(No Model.)

2 Sheets—Sheet 1.

C. ROUX.

VALVE APPARATUS FOR HYDRAULIC AND STEAM MOTORS.

No. 249,150. Patented Nov. 1, 1881.

FIG. 1.

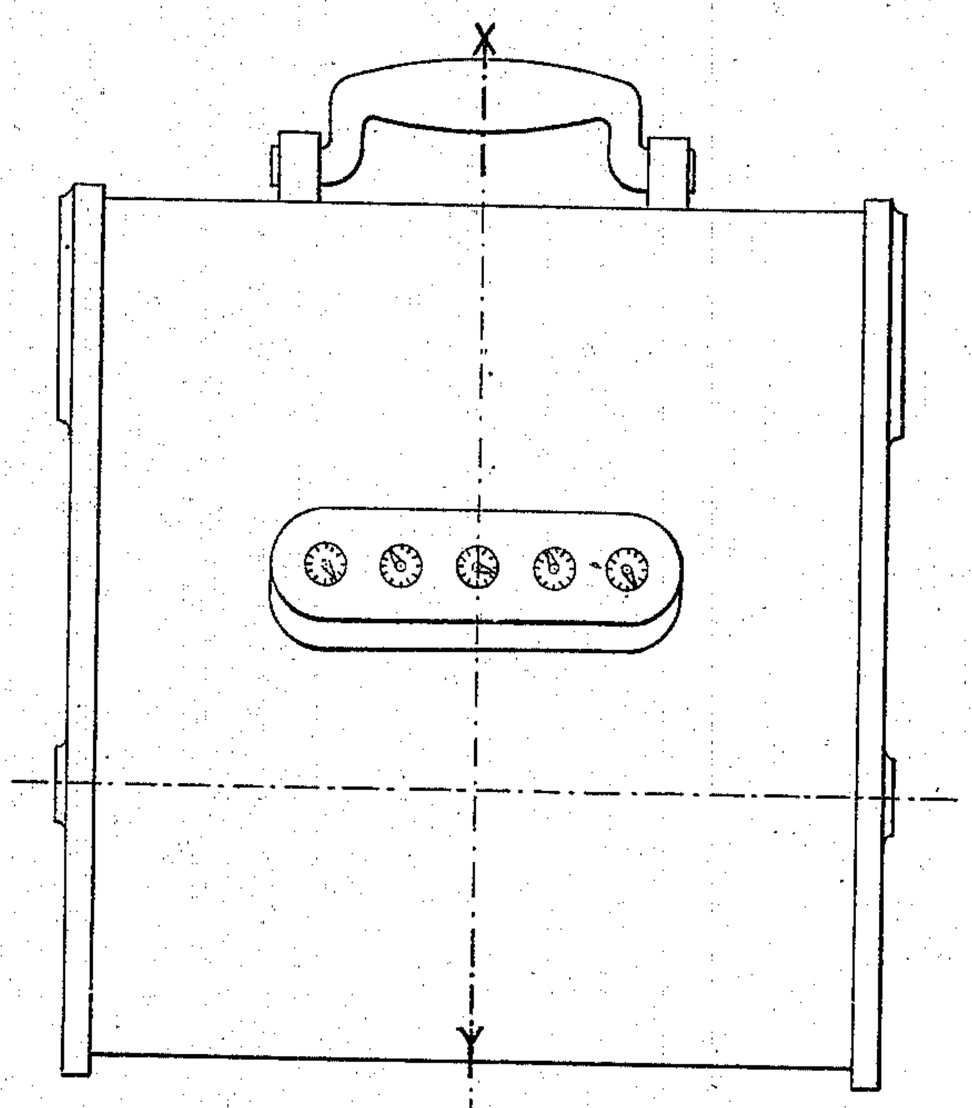


FIG. 2.

