Oct. 10, 1944. L. IVERSEN 2,360,060

HYDRAULIC PRESS

Filed Aug. 6, 1941 3 Sheets-Sheet 1

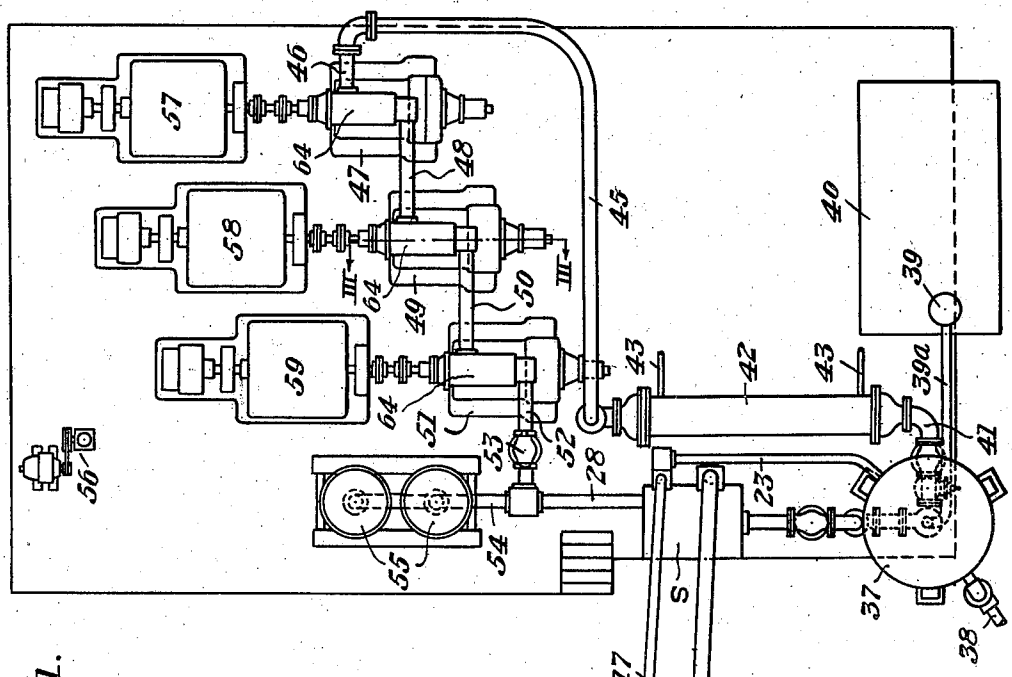


Fig. 1.

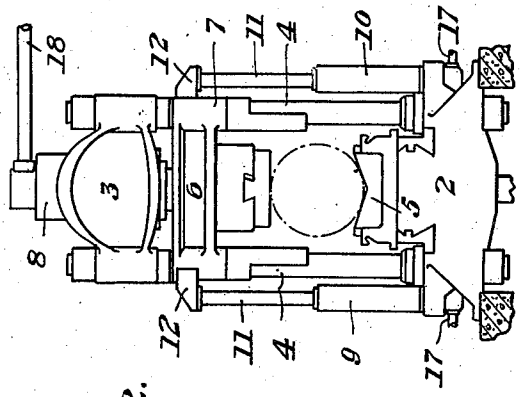


Fig. 2.

INVENTOR

Lorenz Iversen

by his attys.

