Feb. 17, 1925.

1,526,977

T. W. HAND

STEAM HAMMER

Filed March 27, 1924 2 Sheets-Sheet 1

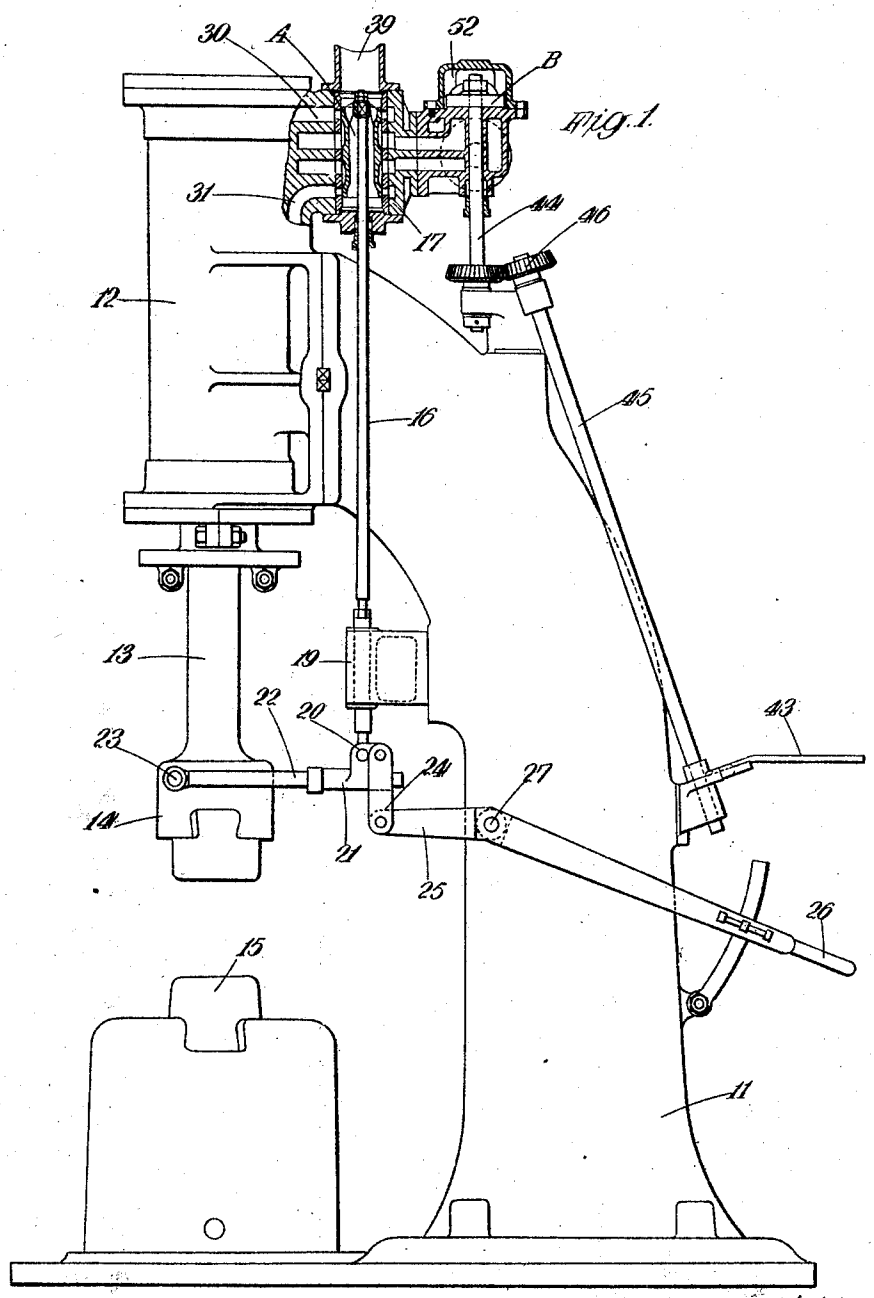


Fig. 1.

