No. 773,764. PATENTED NOV. 1, 1904.

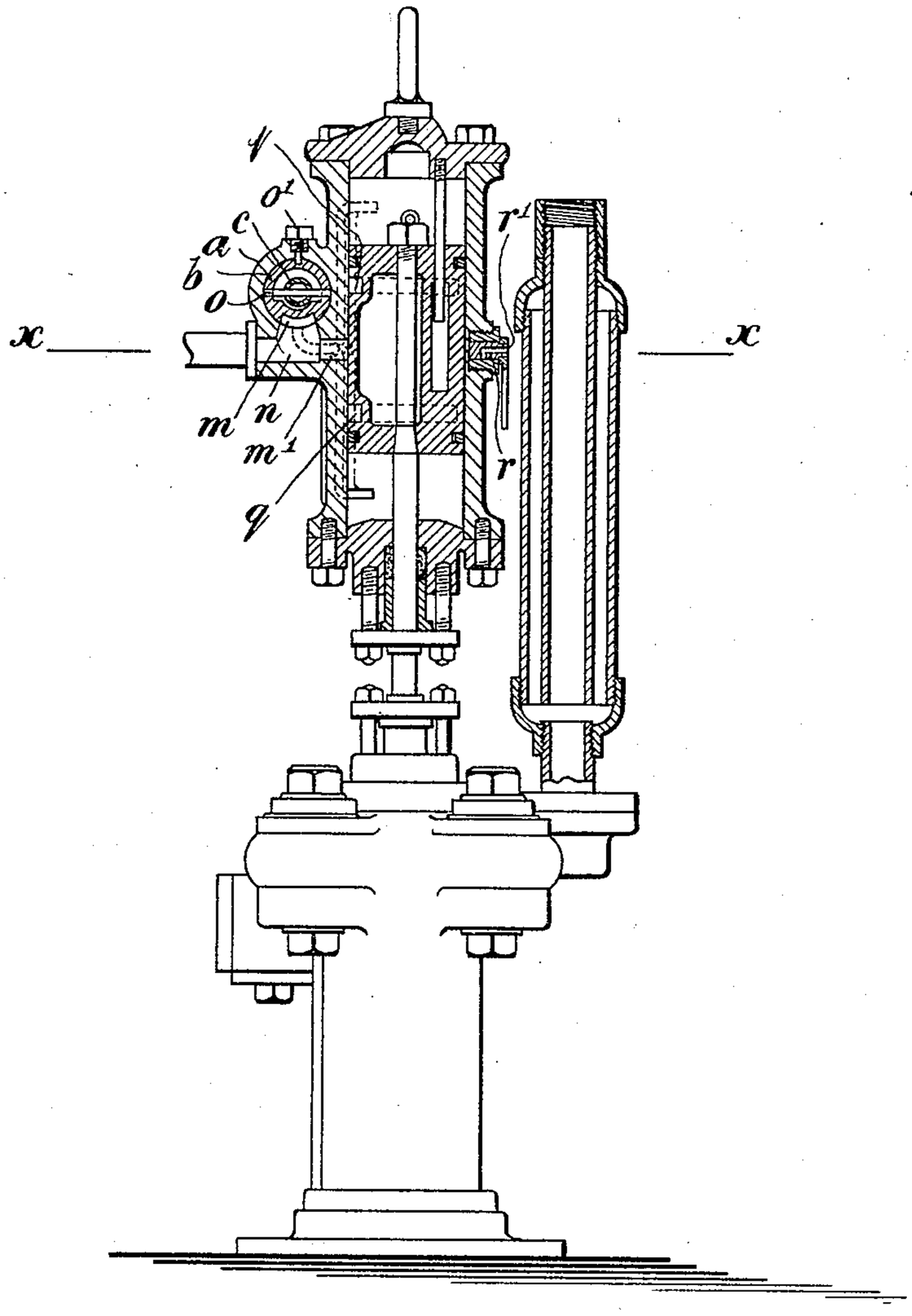
F. McCULLOCH.

PUMP VALVE.

APPLICATION FILED DEC. 29, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
Thos. J. Byrnes
L. L. Dunham.

Finlay McCulloch,
Inventor,
by Kerr, Page & Cooper, Attys.

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PUMP VALVE.