Stebbins and Blenko

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HYDRAULIC PRESS

Filed Aug. 6, 1941 3 Sheets-Sheet 2

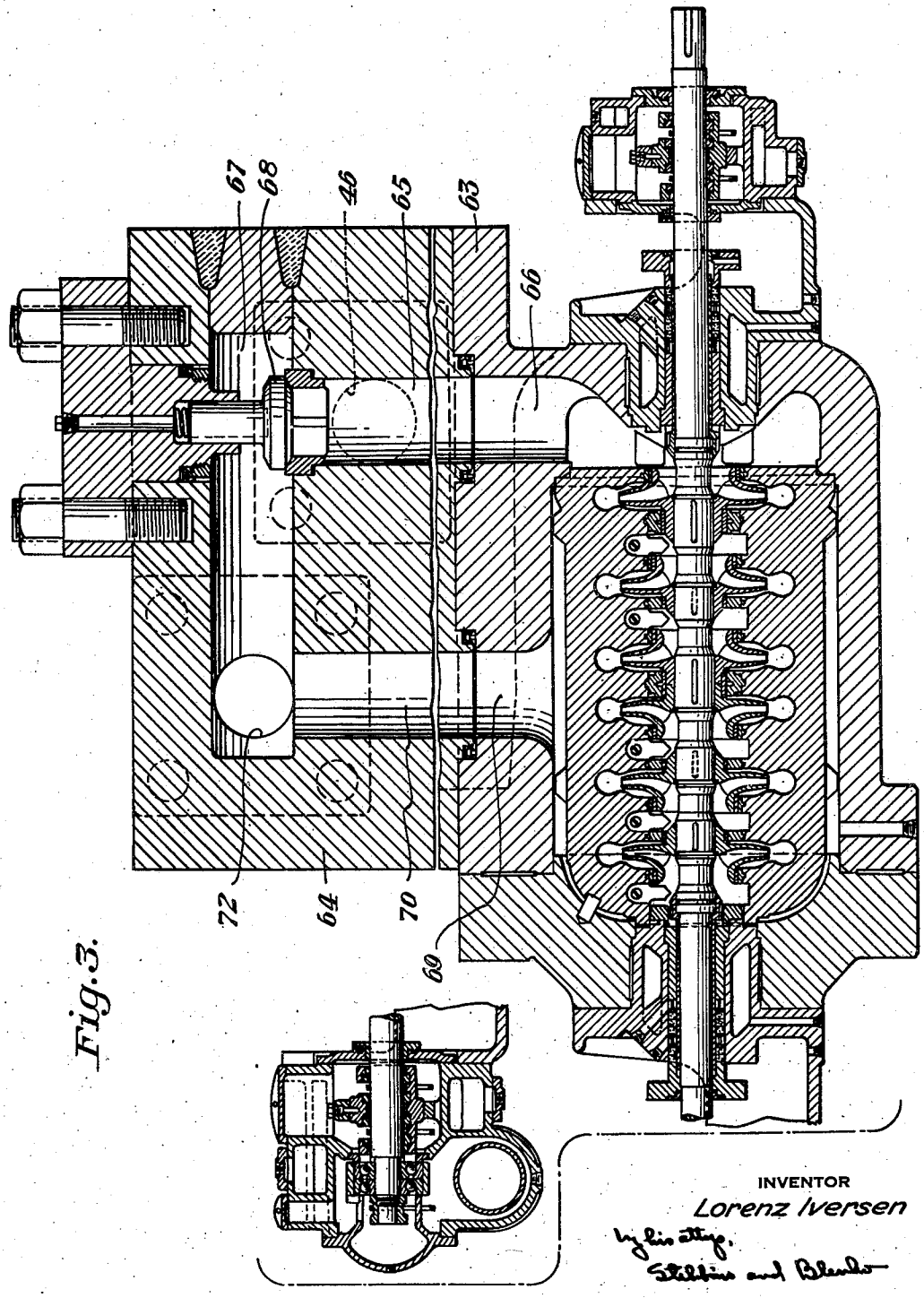


Fig. 3.

INVENTOR
Lorenz Iversen
by his attys.
Stibbins and Blenko

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HYDRAULIC PRESS

Filed Aug. 6, 1941 3 Sheets-Sheet 3

Fig. 4.