INVENTOR
THOMAS WILTON HAND
BY
Brosseau & Schreuder
ATTORNEYS

Feb. 17, 1925. 1,526,977

T. W. HAND

STEAM HAMMER

Filed March 27, 1924 2 Sheets-Sheet 2

Fig. 2.

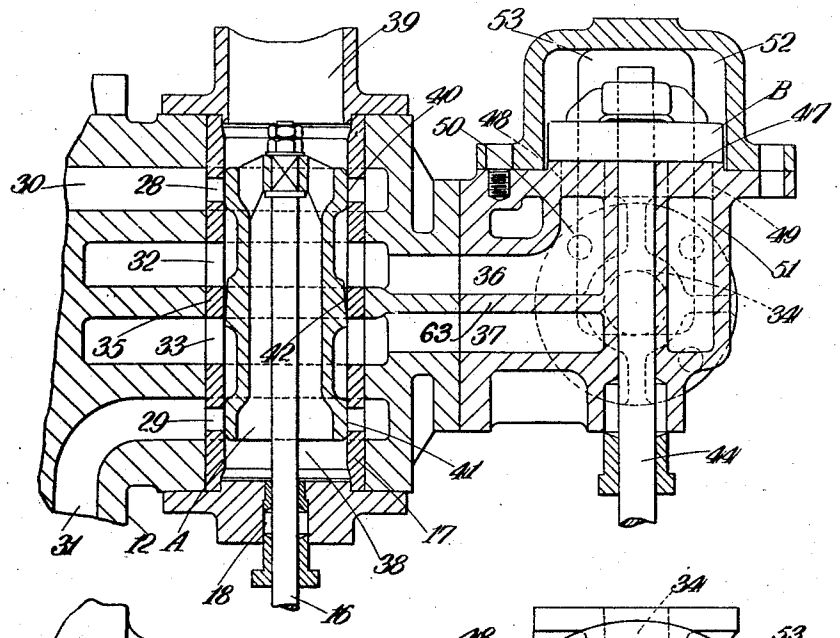
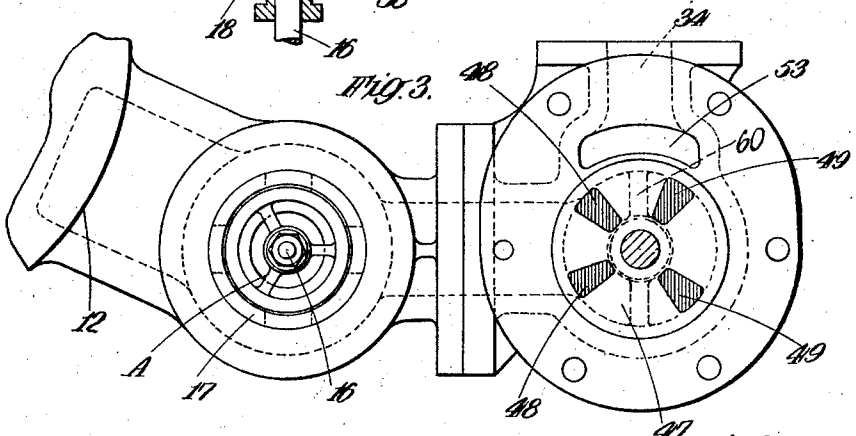


Fig. 3.



