J. H. VAILE.
Pumping-Engine.

No. 203,511. Patented May 7, 1878.

Fig. 1.

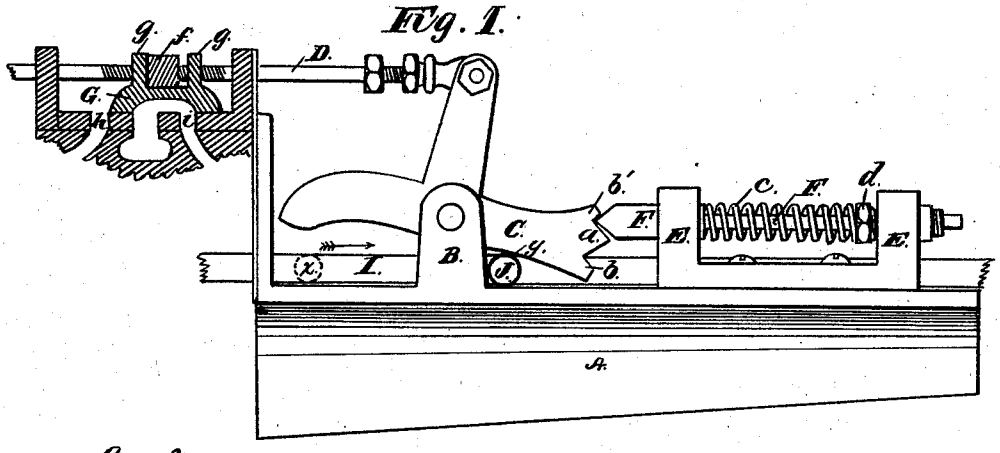


Fig. 2.

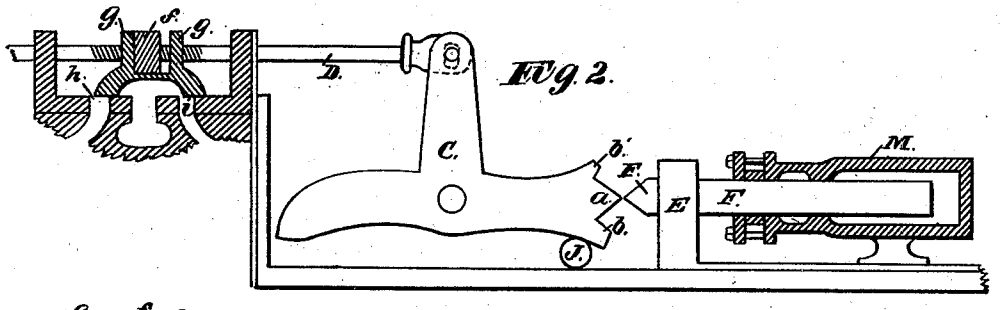


Fig. 3.

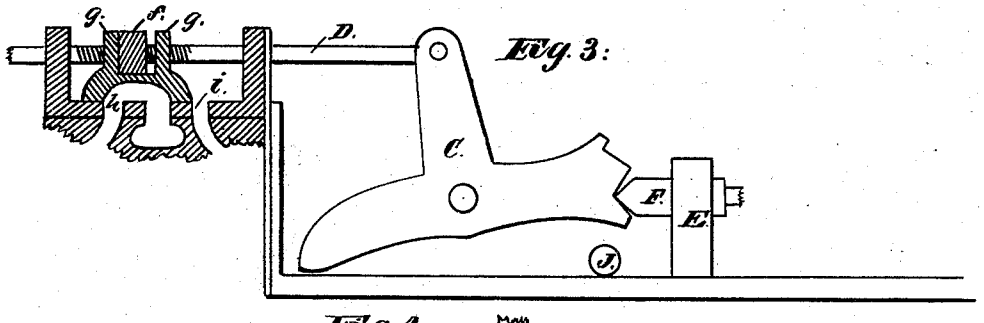
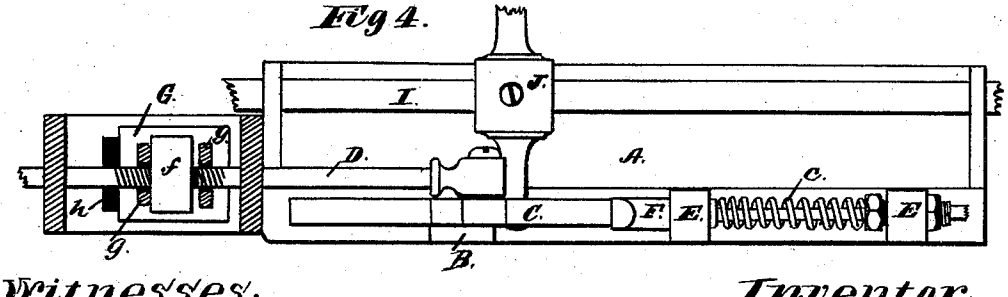


Fig 4.



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UNITED STATES PATENT OFFICE.

JOHN H. VAILE, OF DAYTON, OHIO.

IMPROVEMENT IN PUMPING-ENGINES.

Specification forming part of Letters Patent No. **203,511**, dated May 7, 1878; application filed March 25, 1878.

To all whom it may concern:

Be it known that I, JOHN H. VAILE, of Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Pumping-Engines; and I do hereby declare the following to be a full, clear, and exact description of the same.

