[redacted]

B. Holly,

Compressing Air,

No. 54,905. Patented May 22, 1866.

Fig: 1.

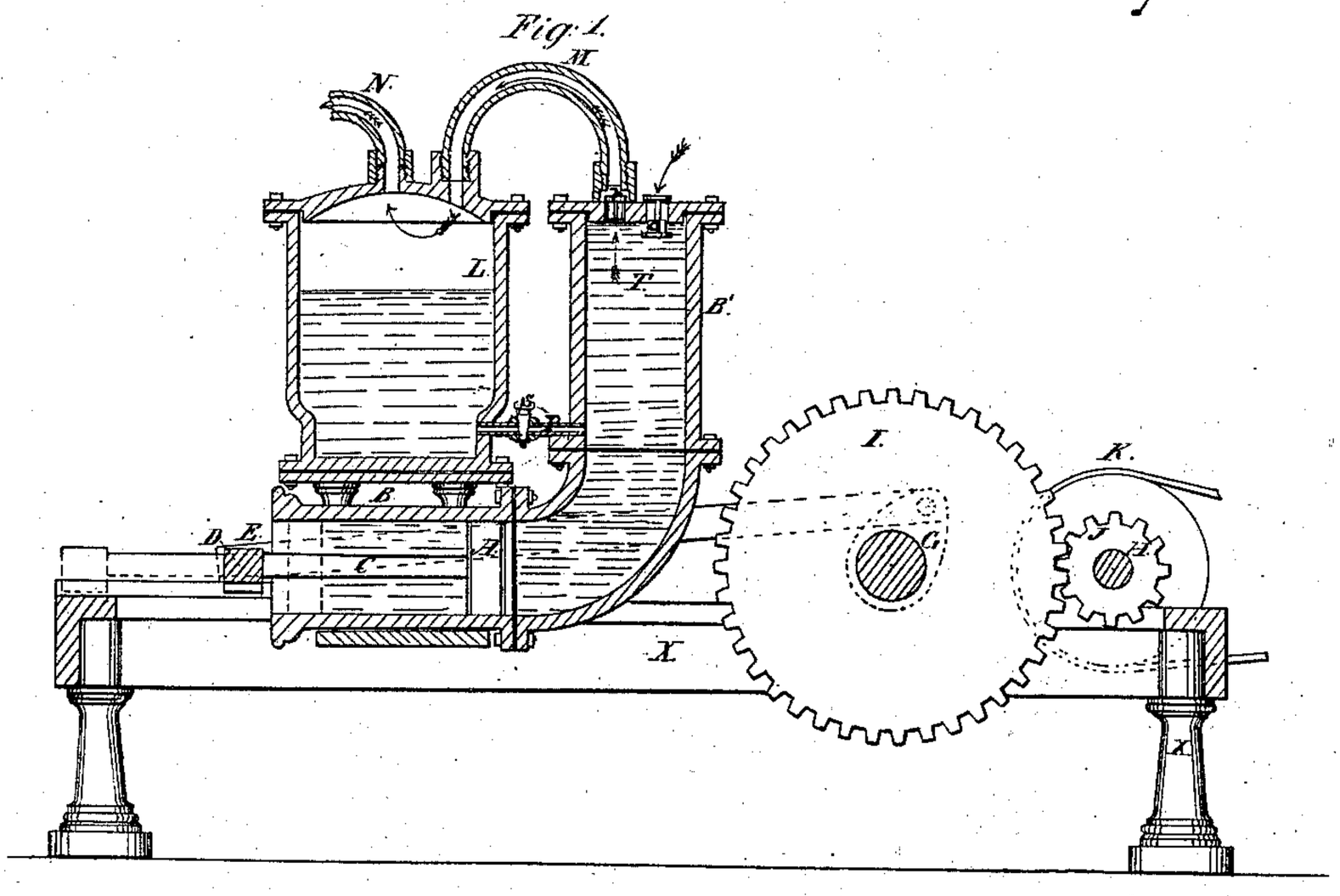
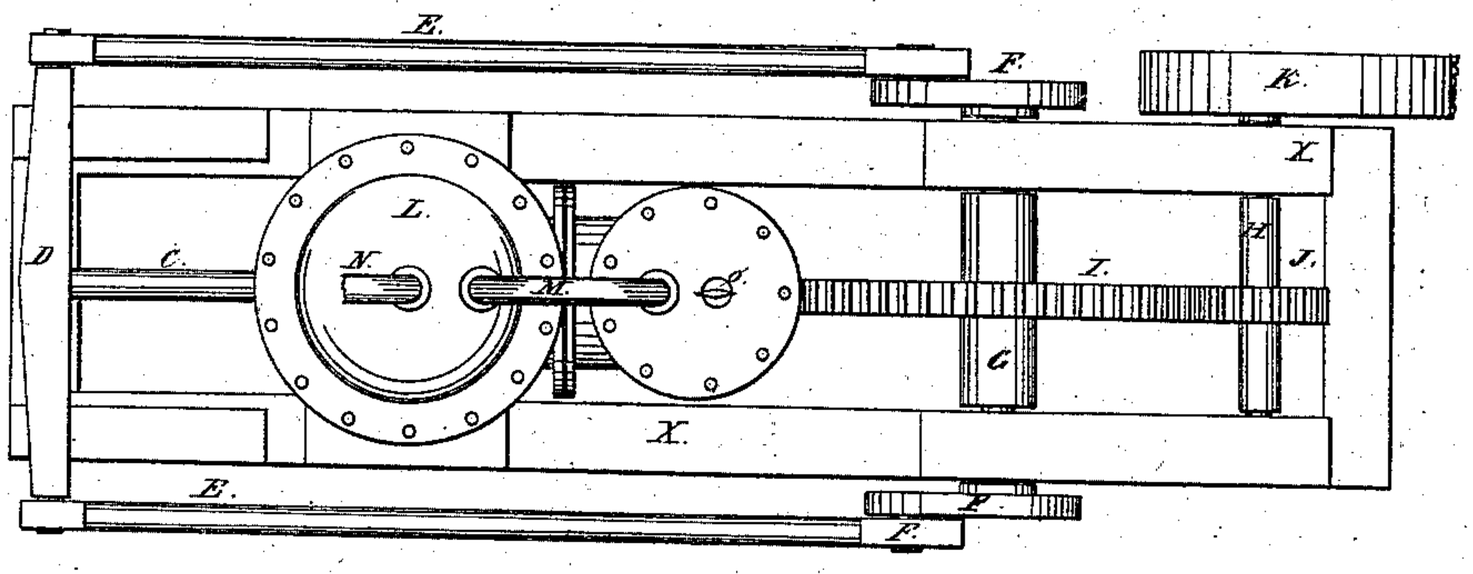


