

D. L. HOLDEN.

PNEUMATIC PUMP FOR REFRIGERATING APPARATUS, &c.

No. 188,137.

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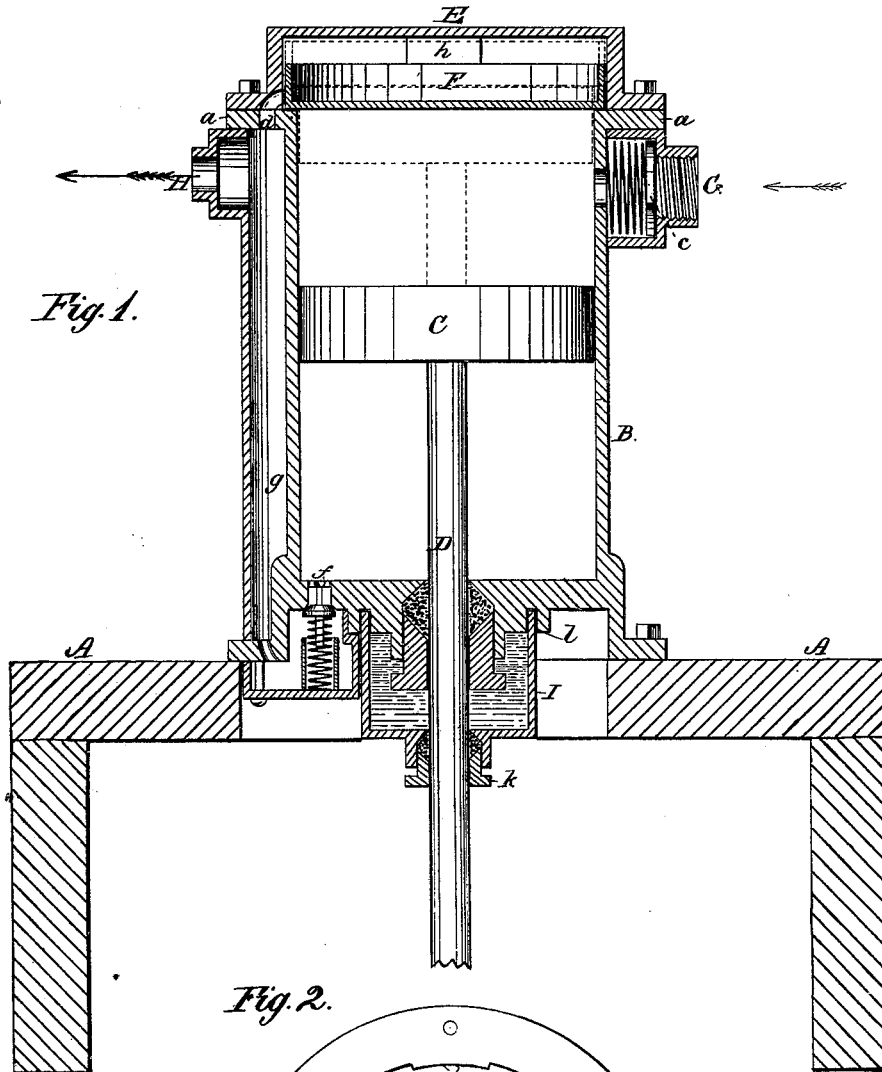


Fig. 1.

Fig. 2.

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IMPROVEMENT IN PNEUMATIC PUMPS FOR REFRIGERATING APPARATUS, &c.

Specification forming part of Letters Patent No. **188,137**, dated March 6, 1877; application filed January 31, 1877.

To all whom it may concern:

Be it known that I, DANIEL L. HOLDEN, of Covington, in the county of Kenton and State of Kentucky, have invented a new and Improved Pneumatic Pump for Refrigerating Apparatus and other Purposes; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, forming part of this specification, in which—

Figure 1 is a vertical longitudinal section, with the elevated position of piston when lifting the valve shown in dotted lines. Fig. 2 is a detail inside view of the top cylinder-head.

My invention relates to certain improvements in pneumatic pumps, designed more particularly for facilitating the evaporation of volatile liquids in making ice, but applicable to all uses for which such pumps may be employed.

The object of my invention is to make, as far as practicable, a perfect vacuum-pump, or a pump in which there is practically no residuum or cushion of the elastic fluid left in the chamber of the cylinder at the end of the stroke, and yet at the same time preserve a strong and durable construction for the pump.

My pump belongs to that class of pneumatic pumps in which a valve of greater diameter than the bore of the cylinder is used to form the cylinder-head, or in which the cylinder-head is made yielding, so as to permit the plain face of the piston to strike against said valve or yielding cylinder-head, to thoroughly expel all air or gas, while its yielding character prevents the shock that would otherwise be produced by the piston.