APPLICATION FILED DEC. 29, 1903.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.

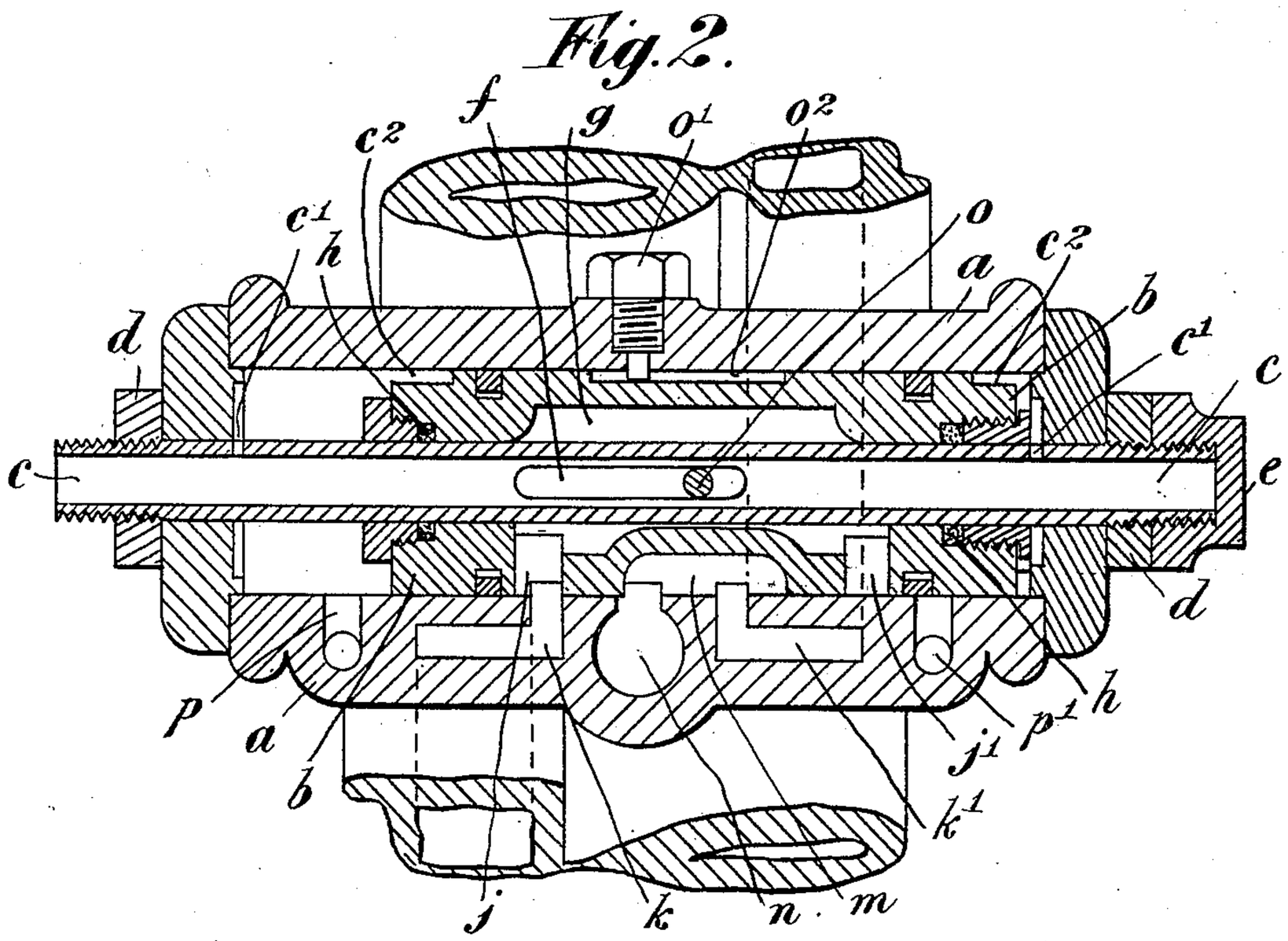
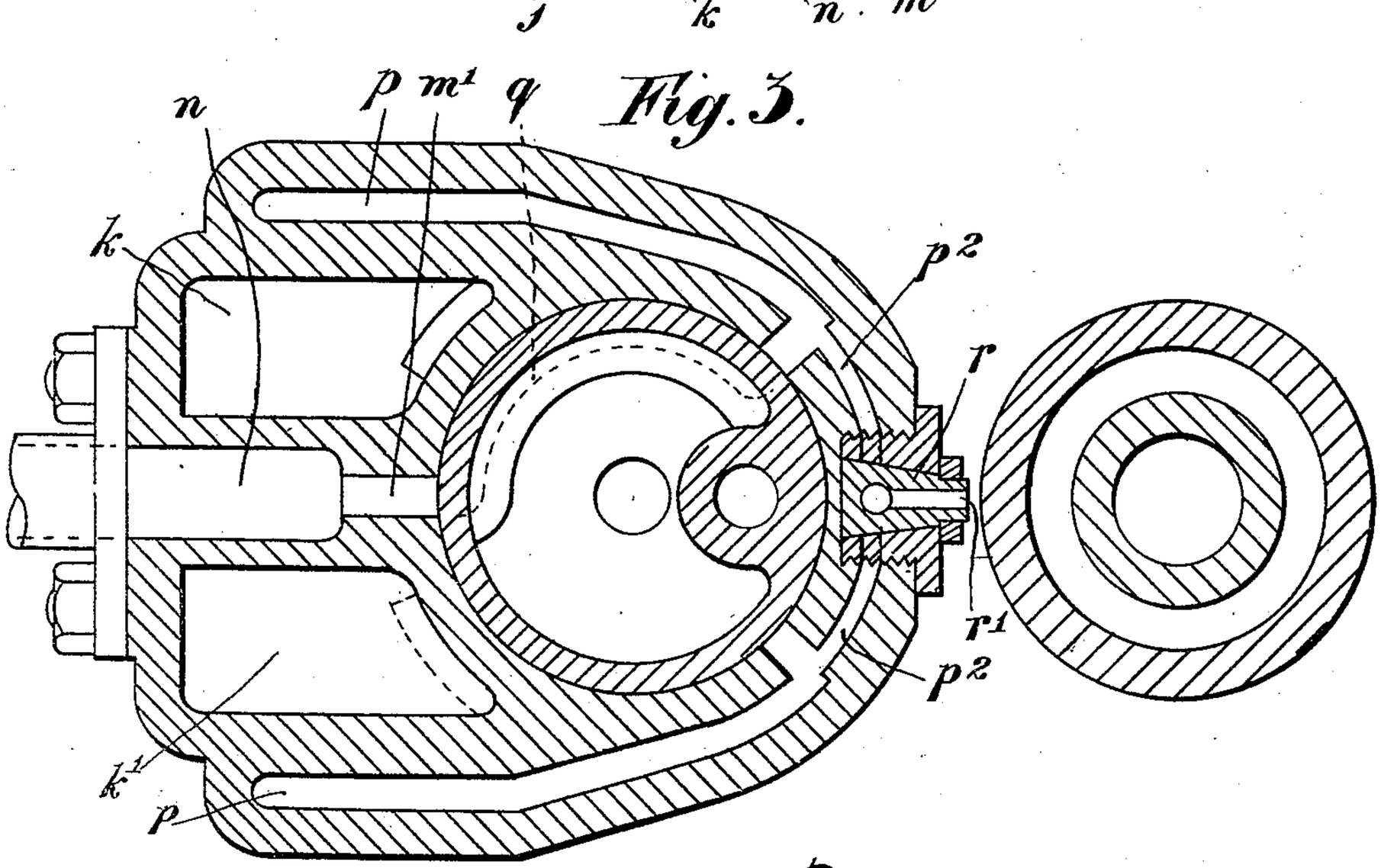


