No. 765,562.

PATENTED JULY 19, 1904.

E. CROWE.

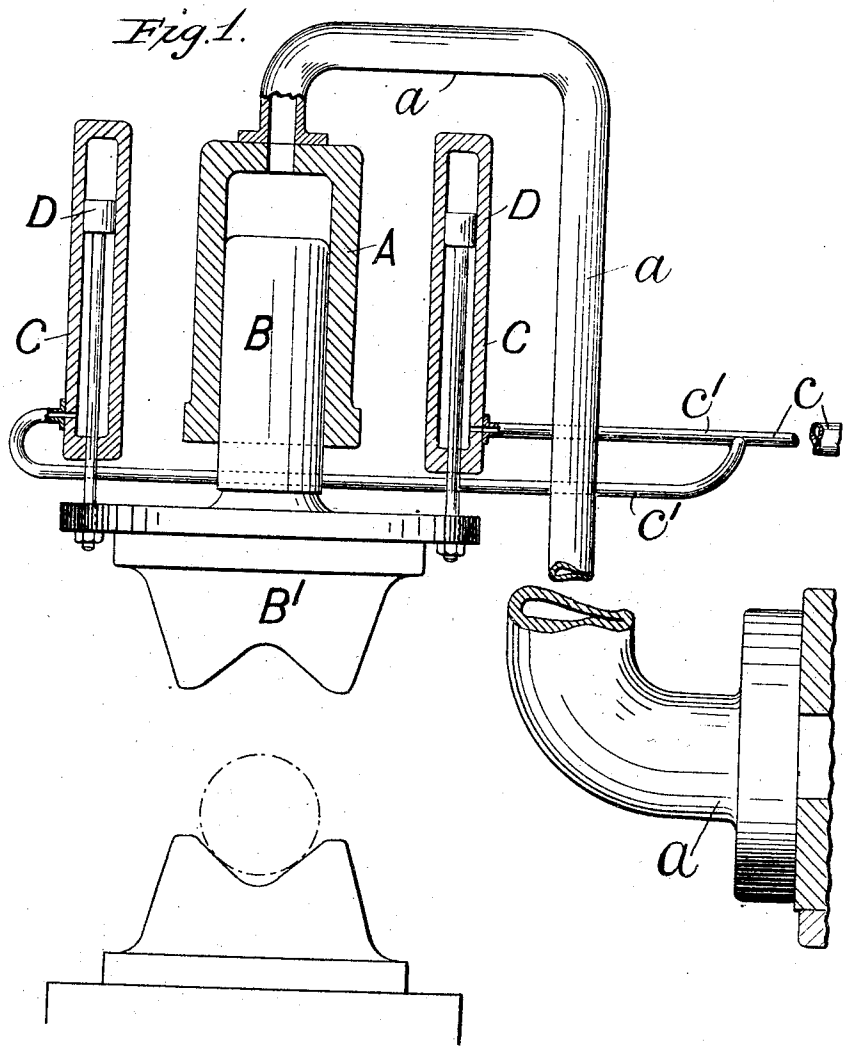
HYDRAULIC PRESS.

APPLICATION FILED OCT. 7, 1903.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.




WITNESSES:

W. M. Avery

A. H. Davis

INVENTOR

Edward Crowe

BY

Munn & Co.

ATTORNEYS.