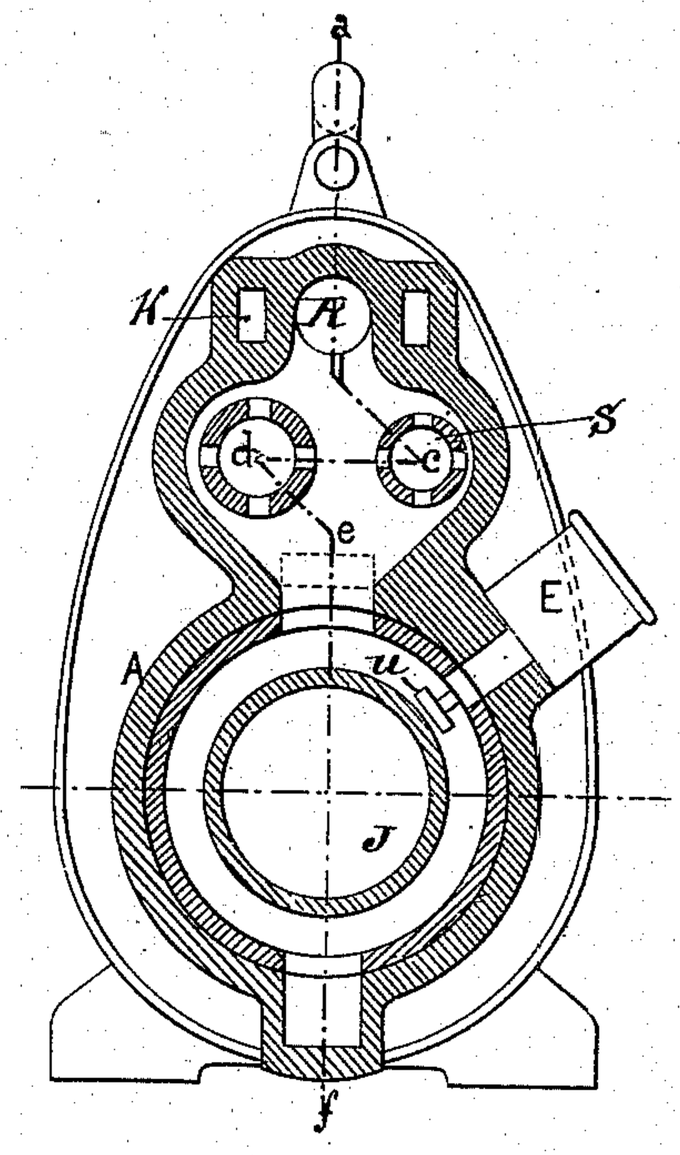
