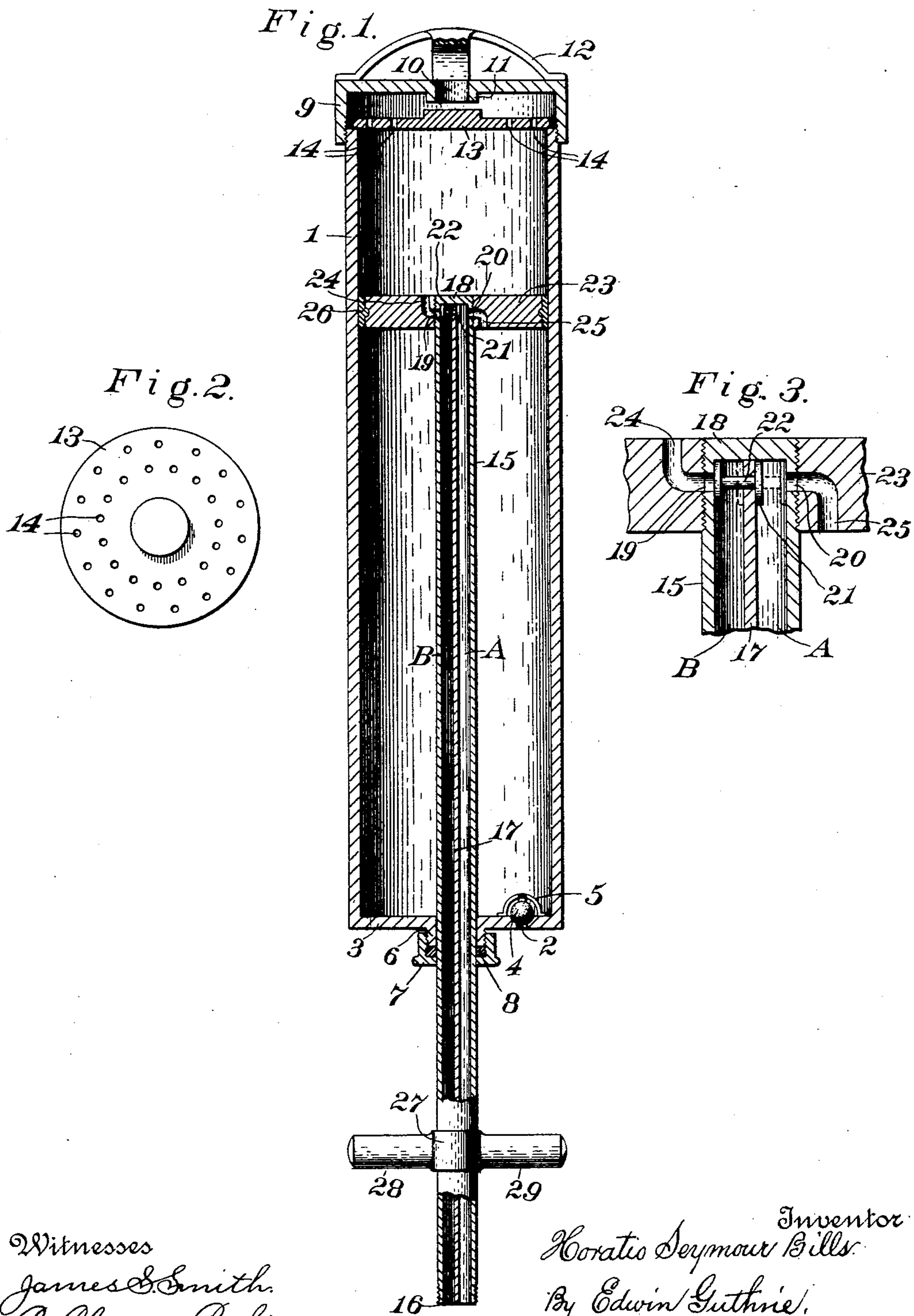


(No Model.)

H. S. BILLS.  
AIR PUMP.

No. 587,638.

Patented Aug. 3, 1897.



Witnesses  
James E. Smith.  
R. Clinton Balinger.