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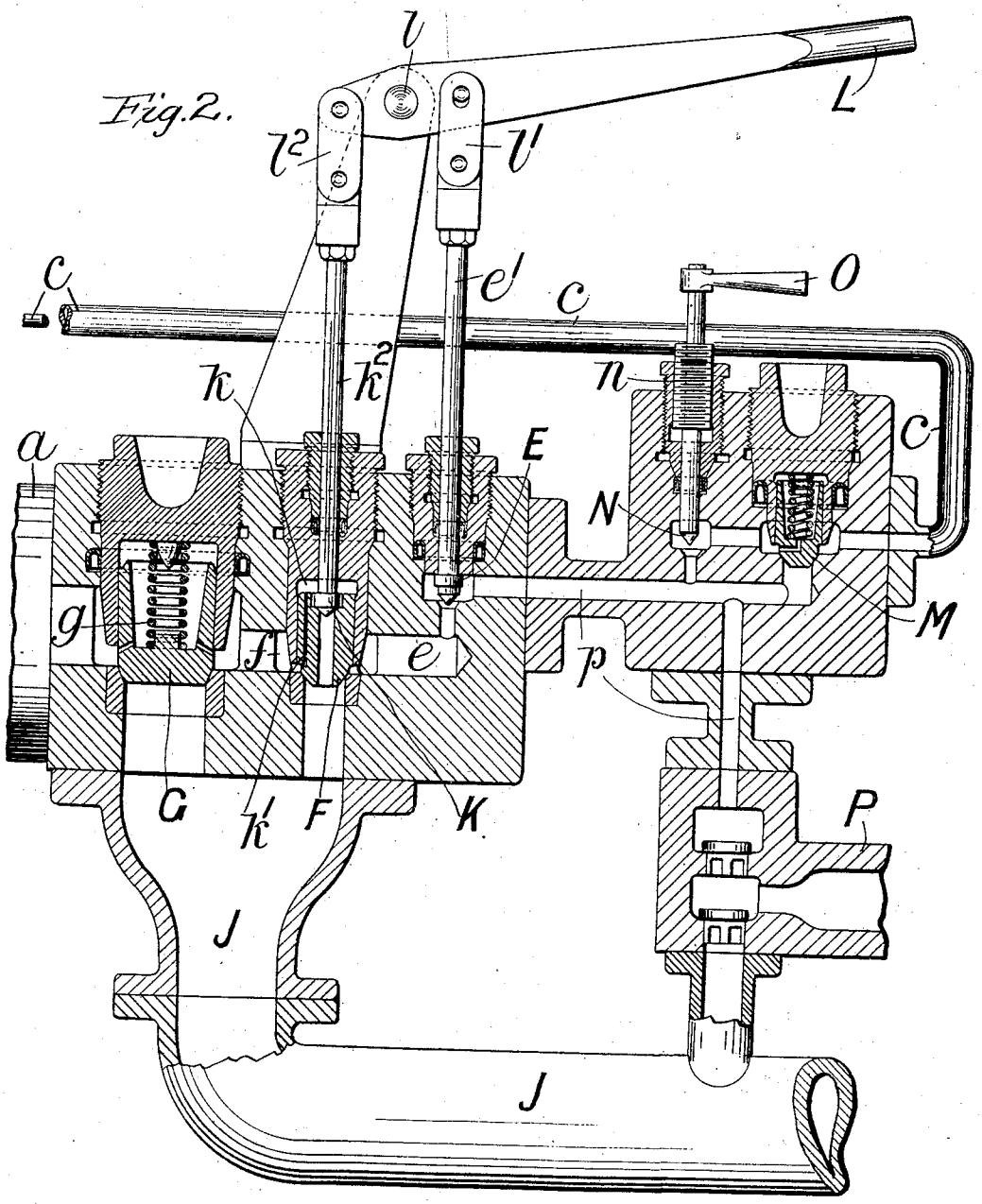
E. CROWE.

HYDRAULIC PRESS.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.




WITNESSES:

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# UNITED STATES PATENT OFFICE.

EDWARD CROWE, OF SHEFFIELD, ENGLAND, ASSIGNOR OF ONE-HALF TO DAVY BROS., LIMITED, OF SHEFFIELD, ENGLAND, AN INCORPORATED COMPANY.

## HYDRAULIC PRESS.

SPECIFICATION forming part of Letters Patent No. 765,562, dated July 19, 1904.

Application filed October 7, 1903. Serial No. 176,077. (No model.)

*To all whom it may concern:*

Be it known that I, EDWARD CROWE, engineer and chief draftsman, a subject of the King of Great Britain, residing at Birchholm, Bushey Wood, Totley Rise, Sheffield, in the county of York, England, have invented certain new and useful Improvements in Hydraulic Presses, of which the following is a specification.

This invention relates to means of controlling the operation of hydraulic presses used for forging and for other purposes—such, for example, as bending and testing armor-plates, flanging, and the like; and the invention has for its objects to enable the valves controlling the action of the press to be worked directly and promptly by hand without the necessity of using auxiliary hydraulic or other fluid-pressure independent of that whereby the press-head itself is operated and to enable the speed of descent of the press-head onto the work to be regulated at will and the press-head to be arrested at any point in its descent.