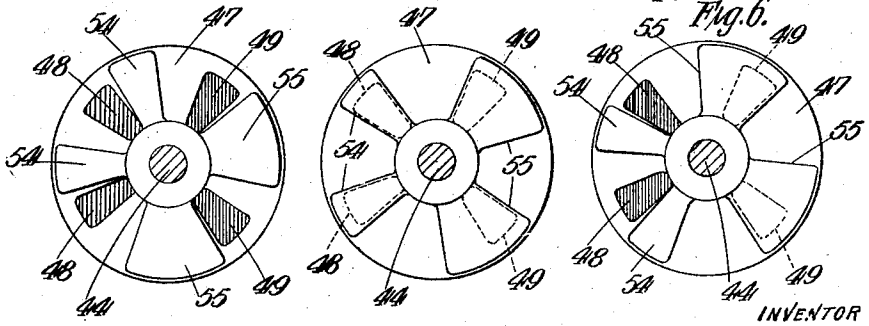


Fig. 5. Fig. 4. Fig. 6.

INVENTOR
THOMAS WILTON HAND
BY
Brown Peterson & Co.
ATTORNEYS

Patented Feb. 17, 1925. 1,526,977

UNITED STATES PATENT OFFICE.

THOMAS WILTON HAND, OF SHEFFIELD, ENGLAND, ASSIGNOR TO DAVY BROS. LIMITED, OF SHEFFIELD, ENGLAND.

STEAM HAMMER.

Application filed March 27, 1924. Serial No. 702,218.

To all whom it may concern:

Be it known that I, THOMAS WILTON HAND, of Park Iron Works, Sheffield, in the county of York, England, a British subject, have invented certain new and useful Improvements in or Relating to Steam Hammers, of which the following is a specification.

This invention relates to hammers and the like (such as stamps for example) which are actuated by elastic fluids under pressure and which are commonly designated by the generic term steam hammers. It is known to provide devices of this character with controlling devices governing the hammer strokes by "automatic control" or by "manual control". By the latter term is meant that for each stroke of the hammer, the operator must actuate a controlling lever, while the former term refers to that method of control, in which a link gearing or other suitable means, connects the hammer head and distribution valve, for causing the movement of the hammer head to reverse the valve and produce successive or continuous strokes of the hammer, without requiring the operator to actuate a lever in order to bring about each stroke. The object of the invention is to provide an improved construction for the better enabling these various methods of control to be exercised to advantage.

According to the present invention, two valves are provided for controlling the supply of motive fluid to the hammer-cylinder; one of said valves being a distribution valve for said cylinder, while the other valve is a combined change-over and regulator valve adapted to permit the fluid pressure to act in the hammer-cylinder either for single-stroke working under purely manual control or for automatic working alternatively at will, this latter valve being also adapted to regulate the rate at which motive fluid passes to the distribution valve.

The distribution valve, which is actuated both automatically by or in time with the movements of the hammer-tup and also manually so as to determine the stroke and cut-off of the valve, has two separate inlet or supply ports adapted to be put in continuous direct communication with the source of motive fluid, one of said ports alone being for use in purely manual working, whereas both ports are for use in automatic working; while the combined change-over and regulator valve, which is only manually operable, and serves to determine whether the one inlet or supply port (or set of ports) or both inlet or supply ports of the distribution valve shall be put in continuous direct communication with the source of motive fluid, has likewise two ports whereof one port alone is for use in purely manual working whereas both ports are for use in automatic working. It will be understood that the separate inlet or supply ports of the distribution valve may be replaced by equivalent arrangements such as, for instance, respond to the term "sets of ports".

The distribution valve may be a rectilinearly-reciprocable slide-valve, preferably a piston-valve, and is actuated by manually-controlled hunting-gear, while the combined change-over and regulator valve may be a rotary disc-valve and is controlled, independently of the distribution valve, by manual action alone.

In the accompanying drawings, which illustrate one form of the invention as applied to a vertically-reciprocable steam-hammer, wherein the distribution valve of the invention is a piston-slide-valve while the combined change-over and regulator valve is a rotary disc-valve, Figure 1 is a side elevation of the hammer as a whole, the two valves of the present invention being shown in axial section. Figure 2 is a sectional elevation of the two valves, shown separately on a larger scale, and Figure 3 is a corresponding plan view, the exhause pipe being removed in the case of the piston-valve, and both the cover of the valve chamber and also the valve itself being removed in the case of the rotary disc-valve, for the sake of clearness. Figures 4, 5 and 6 are three plan views of the rotary disc-valve and its seat, the valve being shown in its three principal angular positions in the respective Figures.