Inventor  
Horatio Seymour Bills.  
By Edwin Guthrie,  
Attorney



# UNITED STATES PATENT OFFICE.

HORATIO SEYMOUR BILLS, OF IONIA, MICHIGAN, ASSIGNOR TO JOHN H. MITCHELL, OF SAME PLACE.

## AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 587,638, dated August 3, 1897.

Application filed December 19, 1896. Serial No. 616,278. (No model.)

*To all whom it may concern:*

Be it known that I, HORATIO SEYMOUR BILLS, a citizen of the United States, residing at Ionia, in the county of Ionia and State of Michigan, have invented certain new and useful Improvements in Air-Pumps; and I do 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 the figures of reference marked thereon, which form a part of this specification.

My invention relates to air-pumps, more particularly to double-acting mechanical air-pumps.

The object of my invention is to produce a simple, cheap, and durable air-pump capable of being operated by hand, that will deliver practically a continuous stream of compressed air into a tubular tire of a bicycle-wheel, or that may be employed for other purposes calling for an uninterrupted gaseous or liquid jet.

I accomplish the objects stated by constructing a suitable cylinder having inlet-valves, a piston-rod consisting of longitudinal compartments, a piston provided with air-ducts connecting the compartments of piston-rod and opposite faces or sides of piston, combined with a valve arranged to close the air-ducts leading to one face, at the same time opening the air-ducts to the opposite face of the piston and alternating those operations regularly when actuated.

Referring to the accompanying drawings, wherein like numerals are used to designate like parts throughout the several views, Figure 1 represents a vertical mid-sectional view of my invention; Fig. 2, a top plan view of the perforated valve-disk; and Fig. 3, an enlarged vertical section of the juncture of piston-rod and piston, enabling the construction and mode of operation of the valve-governing piston-rod orifices and piston air-ducts to be more clearly seen and understood.

Considering Fig. 1, numeral 1 designates the cylinder, having an orifice 2 through a head 3, the orifice being concave upon the in-

side to receive a ball-valve 4, the play of which is limited by the basket 5. Any form of inlet-valve might clearly be selected to replace the ball. Head 3 possesses also a central orifice, which is continued through a projecting exteriorly-threaded nipple 6. An interiorly-threaded gland 7 engages the nipple, and between them a ring of packing 8 may be compressed. The opposite end of cylinder 1 is open and exteriorly threaded, being normally closed by a screw-cap 9, which is provided usually with a central orifice 10, continued slightly below the inner surface of the cap by a narrow flange 11. Upon the outside the cap 9 is spanned by the curving legs of a spider 12. While not absolutely essential, the spider is useful in preventing the hand from coming intimately into contact with cap 9 and closing orifice 10. Less in diameter than the interior of cap 9 and exterior diameter of cylinder 1 is the valve-disk 13, having a solid center and rows of perforations 14. (See Fig. 2.) Disk 13 is adapted to rise and fall within cap 9, and it normally rests upon the end of the cylinder, as shown. In practice I may modify the inlet-valve just described or substitute any convenient known equivalent therefor. The construction specified being of extreme simplicity cannot fail or get out of order in service, and the position of cap 9 may be permanently fixed by soldering or in another effective manner made fast to the cylinder.

Number 15 marks the hollow piston-rod, having the open end 16 screw-threaded and divided lengthwise by a suitable partition 17. The remaining end 18 of the rod is closed and exteriorly threaded. Near the closed end 18 are diametrically opposite orifices—left 19, right 20—through the wall of the hollow piston-rod. (Best shown in Fig. 3.) The partition 17 extends to the inner surface of the closed end of the piston-rod, and as customarily constructed an orifice pierces the partition upon a line with orifices 19 20 of the hollow piston-rod.

Number 21 designates a spool-shaped valve consisting of two heads or disks joined by a cylindrical stem 22. Stem 22 fits movably within the orifice through the partition al-



ready mentioned as alined with orifices 19 20. It will be understood by inspecting Fig. 3 that valve 21 may be reciprocated and caused to close alternately the two orifices 19 20.

5 23 represents the piston, having a central threaded orifice in engagement with the closed end of the hollow piston-rod, as clearly shown in Figs. 1 and 3, and leading to opposite faces or sides of the piston are formed the air-  
10 ducts—left 24, right 25—as drawn. A suitable ring of packing 26 encircles the piston.