Fig: 2.



Witnesses:
R F Osgood
Ja Davis

Inventor:
Birdsill Holly
By J. Fraser & Co
Atty.

[redacted]

UNITED STATES PATENT OFFICE.

BIRDSILL HOLLY, OF LOCKPORT, NEW YORK.

IMPROVEMENT IN AIR-COMPRESSING PUMPS.

Specification forming part of Letters Patent No. **54,905,** dated May 22, 1866.

To all whom it may concern:

Be it known that I, BIRDSILL HOLLY, of Lockport, in the county of Niagara and State of New York, have invented a new and useful Improvement in Pumps for Forcing and Compressing Air, Vapor, and Gases; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section; Fig. 2, a plan view of my improved pump.

Like letters designate corresponding parts in both figures.

My invention relates to that class of pumps for compressing and forcing air and other gaseous fluids which employ a body of water so as to intervene between the piston and fluid to be compressed; and it consists in dispensing with the extra reservoir or cylinder used in such pumps, wherein the compression takes place by extending the pump-cylinder of a uniform size sufficiently to receive a body of water and perform the functions of the two cylinders as are usually required, and in a more effective manner; and in the use of a water-reservoir, through which the compressed air is forced in a manner to maintain the necessary supply of water to the pump-cylinder through the medium of a connecting-pipe, and stop-cock for regulating the amount of the same.

As represented in the drawings, A is an ordinary piston, working in the horizontal portion of the cylinder B, and having the usual adjuncts, consisting of the rod C, cross-head D, and connecting-rods E E. The latter are worked by cranks F F on the shaft G, which is geared with the driving-shaft H by cog-wheels I J. The latter shaft is provided with a belt-pulley, K, for taking motion from a steam-engine or other power, and should be provided with a fly-wheel, (not shown in the drawings,) all supported on a suitable frame, X X.