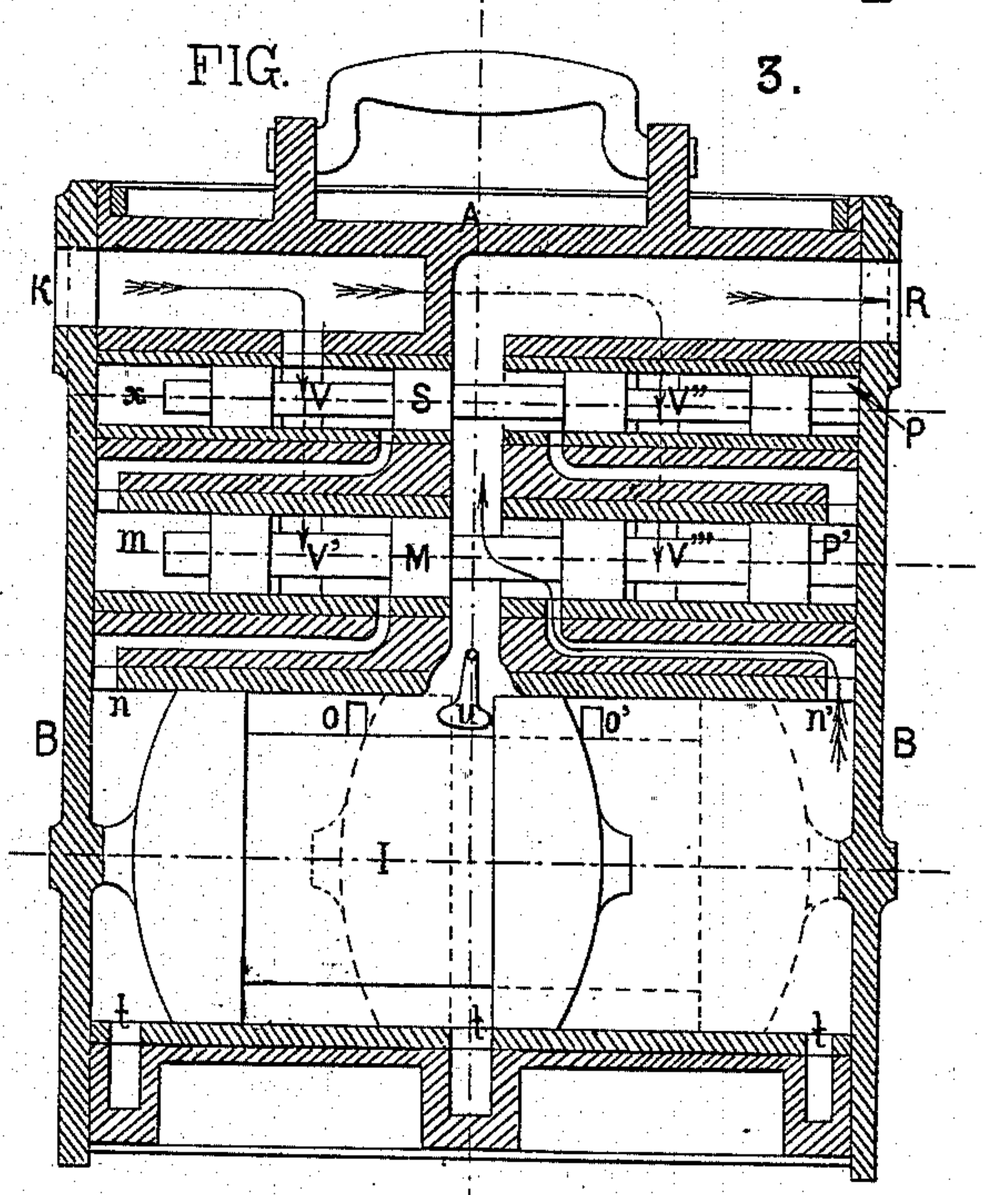


