

A. P. BARK.
LIFTING CYLINDER VALVE FOR FORGING PRESSES.
APPLICATION FILED APR. 11, 1919.

1,343,024.

Patented June 8, 1920.
2 SHEETS—SHEET 1.

FIG. 3

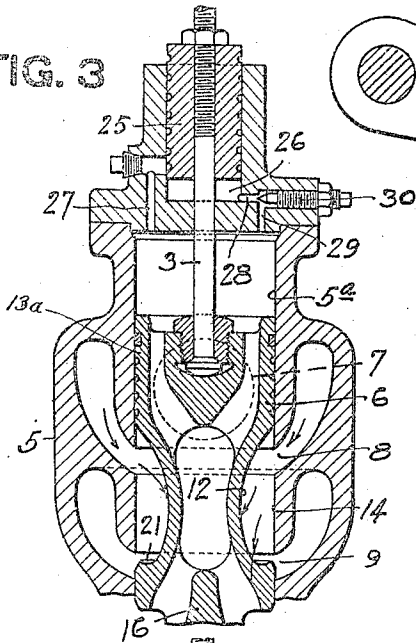


FIG. 2

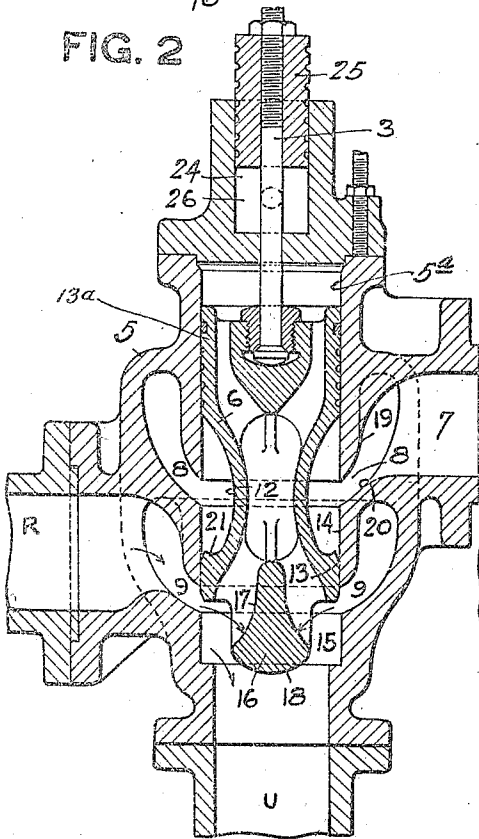
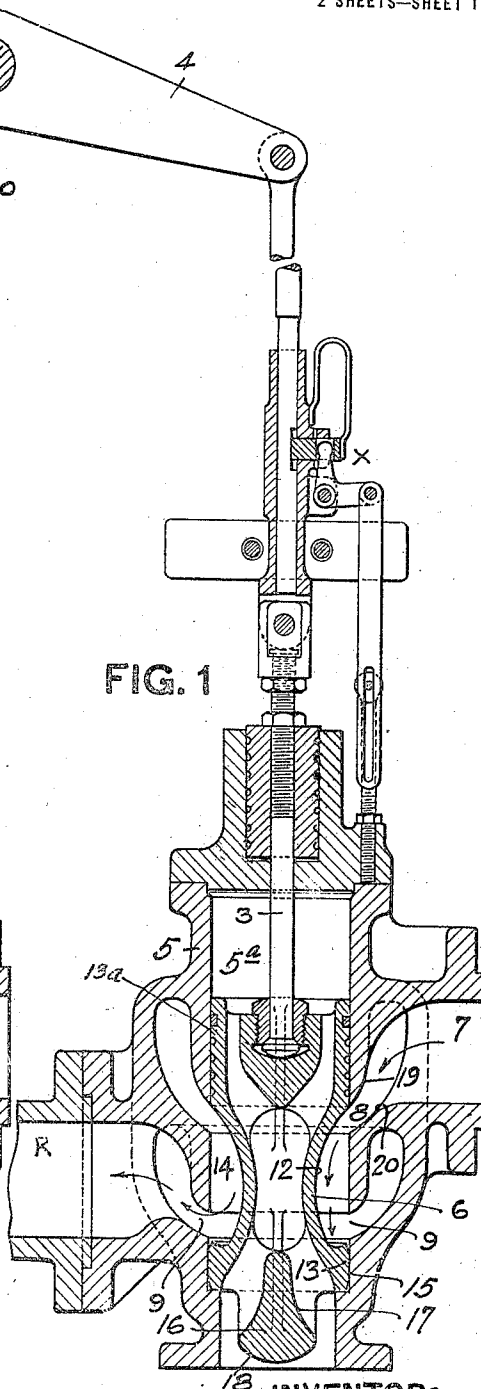


