No. 663,727. Patented Dec. 11, 1900.

J. CHRISTIE & W. B. HUGHES.

HYDRAULIC VALVE.

(Application filed Dec. 27, 1897.)

(No Model.) 2 Sheets—Sheet 1.

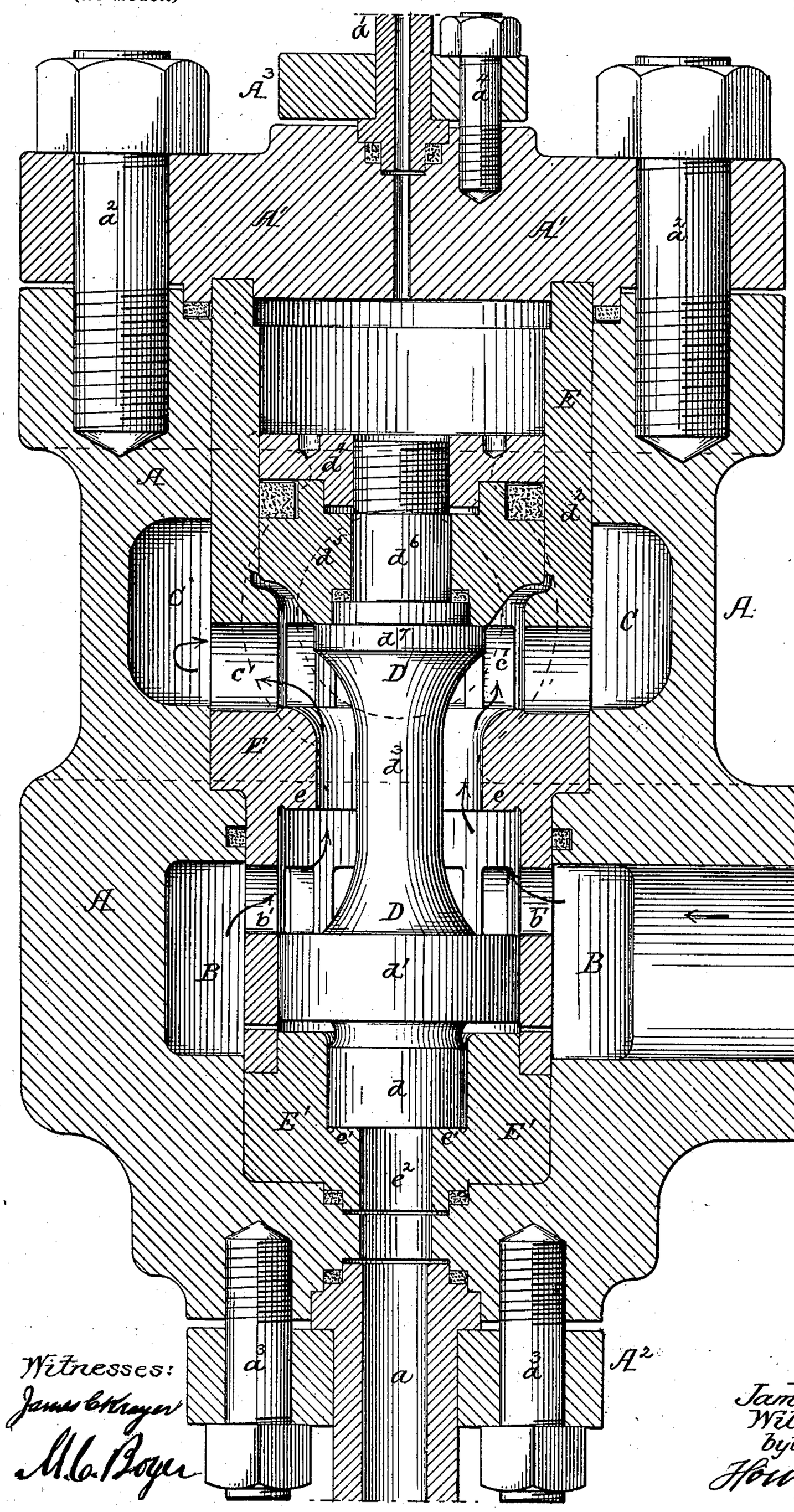

FIG. 1.

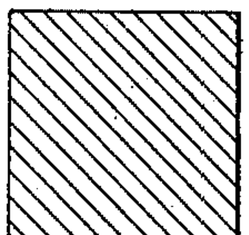

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FIG. 2.

