

W. SMITH.
HYDRAULIC-ENGINES.

No. 177,967.

Patented May 30, 1876.

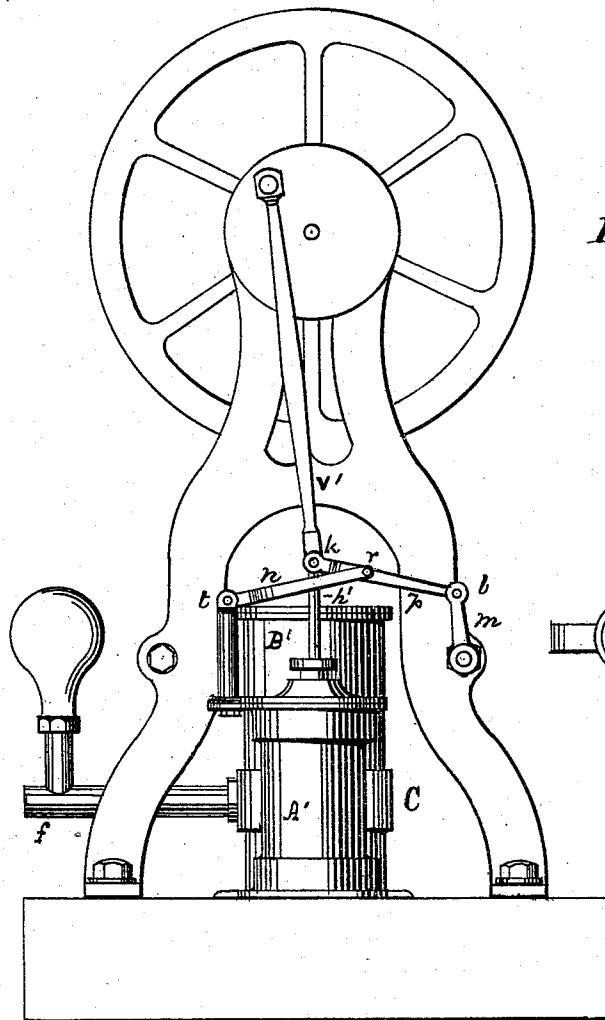


Fig. 1.



Fig. 2.

Witnesses:

C. A. West
O. B. Bond

Inventor:

William Smith

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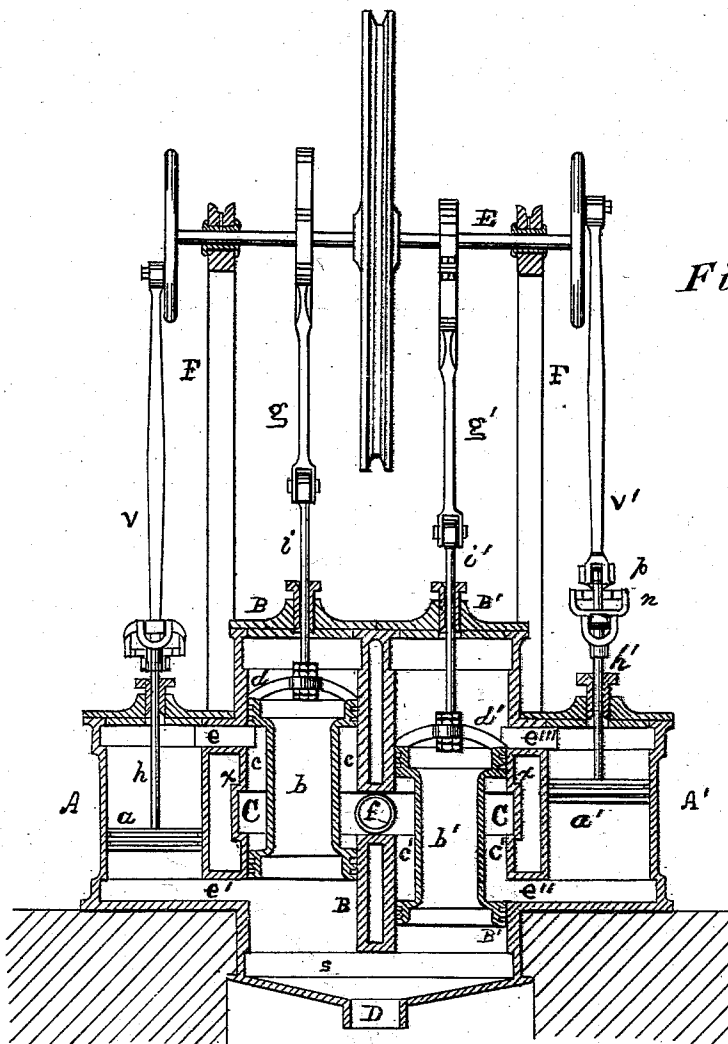


Fig. 3.

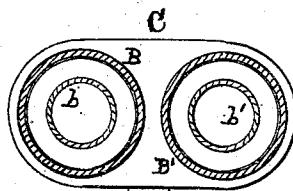


Fig. 4.

Witnesses:

E. A. West.
O. W. Bond.

Inventor:

William Smith

UNITED STATES PATENT OFFICE.

WILLIAM SMITH, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN HYDRAULIC ENGINES.