My improvement consists in combining an imperforate piston with a valve of the above construction, and a cylinder having but a single inlet-valve, in such a manner that the piston, in forcing out the charge of air or gas, produces a partial vacuum beneath the same, and passes the inlet-orifice, whereby the compressed gaseous charge held in said inlet-valve chamber is allowed to pass beneath the piston, and to expand into and be absorbed by the partial vacuum, so that upon the downward exhaust-stroke of the piston there will be no charge of compressed air or gas in the

inlet-valve chamber to expand above the piston, and prevent, by its elasticity, the perfect exhausting-stroke of said piston. An outlet check-valve is employed in the opposite end of the cylinder from the inlet for the discharge of the compressed charges of the air or gas taken from the said inlet-valve chamber.

In the drawing, A represents a portion of any frame-work, upon which the pump may be mounted. B is the pump-cylinder, which preferably occupies a vertical position; and C is a solid imperforate piston, connected with and operated by a piston-rod, D, which emerges from the bottom end of the cylinder. E is the top cylinder-head, which is made with an enlarged cavity to receive the valve, and is bolted to the flange *a* of the body of the cylinder. The cavity or chamber in the cylinder-head is made of a greater diameter than the bore of the cylinder, so as to receive the valve F, which is also of a larger diameter than said bore. This valve is constructed of a cup shape, with a flat ground bottom, and seats itself upon the inner edges of the end of the cylinder, being guided in its movements in the cylinder-head by projections *h*, cast upon the sides of said head. G is the inlet for the air or gas, provided with an inwardly-opening check-valve, *c*; and H is the outlet for the said air or gas, opening into the cylinder-head through an orifice, *d*, beside the cup-valve.

As the piston descends the check-valve *c* opens, and air or gas is drawn through the inlet G to fill the space above the piston, and as the piston rises the check-valve is closed, and the air or gas lifts the large cup-valve, and is forced through orifice *d* to the outlet H, while at the same time a partial vacuum is produced beneath the piston. As the piston continues to rise its smoothly-ground face strikes the smoothly-ground bottom of the cup-valve, and produces a direct contact between the bottom of the valve, which forms the end of the vacuum-chamber, and the movable piston, with no traces of an air-cushion between the same. Consequently, when the piston commences to descend, the vacuum-chamber commences to enlarge from zero, and the most perfect mechanical exhaustion attainable is secured,

which renders the pump specially adapted to inducing evaporation in ice-making, and other uses requiring a perfect vacuum action.

It will be seen that, so far as described, this pump is single-acting, and this is substantially the case in its operation; but it is to a limited extent double-acting, which peculiarity is designed only to render it a more perfect vacuum-pump. As the piston rises it will be seen that there is a degree of compression in the upper part of the cylinder, and as the piston passes over the inlet-orifice a portion of such compressed air or gas would be caught in the space between the inner orifice of the inlet and the check valve; and if, upon the descent of the piston, this were allowed to expand above the piston, it would seriously interfere with the perfect exhausting action of the pump. To remedy this defect I have arranged the piston, in lifting the cup-valve, to pass the inlet-orifice, as shown in dotted lines, which permits the retained charge of compressed gas to expand and diffuse itself beneath the piston, being absorbed by the partial vacuum produced beneath the same. Then, upon the descent of the piston, the air or gas is driven out through a check-valve, *f*, in the bottom, and is conducted through a port, *g*, arranged longitudinally beside the cylinder, to the outlet-pipe H. To prevent leakage of air through the stuff-

ing-box about the piston-rod, said stuffing is hermetically sealed by a water-seal, formed by a cup-shaped box, I, which surrounds said stuffing-box, and fits in a groove, *l*, formed in the lower cylinder-head, which box I is also provided with a stuffing-box, *k*, to hold the water in.

From the above description it will be seen that this pump is as nearly a perfect vacuum-pump as it is possible to obtain by mechanical means, and its simplicity, freedom from derangement, and perfect action recommend it for many uses too varied to enumerate.

Having thus described my invention, what I claim as new is—

The combination, with the cylinder B, having an inlet check-valve, G, and an escape-valve below the piston, of the movable valve F, made of greater diameter than the bore of the cylinder, and the imperforate piston C, arranged to pass the inlet-orifice in forcing out the contents of the cylinder, substantially as and for the purpose set forth.

The above specification of my invention signed by me this 24th day of January, 1877.

D. L. HOLDEN.

Witnesses:

EDWD. W. BYRN,
CHAS. A. PETTIT.