The present invention consists in an improvement on the invention for which I made previous application for Letters Patent, filed on the 15th day of June, 1903, Serial No. 161,538, and will be described with reference to the accompanying drawings, in which—

Figure 1 is a side elevation, partly in section, of a portion of a hydraulic press; and Fig. 2 is a sectional elevation of the valve mechanism of the press, showing my improvement.

In the drawings, A is the main cylinder, and B the ram for imparting the working stroke to the press-head B′, the return stroke being imparted by the pistons D, working in the lifting-cylinders C. The pipe connections, with the cylinders A and C, are controlled by valves arranged to operate in such manner that pressure can be alternatively supplied to the main cylinder A for making the working stroke or to the lifting-cylinders C for making the return stroke, or the main and lifting-cylinders can be connected at the same time with the exhaust-tank or with each other and the exhaust in such manner as to allow the lifting-cylinder C to exhaust into and the main cylinder A to draw from the exhaust-tank, so that the press-head B′ will be permitted to descend freely by its own weight, the pumps P then either running light or being out of operation. Between the main cylinder A and the exhaust-valve F there is provided a self-closing by-pass suction-valve G, which while permitting the main cylinder A to draw from the exhaust during the free descent of the press-head B′ will be closed immediately the descent of the press-head is checked in consequence of the tool meeting the work, so that pressure then brought to bear on the main ram B will cause the descent of the press-head to be continued, but at a slower speed.

The supply from the pumps P to the main cylinder A is under the control of a high-pressure distribution-valve E, which also controls the connection of the lifting-cylinders C with the main cylinder A, this latter connection being opened to afford passage of water from C to A during the descent of the main ram B. The arrangement is such that the pump-pressure has constant access to the lifting-cylinder; but owing to their smaller area as compared with the main cylinder the pressure in the lifting-cylinder is only able to prevail, and thus lift the press-head B′, when by the closure of the high-pressure distribution-valve E the supply of pressure is cut off from the main cylinder A. The exhaust from the main cylinder is under the control of the exhaust-valve F, while the connection of the main cylinder A with the exhaust J for the admission of water to the main cylinder during the idle part of the descent of the press-head B′ is permitted by the opening of the suction-valve G, (closed by the spring *g*,) which controls a by-pass connection with the exhaust J and permits of flow in only one direction when the exhaust-valve F is closed.

The upper end of the main cylinder A is connected by a pipe *a* with the valve-box of the valves G and F and through a constantly-open passage *f* around the latter valve with a passage *e*, which communicates by way of the

high-pressure distribution-valve E with the delivery-pipe $p$ from the pumps P.

The pump delivery-pipe $p$ connects, through the pipes $c$ $c'$, with the lower ends of the lifting-cylinders C, and in order to regulate the speed at which the press-head B′ descends onto its work and to enable the press-head to be arrested and held stationary at any point in its descent two valves M and N are provided on the branch pipe $c$. Of these M is self-acting and while permitting water to flow from the pumps P into the lifting-cylinders C prevents any return flow. This valve M is on a by-pass to the other valve, N, which is adjustable and controlled, preferably, by a screw $n$, worked by a handle O. By varying the extent to which the valve N is opened the rate at which the water escapes from the lifting-cylinders C, and consequently the speed of descent of the press-head B′, can be very effectually regulated, while by closing the valve N the descent of the press-head will be arrested entirely.

The high-pressure valve E is guided and operated by means of its spindle $e'$, whose diameter is equal to the mean between the greater and lesser diameters of the valve-seat, so that the valve when closed is in equilibrium, and therefore capable of being easily opened by means of the handing-lever L, as more fully described hereinafter.

The body of the exhaust-valve F is of two diameters, the portion above the annular passage $f$, already referred to, being of larger diameter than that forming the inner wall of said passage. Above the body of the valve F is a chamber $k$, which communicates with the exhaust J by way of an axial passage traversing the body of the valve F and controlled by a pilot-valve K, the pilot-valve face being of approximately the same diameter as the upper part of the valve-spindle $k^2$, so that the pilot-valve itself is balanced, and therefore easy to open.

