

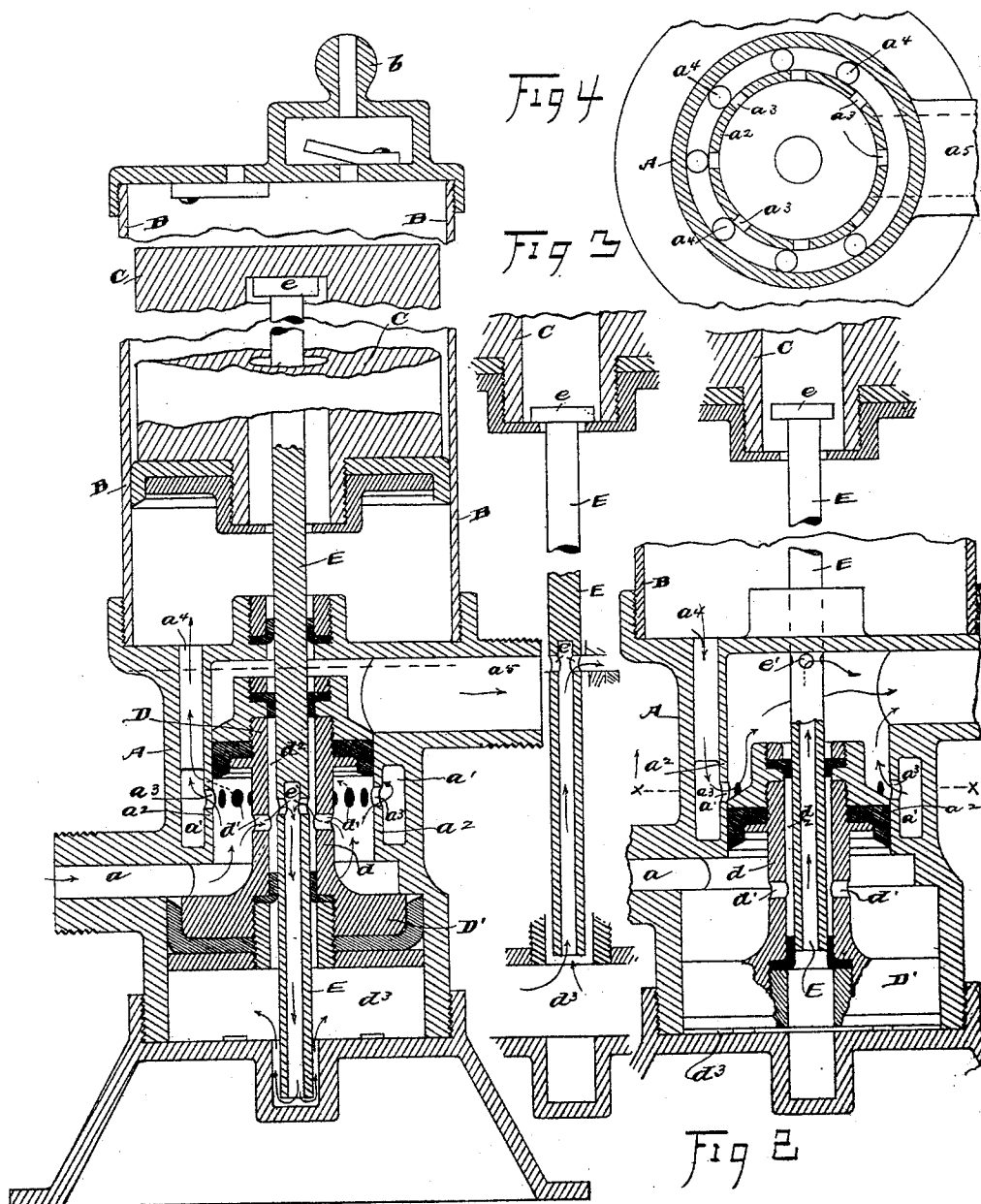
(No Model.)

2 Sheets—Sheet 1.

E. H. WEATHERHEAD.
VALVE.

No. 437,806.