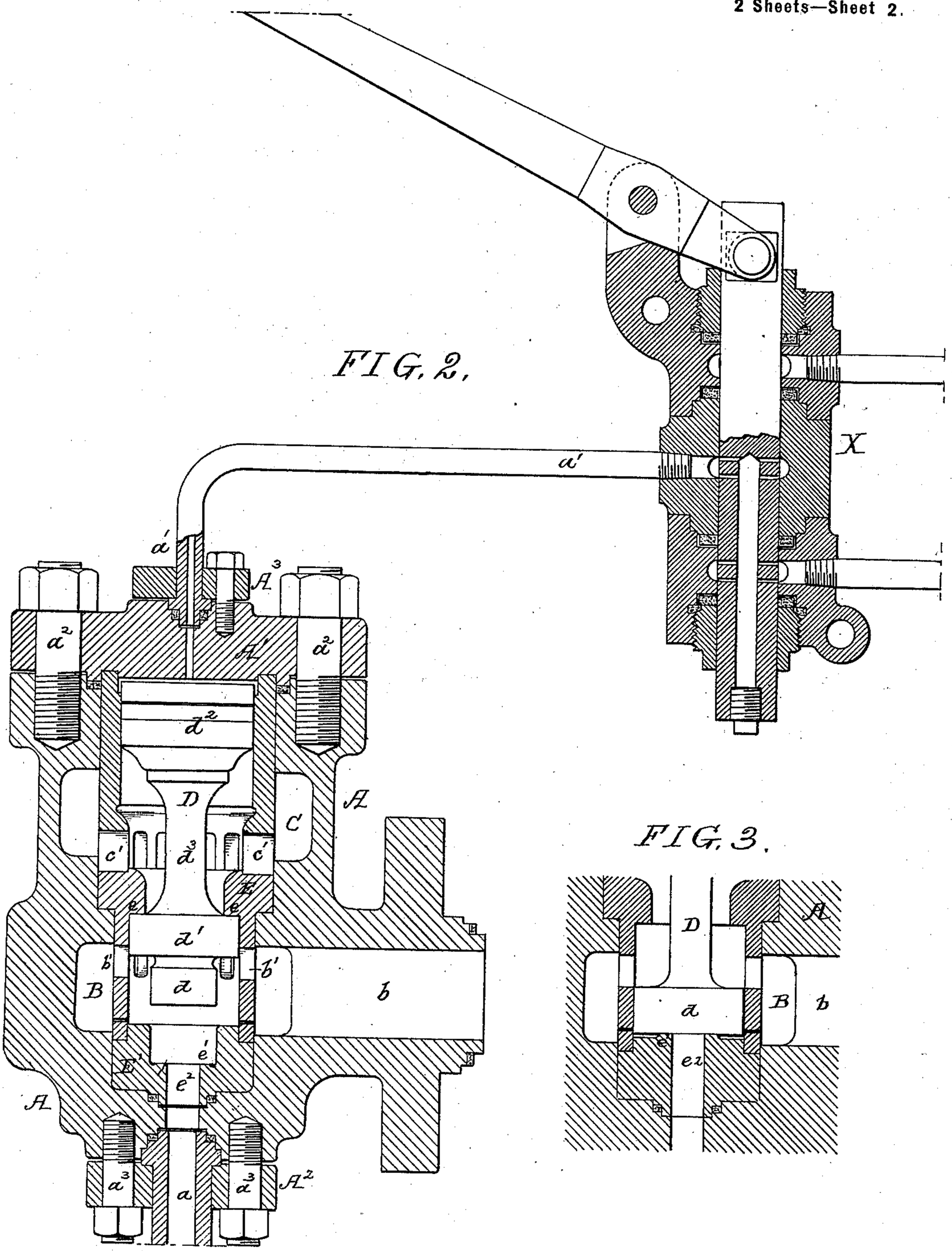

FIG. 3.

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UNITED STATES PATENT OFFICE.

JAMES CHRISTIE AND WILLIAM B. HUGHES, OF PHILADELPHIA, PENNSYLVANIA.

HYDRAULIC VALVE.

SPECIFICATION forming part of Letters Patent No. 663,727, dated December 11, 1900.

Application filed December 27, 1897. Serial No. 663,645. (No model.)

To all whom it may concern:

Be it known that we, JAMES CHRISTIE and WILLIAM B. HUGHES, citizens of the United States, and residents of Philadelphia, Pennsylvania, have invented certain Improvements in Hydraulic Valves, of which the following is a specification.

