

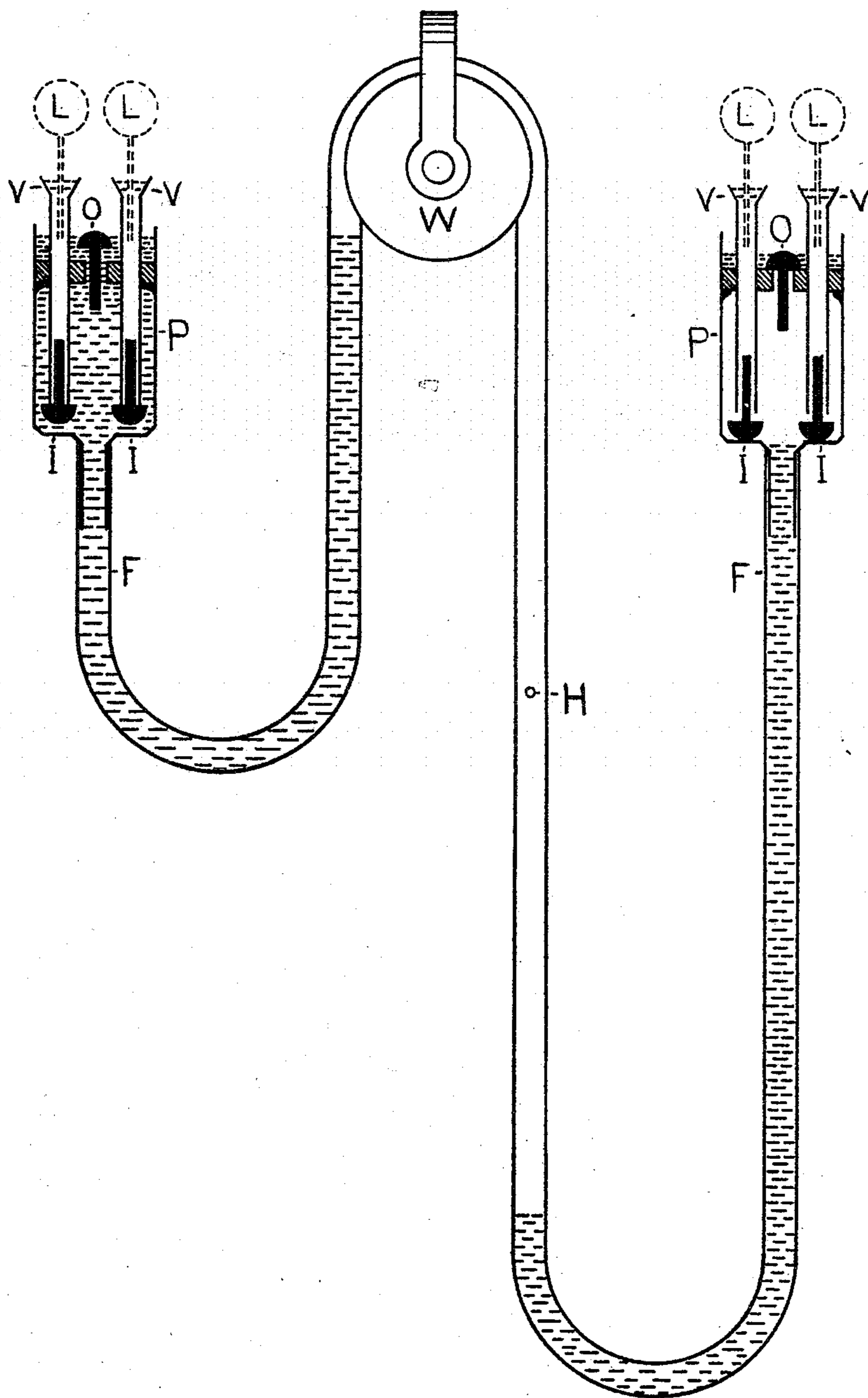
(No Model.)

F. H. SMITH.

VACUUM PUMP.

No. 321,764.

Patented July 7, 1885.



WITNESSES

*Franz Block*  
*Hamilton Delahay*

INVENTOR

*Fredrick H. Smith*

# UNITED STATES PATENT OFFICE.

FREDERICK H. SMITH, OF BALTIMORE, MARYLAND.

## VACUUM-PUMP.

SPECIFICATION forming part of Letters Patent No. 321,764, dated July 7, 1885.

Application filed May 21, 1884. (No model.)

*To all whom it may concern:*

Be it known that I, FREDERICK H. SMITH, a citizen of the United States, residing at Baltimore city, State of Maryland, have invented certain new and useful Improvements in Vacuum-Pumps, the nature of which is set forth in the following specification and the accompanying drawing.

The said drawing represents a sectional view of a vacuum-pump constructed in accordance with my invention.