In Figure 1, 11 is the main frame or standard of the steam hammer; 12 is the steam cylinder; 13 the hammer piston rod; 14 the hammer-head; and 15 the anvil-block; all these parts being of usual construction

and arrangement. A is the piston slide-valve constituting the distribution-valve of the present invention, and B is the rotary disc-valve constituting the combined change-over and regulator valve.

The piston slide-valve A, which is rectilinearly reciprocable in a vertical direction, is carried by an upright valve-stem 16 which passes downwards out of the valve-casing 17 by way of a stuffing-box 18, and through a guide 19 fixed to the main frame 11, and is pivotally attached at 20 to a sleeve 21 through which a lever 22, pivoted at 23 to the hammer-head 14 so as to extend transversely of the path thereof, is fitted to slide; the sleeve 21 being coupled by a link 24 to the shorter arm 25 of the main control-lever 26 which is fulcrumed at 27 to the main frame 11 so as to be adapted for movement in a vertical plane as usual.

The casing 17 of the piston-valve A is provided, towards its opposite ends, with two annularly-arranged ports 28 and 29 (hereinafter referred to as "distribution-ports") which open respectively by way of suitable passages 30 and 31 into the upper and lower ends of the steam cylinder 12 of the hammer; while between said distribution-ports the casing 17 is provided with two additional annularly-arranged ports 32 and 33 (hereinafter referred to as "supply-ports") which are separated from one another by an annular partition 35, and through which steam can gain admission by way of suitable passages 36 and 37 from the steam-pipe 34 under the control of the rotary disc-valve B, by means of which latter valve, when manual control is required, steam is admitted to the upper supply-port 32 alone, whereas when automatic control is required, steam is admitted to both the upper supply-port 32 and the lower supply-port 33, as hereinafter explained.

The piston constituting the valve A is hollow and open at both ends; its interior, and therefore also the space 38 beneath the valve-piston, being in constant communication with the exhaust passage or pipe 39. The exterior of the valve-piston A presents three outstanding annular rims whereof two, 40 and 41, situated respectively at the upper and lower ends of the piston, are adapted to work over the respective distribution-ports 28 and 29 with the requisite amount of lap, both outside and inside, whereas the intermediate valve-rim 42 is adapted to work over the edge of the partition 35 separating the respective supply-ports 32 and 33. Both the cut-off edges of all these three valve-rims 40, 41 and 42 may (with one exception) be square so as to give sharp opening or closure of the ports as the case may be. That is to say, the intermediate valve-rim 42, although square at its lower edge, is bevelled-off from its lower edge towards its upper edge as shown (see Figure 2), around the whole or for a portion of its circumference, so that on the one hand when, during manual control, the valve-piston A is depressed to admit steam from the upper supply-port 32 (which in these circumstances is alone supplied with steam) to the underside of the hammer-piston through the lower distribution-port 29, such admission will increase gradually as the valve-piston descends; whereas on the other hand when, during automatic control, the valve-piston A is depressed to admit steam from the lower supply-port 33 (which, as well as the upper supply-port 32, is in these circumstances supplied with steam) to the underside of the hammer-piston by way of the lower distribution-port 29, such admission will take place sharply. The arrangement as a whole is preferably such that in any event, steam is admitted and compressed above the hammer-piston as the latter rises, so that any risk of the hammer-piston striking the top cover of the cylinder is obviated.

