(No Model.) 2 Sheets—Sheet 1.

F. A. BURNHAM.

DIRECT ACTING STEAM PUMP.

No. 519,857. Patented May 15, 1894.

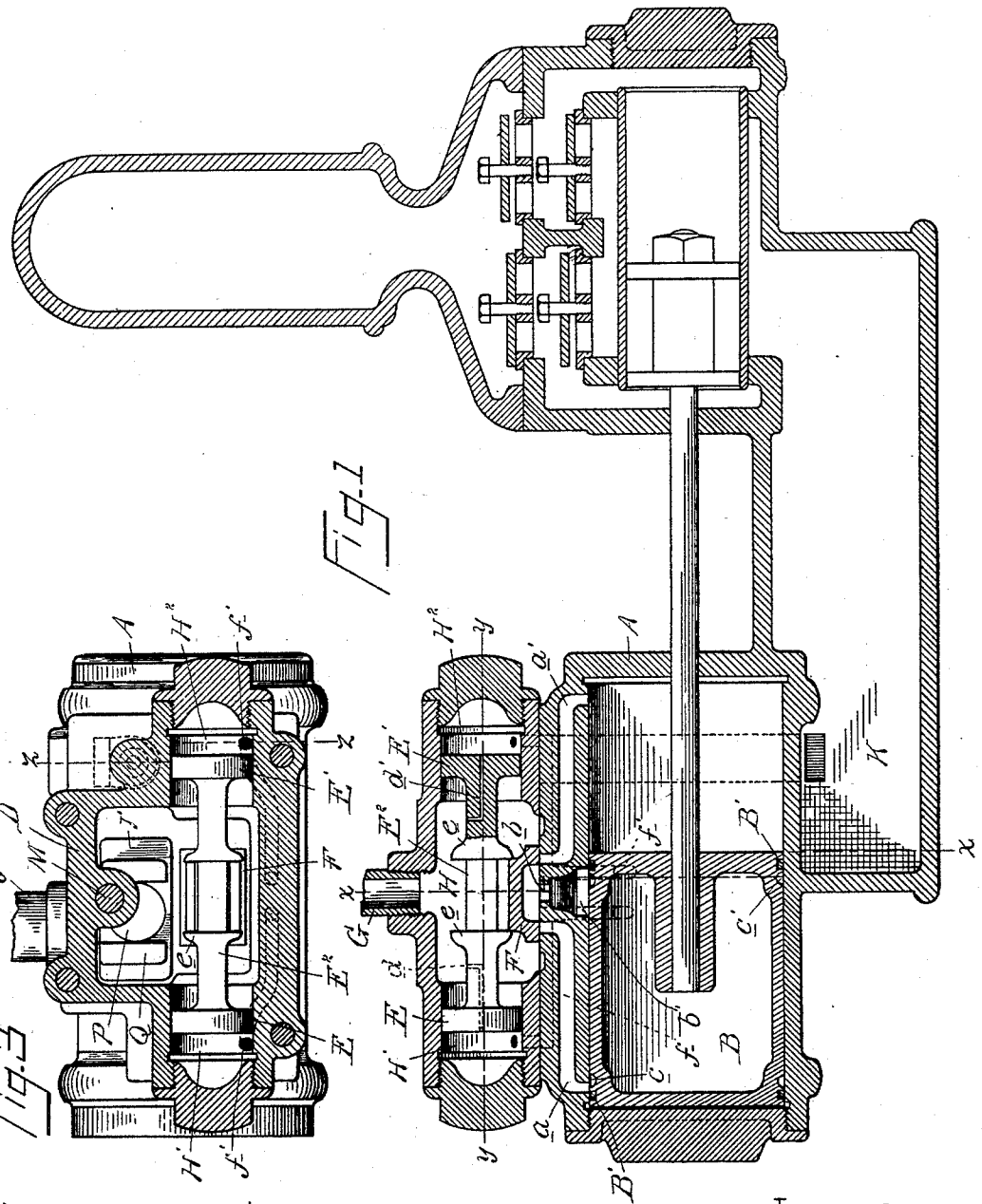

Fig. 1

Fig. 3

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(No Model.) 2 Sheets—Sheet 2.

