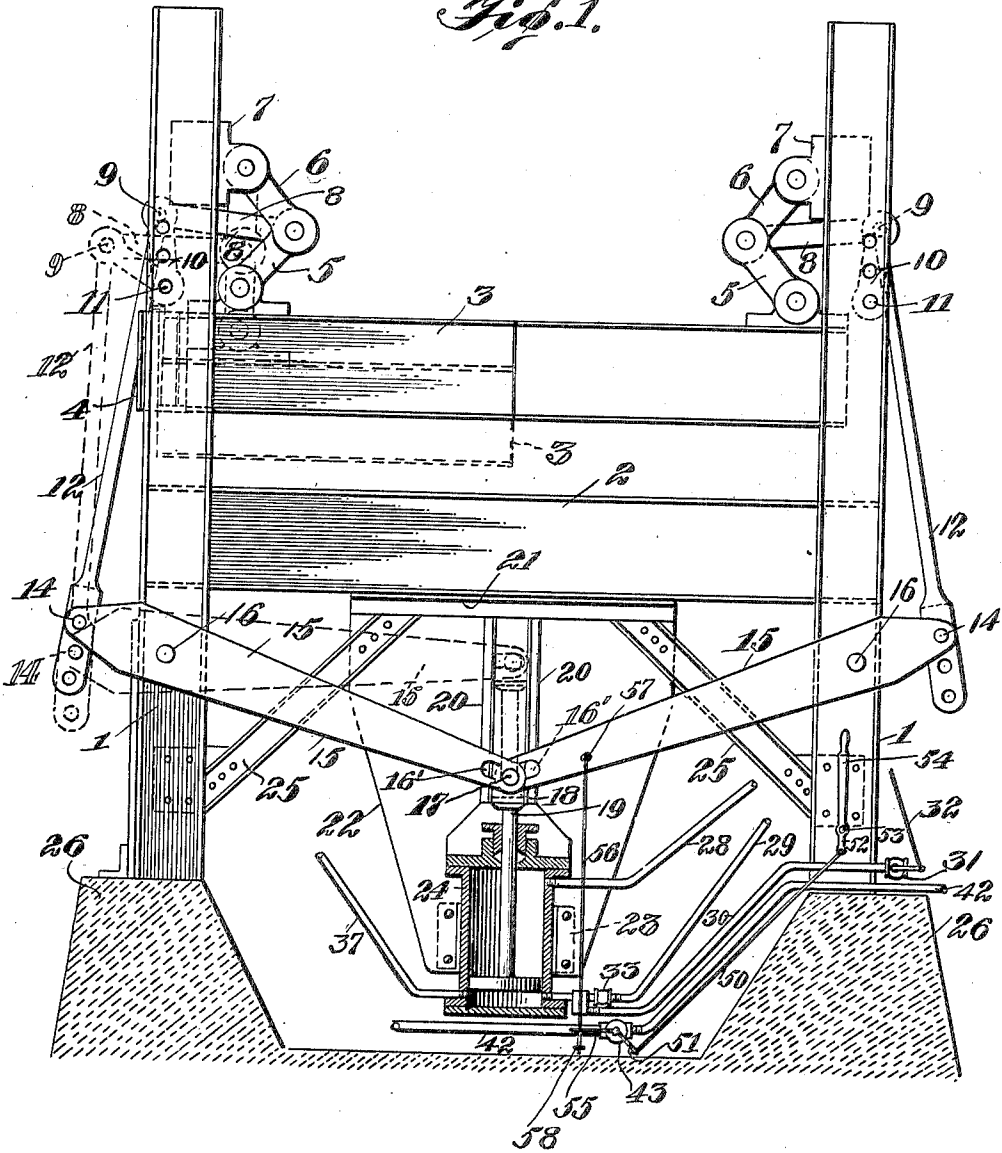


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 FLUID PRESSURE POWER MEANS FOR PRESSES.
 APPLICATION FILED JAN. 16, 1919,

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Patented Mar. 2, 1920.
 2 SHEETS—SHEET 1.

Fig. 1.