The combined change-over and regulator valve B is a rotary disc-valve controlled by a simple hand-lever 43, preferably secured on a shaft 45 geared as at 46 to the spindle 44. The valve-disc B rests upon a horizontal face 47 having two sets of sector-shaped ports 48 and 49 which respectively communicate, by way of suitable passages 50 and 51, with the upper and lower supply-ports 32 and 33 of the piston-valve A. The passages 50 and 51 are separated by a web 60 shown in dotted lines in Fig. 3, extending between the side walls of the casing 61 and a hollow boss 62 located at the center of said casing and through which boss the valve spindle 44 extends. The web 60 is a continuation of the horizontal partition 63 (Fig. 2) which separates the passages 36 and 37, and the passages 50 and 51 are located to the left and right respectively of the said web. The valve-disc B is mounted in a chamber 52 whereof the valve-face 47 forms the lower wall, and into which the steam from the steam pipe 34 is delivered by way of a passage 53. The valve-disc B itself has two sets of sector-shaped openings separated by sets of sector-shaped leaves 54 and 55 of such angular width that, when the valve-disc is in normal angular position (see Figure 4), all the ports 48, 49 are closed, yet on the one hand, when the valve-disc is turned to the extreme position for automatic control (see Figure 5), all the ports 48, 49 will be fully opened, and on the other hand, when the valve-disc is turned to the extreme position for manual control (see Figure 6), only those ports 48 will be fully opened which communicate with the upper supply-port 32 of the piston valve A, the other ports 49 being fully closed. By turning the valve-disc B to various intermediate positions, any

desired combination of opening or closure of the respective sets of ports 48 and 49 may be obtained.

If desired, the width and position of the valve-leaves 54 and 55 relatively to the ports 48 and 49 may be made such as to permit the valve B, when so required during automatic working, to occupy a position wherein only a slight admission of steam is allowed to the lower end of the hammer-cylinder 12 and no steam is admitted to the upper end of said cylinder; such an arrangement enabling the hammer-tup to strike, at will, very light blows by gravity only.

It will be understood that, during manual control, the admission of steam to the underside of the hammer-piston is entirely dependent upon the position of the central valve-rim 42 of the piston-valve A relatively to the annular partition 35 over which said rim works, and that the arrangement and proportions of the parts are such that the maximum travel of the main control-lever 26 will allow full steam-opening of the lower distribution-port 29.

The operation of the device is as follows: If it is desired to operate the hammer by hand control with full steam pressure, the hand lever 43 is actuated to rotate the valve B to the position shown in Fig. 6. In this position of the valve, the steam from pipe 34 flows through passage 53 into chamber 52 past valve B and through the port 48 into passages 50 and 36, being delivered, through the upper supply port 32 only to the distributing valve A. If now the operator moves the main control lever 26 downward, the valve A will be moved upward to uncover the port 28 and permit the steam to flow through the passage 30 to the upper end of the steam cylinder thereby producing a downward stroke of the hammer. To produce the upward movement of the hammer the movement of the valve A is reversed, that is, the valve is moved downward by the handle 26, to place the upper distribution port 28 in communication with pipe 39 and permit the steam in the passage 30 and cylinder 12 to exhaust. As the valve A starts to open, port 28 to exhaust, the bevelled upper edge of the intermediate valve rim 42 permits the steam from the passage 36 to flow past the partition 35 to the lower distribution port 29 and thence to the lower end of the cylinder 12 to raise the hammer. It will be noted that in the raising strokes of the hammer, the pressure of the steam is delivered to the port 29 gradually so as to enable the operator to control the hammer more readily.

When the valve B is set to the position shown in Fig. 5, steam will pass from the chamber 52 through all of the ports 48 and 49 to maintain a supply of steam in both of the passages 36 and 37 so that the steam may be admitted to the cylinder 12 more rapidly for raising the hammer during automatic control, thereby enabling a more rapid operation of the hammer to be obtained. It will be seen that simple manipulation of the valve B enables the hammer to be operated either under manual control or under automatic control under conditions most favorable for each system or method. In addition, the same valve B may be set to permit more or less steam to be admitted to either or both the passages 36, 37 as desired.