Our invention relates to valves for governing the flow of fluid under high pressure—such, for instance, as the hydraulic valves used for controlling the operation of punching, riveting, and like machines; the objects of our invention being to facilitate the operation of such valves to insure a rapid flow of fluid from the machine to be operated and to simplify the construction of the valve by rendering it possible, when desired, to dispense with peripheral packings on the valve-disks which control such flow. These objects we attain in the manner hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal sectional view of a valve constructed in accordance with our invention. Fig. 2 is a similar view on a smaller scale, but showing the movable portion of the valve in a different position, and showing also a supplementary valve whereby the operation of the main valve is governed; and Fig. 3 is a view illustrating a modification of the invention.

A is the valve-casing; a, an inlet-pipe for fluid under pressure; B, a chamber connected to a passage b, leading to the cylinder of the machine to be operated; C, a chamber connected to the exhaust-passage, (shown by dotted lines,) and a' another inlet-pipe for fluid under pressure.

E is a bushing adapted to the casing A, and in this bushing are a series of ports b' c', communicating, respectively, with the chambers B and C, the upper portion of the bushing being somewhat larger in diameter than the lower portion, as shown, and being reduced in diameter at the center, so as to form a seat e.

E′ is a block mounted below the bushing and provided with a seat e' and a passage e^2, communicating with the pipe a, the bushing and block being held in place by a cap A′, secured to the casing A in the present instance by bolts a^2, while the pipe a is secured to the casing by a ring A^2 and bolts a^3, and the pipe a' is secured to the cap A′ by a ring A^3 and bolts a^4, packing being introduced between the several parts, as indicated in the drawings, so as to prevent leakage.

D is a piston having three disks d d' d^2 and a connecting-neck d^3, the disks d d' and the neck d^3 being in the present instance made in one piece and the disk d^2 being in two pieces d^4 d^5, between which is a suitable packing. The section d^4 is screwed onto a stem d^6 of the neck d^3, and thus the section d^5 is confined between the section d^4 and a flange d^7 on the neck.

It will be noticed that the surface of the disk d^2 of the piston D has a greater area than the combined area of the disks d d', and when the valve is closed against pressure, as shown in Fig. 1 of the drawings, the area exposed to the passage e^2 is very much less than the area of the disk d^2, which is exposed to the fluid under pressure admitted through the pipe a', so that when pressure is applied through the pipe a' the valve will remain closed, the flow of fluid through the pipe a will be cut off, and the cylinder of the machine will be open to the exhaust, even if the pressure of the fluid admitted through the pipe a' is considerably less than the pressure of that admitted through the pipe a.

In operating the machine we use a three-way valve X of any desired construction, which is connected to the pipe a', so as to either permit fluid under pressure to be admitted to the valve-chest above the disk d^2 of the piston or to open an exhaust, so as to relieve said disk d^2 from pressure.

When it is desired to admit fluid under pressure to the cylinder of a machine to which the valve is connected, the three-way valve is turned so as to open the chamber above the disk d^2 to the exhaust, and the moment this is done the pressure of the fluid in the pipe a will force the disk d from the seat e' and the disk d' will be carried past the ports b' and will finally close against the seat e, thereby cutting off communication between the chamber B and the exhaust-chamber C, and at the same time opening up the lower portions of the ports b' to the inlet-passage a,

as shown in Fig. 2, so that fluid under pressure will flow from the pipe *a* through the ports *b'*, chamber B, and passage *b* to the cylinder of the machine, the flow being less in volume than the full capacity of the ports, as experience shows that the admission-ports can be much smaller than the exhaust ports, admission being under high pressure while the exhaust is not.

When it is desired to withdraw the pressure, the three-way valve is moved so as to admit fluid under pressure through the pipe *a'* to the space above the disk d^2, and as the area of this disk is greater than the combined area of the two disks *d d'* the piston D will be moved immediately to the position shown in Fig. 1, thereby closing the inlet-opening e^2 and fully opening the ports *b'* to the exhaust, so that the fluid under pressure in the cylinder of the machine will flow quickly therefrom, hence insuring a quick return of the plunger of the machine which is being actuated.

As a seat is provided for the end of the disk *d'* when the latter is adjusted so as to cut off the inflow and also for the end of the disk *d* when the latter is adjusted so as to cut off flow to the exhaust, peripheral packing-rings on these disks are rendered unnecessary, thereby overcoming the objection to such rings when they are caused to traverse a slotted portion of the valve-chest.

