

Feb. 3, 1931.

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1,790,797

OPERATING MECHANISM FOR HYDRAULIC PRESSES

Filed Dec. 3, 1926

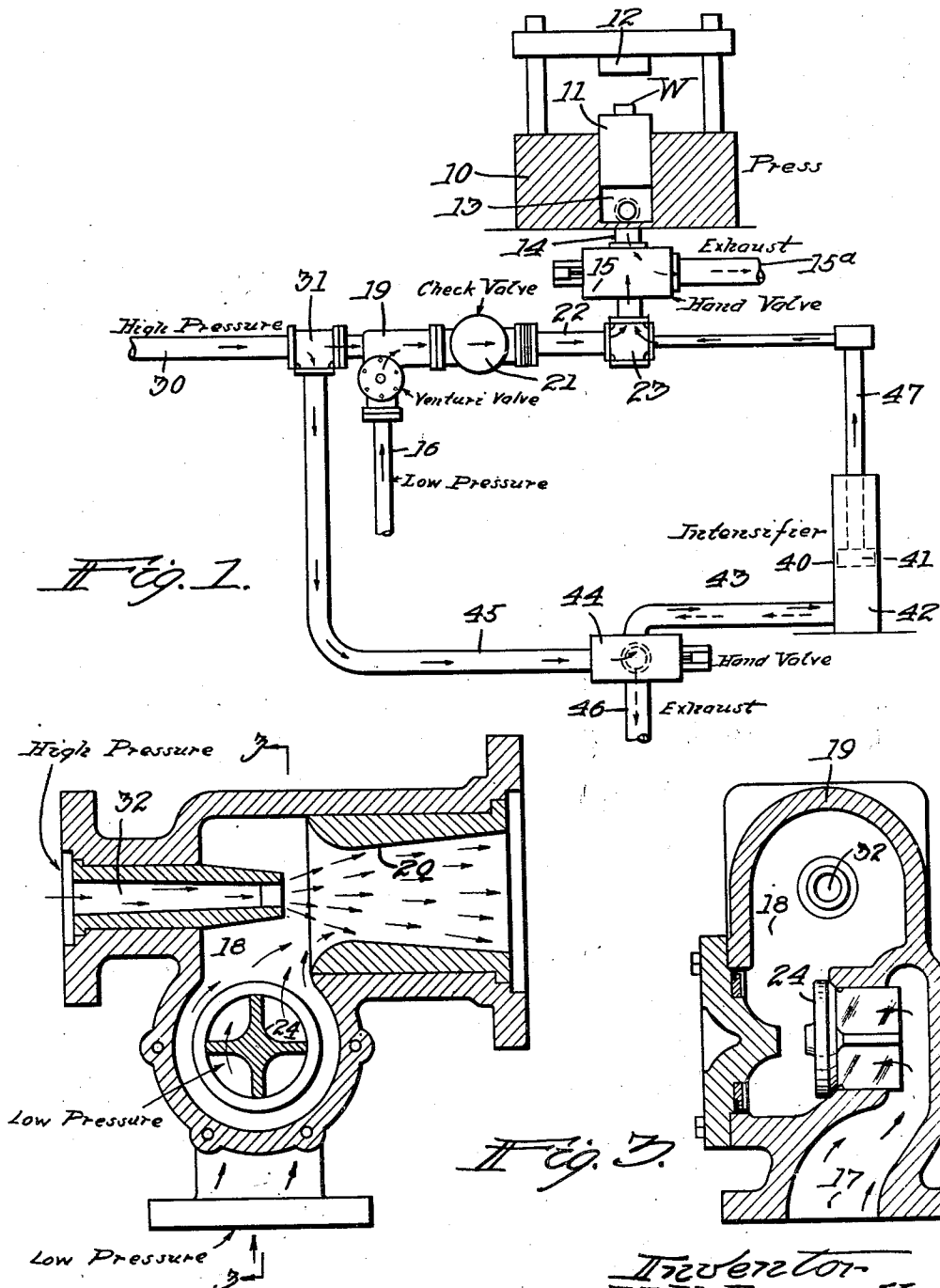


Fig. 2.

Fig. 3.

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OPERATING MECHANISM FOR HYDRAULIC PRESSES

Application filed December 3, 1926. Serial No. 152,491.