FIG. 1



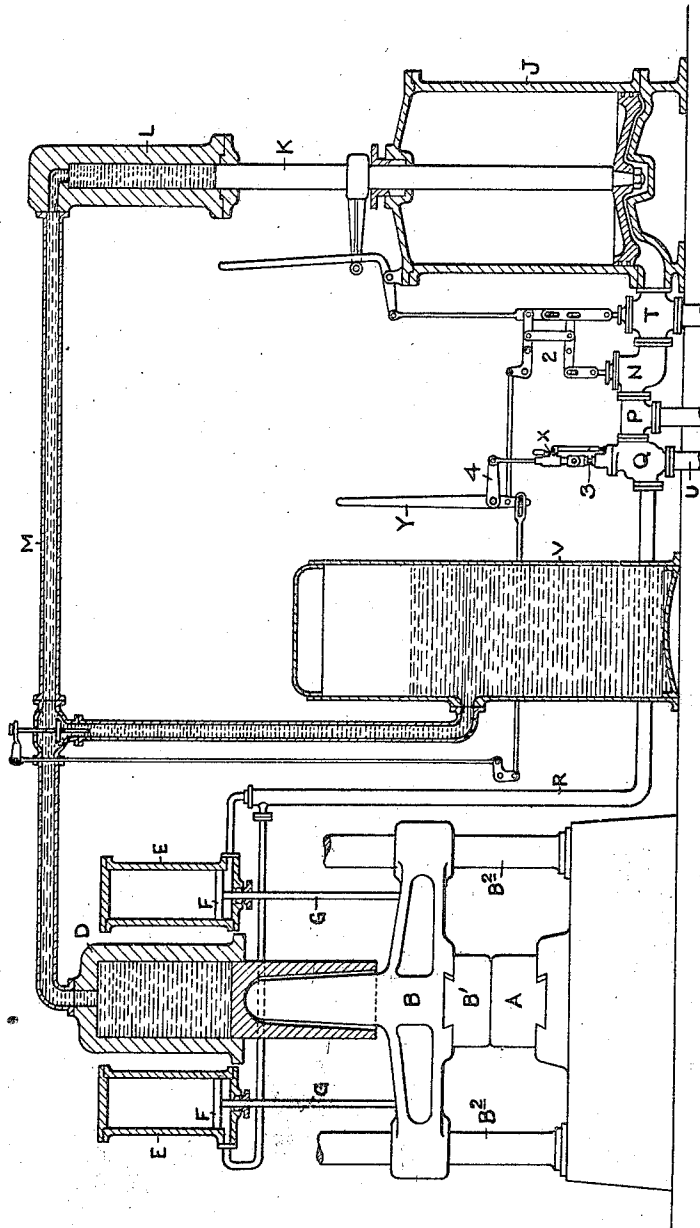
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FIG. 4



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UNITED STATES PATENT OFFICE.

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LIFTING-CYLINDER VALVE FOR FORGING-PRESSES.

1,343,024.

Specification of Letters Patent.

Patented June 8, 1920.

Application filed April 11, 1919. Serial No. 289,339.

To all whom it may concern:

Be it known that I, ARNOLD P. BARK, a subject of the King of Great Britain, and resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Lifting-Cylinder Valves for Forging-Presses; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to valves for steam hydraulic intensifier forging presses, which are employed for all characters of forging, pressing or shearing; and especially to the valve gear for the lifting cylinders of the press head. These presses have been in large use and have been of late years increased in size to provide for pressing strokes of many tons per square inch. They are controlled by a single lever, in the hand of the operator, and it has been found that with the lifting cylinder valve heretofore used certain difficulties arose when applied to very large presses. These valves were liable to "kick" and suddenly jump wide open, getting out of the operator's control, and were also liable to hesitate in their downward travel.

