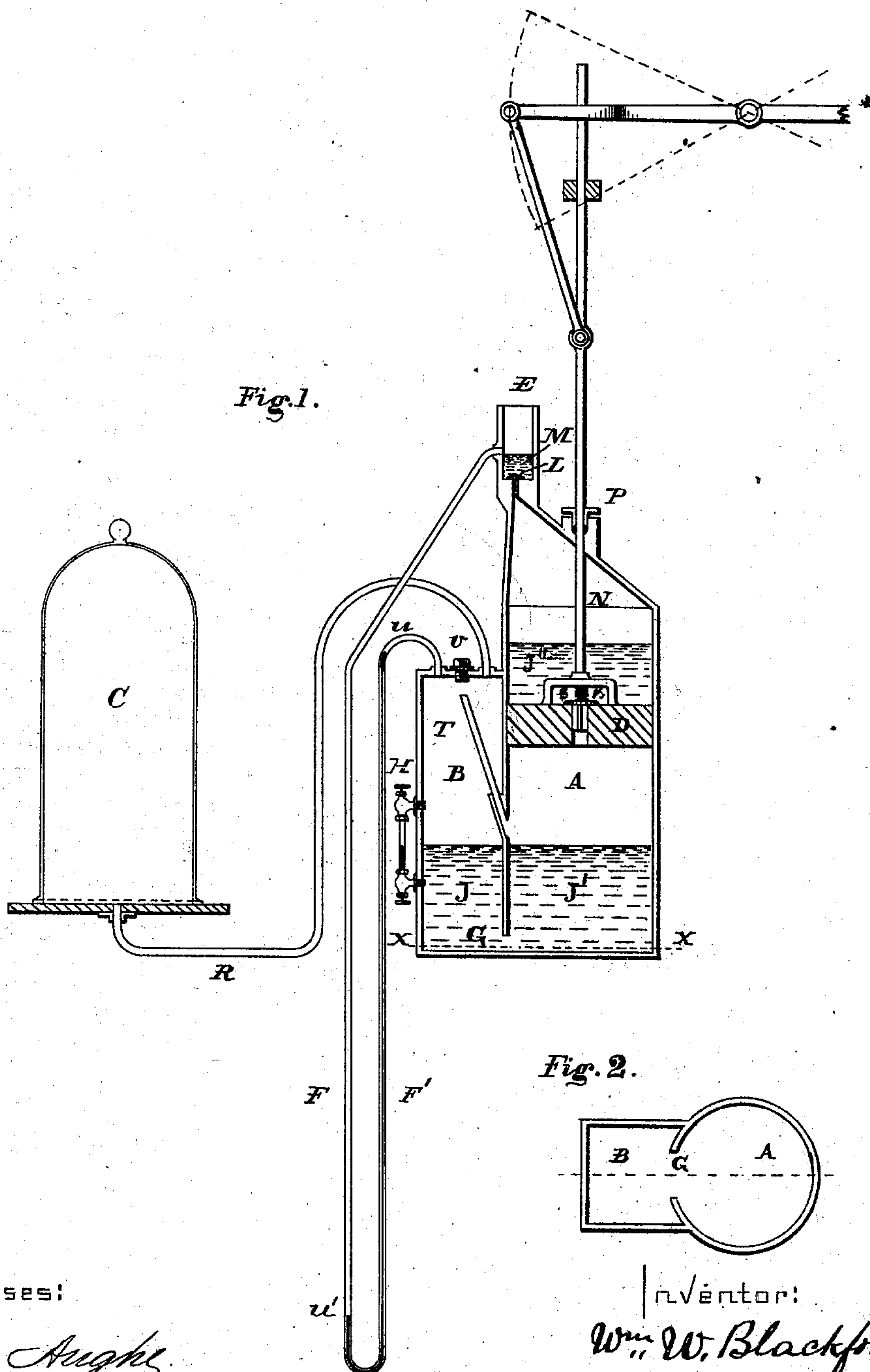


(No Model.)

W. W. BLACKFORD.
Air Pump.

No. 242,743.

Patented June 14, 1881.



Witnesses:

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UNITED STATES PATENT OFFICE.

WILLIAM W. BLACKFORD, OF NEAR TIGERVILLE P. O., TERREBONNE PARISH,
LOUISIANA.

AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 242,743, dated June 14, 1881.

Application filed April 29, 1880. (No model.)

To all whom it may concern:

Be it known that I, WM. W. BLACKFORD, a citizen of the United States, residing near Tigerville P. O., in the parish of Terrebonne and State of Louisiana, have invented certain new and useful Improvements in Air-Pumps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to an improvement in the class of air-pumps wherein mercury is employed to assist in creating a vacuum; and it consists in certain details of construction, hereinafter more fully shown and described. Its object is the production of a simple and inexpensive apparatus that will produce the nearest approximation possible to a perfect vacuum.

In the drawings, Figure 1 is a vertical section of my apparatus. Fig. 2 is a horizontal section through the line *x x* of Fig. 1.

A is the cylinder of the air-pump, made with a conical top, the apex of the cone being surmounted by a valve, L.

B is an auxiliary chamber connecting with the cylinder A and communicating with it by an opening, G, near the bottom; also by an inclined pipe, T, above. C is an air receiver or chamber, from which the air is exhausted.

D is the piston of the pump.

E is a small reservoir or cup at the top of the cylinder around valve L.

F F' is a pipe or tube connecting cup E and chamber B.

H is a mercury-gage, marked to indicate the height of mercury required in the cylinder A and chamber B.

J J' represent mercury in chamber B and cylinder A.