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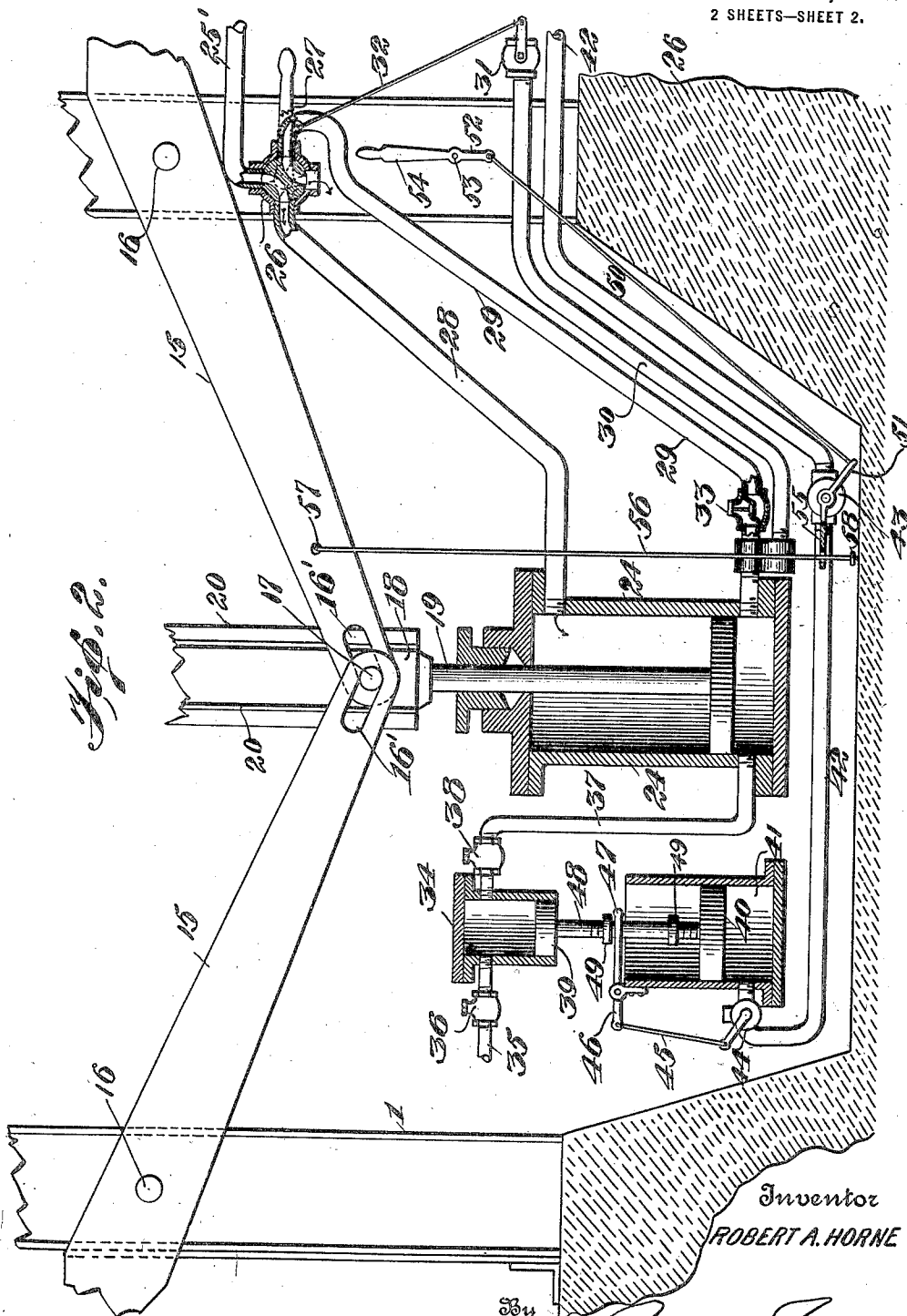


Fig. 2.

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UNITED STATES PATENT OFFICE.

ROBERT A. HORNE, OF TOLEDO, OHIO.

FLUID-PRESSURE POWER MEANS FOR PRESSES.

1,332,340.

Specification of Letters Patent.

Patented Mar. 2, 1920.

Application filed January 16, 1919. Serial No. 271,481.

To all whom it may concern:

Be it known that I, ROBERT A. HORNE, a citizen of the United States of America, residing at Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Fluid-Pressure Power Means for Presses, of which the following is a specification.

My invention relates to presses or machines for shearing, shaping or forming metal and which are operated by hydraulic or compressed air motors.