This invention relates to mechanism for operating a hydraulic press and particularly for controlling the flow of high and low pressure water thereto. Such presses are commonly used for applying very heavy pressure to drop forgings to bring them to exact final form and for many other similar purposes in which the full pressure of the machine is applied only at the final stage of the operation and for a very short distance.

It has been customary, however, to actuate the press for its full stroke by the introduction of water under very high pressure, although the extremely high pressure was commonly utilized only at the final stage of compression. Obviously water cannot be placed under very heavy pressure without the expenditure of power, which necessarily involves corresponding expense.

It is the object of my invention to provide a hydraulic mechanism so designed that a very much reduced amount of high pressure water will be necessary to actuate the press, while the travel of the press to and from final operative position is obtained largely by the use of cheap low pressure water.

My invention further relates to arrangements and combinations of parts which will be hereinafter set forth and more particularly pointed out in the appended claims.

A diagrammatic representation of my invention is shown in the drawings in which

Fig. 1 is a diagrammatic view, partly in section, illustrating a hydraulic press having my improvements applied thereto;

Fig. 2 is a sectional elevation of my improved Venturi connection; and

Fig. 3 is a cross section thereof, taken along the line 3—3 in Fig. 2.

Referring to the drawings, I have indicated a hydraulic press 10 in which a piston 11 is adapted to move outward or upward, applying pressure to the work W and forcing it against a fixed anvil 12. The representation of the press is illustrative only and is greatly reduced in size in relation to the remaining parts shown in Fig. 1.

Water is supplied to the cylinder 13 of

the press 10 through a pipe 14 having a three-way, hand-operated valve 15 mounted therein. Low pressure water from a feed pipe 16 is admitted to the cylinder 12 through passages 17 and 18 (Figs. 2 and 3) in a Venturi valve connection 19, said low pressure water passing from the passages in the Venturi valve to a Venturi tube 20, and thereafter passing a check valve 21 and being led to the press cylinder 13 through a feed pipe 22 and T-connection 23.

A check valve 24 (Figs. 2 and 3) is mounted between the passages 17 and 18 in the Venturi valve 19 and opens freely to permit entrance of low pressure water to the press cylinder 13. The check valve prevents any flow of water in the opposite direction when the pressure in the system exceeds that of the low pressure water supply.

High pressure water is supplied to the system through a pipe 30 and passes through a T-connection 31 to a nozzle 32 in the Venturi valve 19. The high pressure water is discharged from the nozzle 32 directly into the Venturi tube 20, from which it flows to the press cylinder 13 through the connections previously described.

While the parts thus far described substantially embody my present invention, it is frequently desirable to apply an even higher pressure at the final stage of the pressing operation, and for this purpose I have indicated an intensifier 40, comprising a piston 41 in a cylinder 42, said piston having a relatively large low pressure area and a relatively small high pressure area so that the pressure on the outlet connection 47 may be, for illustration, five times the pressure in the inlet connection 43.

The pipe 43 is connected through a three-way, manually-operated valve 44 to a feed pipe 45 and to an exhaust pipe 46. The feed pipe 45 is directly connected to the high pressure pipe 30 through the T-connection 31.

Having described the details of construction of my improved mechanism, I will now describe the operation and advantages thereof.

We will first assume that the piston 11 is at

its lowest position, with the cylinder 13 connected through the three-way valve 15 to the exhaust pipe 15^a and with water at high pressure available in the pipes 30 and 45. The check valve 24 will be closed under these conditions, preventing back flow of high pressure water to the pipe 16 and the three-way valve 44 will be manually set to close the pipe 45 and connect the pipe 43 to the exhaust pipe 46. The high pressure water from the pipe 30 will operate through the pipe 47 to depress the piston 41 in the cylinder 42, forcing the water contained therein out through the exhaust pipe 46.

The apparatus is then placed in operation by moving the valve 15 to shut off the exhaust pipe 15^a and connect the pipe 22 to the cylinder 13. As soon as this is done, high pressure water will begin to flow through the nozzle 32 in the Venturi valve 19. The action of the water from the high pressure nozzle is clearly indicated in Fig. 2, the effect thereof being to lower the pressure in the passage 18 and cause the entrance of a large body of low pressure water through the pipe 16 and past to check valve 24.