The chamber $k$ is in constant communication with the annular passage $f$ by way of small holes or passages, as at $k'$, the collective area of the holes $k'$ being so much less than that of the orifice closed by the pilot-valve K that when the latter is open the water can escape more quickly than it can enter, the action being as follows: Supposing the valves F and K to be closed, the former will be held firmly to its seat by the pump-pressure transmitted through the holes $k'$ and acting on the top of valve F. On the pilot-valve K being opened the pressure tending to hold valve F to its seat will be relieved, and the pressure from the main press-cylinder A acting in the annular passage $f$ upon the area of the valve F, corresponding to the difference of its two diameters, will cause the valve F to rise until the area of the relief-passage through valve K is so diminished as to equal only the collective area of the holes $k'$, and consequently so long as there is sufficient pressure from the main press-cylinder A acting in the passage $f$ the valve F will be caused to follow the upward movement of the pilot-valve K. When once valve F is wide open, there will cease to be any pressure in the system, and consequently there will be no resistance to overcome in closing valve F.

It is a feature of this invention that the exhaust-valve F and high-pressure-distribution valve E are both controlled directly by the same handing-lever L, which is fulcrumed at a fixed point $l$ and connected at opposite sides of the fulcrum by links $l'$ $l^2$ with the valve-spindles $e'$ and $k^2$, respectively, so that a movement of lever L in either direction will open one of the valves and close the other. When the exhaust-valve F is closed, the high-pressure valve E will be held open by pressure acting upon its face, and to enable the valve E to be closed with ease the link $l'$ has a pin-and-slot or equivalent connection with the lever L or the valve-spindle $e'$, so that before the movement of lever L is transmitted to valve E in the direction to close that valve the valve F will have been raised from its seat sufficiently to relieve the pressure tending to hold valve E open. In consequence of this arrangement the valves E and F are under perfect control, and by proper manipulation of the handing-lever L they can both be held open at the same time, so as to allow the press-head B′ to descend onto the work and to hold the latter between the forging or other tools solely by its own weight, the water from the pumps escaping through the open exhaust-valve F, so that no other pressure than that due to the weight of the press-head and attached parts will be brought to bear upon the work. This provision, as well as that by means of which the descent of the press-head can be regulated and arrested by means of the valve N, is of great value in enabling the work to be adjusted under the press without the necessity of interrupting the running of the pumps.

I claim—

1. In a hydraulic press, the combination of main and lifting cylinders, provision for a common source of supply for both, a self-closing suction-valve adapted to permit the descent of the press-head by gravity, a valve adapted to control connection between the lifting-cylinders and the main cylinder and to also control the supply of pressure from the source of power to the main cylinder and, when closed, confine the supply of said pressure to the lifting-cylinders, a valve for regulating the escape of water from the lifting-cylinders, an exhaust-valve interposed between the main cylinder and the exhaust, a balanced pilot-valve seated in said exhaust-valve for controlling the operation thereof, and a hand-operated lever connected to said pilot-valve and to the pressure-distribution

valve, the connection of said valves with the lever being on opposite sides of the fulcrum thereof, whereby when the one valve is open the other valve will be closed and vice versa, substantially as specified.

2. In a hydraulic press, the combination of main and lifting cylinders, a common source of supply for both the main and lifting cylinders, a self-closing suction-valve adapted to permit the descent of the press-head by gravity, a valve adapted to control connection between the lifting-cylinders and the main cylinder and to also control the supply of pressure from the source of power to the main cylinder and, when closed, confine the supply of said pressure to the lifting-cylinders, a valve for regulating the escape of water from the lifting-cylinders, an exhaust-valve interposed between the main cylinder and the exhaust, a balanced pilot-valve seated in said exhaust-valve for controlling the operation thereof, and a hand-operated lever connected to said pilot-valve and to the pressure-distribution valve, the distribution-valve having a loose connection with the lever, whereby the exhaust-valve is permitted to open slightly before the commencement of the closing movement of the pressure-distribution valve, substantially as specified.

3. In a hydraulic press the combination of main and lifting cylinders, provision for a common source of supply for both means for permitting the descent of the press-head onto the work by gravity, a self-acting non-return valve interposed in the supply-pipe to the lifting-cylinders and an adjustable hand-controlled valve on a by-pass to the said non-return valve for the purpose of regulating the speed of descent of the press-head and arresting the same at any level, substantially as specified.

EDWARD CROWE.

Witnesses:
LUTHER J. PARR,
BAIN L. CAMPBELL.