F. A. BURNHAM.

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Fig. 2

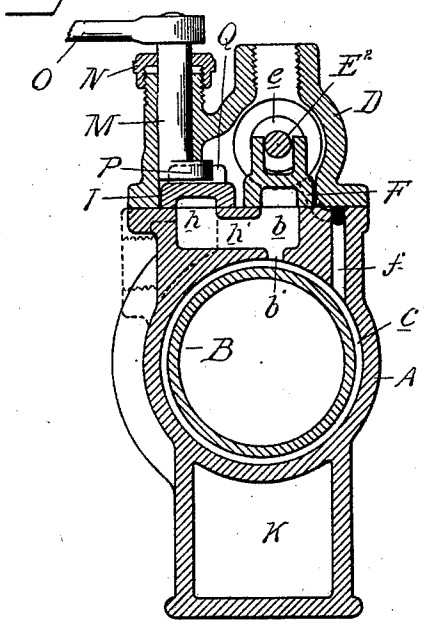


Fig. 3

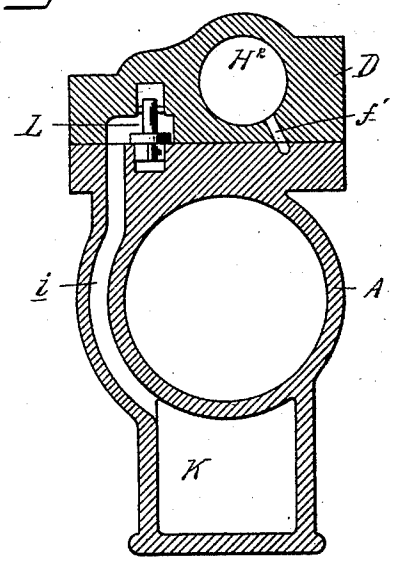
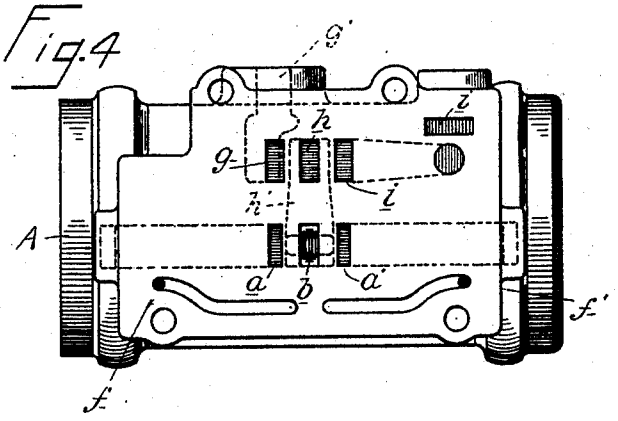


Fig. 4



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UNITED STATES PATENT OFFICE.

FRANK A. BURNHAM, OF BATTLE CREEK, MICHIGAN, ASSIGNOR OF ONE-HALF TO DORR B. BURNHAM, OF SAME PLACE.

DIRECT-ACTING STEAM-PUMP.

SPECIFICATION forming part of Letters Patent No. 519,857, dated May 15, 1894.

Application filed February 11, 1893. Serial No. 461,886. (No model.)

To all whom it may concern:

Be it known that I, FRANK A. BURNHAM, a citizen of the United States, residing at Battle Creek, in the county of Calhoun and State of Michigan, have invented certain new and useful Improvements in Direct-Acting Steam-Pumps, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates more particularly to an improvement in valve gear of direct acting steam pumps, and consists in the improved construction and arrangement of valves in connection with ports and passages by means of which the induction and exhaust of the steam are effected, all as hereinafter described with reference to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section through a direct acting steam pump of my improved construction. Fig. 2 is a cross section thereof on line *x*—*x* Fig. 1. Fig. 3 is a horizontal section on line *y*—*y* in Fig. 1. Fig. 4 is a plan of the top of the cylinder with the valve chest removed. Fig. 5 is a cross-section on line *z*—*z* in Fig. 3.

A represents the main steam cylinder provided with the usual steam ports *a a'* and main exhaust port *b*.

B represents the piston provided with the usual metallic packing rings B' and with annular grooves *c c'* which form exhaust passages near each end of said piston.

D represents the valve chest secured by bolts to the main cylinder and containing a supplemental piston which carries the main valve F. The supplemental piston is formed with heads E E' at opposite ends which move in steam chambers H' H^2 formed in the valve chest and have steam ports *d d'* drilled through them. The stem E^2 connecting these two heads together is provided with collars or projections *e* between which the main valve is held and guided in its movement.

G is the induction pipe through which the live steam is admitted into the steam space H of the valve chest. The steam chambers H' H^2 of the valve chest have supplementary exhaust passages *f f'* connecting the ends of said steam chambers with the main cylinder at points near its center, so located that in the operation of the main piston B, the annular grooves *c c'* therein alternately coincide with such passages just before and during the completion of each stroke of the piston. The valve chest is provided at one side of the main valve with an enlargement D' which incloses an exhaust deflecting valve I controlling three ports *g h* and *i* in the valve seat. This valve is a slide valve provided at the under side with the usual exhaust cavity adapted to coincide with the ports *g h i* in such manner as to connect the ports *g* and *h* or the ports *h* and *i*. The port *g* communicates through a passage *g'* with the exhaust pipes J, the central port *h* communicates through a passage *h'* with the main exhaust port *b* and with an exhaust port *b'* leading directly into the cylinder, and the port *i* communicates through a passage *i'* with the suction chamber K of the steam pump, and in this passage there is located a check valve L.