P and P are pump-chambers, whose lower ends are fitted into or otherwise connected with the opposite ends of the long flexible tube F. The middle portion of this flexible tube passes over the pulley-wheel W, and each end of the flexible tube contains a quantity of mercury, as indicated by the dotted lines within the tube, and a small hole, H, at the middle of the length of the tube maintains connection between the outer air and the air within the tube, while it also facilitates the placing or removing of the mercury.

V and V are vacuum-tubes having their upper ends shaped to receive the stems of the dotted lamp-globes L L or other objects to be exhausted, and the lower ends of these vacuum-tubes pass down through the roofs of the pump-chambers and extend down through the interiors thereof nearly to their floors.

O and O are outlet-valves having guiding-stems, which project down into the pump-chambers through apertures in the roofs thereof, and I and I are inlet-valves having guiding-stems which project upward into the lower ends of the vacuum-tubes.

The operation of my improved vacuum-pump is effected by drawing the middle part of the flexible tube back and forth over the pulley-wheel, thereby causing the mercury to ascend and descend alternately within the pump-chambers. As the mercury descends below the floor of the pump-chamber, (shown in the right-hand side of the drawing,) the outlet-valve floats downward against and closes the aperture in the roof of the pump-chamber, and the inlet-valves next float downward from and open the lower ends of the vacuum-tubes, thus allowing the air within the vacuum-tubes and their connections to expand

and fill the empty space in the pump-chamber. As the mercury ascends again to the roof of the pump-chamber, as shown in the left-hand side of the drawing, the inlet-valves float upward against and close the lower ends of the vacuum-tubes, and the outlet-valve next floats upward from the roof of the pump-chamber and opens the aperture therein, thus allowing the air imprisoned within the pump-chamber to escape into the outer atmosphere. This alternating descent and ascent of mercury within the pump-chamber is continued until, by the removal of successive portions of air from the vacuum-tubes and their connecting lamp-globes or other objects, the desired degree of rarefaction is reached.

The progress of rarefaction can be determined by attaching a pressure or spark gage to any part of the vacuum-tubes, or to the objects to be exhausted, or small eye-pieces of glass can be inserted at such points in the flexible tube as will show when the mercury column stands at thirty inches. Bulbs containing moisture-absorbents can also be attached to the vacuum-tubes or objects to be exhausted. The upper ends of the vacuum-tubes are shown in the drawing as being bell-mouthed to receive stopper-seals pierced by the stems of the lamp-globes; but these upper ends of the vacuum-tubes may be shaped in many other convenient ways to accommodate different objects. The motion of the flexible tube over the pulley-wheel may be produced by merely drawing it back and forth by hand; or the motion may be first applied to the wheel by belt or crank or otherwise, and the revolution of the wheel moves the flexible tube. This flexible tube may be all in one piece, as shown in the drawing; or it may be in two pieces connected over the wheel with each other by means of a chain or belt or cord, and the wheel may be either fixed in one place or adjustable vertically or horizontally, to compensate for any distortion of the flexible tube. I do not, however, confine myself to this particular method of raising or lowering the mercury in the pump-chamber, as this may be effected in many ways, new and old, and I may hereafter wish to use in connection with this improved mercury vacuum-pump the im-

proved method of moving the mercury which I have embodied in another application now on file.

5 The form of valve shown in the drawing is that which places flat surfaces in contact with flat surfaces, and the overflow of mercury completes the hermetic seal; but these valves may be in many other suitable shapes.

10 The outlet-valve is preferably made of heavy material, so as to close down promptly and thus leave a full bed of mercury overflowing the roof of the pump-chamber, while the inlet-valves are of lighter materials, so as to float upon the first rise of the mercury and close  
15 the vacuum-tubes at once.

The drawing shows a double pump, or, rather, two pumps, connected to one flexible tube, as this best utilizes the motion of the tube in both directions; but single pumps are the best  
20 for non-commercial uses.

The roof of the pump-chamber is preferably of wood resting on a shelf, as shown, as this form facilitates removal if access to the interior is desired, and the overflow of mercury  
25 renders the joints all air-tight.

By passing the vacuum-tubes of my improved pump directly downward through the roof of the pump-chamber to their valve-

seats in the interior thereof, I avoid the use of the long, slender, crooked, and fragile glass  
30 tubes which are necessarily used in those pumps in which the vacuum-tubes open into the pump-chamber through its sides or bottom. I thus avoid all liability to breakage or obstruction in these tubes, and so simplify and  
35 render accessible all parts of the apparatus that this pump can be made of much larger sizes than any other, and it can be operated much more rapidly, as it offers no crooked channels or other impediment to the rapid  
40 ebb and flow of the mercury, and its valves are free and frictionless.

I claim—

A vacuum-pump consisting of a pump-chamber open at its bottom, and provided with  
45 a valved roof, a vacuum tube or tubes extending down through the said roof and having valves at their bottoms, and mechanism, substantially as shown, for exhausting the air from said chamber and tubes, as and for the pur-  
50 pose set forth.

FREDERICK H. SMITH.

Witnesses:

W. S. WILKINSON,  
JAMES E. WILKINSON.