I claim:

1. In a hammer or the like adapted for actuation by elastic fluid, the combination of a hammer cylinder, a hammer-tup operatively connected therewith, a distribution valve for said cylinder, a pair of conduits connecting said valve and cylinder, means whereby said valve is automatically actuated in time with the movements of the hammer-tup, means for manually actuating said valve to determine its stroke and cut-off, said valve having two separate inlet or supply ports adapted to be put in continuous direct communication with a source of motive fluid, one of said ports alone being for use in purely manual working whereas both ports are for use in automatic working, substantially as set forth, and a combined regulating and change-over valve for selectively admitting steam to one or both of said ports.

2. In a hammer or the like adapted for actuation by elastic fluid, the combination of a hammer cylinder, a hammer-tup operatively connected therewith, a distribution valve for said cylinder, means whereby said valve is automatically actuated in time with the movements of the hammer-tup, means for manually actuating said valve to determine its stroke and cut-off, said valve having two separate inlet or supply ports, one of which alone is for use in purely manual working, whereas both ports are for use in automatic working and a manually operable combined change-over and regulator valve for selectively placing one inlet or supply port or both inlets or supply ports of said distribution valve in direct communication with a source of motive fluid, said change-over and regulator valve having independent ports, some of which are for use only in purely manual working of the distribution valve and all of which are for use in automatic working thereof substantially as described.

3. In a hammer or the like adapted for actuation by elastic fluid, the combination of a hammer cylinder, a hammer-tup operatively connected therewith, a distribution valve for said cylinder, comprising a rectilinearly-reciprocable slide-valve, means whereby said valve is automatically actuated in time with the movements of the hammer-

tup, manually controlled hunting-gear for manually actuating said valve, the latter having independent inlets or supply ports adapted to be put in direct communication with a source of motive fluid, one of said ports alone being for use in purely manual working and both ports being for use in automatic working, substantially as set forth, and a combined regulator and change-over valve for selectively placing one or both of said supply ports in communication with the source of motive fluid and for regulating the rate at which said motive fluid passes to said distribution valve.

4. In a hammer or the like adapted for actuation by elastic fluid, the combination of a hammer cylinder, a hammer-tup operatively connected therewith, a distribution valve for said cylinder, means whereby said valve is automatically actuated in time with the movements of the hammer-tup, means for manually actuating said valve to determine its stroke and cut-off, said valve having two separate inlet or supply ports, one of which alone is for use in purely manual working whereas both ports are for use in automatic working, a rotary disc-valve constituting a combined change-over and regulator valve for selectively placing one inlet or supply port or both inlets or supply ports of said distribution valve in direct connection with a source of motive fluid and manually operated controlling means for controlling said disc-valve, independently of said distribution valve.

5. In a hammer actuated by elastic fluid, a hammer-cylinder, a hammer-tup operatively connected therewith, a valve casing containing two annular ports opening respectively into the cylinder near the opposite ends thereof, said valve casing having two additional annular supply ports connected to a source of fluid supply, said ports being separated by partitions forming valve seats, a piston valve within the valve casing, said valve containing recesses, so as to present three outstanding annular valve rims, the two rims at its opposite ends controlling communication of the two annular ports opening into the cylinder, and the third or intermediate valve rim seating on the edge of the annular partition separating the two supply ports.

6. In a hammer actuated by elastic fluid, a hammer-cylinder, a hammer-tup operatively connected therewith, a valve casing containing two annular ports opening respectively into the opposite ends of the cylinder, said valve casing having two additional annular ports between the first mentioned ports connected to a source of fluid supply, one of said last named ports alone being for use in purely manual operation of said hammer and both of said last named ports being for use in automatic working, a piston valve within the valve casing, said valve containing recesses so as to present three outstanding annular valve rims, the two rims at its opposite ends controlling communication of the two annular ports opening into the cylinder with the fluid supply ports, and the third or intermediate valve rim seating on the edge of the annular partition separating the two supply ports, said third valve rim having one square edge so as to contact with the intermediate annular partition, the other edge being bevelled-off, so that the admission of fluid will increase gradually as the valve piston descends.