Patented Oct. 7, 1890.



WITNESSES,
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Fig 1

Edward H. Weatherhead INVENTOR.

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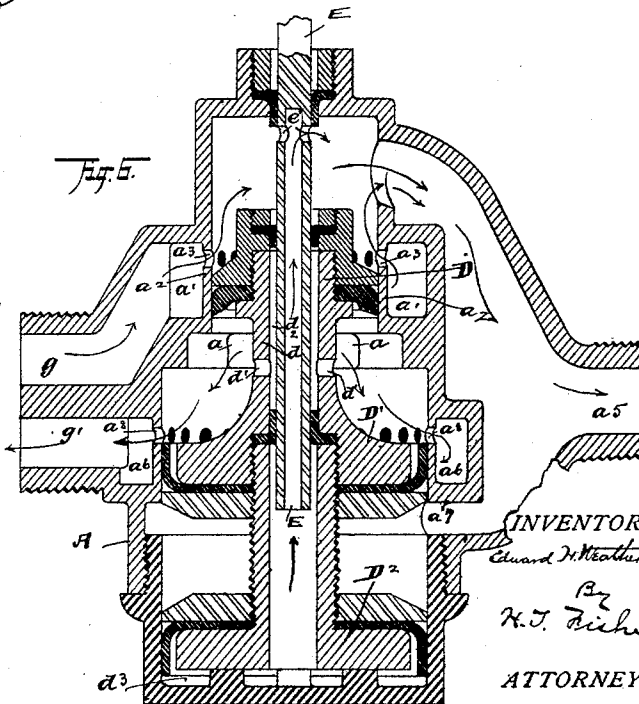
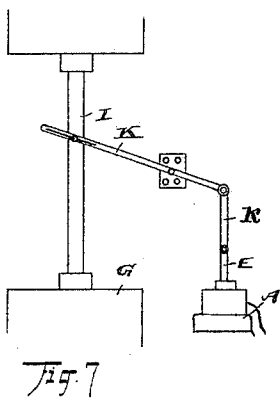
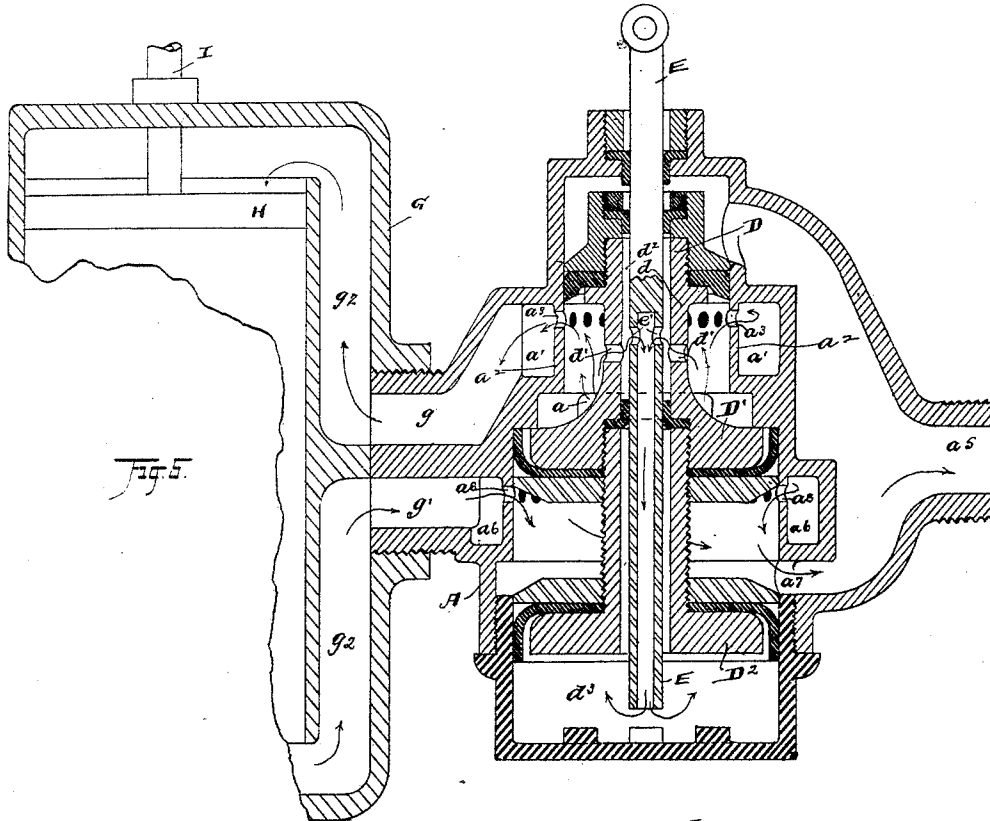
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2 Sheets—Sheet 2.