FIG. 3.



Witnesses:
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(No Model.) 2 Sheets—Sheet 2.

C. ROUX.

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FIG. 4.

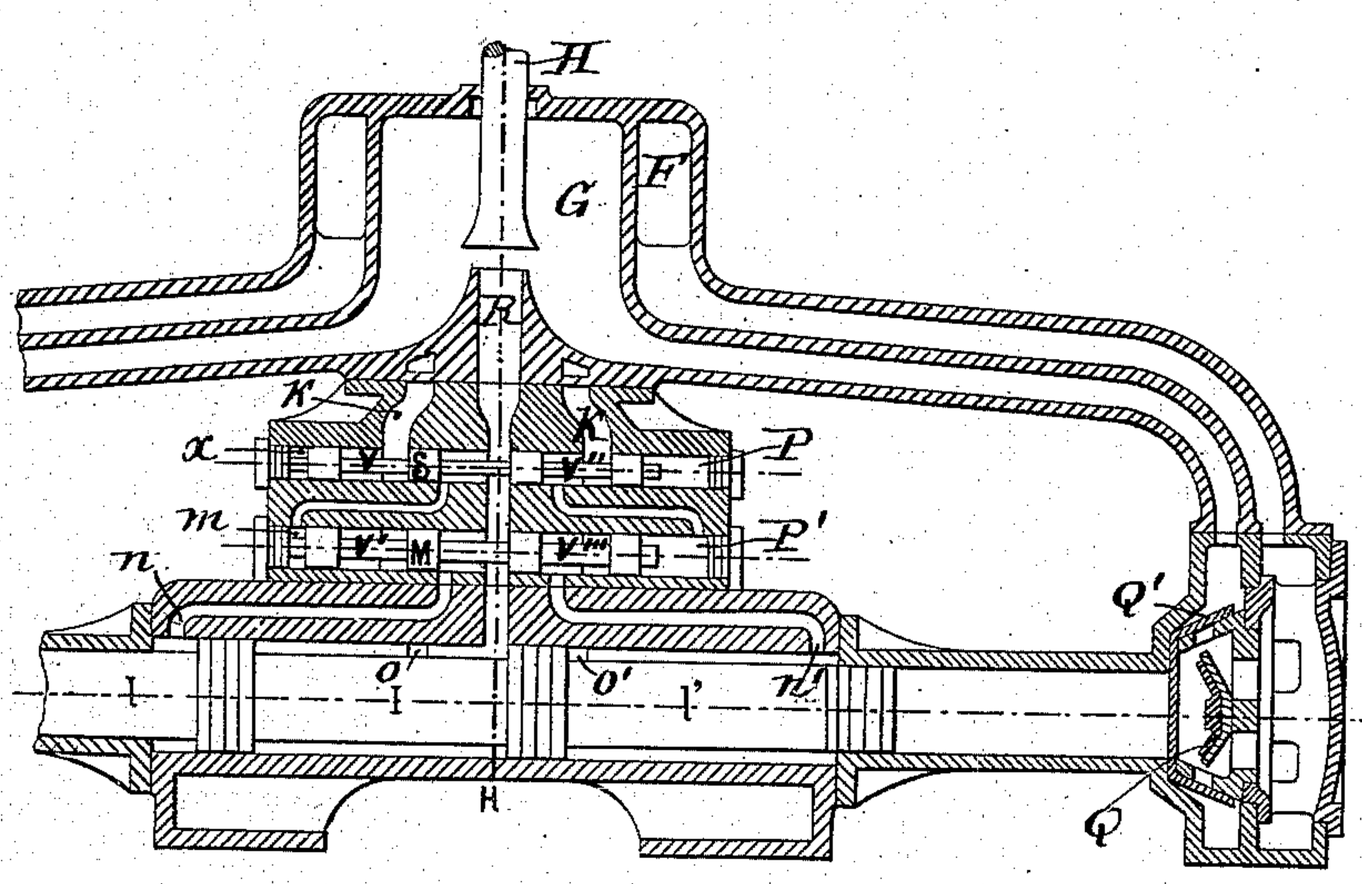


FIG. 5.

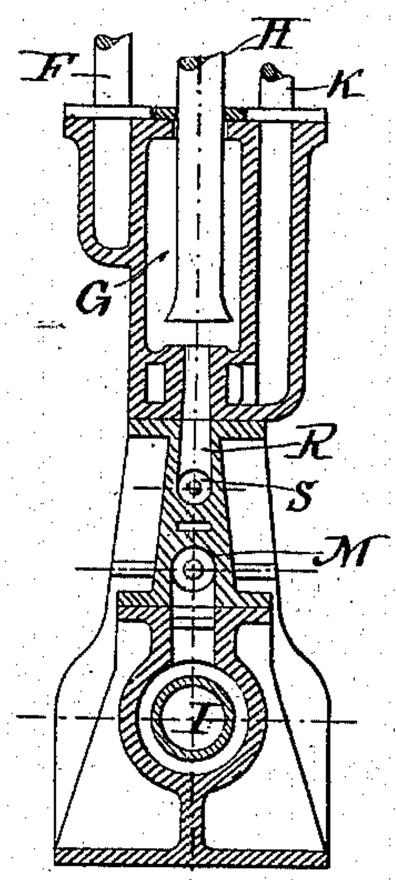


FIG. 6.