My object is to reduce the size and cost of the prime movers for such machines by the provision of means which will supplement their power temporarily at the point of peak load of the power stroke of the press head or equivalent movable element. In bending, flanging, pressing and shaping machines, the peak load on the motor comes at the moment of engagement of the press head or equivalent movable element with the stock and before the latter is broken. After the stock has been broken or substantially deformed the power required to complete the stroke of the press head drops materially. Heretofore it has been necessary to design the capacity of the motor or to increase the pressure of the motive fluid to meet the required peak load power in the prime mover thus materially increasing the cost of the machine or power plant.

The object of my invention is to provide a booster means which will serve to temporarily augment the pressure in the motor cylinder to increase its power at its point of peak load and which will accomplish this without requiring the compressor or pump or power plant to function so as to produce such abnormally high fluid pressure throughout the distributing system.

A further object of my invention is to devise a booster means preferably in the form of a differential piston motor acting upon the air or liquid motor fluid supply to the main cylinder, the larger piston head being exposed to the normal hydraulic or air pressure and acting through the smaller piston in a booster cylinder to raise to an abnormal pressure the motor fluid which is delivered to the main cylinder at the desired point in its power stroke.

My present invention is peculiarly applicable to the type of press forming the subject matter of Letters Patent No. 1,266,684, issued to me on May 21st, 1918, wherein the

prime mover acts through toggles to move the press head, for the toggles at the commencement of the power stroke where the peak load generally comes on are in position of lowest efficiency and by utilizing its booster means I am enabled to increase the initial power applied to the toggles sufficiently to start the press head and as the latter moves the increasing power derived from the toggles will carry the press head through its full power stroke without requiring further assistance from the booster mechanism.

A further object of my invention is to provide novel means for controlling the supply of motor fluid to both main and booster cylinders and automatically cutting off the booster cylinder at a predetermined point in the power stroke of the press when its service can be dispensed with.

My invention further comprises the novel details of construction and arrangements of parts with such modifications thereof as do not involve a departure in principle, such parts being illustrated in their preferred embodiments only in the accompanying drawings which form a part of this specification, and in which:

Figure 1 illustrates the press in side elevation with the press head raised, dotted lines showing the position of the transmission elements when the press head is lowered.

Fig. 2 is a detail view in vertical cross section through the main and booster cylinders forming the prime mover of the press, and also showing the pipes and valve rigging for the main and booster cylinder.

Similar reference numerals refer to similar parts throughout the drawings.

I have illustrated my invention in connection with a press similar to that described in my Letters Patent aforesaid, and which, as the structural details thereof form no part of my present invention and are merely typical of any press, punch, shaper or former, the same will be briefly described as comprising vertical housings 1 formed by pairs of out-turned spaced channels which receive between them I-beams 2 with suitable filler not shown forming the bed or stationary press element. The press head or movable element 3 is likewise formed of I-beams with suitable filler and has its ends working in guides 4 carried between the beams of the housings. The head at each end is connected overhead by a pair of toggle

links 5 and 6 to hanger blocks 7 forming the upper spacing elements made fast between the housing beams. Each toggle is operated by an arm 8 passing between the adjacent housing beams and connected at its outer end by a wrist pin 9 to one or more links 10 mounted to rock on the bearing pin 11 carried by the housing. The wrist pin 9 also serves to connect to each toggle arm 8 an operating rod 12, the lower end of which is provided with a series of holes through one of which a pin 14 is passed, securing it to the outer end of a main press lever 15, one of which is journaled on pin 16 passing between the beams of each housing near its base. The inner end of each main lever is provided with an elongated slot 16', and a pin or roller 17 on the cross head 18 at the top of the piston rod 19 is adapted to pass through the two slots 16' in the adjacent inner ends of the oppositely facing levers 15, the cross head being disposed to work in vertical guides 20 connected overhead to a plate 21 attached to the bottom of the bed plate 2 and extending down at 22 so as to be bolted to side flanges 23 cast integral with the main power cylinder 24. Angle braces 25 lead from the base of the housings to the plate 21 and support the center of the bed 2. The housings are anchored at their bases in a concrete bed 26, the center of which is dropped to a proper level to form the foundation to which the main cylinder 24 is anchored.