E. H. WEATHERHEAD.
VALVE.

No. 437,806.

Patented Oct. 7, 1890.



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EDWARD H. WEATHERHEAD, OF CLEVELAND, OHIO.

VALVE.

SPECIFICATION forming part of Letters Patent No. 437,806, dated October 7, 1890.

Application filed July 11, 1889. Serial No. 317,224. (No model.)

To all whom it may concern:

Be it known that I, EDWARD H. WEATHERHEAD, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Valves; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it ap-

pertains to make and use the same.

My invention relates to improvements in valves; and the object of the invention is to provide valve mechanism whereby the flow of any fluid under pressure may be automatically directed and controlled.

To this end the invention consists in the construction and arrangement of parts, substantially as shown and described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical sectional elevation of one form of the apparatus, showing what may be termed a "single-acting" valve. Fig. 2 is a vertical central section of the same device, showing the valve in the reverse position from Fig. 1. Fig. 3 is a detail view of the valve-tube, partly in section, and showing its position when discharging from beneath the piston to permit the valve to descend. Fig. 4 is a cross-section of the device on line *x x*, Fig. 2. Fig. 5 is a vertical central section of a double-acting valve similar in principle of construction and operation to the device shown in the preceding figures. Fig. 6 is a similar view with a different portion of the parts. Fig. 7 shows the lever mechanism used.

In Figs. 1 to 4 the apparatus is shown in connection with what may be termed a "hydraulic air-pump," whereby hydraulic pressure serves to force air in a compressed state into any attached receptacle, chamber, or the like, and the water acts only on one side of the compression-plunger. In the remaining figures the water passing through the apparatus may act on either side of an associated piston, according to the position of the parts, and this piston has a rod which may operate a compression-plunger, as in the first instance, or serve some other purpose. In either case any fluid—as water, steam, gas, or the like—may be employed, and the pressure thus afforded may be taken off to pump air, water,

gas, or other fluid, or to do other work to which it is adapted.

In the several drawings, A represents the valve-casing, which may be made in as many parts as convenience shall dictate.

The several views, except Fig. 7, are drawn to full working size, but may be made larger or smaller, according to the special work to be done.

Above the casing A in Figs. 1 to 4 is the compression-cylinder B, broken out centrally in Fig. 1 to bring the view within the limits of the drawing. In this cylinder is a plunger C, against which the water acts at the bottom and before which the air is forced out through nozzle *b*, as is common in this art.

Any suitable construction of cylinder B and plunger may be employed, these parts forming no essential part of this invention and serving merely to show one method of operation in which my improved valve is employed.

Assuming now that I have fluid under pressure and I desire to impart this pressure to the plunger C and to automatically charge and discharge the cylinder B beneath said plunger, the case A is provided with an inlet-port *a*, which admits the fluid to the differential chamber within the case. Just above the inlet-port a belt *a'* is formed in the casing and separated from the chamber by a wall *a²*, having perforations or openings *a³*, through which fluid is free to pass into the said belt. From the belt *a'* extends a series of vertical passages or ducts—one or more—which open into the cylinder B, so that when the valve and other parts are in the position shown in Fig. 1 the fluid is free to pass to the cylinder B through the channel above described, as indicated by arrows in Fig. 1. Meantime the fluid has also a downward course, so as to prepare the parts for the reverse movement when such movement should occur. The mechanism for this and other purposes consists in a valve D, fitting closely in the narrower portion of the chamber of the casing and provided with a hollow neck *d*, connecting a piston D', working in the wider portion of the chamber in the bottom of casing A. The valve and piston are packed fluid-tight both within and without, so that no fluid can pass except through the channels provided for that purpose. Extending