This low pressure water may come from any available water supply, such as the public water mains, and may be at any ordinary pressure such as twenty pounds per square inch. The area of the passages 17 and 18 and the low pressure pipes 16 is very much greater than the area of the opening through the nozzle 32, so that the flow of a small amount of high pressure water through the nozzle 32 induces a very large flow of low pressure water through the passages 17 and 18.

The piston 11 is thus moved through its substantially unresisted range by the use of a small amount of expensive high pressure water and a large amount of inexpensive low pressure water. As soon as the piston encounters considerable resistance, the high pressure water will build up the water pressure in the Venturi valve and in the other connections to a pressure above that of the low pressure water. When this occurs, the check valve 24 will close and the piston 11 will thereafter be operated directly by the high pressure water but for a very limited range of travel.

In actual operation, the low pressure water may be at very low pressure or even at atmospheric pressure, while the high pressure water may be at five hundred pounds pressure, which pressure is attained at a cost many times greater than that of the low pressure water.

If a further and very heavy final pressure is desired, the hand operated valve 44 is moved to close the exhaust pipe 46 and connect the pipe 45 to the high pressure pipe 43. High pressure water then enters the cylinder 42, forcing the piston 41 upward and exerting

a pressure perhaps five times as great or twenty-five hundred pounds per square inch through the pipe 47 to the cylinder 13. As soon as the pressure rises, the check valve 21 closes, preventing back flow of this very high pressure water through the Venturi valve into the supply pipes 16 or 30. The piston 11 is substantially at its final position before the intensified pressure is applied, so that there is only a very slight actual flow of water through the pipe 47.

To relieve the pressure, the valve 44 is first actuated to connect the pipe 43 to the exhaust 46, whereupon the high pressure water from the pipe 30 will depress the piston 41 as previously described. The valve 15 is then actuated to connect the cylinder 13 to the exhaust, allowing the piston 11 to return to initial position.

I have thus provided a construction by which a press may be operated to produce heavy final pressure by the use of a large amount of inexpensive low pressure water and a very greatly reduced amount of expensive high pressure water. In actual practice it is found that a press may be thus operated with eighty per cent or more of low pressure water and twenty per cent or less of high pressure water. It will be particularly noted that this saving in high pressure water is effected without any attention by the operator who merely opens or closes the hand valve 15 in the ordinary manner, and who need have no knowledge whatever of the operation of the Venturi valve 19.

While the flow of water past the check valve 24 may be caused to some extent by the low pressure in the pipe 16, it is caused very largely by the Venturi action of the tube 20 and the apparatus will operate satisfactorily when the pipe 16 is connected to an open storage tank or reservoir in which the low pressure water is under no head whatever.

By the use of my improved connections, the cost of operation of large hydraulic presses is reduced to a small fraction of the cost under the usual operation, using high pressure water exclusively. It will be understood that the operation of the intensifier is entirely optional and that the invention is equally valuable whether or not an intensifier is used to give the final extreme high pressure.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed otherwise than as set forth in the claims, but what I claim is:—

1. In a hydraulic mechanism having an actuated member, a low pressure water supply, a high pressure water supply, and means to give said member a substantially unresisted movement by the use of a relatively small amount of high pressure water and

an amount of low pressure water many times greater than the amount of said high pressure water, and to give said member its final movement by the use of high pressure water only, and for automatically regulating the supply of high and low pressure water in accordance with the resistance, said means including a Venturi connection for said high and low pressure water supplies in said mechanism, causing a relatively large induced flow of low pressure water against slight resistance.

2. In a hydraulic mechanism having an actuated member, a low pressure water supply, a high pressure water supply, and means to give said member a substantially unresisted movement by the use of a relatively small amount of high pressure water and a relatively large amount of low pressure water, and to give said member its final limited movement by the use of high pressure water only, and for automatically regulating the supply of high or low pressure water in accordance with the resistance, said means including a Venturi connection having a nozzle connected with the high pressure water supply and provided with a relatively small outlet and having a draft tube connected with a relatively large inlet pipe for the low pressure water supply, and a check valve in said low pressure water supply having a flow opening of several times greater area than the outlet of said Venturi nozzle.

In testimony whereof I have hereunto affixed my signature.

MARK H. DAMERELL.