The object of my invention is to increase the efficiency, durability, and economy of direct-acting steam-pumps; and my improvements consist, principally, in the peculiar construction of a double bell-crank or valve-moving lever, and in the combination therewith of a reciprocating wedge-pointed plunger, projected either by a spring or compressed air, water, or steam, for the purpose of continuing the stroke of the valve at the termination of each stroke of the piston; also, in other details, as will be herewith set forth and specifically claimed.

In the accompanying drawing, Figure 1 is a side elevation of my devices as applied to a steam-pump, showing the valve-seat and valve in section, and at the commencement of the travel. Figs. 2 and 3 are illustrations of the same at the middle and end of the travel, respectively. Fig. 4 is a plan view of Fig. 1.

Corresponding letters of reference refer to like parts in all the figures.

A is the bed-piece, connecting the steam and water cylinders, and of any suitable construction. Upon the edge of the horizontal portion of this latter is a bearing, B, to which is pivoted the double bell-crank lever C, of the shape indicated. The valve-rod D is connected, by a wrist-pin, to the top of the vertical portion of the lever C, so that the oscillation of the latter causes the reciprocation of the rod.

In suitable bearings or supports E upon the bed A, and in line with the plane of the lever C, is journaled a plunger-rod, F, having an enlarged wedge-shaped head, as shown. This head, which is kept from rotating by a key in its bearing, bears against the rear end of the lever C, which is notched to form a V-shaped projection, *a*, and shoulders *b b'*, as indicated. The plunger is held in constant contact with the end of the lever C by a spiral spring, *c*, coiled upon it, and which bears against the shoulder of the wedge-shaped head, and against an adjustable collar-nut, *d*, secured in the rear support E, as illustrated.

G is any ordinary slide-valve, located over the ports in the steam-chest in the usual manner. The rod D actuates the valve through the medium of a yoke-piece, *f*, secured upon it, and confined loosely between ears *g*, projecting from the top of the valve. By this means, which, however, is not novel in itself, lost motion is obtained for purposes to be hereinafter explained.

Upon the piston-rod I is a cross-head, J, of the shape indicated. One of the blocks of this cross-head travels upon the bed A under the lever C, and is the direct means of actuating the lever, the plunger being an extraneous device, which continues and completes the oscillation of the lever after the piston has commenced it. The under side of each half of the horizontal portion of the lever C is slightly concave, as shown, and this construction forms an essential element of my invention. It is to be noted, also, that the edge and axis of the plunger-head is in line with the pivot of the lever C.

The operation of the device is as follows, steam being supposed to enter the full port *h*, and the cross-head block occupying the position *x*, Fig. 1, at the beginning of the stroke: The piston-rod travels in the direction of the arrow without changing the position of the valve until it has gone about midway of its stroke, when the end of the cross-head—*i. e.*, cross-head block—begins to bear upon the under side of the lever C, as at *y*, Fig. 1. Here are seen the offices of the concavities in the under side of the lever C. If the under side were straight, or even concave, from end to end, the sharp and sudden contact of the cross-head block with the lever might, and would be very apt to, trip the lever and change the ports before the stroke of the piston-rod was finished. As it is, by reason of the two concavities, the lever is gradually turned, and the plunger is forced back until the parts occupy the position shown in Fig. 2. The piston-rod is now almost at the end of its stroke, with an opening on the port *h*. In this position the edges of the plunger-head and projection *a* on the end of the lever are coincident. The least fur-

ther motion of the piston, which is necessary to complete the stroke, breaks this coincidence by slightly raising the end of the lever, whereupon the retractile force of the spring *c* projects the plunger, which, acting upon the under side of the V-shaped projection *a*, throws the lever C in the position indicated in Fig. 3, and opens the inlet *i* full port, as shown. The return stroke now begins, and is completed in a similar manner. Without the lost motion in the valve or its connections, the slight opening in the induction-port at the end of the stroke could not be obtained, and without this opening the completion of the stroke would not be insured.

Instead of the spring to actuate the plunger, water or steam might be employed, as illustrated in Fig. 2, where the plunger forms the piston, and is confined in a cylinder, M.

I am aware that it is not new, however, to employ a V-shaped plunger as an extraneous device to complete the throw of the valve, and consequently do not claim it alone; but,

Having thus fully described my invention, I claim as new—

1. The double bell-crank lever C, to the upper arm of which the valve-rod is connected, having its under side, at each end, concave, in combination with the cross-head block, provided with a pin, J, whereby the vibration of the lever is rendered gradual, as and for the purpose set forth.

2. In a pumping-engine, a double bell-crank lever constructed of a single piece, having its under side or actuating-face formed into concavities diverging from its middle to each end, as and for the purpose specified.

3. The combination, with the double bell-crank lever C, having upon its end the V-shaped projection *a*, of the wedge-shape-headed plunger F, projected by the spring *c* or equivalent device, for shifting the valve at the completion of each stroke of the piston-rod, as and in the manner specified.

4. The combination, with the double bell-crank lever C, constructed as described, of the valve of a pump or engine having lost motion in itself or its connections, as and for the purpose set forth.

5. The combination of the valve G, having lost motion in itself or its connections, the rod D, double bell-crank lever C, and plunger F, the whole constructed and arranged in the manner and for the purpose specified.

Witness my hand this 13th day of March, A. D. 1878.

JOHN H. VAILE.

Witnesses:

CHAS. M. PECK,

QUINCY CORWIN.