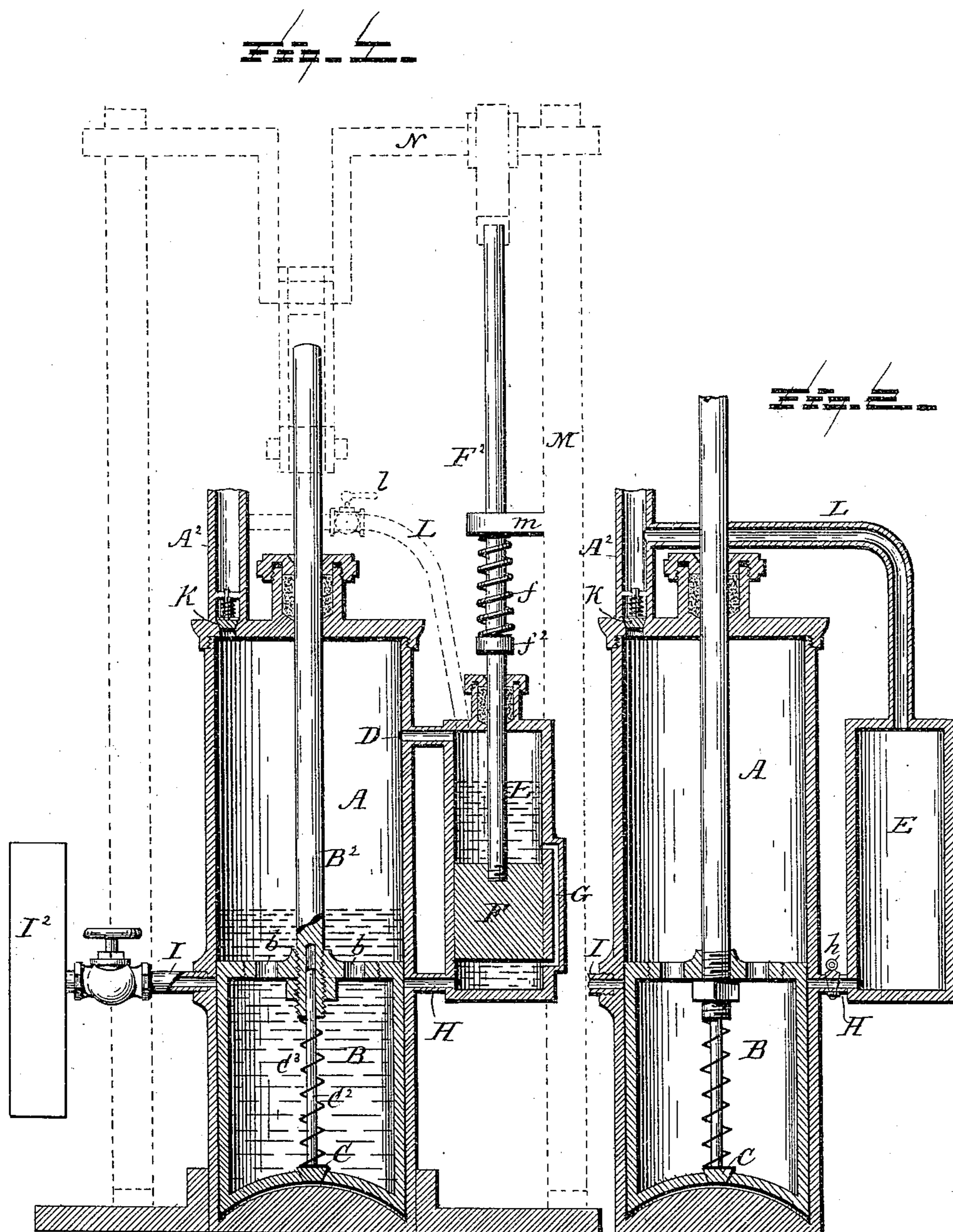


(No Model.)

E. J. HARDY.
AIR PUMP.

No. 547,012.

Patented Oct. 1, 1895.



Witnesses

C. C. Schiller

J. J. Masson

Inventor

Edward J. Hardy

By his Attorney

E. E. Masson

UNITED STATES PATENT OFFICE.

EDWARD J. HARDY, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE HARDY
ICE MACHINE COMPANY, OF SAME PLACE.

AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 547,012, dated October 1, 1895.

Application filed January 28, 1891. Serial No. 379,384. (No model.)