J'' represents mercury being carried up in the cylinder by the piston D.

M represents mercury in the cup E.

L is a valve at the top of the cylinder.

N is the piston-rod, which is actuated by a handle or other suitable means.

P is the packing-box of piston-rod N.

R is a pipe connecting air-receiver C with chamber B.

s is a small spiral spring on the top of piston-valve K, for gently pressing it down, thereby preventing it from floating when submerged in mercury.

T is an inclined tube opening into cylinder A from chamber B at a point slightly above the surface of the mercury.

V is a screw-plug in the top of chamber B, for convenience in inserting tube T and inspecting same.

In order to prepare my machine for operation, I pour the mercury into cup E, where it rises to the mouth of tube F F' and passes through same into chamber B; thence through opening G into cylinder A until it reaches the proper mark indicated on gage H. The operation of pumping then immerses the piston in the mercury, which flows through the valve K until a sufficient amount is above the piston to a little more than fill the conical top of the cylinder, when the piston is raised to the top of its stroke. The quantity of mercury carried up by the piston is governed by the height of the mercury in the cylinder, and can be regulated by means of the gage when the mercury is introduced. As the piston rises it lifts the mercury above it past the mouth of pipe T, thereby cutting off communication between the upper part of the cylinder and chamber B. A small portion of the mercury runs up pipe T until the piston is raised sufficiently to uncover its mouth, when it runs back and mingles with the main body in the bottom of the cylinder. All the air in the cylinder above the piston is forced out through valve L by the rising mercury as well as the excess of mercury which mingles with and increases the volume already in the cup, and overflows through pipe F F' back into chamber B for use again. When a nearly perfect vacuum has been produced within the machine the mercury will stand in the leg of tube F at *u'*, while the surface in leg F' will stand at *u*, the distance between *u* and *u'* being thirty inches, which is the height the pressure of the atmosphere will cause it to assume. During the downstroke of the piston the air will pass upward through valve K so long as the pressure remains sufficient to raise

the valve; but when in the progress of pumping the pressure becomes too slight for this none will enter above the piston until it passes below the mouth of pipe T, when an open and
5 free entrance is afforded from chamber B.

It will be observed that by this construction a complete automatic valve is produced by pipe T being opened by the piston, thereby overcoming a serious defect in pumps as heretofore constructed, more particularly when the
10 air is nearly exhausted and the pressure slight. Having no obstacle whatever to overcome, the air will enter cylinder A so long as there is a particle left in chambers B and C, and however
15 small the quantity entering cylinder A the mercury lifted by the piston will collect it all and eject it at valve L, and this valve, being mercury-sealed, will not permit an atom to re-enter.

20 The chamber B may surround the pump-cylinder A or be placed in any convenient position with relation to it, provided the proper communications are maintained by G and T.

The portion of the tube F F' below the pump
25 may be made flexible for convenience, so that they may be folded for transportation, if desirable.

In case extraordinary perfection of vacuum should be required and any possible leakage
30 through the packing-box obviated, the piston-rod may be inserted through the bottom of cylinder A, so as to have the mercury-pressure upon it from the inside; and where still greater delicacy is wanted, the packing-box may be
35 placed still lower by placing it at the end of a tube secured to and constituting a prolongation of cylinder A, this tube to be of sufficient size to inclose the piston-rod and a surrounding jacket of mercury. If this tube were made
40 of a sufficient length to hold a mercury column thirty inches high above the packing-box it would then overcome the atmospheric pressure and effectually exclude all air.

Although I have employed mercury in describing the operation of my machine, I do not
45 limit myself to its use, as any other suitable fluid that will accomplish the same result may be employed.

Having thus described my invention, what I
50 claim, and desire to secure by Letters Patent, is—

1. The combination, with the pump-cylinder and piston in an air-pump, of a cup with a check-valve at the air-discharge port above the

piston, and an overflow-pipe connecting with
55 the cup, and arranged to establish communication between the same and the pump-cylinder below the piston, whereby mercury forced into the cup by the action of the piston will be
60 conducted back to the cylinder, substantially in the manner and for the purpose set forth.

2. The combination, with the upright pump-cylinder and the piston in an air-pump, of an open cup provided with a check-valve and arranged at the discharge-port of the cylinder
65 at a point above the piston, and the overflow-pipe F, connecting said cup with a chamber communicating with the pump-cylinder at a point below the piston, substantially as and for
70 the purpose set forth.

3. The combination, in an air-pump, of the pump-cylinder A, with the cup arranged at the top of said cylinder, a check-valve arranged to close communication between the cylinder and the cup, and the overflow-pipe F, connecting
75 said cup with the chamber B, the overflow-pipe being extended down alongside of said chamber, in the manner herein shown, and for the purpose specified.

4. In an air-pump, the combination of the
80 cylinder A and chamber B, provided with mercury, and connected by passage G and pipe T, the piston D, and valve L, substantially as described.

5. The combination of the inclined pipe T
85 with chambers B and A, supplied with mercury, and the piston D, substantially as described, and for the purpose specified.

6. In an air-pump wherein mercury is employed, the spring s, in combination with the
90 valve, substantially as described, and for the purpose set forth.

7. The cylinder A, provided with mercury, piston D, valve L, cup M, pipe F F', and receiver C, with its connecting-pipe, all constructed and combined substantially as and
95 for the purpose described.

8. The combination of chambers A B, provided with mercury-openings G T, piston D, valves K L, cup M, receiver C, and pipe R, substantially as described, and for the purpose
100 specified.

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

WM. W. BLACKFORD.

Witnesses:

PERCY AUGHE,
F. W. BROOKS.