The exhaust deflecting valve is to be operated by hand preferably by means of a rock shaft M journaled in suitable vertical bearings formed in the valve chest above the deflecting valve. This rock-shaft passes through a stuffing box N to the outside where it is provided with a handle O and at its lower end it is provided with a lateral arm P which projects between two guide flanges Q formed on top of the deflecting valve. It is obvious that a straight stem passing through the end of the chest may be used in place of the rock shaft for operating the valve.

In practice the parts being arranged and constructed substantially as shown and described, they are intended to operate as follows: In the position shown in Fig. 1, the main piston has just completed its travel toward the left and in this position the annular groove *c'* in the main piston now coincides with the passage *f'* and the steam contained in the steam chamber H^2 is exhausted more freely by way of the passage *f'*, annular groove *c'*, and port *b'* into the main exhaust port *b*; then it can flow into the chamber from the valve chest through the small passage *d'*. The valve controlling or supplementary piston being now exposed to the full pressure or stress of steam only against the head E is forced to the right and carries the main valve F with it, thus

opening the passage *a* to the induction of steam and connecting the passage *a'* to the exhaust. The exhaust passage *f'* is closed by the head E E' and the piston becomes balanced again. The movement of the main piston then takes place toward the right and when it is near the end of its travel the annular groove *c* will now be brought into coincidence with the opening of the passage *f* into the cylinder. This permits the steam from the steam chamber H' to exhaust and therefore the valve controlling piston will be forced to the left and carry the main valve back again and reverse the movement of the main piston. The movement of the main valve is thus accomplished by exhausting live steam alternately from the steam chambers in which the opposite heads of the valve controlling piston move. The ports *d d'* may be made very small as it requires but little steam to move the valve controlling piston and it is obvious that if the piston heads E E' are made loose fitting the leakage of steam past these heads into the valve chambers H' H² will accomplish the objects of the ports *d d'* and the latter may then be entirely omitted and it is the very advantage of this valve construction that the piston E E' need not be tight. By turning the handle O of the deflecting valve into the position shown in Fig. 3 the exhaust valve is in such position that it deflects the exhaust steam from the cylinder through the cavity of said valve into the passage *i'* which conducts it into the suction chamber of the pump where it is condensed and heats the water which makes the pump especially adapted for boiler feeding purposes. By turning the handle O into the position shown in dotted lines, the exhaust steam from the cylinder is conducted into the exhaust pipe J.

A salient feature of my construction is that the deflecting valve is always held to its seat with the full pressure of the live steam in the chest. This overcomes the great objection against the use of a deflecting valve, namely, that in case the valve is not absolutely tight, air will leak in through the open exhaust pipe under the valve into the passage *i'* and destroy the suction of the pump.

My construction has also the advantage of great simplicity and compactness, the main valve and deflecting valve are arranged side by side inclosed in a common steam chest and moving on a common valve seat, so there is but one seat to face off and by removing four bolts every part of the whole valve mechanism can be examined.

What I claim as my invention is—

1. In a steam pump, the combination with the steam cylinder and valve chest containing the main steam valve, of an exhaust deflecting valve provided with an exhaust cavity and ports and passages adapted to be connected alternatively through said exhaust cavity to exhaust the steam from the cylinder into the exhaust pipe or into the suction chamber of the pump, said exhaust deflecting valve being inclosed in a valve chest and under live steam pressure, substantially as described.

2. In a steam pump, the combination with the steam cylinder and valve chest containing a main slide valve, of an exhaust deflecting valve inclosed in a chamber contiguous to said main valve chest, exhaust ports and passages controlled by said deflecting valve, whereby the exhaust steam from the cylinder may be alternatively deflected into the suction of the pump, and a rock shaft journaled in the valve chest on top of said deflecting valve and adapted to move said valve into its alternative position, substantially as described.

3. In a steam pump, the combination with the steam cylinder having steam ports leading into the ends of the cylinder and a central main exhaust port, of a main slide valve controlling said port, the exhaust port *h* communicating with the main exhaust port of the cylinder, the exhaust ports *g* and *i* communicating respectively into the exhaust pipe and into the suction chamber of the pump, the exhaust deflecting valve provided with an exhaust cavity adapted to alternately connect the exhaust port *h* with the exhaust ports *g* and *i* and the rock shaft M journaled in the valve chest and provided with means for operating the exhaust deflecting valve, all combined and arranged to operate, substantially as described.

4. In a steam pump, the combination with the steam cylinder, a valve chest containing a valve moving piston provided with the heads engaging in steam chambers in the opposite ends of said valve chest and carrying the main slide valve centrally of said piston, an exhaust deflecting valve located alongside said main slide valve in the lateral enlargement formed in said valve chest, and exhaust ports and passages controlled by said deflecting valve, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

FRANK A. BURNHAM.

Witnesses:
M. B. O'DOGHERTY,
N. L. LINDOP.