Fig. 3.



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No. 773,764. Patented November 1, 1904.

UNITED STATES PATENT OFFICE.

FINLAY McCULLOCH, OF MANCHESTER, ENGLAND.

PUMP-VALVE.

SPECIFICATION forming part of Letters Patent No. 773,764, dated November 1, 1904.

Application filed December 29, 1903. Serial No. 186,954. (No model.)

To all whom it may concern:

Be it known that I, FINLAY McCULLOCH, a subject of the King of Great Britain, residing at Merrion Place, Higher Broughton, Manchester, England, have invented certain new and useful Improvements in Pump-Valves, of which the following is a specification.

My invention relates to pumps actuated by steam or other fluid pressure for pumping liquids and compressible fluids under a pressure or vacuum, such as air-pumps for condensers and pumps for general purposes—boiler feeding, circulating, and the like.

The chief feature of my present invention relates to the provision of a tube on which the distributing-valve of the working cylinder slides and by which the balancing of the valve is facilitated, the wear of the valve and valve-chest is reduced to a minimum, and the pressure required to move the valve is also greatly reduced. It is essential that valves of this type should move very freely, and such free movement is secured by my invention. To obtain these results according to my present invention, the tube aforesaid passes completely through the valve-chest and the steam or other working fluid is admitted through the said tube to the interior of the piston-valve, the rotation of the latter being prevented by a pin passing transversely through the tube or by other convenient means. Suitable means are employed for balancing the valve, and ports or passages are provided forming communications between the ends of the valve-chest and the working cylinder, so that at the desired times there is a sufficient excess of pressure on one side of the valve to effect the required movements of the said valve. A valve thus constructed possesses important advantages as compared with those valves on the back of which the steam is allowed to press, and thus set up considerable resistance to movement.

For starting the engine I provide a conical plug-cock communicating with the passages that lead from the pump or working cylinder to the ends of the valve-chest. By momentarily turning this cock steam can be exhausted from either end of the valve-chest, and so the valve will be moved to that end and the engine started.

My improvements are applicable to vertical or horizontal cylinders, and in either case I may arrange the steam-chest transversely to the cylinder.

In the accompanying drawings, Figure 1 shows, partly in central section and partly in elevation, a pump with a vertical cylinder having my improvements applied thereto. Fig. 2 shows, on an enlarged scale, a central section taken axially through the valve-chest of the pump shown in Fig. 1; and Fig. 3 shows a section, also on an enlarged scale, taken on the line *x x*, Fig. 1.

Referring to the drawings, *a* is a valve-chest, *b* is a piston-valve, and *c* is a tube passing completely through the said valve-chest and the said valve. This tube *c* is secured to the cover or end plates of the valve-chest—for example, by nuts *d d*—and one end of the said tube is closed or capped, as at *e*, the other end being open for connection to the pipe supplying the motive fluid. A slot *f* in the tube *c* admits the motive fluid to a space *g*, formed in the valve *b*, the ends of the latter being made to fit fluid-tight on the said tube by suitable packing *h*.

j j' are ports leading from the space *g* and arranged to coöperate, respectively, with the ports *k k'*, leading to the working cylinder, in such a manner that by the reciprocatory movements of the valve *b* the proper distribution of the motive fluid to the said working cylinder is insured.

m is the exhaust-passage of the valve making communication between the ports *k k'* and the exhaust-port *n*. The rotation of the valve is prevented, for example, by a pin *o* traveling in the slot *f* of the tube *e* or by a set-screw *o'* entering a slot o^2 in the valve.

Small openings *c' c'* connect the interior of the tube *c* with the valve-chest, near each end of the latter, to equalize the pressures at the opposite ends of the valve, and c^2 c^2 are flats or depressions formed on the upper part and toward the ends of the valve. The effective surface of these flats or depressions is preferably so proportioned that under the action of

the fluid-pressure admitted through the openings c' c' the lifting effort operating in the neighborhood of the ports j' j'' to raise the valve b from its seat is balanced. In order to insure an excess of pressure on one side of the valve in order to effect the movement of said valve at the desired times, the ends of the valve-chest are in communication with the working cylinder through ports or passages p p', and the said ports or passages when the main or working piston is in certain positions are in communication with the exhaust-passage m' (leading to the exhaust-port n) through grooves q, arranged in the body of the main or working piston. These ports p p' preferably open into the valve-chest at a short distance from each end thereof, and the said ports open into the cylinder at the side thereof remote from the valve-chest, as best shown in Fig. 3.

In order to move the valve b to either end of the valve-chest when starting the pump no matter what may be the position of the working piston, the ports p p' are placed in communication with the atmosphere through channels or passages p^2 p^2, controlled by a cock r. Said cock when in its mid-position closes both channels p^2, and when turned from its mid-position it places one of said channels p^2 in communication with the atmosphere through the bore r' of the cock. (See Fig. 3.) Therefore by turning the cock r the motive fluid at one end of the valve-chest is allowed to escape into the atmosphere, and the pressure at this end being thereby reduced the valve moves toward said end and starts the engine. The cock being conical and the steam acting to press it to its seat no packing is here required.