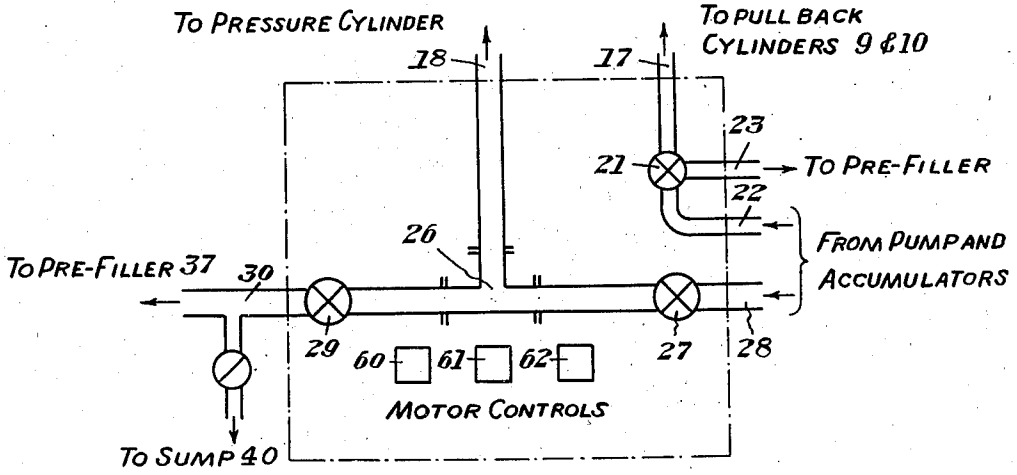
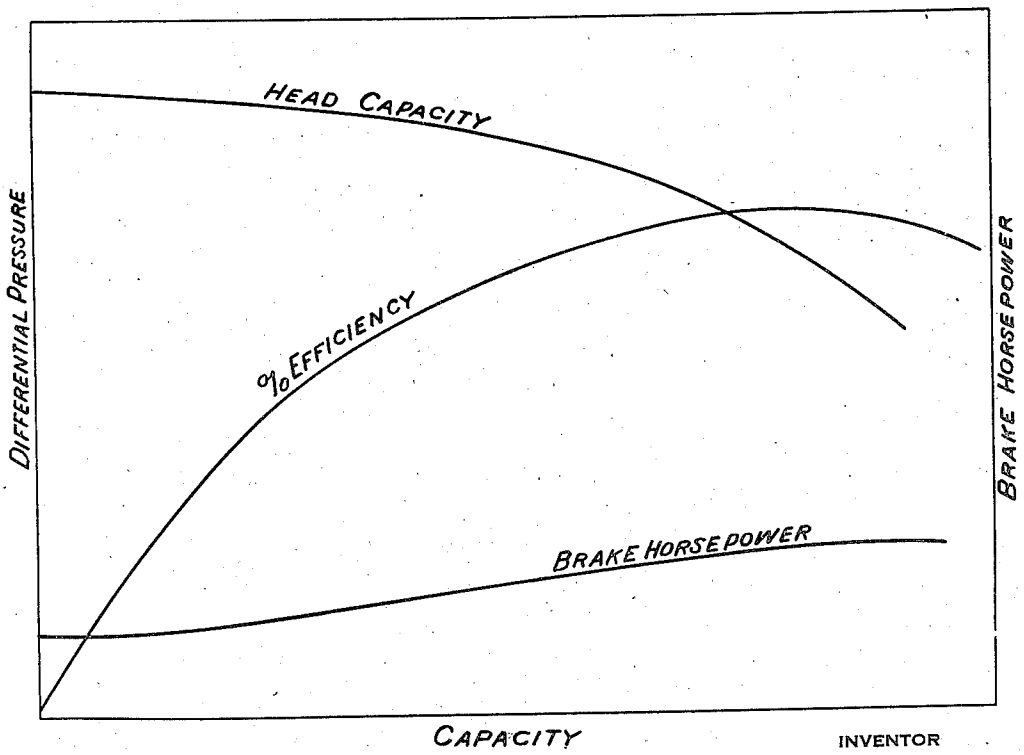


Fig. 5.



INVENTOR

Lorenz Iversen

by his attys.

Stibbins and Blenko

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UNITED STATES PATENT OFFICE

2,360,060

HYDRAULIC PRESS

Lorenz Iversen, Pittsburgh, Pa., assignor to Mesta Machine Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application August 6, 1941, Serial No. 405,639

2 Claims. (Cl. 60—52)

This invention relates to hydraulic presses. It provides a novel mechanism whereby the flexibility of operation is greatly increased with marked improvement in output. Material simplification of the installation and, in certain cases, very substantial reductions in cost are also obtainable.

Heretofore hydraulic presses, particularly in the larger sizes, have been either of the so-called "steam hydraulic" type or the "straight hydraulic" type with reciprocating pumps. In the steam hydraulic type, the hydraulic pressure is produced by intensifiers receiving pressure from steam boilers. In the straight hydraulic type, several motor- or steam-driven reciprocating pumps are connected in parallel to the press cylinders. In both types, variable pressure of the press head is obtained by cutting the press cylinders in or out, the line pressure being constant at all times. In these prior presses, the press head is raised by auxiliary hydraulic cylinders called "pullbacks." Idle strokes are effected by the force of gravity which comes into play when the pressure on the pullback cylinders is relieved.

The presses just described have very little flexibility and their output has been seriously limited. They are necessarily designed for the heaviest work and are correspondingly slow. On lighter work they operate at a speed far less than the ability of the workmen to manipulate the workpiece.

In my improved system, I depart entirely from the principle of the old style press systems and employ pumps of the centrifugal type which are without positive displacement in contrast to the intensifiers and reciprocating pumps in common use. I arrange these pumps in series and in this fashion and with the related structures herein described, I have been able to use them with entire success and with the improvements in operation above noted. I am able to obtain a variable line pressure by employing the pumps in series and by using pumps having the characteristic of delivering maximum pressure at shut-off (zero capacity), I can obtain a very rapid press operation.