through the neck of the valve and piston is a valve tube or pipe E, having a bore a portion of its length and provided with a head *e* at its top. This tube is free to slide longitudinally in the valve within certain limits (fixed in Fig. 1, 2, and 3) by the construction and movements of plunger C—that is, when the plunger C rises to its extremity it catches the head *e* of the tube, as seen in Fig. 3, and carries said tube to the position seen in said Fig. 3, and when the plunger is down the tube E is pressed down by the head of the plunger C, bearing on the head of the tube E, Fig. 1. Now, in order that the pressure-fluid may find its way beneath piston D', the neck *d* has a series of openings *d'*, or one or more at intervals about its center, which admit the fluid to the chamber *d*² in said neck between its extremities and extending around the tube E. The tube E has corresponding openings *e'*, which admit the fluid from chamber *d*² to the inside of tube E, whence it flows into chamber *d*³ beneath piston D' through said tube. The pressure-fluid will continue to flow through *d'*, *d*², *e'*, and hollow tube E to chamber *d*³ until piston D' is forced up as far as it can go, which is the position seen in Fig. 1. When in this position the valve D of course has moved up and uncovered openings *a*³, whereby the fluid is enabled to flow into cylinder B, as seen in Fig. 1, and this position of the parts continues until the plunger C has sufficiently risen to carry the tube E up to the position shown in Fig. 3. When this occurs, the plunger C has spent its stroke, and the fluid beneath piston D' begins to discharge through the tube E and openings *e'*, Fig. 2, above valve D, and out through exhaust-port *a*⁵. As the discharge continues beneath piston D', the said piston and valve D continue to descend, not alone by gravity, but by reason also of the pressure on the greater area of the back of piston D' compared with the exposed area of valve D. The discharge from chamber *d*³ goes on till the chamber is emptied, and meantime the valve D drops down past openings *a*³, which places said openings in free communication with the space above said valve and the exhaust-port *a*⁵, as seen in Fig. 2. The fluid in cylinder B will then escape through the channel thus opened and the respective parts will resume the position from which they start to repeat the operation above described—that is, the fluid will again flow in through openings *d*² *e'* beneath piston D' and cause a balanced pressure on either side of piston D', and thereby allow the entire fluid-pressure to act on valve D and force it to its proper position, as seen in Fig. 1, when the channel to cylinder B will be reopened. Thus the operation continues automatically and repeats itself indefinitely.

The same principles of construction and operation reappear in Figs. 5 and 6 with certain additions of elements. Here I have valve D' and pistons D² in part with valve D, an additional fluid-belt *a*⁶, and an additional ex-

haust *a*⁷, which is from the lower portion of the casing between the two pistons. The fluid-pressure in this construction is taken from the side of the casing through ducts *g* and *g'* alternately instead of at the top, where in Fig. 1 ducts *a*⁴ are shown for a like purpose, and the fluid is delivered to a cylinder having fluid-channels *g*² running to its extremities and communicating with the ducts *g* and *g'*. A piston H, with a rod I, plays in this cylinder, and pressure is automatically introduced to either end alternately, according to the position of the valve mechanism. Thus if the parts are in starting position the fluid will pass through openings *d*² *e'* and the tube E beneath the lower piston, and the valve D will be forced into the position shown in Fig. 5. This will open the way for the fluid from the induction-port *a* into the chamber between valve D and valve D', and thence through openings *a*³ and belt *a*⁶ to the port *g* and above the piston H. At the same time valve D' will be carried above belt *a*⁶ and openings *a*⁸, so that the fluid beneath piston H may flow out through port *g'* and said openings to exhaust *a*⁷ and *a*⁵. The induction-port *a* is on the opposite side of the casing, as seen centrally in Figs. 5 and 6. When the piston H descends under the pressure thus introduced, it carries its rod I down with it. The valve-tube E is therefore connected with this rod to get a similar movement to that obtained in Figs. 1 to 4, and for this purpose I employ a lever K, pivoted toward its lower end to a suitable support and connected by a link *h* to the top of tube E, while its upper end is slotted and attached to the rod I. Thus when the rod I descends it raises the tube E to the position seen in Fig. 6, which provides an exhaust-channel for the chamber beneath piston D². As this exhaust goes on the valve D' and piston D² and valve D descend, and when down, as in Fig. 6, an open fluid-channel is made to the opposite or lower side of piston H, as indicated by arrows in said figure. The exhaust now is from the upper portion of cylinder G and all the actions are reversed, substantially as above described with reference to the single-acting valve mechanism.