Specification forming part of Letters Patent No. **177,967**, dated May 30, 1876; application filed June 25, 1875.

To all whom it may concern:

Be it known that I, WILLIAM SMITH, of the city of Chicago, Cook county, State of Illinois, have invented new and useful Improvements in Hydraulic Engines, of which the following is a full description, reference being had to the accompanying drawings, in which—

Figure 1 is an end elevation; Fig. 2, a detail; Fig. 3, a front elevation of the upper part of the machine and a vertical section of the lower part; Fig. 4, a detail, being a horizontal section of the parts shown, and is taken at *x*, Fig. 3.

The invention consists in the combination of the parts hereinafter more fully described, and pointed out in the claims.

I use four cylinders, two of which are for the engine proper and two are valve-cylinders. The water surrounds the valve-cylinders, pressing equally on all sides, so that they can move up and down very freely without any friction.

In the drawings, A A' represent two cylinders, in each of which is an ordinary piston-head, *a a'*. B B' are two valve-cylinders, and *b b'* are the valves. The upper and lower ends of these valves fit the inside of their respective cylinders, while the remaining portion of each valve is itself a cylinder, somewhat smaller than the cylinders B B', leaving spaces *c c'* between the main portion of each valve and the wall of the valve-cylinder, and entirely surrounding the valve. The valves are open both at the top and bottom, to admit of the free passage of water through them. *d d'* are cross-bars, one at the top of each valve, to which the valve-rods *i i'* are connected. The ends of each valve *b b'*, which fit their cylinders, as stated, are provided with grooves for a water-packing. C is a chamber surrounding the valve-cylinders B B', into which water is admitted through the pipe *f*. D is the outlet for the water. *e e'''* are openings or passages, forming communication between the upper end of each piston-cylinder and its adjoining valve-cylinders. *e' e''* are corresponding passages at the bottom of the cylinders. *h h'* are the piston-rods, connected by a peculiar joint to the crank-arms *v v'*. The upper end of each of these piston-rods *h h'* is jointed at *k*, (see Fig. 2,) to a forked bar, *p*, which bar is pivoted at its outer end *l* to an arm, *m*,

which is pivoted to the standard. This bar *p* is also pivoted at *r* to another forked bar, *n*, which, at its outer end *t*, is pivoted to a post. *g g'* are crank-arms connected to *i i'*. *g g'* are connected to eccentric wheels, in the usual manner, upon the shaft E. *v v'* are connected to crank-pins on wheels upon the same shaft E, which shaft is supported in bearings in the outer ends of the standards F F. *s* is a chamber beneath the valve-cylinders, into which the water passes on its way to the outlet-pipe D. The parts are so constructed and arranged that when the piston-head *a* is at the bottom of its cylinder A, *a'* will be near the top of its cylinder A'; and at the same time the valve *b* will be at or near the top of its cylinder B, and *b'* at or near the bottom of its cylinder B'. These parts are nearly in the position described in Fig. 3.

In use, water is admitted through the pipe *f* into the chamber C, from which it flows into the spaces *c c'* surrounding the valves, and when the parts are in the position shown in Fig. 3 water will flow from the space *c*, through the passage *e*, into the cylinder A, above the piston *a*, forcing it down. At the same time the water below the piston-head *a* will flow out through the passage *e'* into the lower part of the cylinder B, thence into the chamber *s*, thence out through D. At the same time, on the other side, water will flow from *c'*, through *e''*, into the cylinder A' below the piston-head *a'*, forcing it up, and the water above this piston-head *a'* will flow out through the passage *e'''* into the cylinder B', and down through the cylindrical valve *b'* into the chamber *s*, and thence out through D. The valves *b b'* rise and fall, alternately opening and closing the passages at the top and bottom of the cylinder A A'. The crank-arms *v v'* are to be so connected at their upper ends to their crank-pins that, when the piston *a* is at its lowest point, the piston *a'* will not have performed its full upward stroke, so that the passages from the valve-cylinders will be so opened and closed as to keep up a continuous motion.

By means of the chamber C and the large space about the valves I present a sufficient amount of water directly in contact with the valves, and do not have to take it immediately from the supply-pipe.

The parts connected with the joint which

connects the piston-rod with its crank-arm will keep the piston-rod at all times in a perpendicular position.

This device makes a very accurate water-meter, an index being suitably attached. It may be placed upon either end of the shaft E.

Where a limited power only is required, one-half the machine may be used—that is to say, a single engine-cylinder and a single valve and its cylinder may be combined and will operate. In such case the chamber C will be made to surround the single valve-cylinder, and the passages between the piston and valve-cylinders will be retained, as well as an outlet, D.

What I claim as new is as follows:

1. The combination of vibrating arm *m*, piv-

oted to the main frame, rod *p* connecting said arm and the piston-rod, and forked rod *h*, pivoted to *p*, as shown, with the piston-rod, substantially as and for the purpose specified.

2. The combination of the inner chamber, valve-cylinder with water-packing, and the piston-cylinders, constructed and arranged substantially as and for the purpose set forth.

3. The chambers C and pipe *f*, in combination with cylinders B B', constructed to form spaces *c c'*, and the valves *b b'*, substantially as and for the purpose specified.

WILLIAM SMITH.

Witnesses:

E. A. WEST,

O. W. BOND.