7. A piston valve for a fluid actuated hammer, comprising a cylindrical surface having recesses therein so as to present three outstanding annular valve rims, the two outer rims having square cut-off edges, the third or intermediate annular valve rim having one square cut-off edge, the other being bevelled-off.

8. In a hammer actuated by elastic fluid, a hammer-cylinder, a hammer-tup operatively connected therewith, a valve casing containing two annular ports opening respectively into the opposite ends of the cylinder, and having two additional annular ports behind the first mentioned ports connected to a source of fluid supply, annular partitions separating the said ports, a piston valve within the valve casing, said valve containing recesses so as to present three outstanding annular valve rims, the two rims at its opposite ends controlling communication of the two annular ports opening into the cylinder with the fluid supply ports, and the third or intermediate valve rim seating on the edge of the annular partition separating the two supply ports, said third valve rim having one square edge so as to contact with the intermediate annular partition, the other edge being bevelled-off, so that the admission of fluid will increase gradually as the valve piston descends, and means for cutting off the supply of motive fluid to one of the fluid supply ports.

9. In a hammer actuated by elastic fluid, a hammer-cylinder, a hammer-tup operatively connected therewith, a valve casing containing two annular ports opening respectively into the cylinder and near the opposite ends thereof, and having two additional annular supply ports connected to a source of fluid supply, said ports being separated by partitions forming valve seats, a piston valve within the valve casing, said valve containing recesses so as to present three outstanding annular valve rims, the two rims at its opposite ends controlling communication of the two annular ports opening into the cylinder, and the third or intermediate valve rim seating on the edge of the annular partition separating the two supply ports, a motive fluid control

comprising a casing having ports communicating with said fluid supply ports, an intake port and a valve within said casing having cut-out portions for establishing communication between said intake port and supply ports, and solid portions adapted to register with said fluid supply ports and a manual control for said valve for shifting it so as to cut off one fluid supply port or both, as desired.

10. In a hammer actuated by elastic fluid, a hammer-cylinder, a hammer-tup operatively connected therewith, a valve casing containing two annular ports opening respectively into the cylinder near the opposite ends thereof, and having two additional annular supply ports connected to a source of fluid supply, said ports being separated by partitions forming valve seats, a piston valve within the valve casing, said valve containing recesses so as to present three outstanding annular valve rims, the two rims at its opposite ends controlling communication of the two annular ports opening into the cylinder, and the third or intermediate valve rim seating on the edge of the annular partition separating the two supply ports, a motive fluid control means comprising a casing having ports communicating with said fluid supply ports, an intake port, and a disk valve within said casing registering with said first named ports and having cut-out portions establishing communication between said intake port and supply ports, and a manual control for said valve for shifting it so as to close one fluid supply port or both, as desired.

11. In a hammer actuated by elastic fluid, a hammer-cylinder, a hammer-tup operatively connected therewith, a valve casing containing two annular ports opening respectively into the cylinder and near the opposite ends thereof, and having two additional annular supply ports connected to a source of fluid supply, said ports being separated by partitions forming valve seats, a piston valve within the valve casing, said valve containing recesses so as to present three outstanding annular valve rims, the two rims at its opposite ends controlling communication of the two annular ports opening into the cylinder, and the third or intermediate valve rim seating on the edge of the annular partition separating the two supply ports, a motive fluid control means comprising a casing having ports communicating with said fluid supply ports, an intake port, a disk valve having cut-out portions of irregular size for registering with said fluid supply ports, and establishing communication between said intake port and supply ports, and a manual control for said valve for shifting it to regulate the supply of fluid to one supply port or both, as desired.

THOMAS WILTON HAND.