W. H. HARRISON.

Valve for Pumping Engines.

No. 168,251. Patented Sept. 28, 1875.

FIG. 1.

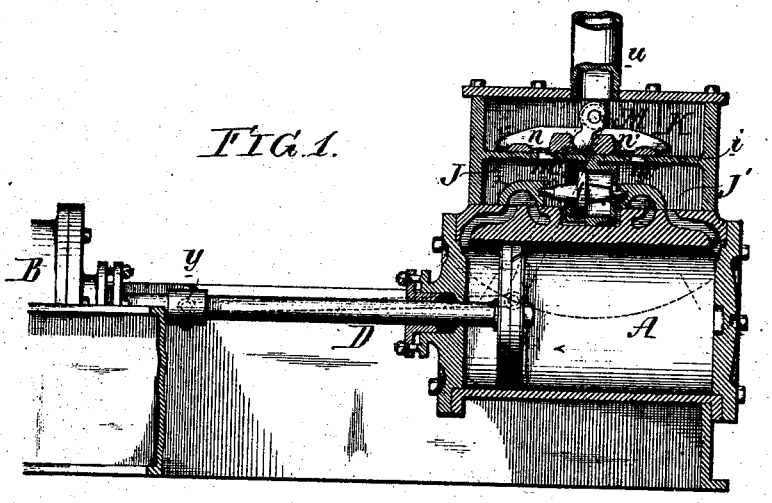


FIG. 3.

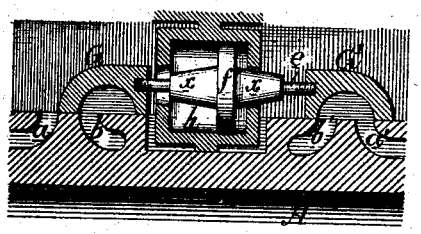
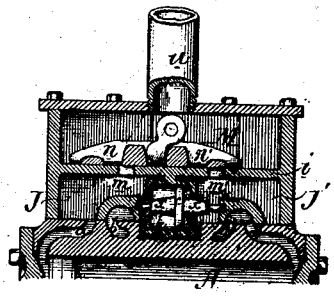


FIG. 2.



Witnesses,

Thomas McIlvain

Harry Smith

W. H. Harrison

by his Attys.

Howson & Sons

UNITED STATES PATENT OFFICE.

WILLIAM H. HARRISON, OF BETHLEHEM, PENNSYLVANIA.

IMPROVEMENT IN VALVES FOR PUMPING-ENGINES.

Specification forming part of Letters Patent No. **168,251**, dated September 28, 1875; application filed November 3, 1874.

To all mwho it may concern:

Be it known that I, WILLIAM HENRY HARRISON, of Bethlehem, Northampton county, Pennsylvania, have invented certain Improvements in Pumping-Engines, of which the following is a specification:

The main object of my invention is to prevent the detrimental shocks which occur in direct-acting pumping and blowing engines, and which are attributable to the too sudden stoppage of the piston on reaching the ends of its stroke, and the too sudden starting of the piston on commencing its reverse movement; and this object I attain by a controlling-valve moving in coincidence with the piston, in combination with a main valve moved by steam, as explained hereafter.

Figure 1 in the accompanying drawing is a vertical section of sufficient of a direct-acting steam-pump to illustrate my improvement; Fig. 2, part of Fig. 1, showing the valves in a different position; and Fig. 3 an enlarged view of the main valve and its connections.

A is the steam-cylinder, the piston of which is connected to that of the pump-barrel by the piston-rod D, as in ordinary direct-action steam-pumps. The face for the main valve has the usual steam-ports *a a'*, and exhaust-ports *b b'*, adapted to a valve made in two parts, G G', connected together by a rod, *e*, on which is a piston, *f*, adapted to a small cylinder, *h*, the latter forming part of a vertical partition, which separates the lower steam-chest into two compartments, J and J'. This lower steam-chest is separated from the upper, to which steam is admitted through a pipe, *u*, by a horizontal partition, *i*, which forms the seat for the controlling-valve M, the said partition having a port, *m*, communicating with the compartment J, and a port, *m'*, communicating with the compartment J', of the steam-chest below, and the controlling-valve, having two openings, *n n'*. This valve is operated from a collar, *y*, on the piston D, through the medium of any suitable mechanism which will insure a movement of the valve coincident with the movement of the piston. The two-part main valve is dependent for its movement entirely upon the pressure of steam, or rather upon the difference of the pressure of steam in the two compartments J and J' of the lower steam-chest, as will be rendered apparent hereafter.

In Fig. 1 the piston of the engine is approaching the termination of its stroke in the direction of the arrow, the steam-port *a'* being full open, but the port *m'* in the partition *i* is very nearly closed by the controlling-valve M, which is in the act of moving in the same direction as the piston; hence but little steam can gain access to the compartment J', and thence to the cylinder A, and therefore the movement of the piston must decrease in speed as it nears the termination of its stroke. The moment the regulating-valve closes the port *m'*, as shown in Fig. 2, the port *m* being slightly open, the pressure of steam in the compartment J will necessarily exceed that in the compartment J', and the main valve, owing to the excess of pressure on the front side of the small piston *f*, will be suddenly moved to the position shown in Fig. 2, thereby closing the steam-port *a'*, and exposing the entire steam-port *a*, so that the rear end of the cylinder A will be open to the exhaust, and the front end to the steam; but it will be noticed, on referring to Fig. 2, that the regulating-valve has exposed but very little of the port *m* in the partition *i;* hence the supply of steam to force the piston back will be very limited in the first instance, and its movement will consequently be slow, as it commences its return stroke, the controlling-valve, however, exposing more of the port *m*, as this return stroke is continued, until a full supply of steam is afforded to the piston. The latter, therefore, increases in speed until it approaches the rear end of its stroke, when the movement of the piston decreases, owing to the partial throttling of the port *m* by the controlling-valve, and this port remains closed until the piston has again commenced its forward movement.

It will now be seen that the piston, on approaching and commencing to return from the limits of its strokes, must be so gentle in its movements that the shocks common to engines of this class, and due to the sudden reversing of the piston, are obviated.

In order to relieve the two-part main valve from sudden and detrimental shocks I arrange on each side of the piston *f* of the small cylinder *h* a cone, *x*, of such dimensions, in relation

to an opening in each side of the said small cylinder, that the said opening cannot, under any circumstances, be entirely closed; but when the small piston is suddenly moved toward one end of the cylinder *h* the cone will contract the opening at that end so much that the piston will operate against a cushion of steam, which cannot escape through the contracted opening as fast as the live steam, acting on the opposite side of the piston, moves the latter.

I wish it to be understood that I do not claim, broadly, the combination in direct-action pumping-engine, of a main valve operated solely by the pressure of steam with a supplementary valve operated by the engine; but

I claim as my invention—

1. The combination, in a direct-action pumping-engine, of the regulating-valve K, operated by and moving simultaneously and in unison with the engine, the main valve operated by the pressure of steam, the partition in the chest of the main valve, and a partition having ports adapted to the regulating-valve, substantially as described, so that the admission of steam to the chest of the main valve shall be graduated by the regulating-valve, in the manner set forth, as the piston is concluding and commencing each stroke, for the purpose specified.

2. The combination of the small cylinder *h*, its piston *f*, connected to the two parts of the main valve, and the cones *x x*, adapted to openings in the cylinder-heads, all as set forth.

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

WILLIAM H. HARRISON.

Witnesses:
HUBERT HOWSON,
HARRY SMITH.