Study of the problem has shown that in these large presses the sudden rush of partially condensed steam was liable to be so great and rapid that the valve was forced upwardly before there was time for the pressure to equalize, and so imparted the kicking action above referred to; while the hesitating action was due to a loss of pressure between the steam entering and leaving the valve chamber, so that the upward pressure was greater than the downward pressure, for a short time during which the steam was in rapid motion, and the valve was not perfectly balanced. The object of the present invention is to overcome these difficulties, and this is accomplished in the manner hereafter described and claimed, which can be better understood by a full description of the apparatus.

In the accompanying drawing, Figure 1 is a vertical section with parts in elevation of the lifting cylinder valve in its lowest position when admitting steam to the lifting cylinders. Fig. 2 is a like view of the valve in raised position where the steam supply is cut off. Fig. 3 is a vertical section partly

broken away and at right angles to Fig. 2, showing especially the dash pot construction; and Fig. 4 is a diagrammatic view of a steam hydraulic forging press illustrating an approved construction to which the valve is applied.

In the diagrammatic view Fig. 4 the lifting cylinder valve is shown at Q, the steam entering at P and flowing through said valve and through the pipe R to the lifting cylinder or cylinders E which are connected to the press head B, the forging die B' of which operates upon the anvil or bottom die A, the press head being mounted on the guides B². The pistons F are connected by the piston-rods G to the press head, the weight of the press head being sufficient to press back the steam through the valve Q, the lower end of which connects with the exhaust pipe U. The steam inlet P connects with the main steam valve N leading to the steam intensifier cylinder J, the exhaust valve from said cylinder being shown at T. The hydraulic ram K of the intensifier cylinder J operates in the ram cylinder L and forces the water through the hydraulic high pressure pipe M to the hydraulic cylinder D in which the main hydraulic ram operates, said ram being connected to the press head B. To maintain the hydraulic high pressure pipe full of water, the particular tank V is employed. The operating or hand lever Y is connected to the operating lever mechanism 2 for the steam intensifier, employing therein a floating link construction which does not require full description. This lever Y operates through the trip gear construction X to take hold on the valve stem 3 through the arm 4 for operating the valve Q. It seems unnecessary to describe further the construction of the press as the invention relates particularly to the lifting cylinder valve Q, which is illustrated in detail in Figs. 1 to 3. The valve casing 5 has the valve chamber 5^a of uniform diameter, in which fits the valve member 6 connected to the valve stem 3. The lower end of the valve chamber 5^a connects with the exhaust pipe U. In the upper part of the valve casing is the steam supply passage 7 which communicates with the valve chamber at 8 and the port 9 connects with the steam pipe R leading to the lifting cylinders E. It will be seen that the main reciprocating valve

member 6 is hollow connecting with the valve chamber 5^a both above and below the valve to provide for balancing the same. In the construction illustrated in the drawings, the valve 6 has the central reduced portion 12 and below the same has the enlarged portion 13, fitting within the valve chamber and traveling normally opposite the portion 14 of the valve chamber between the ports 8 and 9 to cut off the steam supply from the passage 7 and port 8 to the port 9 and pipe R. This enlarged portion 13 passes down below the port 9 into the bottom portion 15 of the valve chamber. Above the central reduced portion 12 is the enlarged portion 13^a. This also fits within the valve chamber and normally seals communication between the portion 14 of the valve chamber 5^a and the upper portion of this chamber. The diameter of the reduced portion 12 of the valve 6 decreases gradually from the upper portion 13^a to its mid-portion and thence it similarly increases gradually as far as the abrupt shoulder 21 which forms the upper edge of the portion 13.