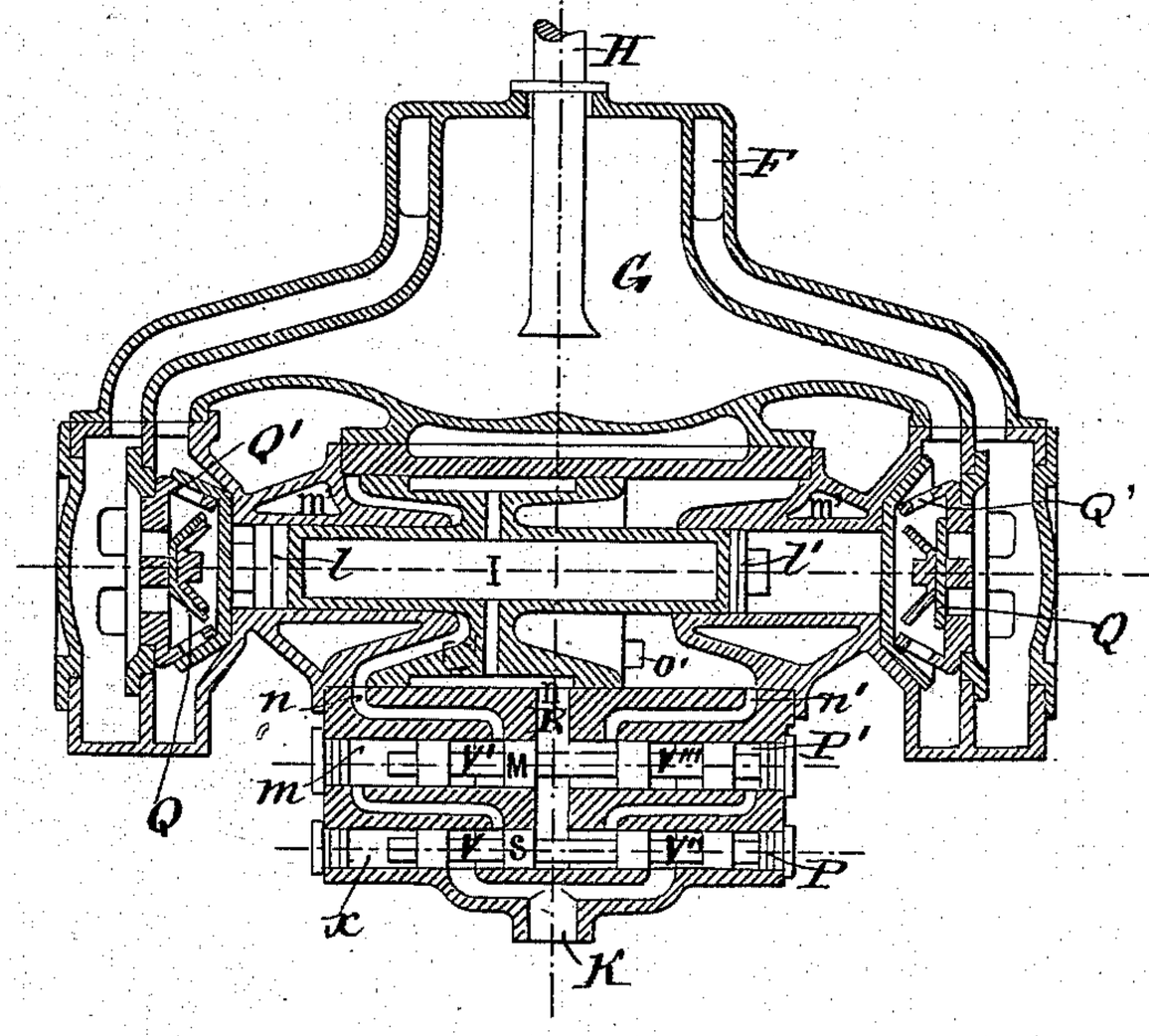
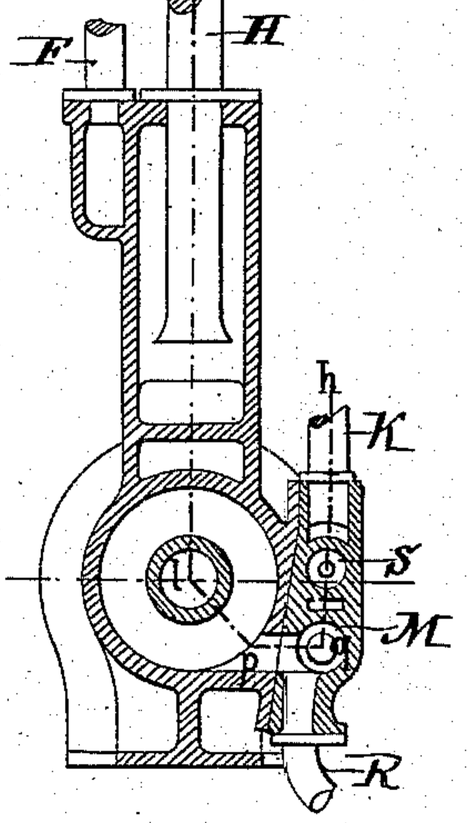