By the improved construction, as hereinbefore stated, the balancing of the valve is facilitated, the excess of pressure required to move the valve is reduced, and the said valve can be readily brought to the starting position independently of the position of the working piston.

What I claim, and desire to secure by Letters Patent, is—

1. In a pump, the combination with the working cylinder and the piston therein, of a valve-casing, a hollow reciprocating distributing-valve in the casing, a motive-fluid-supply pipe extending through the valve, on which the valve reciprocates, ports in the tube in constant communication with the interior of the valve, passages from the valve-casing to opposite ends of the cylinder whereby the reciprocation of the valve opens said passages alternately, and means for reciprocating the valve, as set forth.

2. In a pump, the combination with the working cylinder and the piston therein, of a valve-casing, a hollow reciprocating distributing-valve in the casing, a motive-fluid-supply pipe extending through the valve, on which the valve reciprocates, ports in the tube in constant communication with the interior of the valve, passages from the valve-casing to opposite ends of the cylinder whereby the reciprocation of the valve opens said passages alternately, ports in the supply-tube in constant communication with the interior of the casing outside of the valve, and means for relieving the pressure in the valve-casing on opposite ends of the valve alternately, as set forth.

3. In a pump, the combination with the working cylinder and the piston therein, of a valve-casing, a hollow reciprocating distributing-valve in the casing, a motive-fluid-supply pipe extending through the valve, on which the valve reciprocates, ports in the tube in constant communication with the interior of the valve, passages from the valve-casing to opposite ends of the cylinder whereby the reciprocation of the valve opens said passages alternately, ports in the supply-tube in constant communication with the interior of the casing outside of the valve, and passages connecting the working cylinder and opposite ends of the valve-casing exterior to the valve, said last-mentioned passages being closed alternately by the reciprocation of the valve, as set forth.

4. In a pump, the combination with the working cylinder and the piston therein, of a valve-casing, a hollow reciprocating distributing-valve in the casing, a motive-fluid-supply pipe extending through the valve, on which the valve reciprocates, ports in the tube in constant communication with the interior of the valve, passages from the valve-casing to opposite ends of the cylinder whereby the reciprocation of the valve opens said passages alternately, ports in the supply-tube in constant communication with the interior of the casing outside of the valve, passages connecting the working cylinder and opposite ends of the valve-casing exterior to the valve, said last-mentioned passages being closed alternately by the reciprocation of the valve, and means for relieving the pressure in the casing at either end of the valve at will, to start the valve from any position of rest, as set forth.

5. In a pump, the combination with the working cylinder and the piston therein, of a valve-casing, a hollow reciprocating distributing-valve in the casing, a motive-fluid-supply pipe extending through the valve, on which the valve reciprocates, ports in the tube in constant communication with the interior of the valve, passages from the valve-casing to opposite ends of the cylinder whereby the reciprocation of the valve opens said passages alternately, ports in the supply-tube in constant communication with the interior of the casing outside the valve, passages connecting the working cylinder and opposite ends of

the valve-casing exterior to the valve, said last-mentioned passages being closed alternately by the reciprocation of the valve, and a manually-operated top common to said last-mentioned passages and open to the external air, whereby either passage may be opened to the air at will to relieve the pressure in the respective ends of the casing, as set forth.

6. In a pump, the combination with the working cylinder and the piston therein, of a valve-casing, a hollow reciprocating distributing-valve in the casing, a motive-fluid-supply pipe extending through the valve, on which the valve reciprocates, ports in the tube in constant communication with the interior of the valve, passages from the valve-casing to opposite ends of the cylinder whereby the reciprocation of the valve opens said passages alternately, ports in the supply-tube in constant communication with the interior of the casing outside the valve, passages connecting the working cylinder and opposite ends of the valve-casing exterior to the valve, said last-mentioned passages being closed alternately by the reciprocation of the valve, and means for balancing the pressure exerted on the valve by the fluid in the closed passage, as set forth.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

FINLAY McCULLOCH.

Witnesses:
W. H. PIDGEON,
JOHN W. THOMAS.