In the accompanying drawings illustrating a present preferred embodiment of the invention:

Figure 1 is a top plan view of a hydraulic press and its fluid-supply system;

Figure 2 is a front elevation of the press per se;

Figure 3 is a vertical section to enlarged scale on the line III—III of Figur 2;

Figure 4 is a diagram showing the control system; and

Figure 5 is a chart showing the characteristics of one of the pumps employed.

Referring first to Figure 2, there is shown a hydraulic press having a base 2 and a head 3 connected by vertical posts 4. The base carries a platen 5 for accommodating the workpieces and a cross-head 6 is arranged to move vertically toward and away from the platen 5, being guided by slides 7 on the posts 4. The head 3 is bored to provide a cylinder 8 arranged in the vertical center line of the press. A piston in the cylinder is secured to the cross-head 6. Lifting cylinders 9 and 10 are disposed at the ends of the press and have pistons 11 therein bearing on shoulders 12 on the cross-head 6. The cylinders 9 and 10 serve to return the cross-head after a working stroke effected by the cylinder 8.

The cylinders 9 and 10 are connected to a pipe 17 leading from a control station indicated generally at S in Figure 1 and hereinafter described in detail. A pipe 18 connects the cylinder 8 to the control station S.

The control station is shown in diagram in Figure 4. In this diagram the valves have been indicated conventionally, but it will be understood that at the pressures which may be employed and with the volume of water to be controlled, it will generally be necessary to use power-actuated valves with manual controls for the valve-actuating mechanism. The pipe 17, which supplies the cylinders 9 and 10, is connected through a 3-way valve 21 to a supply pipe 22. Ordinarily the valve 21 remains open and water is supplied to the pipe 22 under constant pressure so that the cylinders 9 and 10 constantly urge the cross-head 6 of the press upwardly.

The valve 21 may be shifted to connect the pipe 17 to the supply pipe 22 or to a discharge pipe 23, as desired.

The pipe 18 is connected to a T 26. The T 26 connects the pipe 18, through a valve 27, to a supply pipe 28. The T 26 also connects the pipe 18, through a valve 29, to a discharge pipe 30. If the valve 29 is closed and the valve 27 opened, fluid under pressure passes to the T 26 and thence to the main press cylinder 8, overcoming the force of the lifting cylinders 9 and 10, and effecting a working stroke of the press. Closing of the valve 27 and opening of the valve 29 releases the pressure of the fluid in the main cylinder and permits the lifting cylinders to raise the cross-head for another working stroke. The valves 27 and 29 may be controlled by the move-

ment of the cross-head to effect automatic stroking.

The water for the cylinders 8, 9, and 10 is taken from a prefiller tank 37 operating under a low head, say, 40 to 100 pounds per square inch. This tank has an air space above the water level so as to accommodate the varying quantities of water which are supplied to it in operation. Make-up water is supplied to the tank under pressure through a valved supply pipe 38, but in general the system is a circulatory one, the water being discharged from the cylinders back to the prefiller through the pipes 23 and 30. A pump 39 supplies water from a sump 40 to the prefiller through a pipe 39a.

Water from the prefiller 37 passes through a pipe 41 to a cooler 42 consisting of a pipe coil having a water jacket provided with pipes 43, whereby cooling water may be circulated through the jacket. The water passes from the cooler 42 through a pipe 45 terminating in the inlet 46 of a centrifugal pump 47. The outlet of the pump 47 is connected through a pipe 48 to the inlet of a centrifugal pump 49. The outlet of the pump 49 is, in turn, connected through a pipe 50 to the inlet of a centrifugal pump 51. Its outlet is connected through a pipe 52 and a check valve 53 to the pipe 28 leading to the control station S. A branch pipe 54 leads from the check valve 53 to a pair of accumulator bottles 55 providing an air cushion for the system. An air compressor 56 is provided for supplying air as required to these bottles through a connecting pipe (not shown).

The pumps 47, 49, and 51 are each independently driven by motors 57, 58, and 59, respectively, and these motors are separately controlled by switches 60, 61, and 62, respectively, at the control station S. It will be noted that the pumps are arranged in series so that by actuating one, two or three of them, as may be desired, three stages of pressures may be obtained, for example, stages of 1250, 2500 and 4500 pounds per square inch.

The pumps employed are of the multi-stage centrifugal type. In order to minimize the pressure drop in the system, I provide for bypassing any idle pump or pumps through mechanism shown in detail in Figure 3.