FIG. 7.



Witnesses:

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UNITED STATES PATENT OFFICE.

CHARLES ROUX, OF PARIS, FRANCE.

VALVE APPARATUS FOR HYDRAULIC AND STEAM MOTORS.

SPECIFICATION forming part of Letters Patent No. 249,150, dated November 1, 1881.

Application filed July 26, 1881. (No model.) Patented in France April 16, 1880.

To all whom it may concern:

Be it known that I, CHARLES ROUX, of Paris, in the Republic of France, have invented certain new and useful Improvements in Valve Apparatus for use in Hydraulic Motors, Direct-Acting Steam-Pumps, and other Machines, of which the following specification is a full description.

The invention has for its object to dispense with the usual mechanical devices—such as sliding or jointed rods for imparting motion to the valves; and it consists in an arrangement of cylinders and pistons whereby the pressure of the fluid itself is made to control the inlet and outlet ports. The said cylinders and pistons are arranged in series and operate successively, being moved each by the pressure of fluid from the preceding cylinder and controling the inlet and outlet of the succeeding one.

This valve apparatus is applicable to various kinds of machines driven by water, steam, compressed air, or other fluid. In the accompanying drawings it is shown applied to a water-meter, a hydraulic motor, and a direct-acting steam-pump.

Figures 1, 2, and 3 represent a water-meter provided with the improved valve apparatus, Fig. 1 being an elevation; Fig. 2, a transverse section on line *x y*, Fig. 1; and Fig. 3, a longitudinal section on line *a b c d e f*, developed. Figs. 4 and 5 represent a hydraulic motor, Fig. 4 being a longitudinal, and Fig. 5 a cross, section; and Figs. 6 and 7 are views of a direct-acting pump, Fig. 6 being a development of a longitudinal section on line *k l p q h*, Fig. 7, and the latter a cross-section. The valve apparatus is substantially the same in all the figures.

The three pistons S M I work in their appropriate cylinders, which are divided into several compartments by the piston-heads—the main cylinder into three compartments by the two heads of piston I, and the others each into five compartments by the four heads of their respective pistons S M.

The compartments V V′ V″ V‴ are in direct and constant communication by suitable passages with the inlet K. The central compartments of all three cylinders are in direct and constant communication with the outlet R. The port *o* of the main cylinder is connected by a passage with the compartment P at one end of the piston S, and the port *o′* with the compartment *x* of the opposite end of said piston. At the end of the main cylinder are ports *n n′*, through which communication is established alternately with inlet K and outlet R, according to the position of the piston M, and the compartments *m* P′ at the ends of said piston are in like manner alternately put in communication with the inlet K and outlet R by the piston S. The passages leading from the compartments at ends of pistons I and M are clearly shown in Figs. 3, 4, and 6.