Any suitable manner of operating the valve-tube E may be adopted, and the valve mechanism may be employed wherever it may be found practicable.

The operation will readily be understood from the foregoing description, and need not be more fully described.

In the construction shown in Figs. 1 to 4 the plunger C ordinarily is made of such weight as will assist in the rapid discharge of the fluid from beneath it; but in the double-acting form shown in the other figures the counter-pressure of the fluid serves to aid in the discharge, and with such form a horizontal cylinder G is equally practicable.

The position of the valve mechanism and casing herein described is not material; but the terms "top," "bottom," and "sides" are

used to facilitate description, and not in the sense that the case must always be placed in the positions shown.

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

1. A valve and a piston of different areas having a rigid open connection and a reciprocating tube extending through said parts, said tube provided with lateral ports opening into an inner passage extending to the end of the tube below the piston, said ports and passage in the tube admitting fluid beneath the piston and discharging the same therefrom, in combination with the casing having ports leading into and out of the same, substantially as described.

2. A valve and piston rigidly connected and an independently-reciprocating tube fixed fluid-tight upon its outside in said parts and extending through the same, said tube having perforations through its side to admit fluid beneath the piston and to discharge it behind the valve, in combination with the main casing having a port to admit fluid between the piston and the valve and a discharge-port behind the valve, substantially as described.

3. The main casing having differential chambers and inlet and discharge ports and a connected valve and piston of differential area in said chamber, in combination with a tube fluid-tight on its outside in said valve and piston, having lateral openings adapted to work above and below the valve, and open at its lower end, and a device under fluid-pressure to move said tube independently of the said valve and piston, substantially as described.

4. A casing having differential fluid-chambers, with inlet and discharge ports at its sides and closed at one end, in combination with a piston working in said closed end, a reciprocating tube extending through said piston and having perforations outside of the

piston, and a channel communicating therewith to admit fluid behind said piston, and a valve of less area than said piston rigidly connected with said piston and packed fluid-tight on said tube, substantially as described.

5. The main casing having chambers of differential diameters, a piston in the larger chamber, and a valve in the smaller chamber having rigid open connection with the piston, an inlet-port between piston and valve, and an outlet-port behind the valve, in combination with a tube extending through valve and piston and having side openings and open at one end to admit fluid before the piston and to discharge fluid behind the valve, and means to operate the tube independently of valve and piston, substantially as described.

6. In combination, the casing, a pair of valves and a piston rigidly connected, and a hollow tube extending through the valves and piston, said several parts provided with suitable fluid-channels, substantially as set forth.

7. The casing provided with induction and eduction ports and a double set of fluid-belts and ducts leading from said belts, in combination with a pair of valves and a piston connected together, a hollow independently-sliding tube extending through the valves and piston, and openings for the passage of fluid from the inside of the casing through said tube, substantially as set forth.

8. The casing provided with suitable induction and eduction ports and a double set of fluid channels or ducts alternately admitting fluid under pressure to a supplemental cylinder and discharging the same, in combination with valves and a piston connected together, and a free-sliding valve-tube extending through said valves and pistons, substantially as set forth.

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Witnesses:

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