Referring to Figure 3, the pump casing is indicated at 63. It is surmounted by a check valve body 64 having a vertical bore 65 which registers with the inlet 66 of the pump. The inlet 46 communicates with this bore. At its upper end the bore 65 leads to a horizontal bore 67, but communication between the two is shut off when the pump is running by a check valve 68. Water entering the inlet 46, therefore, passes downwardly through the bore 65 into the inlet 66 of the pump. The pump discharges the water at materially higher pressure through the discharge port 69 into a vertical bore 70 in the valve body 64. The bore 70 communicates with the horizontal bore 67. Water discharged from the pump is, as stated, at a materially higher pressure than the water entering through the inlet 46 and the check valve 68 is therefore held closed. The water is finally discharged from the pump through an outlet 72 communicating with the pipe 48, 50 or 52, as the case may be.

In case a pump is standing idle, water entering through its inlet 46 raises the valve 68 and passes through the horizontal bore 67 directly to the outlet 72, thus saving the material loss of head which would be encountered if it were attempted to circulate it through the pump and letting the pump idle. Indeed, in many cases, it may not be feasible to circulate water through the idle pump at all.

Figure 5 shows the characteristics of the pumps above described. It will be noted therefrom that the pumps deliver maximum head at zero capacity and that only a slight drop in pressure occurs when delivering at full rated volume. By way of example, the pumps 47, 49, and 51 deliver maximum heads of approximately 1250, 1250, and 2000 pounds per square inch, respectively, so that by using pumps 47 and 49 in series, a working pressure of 2500 pounds per square inch is obtained and by using all three pumps in series a working pressure of 4500 pounds per square inch is obtained. Whatever working pressure is used, the cylinder 8 easily overcomes the cylinders 9 and 10 because the total cross sectional area of the former is very much greater than the sum of those of the latter. The valve 21, however, may be shifted to its second position to connect the pipe 17 to the pipe 23. The cylinder 8 then has to overcome only the prefiller pressure in the cylinder 9 and 10, instead of the main working pressure, thereby increasing somewhat the capacity of the main power cylinder.

For low pressure work, the pump 47 alone will be operated, the water bypassing the pumps 49 and 51 as above described. When a higher pressure is required, the pump 49 is placed in operation in series with the pump 47, and when the maximum pressure is required, all three pumps are operated. Since the pumps are connected in series, the output in gallons per minute must be the same regardless of whether one, two or three pumps are operating. Thus the speed of the press head is substantially the same regardless of the pressure employed.

Numerous advantages are obtained by my invention. One of the primary ones is simplicity of control. Another is the speed with which the head can be moved from its top position into engagement with the work. This is due to the fact that the pumps are delivering maximum pressure with the valve 27 closed, and that substantially maximum pressure is immediately imparted to the working cylinders when the valve is opened. This gives speedy idling and rapid stroking during the working of the press. A further advantage is that my improved press has greater flexibility of operation and that as soon as the workers become skilled in its use they can accomplish far more with it than with ordinary presses.

I have illustrated and described a present preferred embodiment of the invention. It will be understood, however, that this is by way of illustration only and that it may be otherwise embodied within the scope of the following claims.

I claim:

1. A hydraulic press comprising a movable press head, a pressure cylinder having a plunger therein connected to the press head, a water supply pipe leading to the cylinder, a plurality of centrifugal pumps having the characteristic of delivering substantially maximum head at zero capacity, the pumps being connected in series to the supply pipe, motors for individually driving the several pumps, separate controls for each motor whereby a pump may be controlled at will independently of the control of any other pump and the line pressure thereby varied, a by-pass around at least one pump having a check-valve

therein and a shut-off valve in the supply pipe between the cylinder and the pumps.

2. A hydraulic press comprising a movable press head, a pressure cylinder having a plunger therein connected to the press head, a water supply pipe leading to the cylinder, a plurality of multi-stage centrifugal pumps having the characteristic of delivering substantially maximum head at zero capacity, the pumps being connected in series to the supply pipe, motors for individually driving the several pumps, separate controls for each motor whereby a pump may be controlled at will independently of the control of any other pump and the line pressure thereby varied, a by-pass around at least one of the pumps having a check-valve therein movable to closed position when the pump with which the by-pass is associated is in operation but movable to open position when not subject to the pressure generated by said pump, whereby the by-pass short-circuits the pump when the same is not operating, and a shut-off valve in the supply pipe.

LORENZ IVERSEN.