As thus far described the reciprocation of the piston rod 19 will act through the power multiplying agency of the levers 15 to draw down the rods 12 and by means of the arms 8 to shift the toggles from full line to dotted positions, thus forcing the press head down for its power stroke and the reverse movement of the piston rod through the instrumentalities described will raise the press head. While I have thus described the press in detail, it is to be understood that in making use of the booster means which will now be described, I contemplate its association with various arrangements of power transmission and multiplying agencies and with various types of motors and various sources of fluid pressure.

The power mechanism, as illustrated, comprises a compound air cylinder 24 having a supply pipe 25' leading from a tank or air compressor, not shown, to the four-way valve 26 operated by a handle 27 and adapted to distribute the pressure through pipes 28 and 29 to the opposite ends of the cylinder 24 and to exhaust air therefrom through pipe 28 only. The cylinder is provided with an exhaust pipe 30 leading from its bottom and having therein a valve 31 connected by a rod 32 to the lever 27 in such manner that when the lever sets the valve 26 to admit pressure to the top of the cylinder 24 the

valve 31 is open to exhaust the bottom end of the cylinder. A check valve 33, operating to prevent the exhaust of pressure through pipe 29, makes this exhaust pipe 30 necessary.

The booster mechanism comprises a booster cylinder 34 connected by a pipe 35 with a suitable source of fluid pressure, preferably the same as that which supplies the cylinder 24. This pipe 35 enters one end of the cylinder 34 past a check valve 36 and from the same end of the cylinder 34 leads a pipe 37 which connects with the lower end of the power cylinder 24 and has a check valve 38 therein set to prevent the normal pressures passing it and entering the cylinder 24. The smaller head 39 of a differential piston works in the cylinder 34, and the larger head 40 of this piston is disposed to work in a cylinder 41 to which fluid pressure is supplied by a pipe 42 from the air compressor tank or other source of supply past an automatic one-way valve 43 and past a three-way valve 44 adapted to directly control the supply and exhaust of pressure from below the piston head 40. This valve 44 is adapted to be automatically operated by a rod 45 connected overhead to a rocking lever 46 journaled in the upper open end of the cylinder 41 and having its yoke end 47 adapted to straddle the piston rod 48 connecting the piston heads 39 and 40. This rod 48 carries spaced stops 49 which engage and rock the lever 46 so as to open valve 44 to admit pressure as the piston reaches the lower end of its stroke and to open the valve 44 to exhaust the cylinder as the piston reaches the top of its stroke.

The valve 43 is subject to both manual and automatic control, being adapted to be opened by a rod 50 connected to a crank 51 on the valve at one end and at the other end connected to the lower end of a lever 52 pivotally mounted on one of the housings at 53 and having its handle 54 disposed adjacent to the four-way valve 26. Another crank 55 on the valve 43 has a lost-motion connection with a rod 56 which is pivotally connected by a pin 57 to the power lever 15 above it. The rod 56 slides freely through the crank 55 and has screwed on its lower end a stop nut 58 which is adjustable thereon to pick up the valve stem 55 at the desired point in the upward movement of the power lever 15 and move the valve 43 to closed position, thereby cutting off power to the booster mechanism. The valve will remain in this closed position without being responsive to the reverse movement of the power lever and must be opened by the hand lever 54 to bring the booster cylinder again into operation.

The general operation of the apparatus described is as follows: Assuming the piston rod 19 in lowered position with the press

head raised for normal operation, the valve handle 27 is raised and lowered, thus alternately supplying and exhausting pressure from the ends of cylinder 24 and reciprocating the press head. Whenever the duty on the press needs supplemental power, as the valve 26 is shifted to admit power to the bottom of the cylinder 24, the lever 54 is shifted to open valve 43 and as the piston head 40 normally stands in lowered position holding the valve 44 open to admit fluid pressure from pipe 42 below it, fluid pressure will at once take effect under piston head 40 and will raise it, and, due to differential piston between the piston heads 39 and 40, will act to highly compress the fluid which is normally maintained in cylinder 34 by the action of the check valves 36 and 38. The valve 36 will close to prevent this abnormal pressure escaping through the pipe 35 while the check valve 38 will open to permit it to pass through pipe 37 and augment the pressure in the main cylinder to the desired extent. As the power levers 15 rise, the valve 43 is moved to shut off pressure to the cylinder 41 and at the same time one of the stops 49 will open valve 44 to exhaust the cylinder 41, thereby permitting the differential booster piston to drop until a stop 49 shifts the valve 44 from exhaust position back to position to admit pressure from pipe 42 when valve 43 is open. When the four-way valve 26 is reversed to move the power levers 15 downwardly to initial position, the rod 32 opens to exhaust valve 31, permitting the cylinder to exhaust freely.