To all whom it may concern:

Be it known that I, EDWARD J. HARDY, a citizen of Great Britain, residing at Brooklyn, in the county of Kings, State of New York, have invented certain new and useful Improvements in Air-Pumps, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to air or vacuum pumps in which a substantially non-volatile liquid is used to seal the valves and pistons to facilitate their operation; and the objects of my improvement are to produce a simple and inexpensive device of this class having its movable parts liquid-sealed, as will be hereinafter described, and specifically set forth in the claim. I attain these objects by the construction illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section of an air-pumping apparatus constructed in accordance with my invention. Fig. 2 is a longitudinal vertical section of a modification of the same.

This invention is an improvement on the pump shown in Patent No. 446,205, granted to me February 10, 1891.

In the present construction, (shown in Fig. 1,) A represents a cylinder or pump-barrel, which at the beginning of the operation is to be nearly filled with a substantially non-volatile liquid—as oil, mercury, or sulphuric acid—admitted preferably through the pipe A², projecting upward from the cover of the cylinder, while the valve K in said pipe is temporarily lifted by the operator. Within said cylinder is placed a hollow piston B, having in its concaved bottom an opening closed by an upwardly-lifting valve C, the stem C² of which has its upper end guided in a recess in the lower end of the piston-rod B², and a spring C³ coiled upon said stem has one end bearing against the lower end of the piston-rod, while the opposite end bears upon the valve and normally keeps it upon its seat. The top of the piston B has openings b therein, through which the air and liquid received therein through the bottom can escape into the upper portion of the cylinder A.

On the side of the pump-cylinder A is placed a smaller cylinder E, having its upper end

connected by port or pipe D and its lower end by a port or pipe H with said cylinder A. Within the cylinder E is placed a solid piston F, which divides the interior of said cylinder into two chambers, which are either closed to each other or connected with each other, according to the location occupied by the piston F, as there is a port or pipe G in the side or wall of the cylinder, which pipe has its upper opening in the top chamber and its lower opening in the bottom chamber, and the piston is adapted to close said lower opening. The piston F is forced down, preferably by a spring f, coiled upon the piston-rod F², one end of said spring bearing upon a collar f², secured to said rod, and the other end bearing against an arm m, projecting from the side of the frame M. The piston F is elevated by means of a pin or cam on the crank-shaft N, engaging with or under a projection on the upper end of the piston-rod F²; but other well-known means may be used to reciprocate the piston at a proper time relatively to the position occupied by the hollow piston B. In the position shown in Fig. 1 the piston F is represented at substantially the upper end of its stroke. At this point the liquid above the piston F passes through the port G into the lower part of the cylinder E below the piston, remaining there until the piston B is on its upward stroke. A small portion of the liquid then escapes through the pipe H and lubricates the sides of said piston B. When the latter is at the end of its upward stroke its bottom has passed above the port or pipe H and opened it. At that moment the piston F, actuated either by its operative cam or by the spring f, descends to the bottom of the cylinder E and forces the liquid therein through the pipe H into the cylinder A below the piston B. At the same time the air to be exhausted from the vessel I² or any other vessel passes through the pipe I into the cylinder A under the piston B. During the upper stroke of this hollow piston a portion of the liquid above it passes through the pipe D into the cylinder E to continue the operation above described, and a small portion is splashed against and around the valve K and lubricates it, and the air compressed above the piston B escapes through the pipe A². To

release the pipe A² of liquid in case it should accumulate therein a pipe L may have one end inserted in the side thereof and the opposite end made to enter the top of the cylinder
5 E; but said pipe L is normally closed by a cock l, which is opened only occasionally to relieve the pipe A² of liquid.

In the modification shown in Fig. 2 cylinders A and E are used; but the connecting-
10 pipe D of Fig. 1 is dispensed with, and also the port G and the piston F of the small cylinder; but the top of the cylinder E is connected with the discharge-pipe A² by the pipe L, and the pipe H, uniting the cylinders A
15 and E, is contracted or controlled by a cock h, by which its area can be regulated, so as to admit only a small amount of liquid into the cylinder A, corresponding with the amount expelled therefrom past the upper valve K;
20 but by the arrangement shown in Fig. 1 a determined amount of liquid is forced into the

cylinder A by the piston F, in accordance with its stroke and the area of the bottom of the cylinder E.

Having now fully described my invention, 25 I claim—

The combination in an air pumping apparatus of a pump cylinder having an air inlet in the side and a valve in the top thereof and a piston B therein having an upwardly lifting
30 valve with a cylinder E having its top and bottom connected by pipes with the cylinder A, a piston F in the cylinder E and a port or pipe G in the side of said cylinder E, said pipe G connecting the chambers above and
35 under the piston F, substantially as described.

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

EDWARD J. HARDY.

Witnesses:

JOSEPH M. KEANE,

N. R. COTTMAN.