In the construction heretofore employed it was found that on the return of the steam from the lifting cylinder the sudden rush of partially condensed steam was so great and rapid that the valve was forced up before there was time for the pressure to equalize, and this action through the valve stem gave the sudden "kick" to the operating lever Y and was liable to force it out of control. To overcome this difficulty, I have provided on the main reciprocating valve 6 the knob 16 projecting centrally below the valve face 13 so that when the valve 6 is raised to the position shown in Fig. 2, the outrushing steam from the lifting cylinders under the weight of the press head B impinges on this knob and retards the upward movement or jump or "kick" of the reciprocating valve 6, preventing such sudden upward movement of the valve. As illustrated, in said Fig. 2, this knob projects downwardly within the valve chamber and its side walls 17 are gradually upwardly curved so that the outrushing steam impinges against them and provides a downward holding force until the steam can rise through the hollow valve into the upper portion of the valve chamber 5^a and cause a better balance of the valve.

It will be noted that the steam supply passage 7 leads downwardly on a gradual curve to the port 8, the top and bottom walls of the port 8 being both inclined downwardly as shown at 19 and 20 so as to project the entering steam from the passage 7 into the portion 14 of the valve chamber 5^a in a downward direction. It will also be seen that the central reduced portion 12 is curved or tapered gradually downward, having its smaller diameter adjacent to the valve portion 13, and terminates in the up-

per face of the valve portion 13 of the reciprocating valve 6 which is practically square or dished as at 21, so that the downwardly rushing steam strikes against the abrupt top face 21 and acts by its impingement to force the valve downwardly, pressing on the same as the valve portion 13 passes the port 9, when the steam escapes through the pipe R to the lifting cylinders. In the former construction, as above stated, this valve was liable to hesitate in its downward movement, as the steam from the steam inlet struck horizontally against the valve body maintaining a high pressure in the upper part of the portion 14 of the valve chamber and tending to lift the valve by pressure exerted on the lower face of the valve portion corresponding to the portion 13^a in the present case, which, in previous constructions, was practically square, while a lower pressure was exerted downwardly on a similar area when the valve was in the position shown in Fig. 3, thus throwing the valve out of balance until the pressure in the inlet and outlet ports became equalized. By these changes in construction, I utilize the impingement of the steam against the shoulder 21 to overcome this hesitation of the valve and to act upon it with sufficient force to obtain a positive movement of the valve downwardly.

Practical use has shown that more than sufficient force for this operation is obtained by such construction of the valve casing and valve and in order to control the valve, I provide a dash-pot 26, the construction of which is more particularly shown in Fig. 3. At the upper end of the valve casing is the supplemental chamber 24 through which the stem 3 passes, and this stem carries the supplemental portion 25 playing therein. The lower portion of this supplemental chamber forms a dash-pot 26 more particularly shown in Fig. 3. The main valve chamber 5^a connects with the supplemental chamber 24 through the port 27 which leads into the supplemental chamber some distance above the bottom of this chamber. At the bottom of this chamber 24 is located the small port 28 which communicates with the main valve chamber 5^a, through the port 29. These ports are under the control of the choke valve 30 so that the control of the dash-pot can be accurately regulated to give the desired resistance to the downward movement of the valve.

In the operation of the apparatus, as so described, steam passes through the valve Q, by the communicating ports 8 and 9 to the lifting cylinder or cylinders E. When it is desired to cut off the steam supply the valve 6 is lifted and in its further upward movement for the purpose of reversing the direction of travel of the press-head, the steam from the cylinder E exhausts sud-

denly, striking against the knob 16 and by its impingement overcomes any rapid rise of the valve under the unbalanced pressure and overcomes the liability of "kicking", as the valve quickly becomes balanced and remains within the operator's control. In this action the steam strikes on the upwardly inclined faces 17 of the knob and provides the necessary retardation. When it is desired to open communication between the steam supply passage 7 and the cylinders, as the operator starts the downward movement of the valve, the steam from the supply pipe overcomes the hesitation of the valve by striking in a downward direction from the downwardly inclined port 8 with its downwardly inclined sides 19 and 20 leading from the steam supply passage to the main valve chamber and by contacting with the abrupt valve face 21 and so develops sufficient power to give the necessary desired movement. In case this movement is greater than required, and in order to cushion the downward movement of the valve, the steam, under the normal back pressure which exists within the valve chamber 5^a by reason of the fact that the entire steam line is constantly filled with steam under pressure, enters through the port 27 into the lower portion 26 of the supplemental chamber 24 and acts to retard sudden movement. When the valve passes the inlet of said port 27 into the supplemental valve chamber the confined steam is choked in the dash-pot 26 and the downward movement of the valve is checked according to the adjustment of the choke valve 30. Thus, I am enabled to obtain a steady movement of the parts and an easy hand control of the operating lever Y, even in valves of large dimensions.