It will be obvious that the instrumentalities described are capable to bring in the boosting effect at the desired point in the operation of the main motor and the connections may be such between the main motor and the booster as to give its effect at any desired point in either stroke of the piston rod of the main motor.

This invention is not intended to be restricted in scope to the specific embodiments shown, but contemplates such modifications as come within the spirit and scope of the claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a power press, a fluid pressure motor adapted to operate the press, a source of non-condensable motor fluid, and power means automatically cut off by the motor to temporarily increase the pressure therein, as and for the purposes described.

2. In a power press, a main cylinder having a press operating piston, pipe and valve means to supply compressed air or liquid to and exhaust it from said cylinder to reciprocate said piston, an auxiliary differential cylinder supplied at both ends with said compressed air or liquid, a valve controlling such

supply to the larger end of said auxiliary cylinder, a pipe connecting the smaller end of said auxiliary cylinder to the main cylinder in position to deliver high pressure fluid thereinto to assist in the power strokes, a valve means in said pipe to prevent the escape of normal pressure from said auxiliary cylinder, and a valve to prevent the escape of the abnormal pressure through the normal pressure supply pipe for the piston's power stroke.

3. In a press having a motor adapted for operation by hydraulic or air pressure, an auxiliary fluid motor having differential cylinders supplied with said fluid pressure and adapted in the smaller cylinder to increase the pressure of said motor fluid, and means to deliver the motor fluid only under abnormal pressure from the smaller of said differential cylinders to the motor for the press, substantially as described.

4. In a power press, a main cylinder, a source of compressed air or liquid having pipe connections to both ends of said cylinder, a distributing valve means controlling the supply and exhaust of motor fluid to said main cylinder, a supplemental exhaust at one end of said main cylinder, a check valve in the supply pipe for said latter end of the cylinder, a valve in said supplemental exhaust, and means to temporarily boost the pressure of the motor fluid in said latter end of the main cylinder, substantially as described.

5. In a power press, a main cylinder, a source of compressed air or liquid having pipe connections to both ends of said cylinder, a distributing valve controlling the supply and exhaust of motor fluid to said main cylinder, a supplemental exhaust at one end of said main cylinder, a check valve in the supply pipe for said latter end of the cylinder, a valve in said supplemental exhaust, means to temporarily boost the pressure of the motor fluid in said latter end of the main cylinder, and means automatically responsive to the action of the press for controlling the action of said booster means.

6. In a power press, a cylinder, a source of compressed air or liquid, means to distribute the same to both ends of the cylinder, a check valve in the means distributing motor fluid to the bottom of the cylinder, an auxiliary valve controlled exhaust for the bottom of the cylinder, a differential cylinder having pipe connections at both ends with the source of motor fluid, a check valve in the supply pipe to the small end of the cylinder, a pipe leading from said small end to the bottom of the main cylinder and having a check valve therein, and valve means controlled by the operation of said differential cylinder to automatically supply and exhaust motor fluid to the large end of said differential cylinder.

7. In a power press, a cylinder, a source of
compressed air or liquid, means to distribute
the same to both ends of the cylinder, a check
valve in the means distributing motor fluid
5 to the bottom of the cylinder, an auxiliary
valve controlled exhaust for the bottom of
the cylinder, a differential cylinder having
pipe connections at both ends with the source
of motor fluid, a check valve in the supply
10 pipe to the small end of the cylinder, a pipe
leading from said small end to the bottom of
the main cylinder and having a check valve
therein, valve means controlled by the opera-

tion of said differential cylinder to automati- 1
cally supply and exhaust motor fluid to the
large end of said differential cylinder, and a
master valve in the supply pipe to the large
end of the differential cylinder having a
positive manual control means and a lost- 2
motion press controlled means, substantially
as described.

In testimony whereof, I, ROBERT A. HORNE,
affix my signature.

ROBERT A. HORNE.

Witness:

GEO. W. TAGGART.