The disk *d'* may, if desired, be dispensed with and the inlet controlled directly by the disk *d*, the latter in this case closing against a seat *e'*, formed on the inner face of the block E', as shown in Fig. 3.

Having thus described our invention, we claim and desire to secure by Letters Patent—

1. A valve having a ported casing through which the motive fluid flows to and from the point of use, an inlet-passage with surrounding seat on one side of said ported portion of the casing, and an exhaust-passage with surrounding seat on the other side of the same, and a piston structure having a disk portion which fits snugly to the ported casing and has ends which bear upon said seats alternately, said disk bearing such relation to the ports of the casing that it will close communication between said ports and the exhaust-passage before opening communication between said ports and the inlet-passage, substantially as specified.

2. A valve having a ported casing through which the motive fluid flows to and from the point of use, an inlet-passage with surrounding seat on one side of said ported portion of the casing, and an exhaust-passage with surrounding seat on the other side of the same, a piston structure having a disk portion which fits snugly to the ported casing and has ends which bear upon said seat alternately, said disk being so disposed in respect to the ports of the casing that it will close communication between said ports and the exhaust-passage before opening communication between said ports and the inlet-passage, and said piston having another disk of greater diameter than that which controls said ports, said disk being contained within a cylinder combined with means whereby the disk may be alternately subjected to and released from pressure in order to effect movement of the piston, substantially as specified.

3. A valve having a ported casing through which the motive fluid flows to and from the point of use, an inlet-passage with surrounding seat on one side of said ported portion of the casing, and an exhaust-passage of larger area than the inlet-passage and also having a surrounding seat on the other side of said ported portion of the casing, and a piston structure having a disk fitting snugly to said ported portion of the casing, and adapted to bear at one end against the seat of the exhaust-passage and having at the other end a projection adapted to bear against the seat of the inlet-passage, said disk being so disposed in respect to the ports of the casing that it will close communication between said ports and the exhaust-passage before opening communication between said ports and the inlet-passage, substantially as specified.

4. A valve having a ported casing through which the motive fluid flows to and from the point of use, an inlet-passage with surrounding seat on one side of said ported portion of the casing and an exhaust-passage of larger area than the inlet-passage and also having a surrounding seat on the other side of the ported portion of the casing, a piston structure having a disk adapted to bear at one end against the seat of the exhaust-passage and having at the other end a projection adapted to close against the seat of the inlet-passage, said disk fitting snugly to the ported portion of the casing and being so disposed in respect to said ports that it will close communication between the same and the exhaust-passage before opening communication between said ports and the inlet-passage, a disk of larger diameter than the port-controlling disk secured to said piston structure, and a cylinder containing said larger disk and combined with means for alternately subjecting said disk to and releasing it from pressure in order to effect movement of the piston, substantially as specified.

5. A valve having a ported casing through which the motive fluid flows to and from the point of use, a piston having a disk which moves across said ported portion of the casing and opens the same alternately to pressure and exhaust, and provision for limiting the movement of said piston, whereby the ports are only partially uncovered to pressure, but are fully uncovered to exhaust, substantially as specified.

6. A valve having a ported casing through which the motive fluid flows to and from the point of use, an inlet-passage with surrounding seat on one side of said ported portion of

the casing and an exhaust-passage with surrounding seat on the other side of the same, and a piston structure having a disk portion which moves across said ported portion of the casing, one end of said disk portion being adapted to close against the seat surrounding the inlet-passage and the other end being adapted to close against the seat surrounding the exhaust-passage and said seats being so disposed that when the inlet-passage is open the disk will only partially uncover the ports of the casing but when the exhaust-passage is open will fully uncover said ports, substantially as specified.

7. The combination of the valve-casing having a main inlet-pipe for fluid under pressure, and a supplementary inlet-pipe with three-way valve therein, a ported chamber communicating with the point of use of the fluid, an exhaust-chamber and a piston having three disks of different diameters, the smallest being adapted to close the opening of the main inlet-passage, the intermediate disk being adapted to close the opening leading to the exhaust-passage, and the largest disk being contained in the chamber to and from which the flow of motive fluid is governed by the three-way valve, all of said disks fitting snugly to their respective portions of the casing, and the intermediate disk being so disposed in respect to the ports of its chamber that it will close communication between said ports and the exhaust-passage before it opens communication between said ports and the inlet-passage, substantially as specified.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

JAMES CHRISTIE.
WILLIAM B. HUGHES.

Witnesses:
WILL. A. BARR,
JOS. H. KLEIN.