In the above specification I have described the position of the valve as illustrated in the drawing. It is to be understood, however, that the position of the parts is relative and the description and claims apply to the valve placed in the positions shown, and are intended to cover the apparatus broadly to perform the special functions aimed at.

What I claim is:

1. In a valve for steam hydraulic presses, the combination with the valve casing having ports leading from the steam supply, to the lifting cylinder, and to the exhaust, of a reciprocating valve in said casing controlling said port to the lifting cylinder, said valve being provided with a central knob at one end to receive the impinging steam from the lifting cylinder and to balance the pressure on the valve.

2. In a valve for steam hydraulic presses, the combination with the valve casing having ports leading from the steam supply and to the lifting cylinder, and to the exhaust, of

a hollow reciprocating valve therein controlling said port to the lifting cylinder, and provided with a central knob below the central hollow portion at one end to receive the impinging steam from the lifting cylinder and balance the pressure on the valve.

3. In a valve for steam hydraulic presses, the combination with the valve casing having ports leading from the steam supply and to the lifting cylinder, and to the exhaust, of a reciprocating valve therein controlling the port to the lifting cylinder and provided with a central knob at one end having gradually upwardly receiving side walls to receive the impinging steam from the lifting cylinder and balance the pressure on the valve.

4. In a valve for steam hydraulic presses, the combination with a valve casing having a valve chamber of uniform diameter, and an admission port from the steam supply provided with downwardly extending port walls, a port leading to the lifting cylinder, and a valve therein having a reduced portion opposite the steam supply port, and enlarged to full size of the valve chamber and provided with an abrupt shoulder below the reduced portion, substantially for the purposes set forth.

5. In a valve for steam hydraulic presses, the combination with a valve casing, having a valve chamber of uniform diameter and a steam supply admission port 8 provided with the downwardly extending walls 19 and 20, and a valve therein having a reduced portion 12 opposite the said steam supply, the valve portion 13 enlarged to full diameter of the valve and provided with an abrupt shoulder below the reduced portion to receive the steam pressure from said steam supply port and overcome the hesitating action of the valve.

6. In valve for steam hydraulic presses, the combination with a valve casing having ports leading from the steam supply and to the lifting cylinder, and having a supplemental chamber at the upper end thereof provided with a piston forming a dash-pot, of a main valve mounted in the main valve chamber, a connection between said main valve and said piston and means for establishing communication between said valve casing and said supplemental chamber.

7. In a valve for steam hydraulic presses, the combination with a valve casing having a main valve chamber provided with ports leading from the steam supply and to the lifting cylinder and to the exhaust, and having a supplemental valve chamber, of a main valve mounted in said main valve chamber and controlling said main ports, and a valve stem carrying the said main valve and also carrying a supplemental valve cooperating in the said supplemental chamber and acting as a dash pot to control the downward movement of the valve.

8. In a valve for steam hydraulic presses, the combination with a valve casing having a valve chamber provided with ports leading from the steam supply to the lifting
5 cylinder and to the exhaust, and having a supplemental valve chamber provided at its base with a choke port, of a main valve controlling the ports of the main valve chamber and having a stem carrying a supplemental
10 valve operating in the supplemental valve chamber, and coöperating in the dash pot to control the downward movement of the main valve.

9. In a valve for steam hydraulic presses, the combination with a valve casing having
15 a valve chamber provided with a steam supply port having downwardly extending port walls, and a port leading to the lifting cylin-

der, and having a supplemental valve chamber provided at its base with a choke port, 20 of a main valve in the valve casing having a reduced portion opposite the steam supply port and enlarged to full size and provided with an abrupt shoulder below the reduced
25 portion, and a stem carrying a supplemental valve operating in the supplemental valve chamber and coöperating in the dash pot to control the downward movement of the main valve.

In testimony whereof I, the said ARNOLD P. BARK, have hereunto set my hand. 30

ARNOLD P. BARK.

Witnesses:

H. F. VALENTINE,
H. D. PENNINGTON.