The operation is as follows: The fluid entering at K fills the compartments V V′ V″ V‴. Its pressure being balanced, it is without effect upon the pistons S M. Taking the apparatus in the position shown in Figs. 3 and 6, the fluid flows from the compartment V′ through the port *n* into the main cylinder and forces the piston I to the right. It also fills the compartment *m* from V and holds the piston M in the position shown. As the piston I moves to the right it expels the fluid through the port *n′* and outlet R. At or near the end of its stroke it uncovers the port *o*. The pressure of the inflowing fluid is at once conveyed through this port to the compartment P, and being opposed only by the smaller pressure of the outflowing fluid conveyed to the compartment *x* through the port *o′*, it forces the piston S to the left, cutting off the communication between the compartments V and *m* and establishing it between V″ and P′. The fluid being now let into the compartment P′, the pressure moves the piston M to the left and puts the port *n′* in communication with the inlet K through the compartment V‴, and the port *n* in communication with the outlet R, so that the pressure of the incoming fluid begins to act upon opposite ends of piston I and force it to the left. This position is shown in Fig. 4. At or near the end of its stroke it establishes communication for the inflowing fluid through the port *o′* into the compartment *x*, whereupon the piston S moves to the right and puts the compartment V in communication with *m*, so that the piston M is forced to the right in its turn and establishes communication through the compartment V′ and port *n* between the inlet K and left end of main cylinder.

In the water-meter the various cylinders,

ports, and passages are or may be made in one casting.

The pistons may be of any suitable construction. The cylinders are preferably fitted with a lining of copper. Tubes or cylinders of suitable diameter and pierced with the proper ports can be inserted into the openings in the casting A. At the bottom of the main cylinder are sediment-traps *t*. The number of reciprocations of the piston I, which measures the amount of water flowing through the heater, is indicated by the enumerator E, operated by the vibratory arm *u*, which is struck and moved back and forth by the piston I.

The hydraulic motor is shown in Figs. 4 and 5, combined with a pump. It is adapted for utilizing a small body of water under a strong head to raise a large body a short distance. The piston I is provided with extensions *l l'*, which form the pistons for the pump. They draw in the water through the pipe F and expel it into the air-chamber G, from which it passes out by the pipe H. The water for operating the motor enters by inlet K, and after passing through the cylinders escapes by the outlet R into the air-chamber G, wherein it mixes with the discharge-water of the pump. Q Q' are the inlet and outlet valves for the pump.

In the direct-acting steam-pump, Figs. 6 and 7, the pumping apparatus is similar to that shown in Figs. 4 and 5. The construction is, however, specially adapted to prevent as much as possible the condensation of the steam. The pistons S M are separated from the air-chamber and inlet and outlet pipes for the water, and the steam, after acting in the main cylinder, is caused to circulate through the chambers *m'* surrounding the pump-cylinders and through the interior of the piston I before escaping by the outlet R.

It is obvious that various modifications and alterations could be made in the details of construction of the improved valve apparatus without departing from the spirit of this invention.

Having thus fully described my said invention and the manner in which the same is or may be carried into effect, what I claim, and desire to secure by Letters Patent, is—

1. The combination, with a main cylinder piston and ports, of valve apparatus comprising a piston operated by the pressure of the fluid in the main cylinder, and one or more intermediary pistons controlled by said last-named piston, said intermediary piston controlling the admission of the fluid into the main cylinder, substantially as described.

2. The combination of three or more pistons and cylinders, arranged in series, substantially as described, so that each piston controls the position of the succeeding one in the series by direct pressure of fluid without the intervention of levers, sliding or jointed rods, or similar mechanical devices, as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

C. ROUX.

Witnesses:
G. DUPONT,
EM. PITIOT.