in the main cylinder. The fluid under high pressure is prevented from backing up into the low pressure line by means of the valve 30, which will close the minute the valve 4 is opened.

When the high pressure limit is reached, the automatic control described above will reverse the radial pump, and the pressure will then be applied at the return line 45. This will apply pressure not only to the push back cylinder 46, but also to the under side of both the packings 13 and 23, and will lift the stems 3 and 6, respectively, keeping the stem 3 in its previous open position. The low pressure pump will then continue its by-pass, and the fluid excess of the main cylinder will pass from the chamber 31 through the open valve seat 19 into the chamber 7 and thence to the reservoir. This is rendered necessary because the area of the main cylinder is always far in excess of the push back cylinder, and, since both are running at the same speed, the valve 18 must be opened to allow the fluid to escape from the main cylinder into the reservoir on the return stroke. This cannot be done by means of the check valve 30, which is closed at this time.

As soon as the press platen has reached its normal position, the control mechanism described above will then throw the pump into neutral position, so that the press will remain in its upper position until the control is operated for a subsequent cycle of operations.

Instead of the device shown in Figure 4, there may be incorporated into the system a simpler form illustrated in Figure 5, which will now be described.

A modified form of pump unloader is shown in Figure 5. In this case, the pump unloader F' does not employ the check valve 30 shown in the first form, but a valve stem 3 and all of the connections are identical with the corresponding parts in the first form, and have been given identical reference numerals so that no further description is necessary.

In this form, a check valve comprising a stem 50 and a valve head 51, which is normally seated on the seat 52 by the tension of a

spring 53, opens when fluid passes into the chamber 29. When the pressure reaches a predetermined point, as before described, the valve 4 opens and the fluid under low pressure by-passes into the chamber 7 and back to the reservoir in the usual manner. When the pump is reversed and fluid under pressure is supplied to the push back cylinders, the fluid entering the inlet 27 in the block 59 comes against the under side of a piston plunger 58 held normally downward by a spring 57 in a chamber 56, which piston plunger is carried by a stem 54, guided in packing 55, and has its upper end just beneath the valve 51 when the latter is in closed position. The fluid under pressure in the push back line will therefore lift the stem 54 and raise the valve 51 from its seat so that the fluid returning from the main cylinder through the passage 1 will enter the chamber 32, pass into the chamber 29, through the connection 28 into the chamber 2, and through the open valve into the chamber 7, from which it returns to the reservoir. It will be obvious that this construction combines the check valve 30 and the valve stem 16 of the construction shown in Figure 4 in a single mechanism.

It will be obvious that the invention provides a very simple and efficient mechanism which acts automatically in accordance with the pressure in the various pipe lines for the purpose of by-passing the fluid under low pressure when this reaches a predetermined point, and also for the purpose of allowing the fluid to return from the main cylinder when the press platen is returned to its normal position under influence of the pressure of fluid in the push back line. While a particular form of press, pump mechanism, and control mechanism has been described, it is to be understood that this pump unloader or by-pass mechanism is capable of use in many different relations, and the invention is to be considered as limited only by the scope of the appended claims.

I claim as my invention:

1. In an automatic hydraulic press mechanism having a main cylinder, means for supplying fluid under low pressure thereto, and means for supplying fluid under high pressure thereto, a by-pass mechanism which comprises a valve and means for opening the same at a predetermined pressure to allow the fluid under low pressure to circulate idly, and a second valve and means for opening the same to permit the return of fluid from the main cylinder.

2. In an automatic hydraulic press mechanism having a main cylinder, means for supplying fluid under low pressure thereto and means for supplying fluid under high pressure thereto; a by-pass mechanism which comprises a valve and means controlled by the pressure in the main cylinder for opening the same to allow the fluid under low pressure to circulate idly, and a second valve and means for opening the same to permit the return of fluid from the main cylinder.

3. In an automatic hydraulic press mechanism having a main cylinder, a pump for supplying fluid under low pressure thereto, and a second pump for supplying fluid under high pressure thereto; a pump unloader and by-pass mechanism which comprises a valve and means controlled by the pressure in the main cylinder for opening the same to allow the low pressure pump to operate idly, and a second valve and means for opening the same to permit the return of fluid from the main cylinder.

4. In an automatic hydraulic press mechanism having a main cylinder, a push back cylinder, a pump for supplying fluid under low pressure to the main cylinder, a second reversible pump for supplying fluid under high pressure to the main cylinder and for supplying fluid under pressure to the push back cylinder; a pump unloader and by-pass mechanism which comprises a valve and means controlled by the pressure in the main cylinder for opening the same to allow the low pressure pump to operate idly, and a second valve and means controlled by the pressure in the push back cylinder for opening the same to permit the return of fluid from the main cylinder.

5. In an automatic hydraulic press mechanism having a main cylinder, a push back cylinder, a pump for supplying fluid under low pressure to the main cylinder, a second reversible pump for supplying fluid under high pressure to the main cylinder and for supplying fluid under pressure to the push back cylinder; a pump unloader and by-pass mechanism which comprises a valve and means controlled by the pressure in the main cylinder for opening the same to allow the low pressure pump to operate idly, a second valve and means controlled by the pressure in the push back cylinder for opening the same to permit the return of fluid from the main cylinder, and connections whereby the first valve is held open at this time by the pressure in the push back cylinder.

6. In an automatic hydraulic press mechanism having a main cylinder, a push back cylinder, a low pressure pump for supplying fluid to the main cylinder, and a reversible pump for first supplying fluid to the main cylinder and thereafter to the push back cylinder instead; a pump unloader which comprises means for allowing the low pressure pump to operate idly when the pressure reaches a predetermined point and also means for permitting the return of fluid from the main cylinder when fluid is admitted to the push back cylinder.

7. In an automatic hydraulic press mechanism having a main cylinder, a push back

cylinder, a low pressure pump for supplying fluid to the main cylinder, and a reversible pump for first supplying fluid to the main cylinder and thereafter to the push back cylinder instead; a pump unloader which comprises means controlled by the pressure in the main cylinder for allowing the low pressure pump to operate idly when the pressure reaches a predetermined point and also means controlled by the pressure in the push back cylinder for permitting the return of fluid from the main cylinder.

In testimony whereof, I have hereunto subscribed my name.

WALTER ERNST.