The cylinder B B′ is preferably made of the form shown, consisting of a horizontal portion, B, in which the piston operates, and the extended portion B′, curved upward, of the same diameter and about the same length as B.

This construction avoids the great objection of the small and contracted passage or pipe which usually connects the pump-cylinder with the extra cylinder wherein the compression of the fluid takes place, and hence prevents that commotion caused by the water being so rapidly forced from one cylinder to the other through a comparatively small passage, and prevents the waste of the extra power required in accomplishing the same.

Besides the upright part B′, a large chamber or reservoir, L, is provided, which for compactness of construction may be placed directly above the part B of the cylinder, and is connected with the closed head of B′ by the pipe M. An eduction-pipe, N, starting from the upper part of the chamber L, extends to the oil-well or other place where the compressed air is to be employed.

The upright end of the cylinder B′ has an induction-valve, *o*, opening inward for the entrance of air, and an eduction-valve, *r*, situated in the pipe M and opening outwardly from the cylinder, through which the air is forced by the action of the piston A into the reservoir L, as will presently be described,

When the piston A is at the end of its forward or forcing stroke, as shown in the drawings, the cylinder B′ is filled with water, oil, or other suitable liquid, T, which expels the air therefrom. The chamber L should also be allowed to fill partially, so as to rise above the small connecting-pipe *p*, which it may be allowed to do through the cock *s*. The filling of the cylinder may be effected through the induction-valve *o*, or another valve may be provided for this purpose, to be open only when required.

The operation of pumping is as follows: The cylinder B′ being filled with water or other liquid, when the piston A begins its receding stroke the water follows, and its surface falls a corresponding distance in the upright portion of the cylinder, (its diameter being the same as the horizontal part,) so that its surface is lowered to the horizontal red lines on the drawings when the piston is in the position indicated in a like manner. As the water sinks the air enters through the valve *o* and fills the chamber, and when the piston begins its forward stroke the valve *o* immediately closes, and the air is forced out through the valve *r* by the rising of the water. Thus a compact body of water constantly intervenes between the head of the piston and the air or gas which is pumped, and of sufficient quantity to fill chamber B′ when the piston completes its stroke, in order to drive every particle of air out. To be certain that this is ac-

complished it is advisable to have a small excess of water in the chamber B′ above what it will contain on completing the expulsive stroke. This excess will follow the air through the valve *r* and pipe M into the reservoir L.

To prevent the waste so caused from diminishing the quantity of water below that required in the cylinder the valve *s* should be kept open, not to its full extent, but only far enough to allow an equal quantity to pass through the pipe *p*. This it will do when the piston makes its receding stroke, as then the water in B′ is subject only to atmospheric pressure, while that in the reservoir L is under the pressure of the compressed air, which will be equal to power brought upon it through the action of the pump. This difference of pressure in the two chambers L and B′ prevents the water from passing from B′ to L through pipe *p* at the forward stroke of the piston and renders a check-valve at that point unnecessary.

It is of great importance that the intervening body of water T should be kept intact during the working of the pump; otherwise, if much broken or disturbed, the air would become mixed with it, causing it to foam and pass off in spray. I therefore construct the cylinder B B′ of a uniform size, avoiding any contraction, sudden turn, throat, or valve in that part in which the water moves. The water portion of it may be larger than the piston portion without an injurious effect; but I prefer to make it a trunk of uniform size. The piston may work vertically directly under the water, in which case a straight cylinder is required; but for convenience of working I prefer to have a horizontal movement of the piston, which is converted into a vertical one of the water by a curve of a quarter of a circle, as shown.

I have represented a single-acting pump; but my invention is not confined to that, as by a duplication of the waste-chamber B′ it may be made double acting.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination and arrangement of the air and water reservoir L with the water-extension B′ of the pumping-cylinder B, operating substantially as described.

2. The cylinder B, constructed substantially as described, in combination with the reservoir L and water-extension B′.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

BIRDSILL HOLLY.

Witnesses:

CHAS. G. HILDRETH,

J. K. MCDONALD.