Hollow piston-rod 15 extends through the central orifice in cylinder-head 3 and through the stuffing-box device described as far as  
15 may be desired, and a collar 27, from which project handles—left 28, right 29—is secured upon the rod at a convenient point.

I do not confine myself to the use of any special form of valve at any point in my in-  
20 vention.

The mode of operation will now be readily followed. Assume the parts to be assembled and to be relatively situated as shown in Fig. 1. Grasping the cylinder in one hand and  
25 handles 28 29 in the other, let the cylinder be caused to move from the handles, head 3 approaching the piston 23. Compression of air below the piston results, the ball-valve 4 closes, the air rushes through duct 25 and ori-  
30 fice 20, driving the spool-valve 21 toward and closing orifice 19, and having no other avenue of escape traverses the right compartment (marked *a*) of the piston-rod. Meantime air enters above the piston through orifice 10 in  
35 cap 9 by way of perforations 14 in valve-disk 13. The piston and head 3 being in close proximity, let the reciprocal operation begin, the piston approaching cap 9. Disk 13, lifted by the compression now above the piston,  
40 closes the orifice encircled by flange 11. The air rushes through duct 24 and orifice 19, driving the spool-valve forward and closing orifice 20. Under these assumed conditions the only path for the air is supplied by  
45 the left-hand compartment of the hollow rod, (marked *b*.) External air follows the piston through orifice 2 in head 3. Performed with ordinary rapidity these operations cause a practically constant blast to be delivered at  
50 end 16 of the piston-rod.

Having thus fully described my invention, what I claim, and desire to protect by Letters Patent of the United States, is—

1. In an air-pump, the combination of a  
55 cylinder having inlet-valves, said cylinder provided with suitable heads, one head having a piston-rod aperture, a hollow piston-rod divided longitudinally into independent compartments, said piston-rod having one end  
60 closed, said piston-rod having orifices opening into said compartments, a piston having ducts leading to its opposite faces, said piston being secured to said piston-rod and the inner mouths of said ducts arranged to register with said orifices, and valves for simultaneously opening and closing said compartments alternately into said cylinder upon

opposite sides of the piston by way of said ducts, substantially as described.

2. In an air-pump, the combination of a  
70 cylinder having inlet-valves, said cylinder provided with suitable heads, one head having a piston-rod aperture, a hollow piston-rod divided longitudinally into independent compartments, said piston-rod having one end  
75 closed, said piston-rod having orifices opening into said compartments, a piston having ducts leading to its opposite faces, said piston being secured to said piston-rod and the inner mouths of said ducts arranged to register with said orifices, valves for simultaneously opening and closing said compartments alternately into said cylinder upon opposite sides of the piston by way of said ducts, and  
80 a handle fixed to said piston-rod, substantially as described.

3. In an air-pump, the combination of a  
cylinder having inlet-valves, said cylinder provided with suitable heads, one head having a piston-rod aperture, a hollow piston-rod  
90 divided longitudinally into independent compartments by a partition, said partition having an orifice, said piston-rod having one end closed, said piston-rod having orifices opening into said compartments, a spool-shaped  
95 valve having its stem movably engaging the orifice in said partition, said spool-shaped valve adapted, when actuated, to alternately close the orifices in said piston-rod, a piston having ducts leading to its opposite faces,  
100 said piston being secured to said piston-rod and the inner mouths of said ducts arranged to register with the orifices in said piston-rod, substantially as described.

4. In an air-pump, the combination of a  
105 cylinder having one head provided with an inlet-valve and a piston-rod aperture, the remaining end of said cylinder being exteriorly threaded and closed by a screw-cap 9, said screw-cap having an orifice 10 and flange  
11, a spider 12 secured upon the outside of said screw-cap, a perforated valve-disk 13, a hollow piston-rod divided longitudinally into independent compartments by a partition, said partition having an orifice, said piston-  
110 rod having one end closed, said piston-rod having orifices opening into said compartments, a spool-shaped valve having its stem movably engaging the orifice in said partition, said spool-shaped valve adapted, when  
115 actuated, to alternately close the orifices in said piston-rod, a piston having ducts leading to its opposite faces, said piston being secured to said piston-rod and the inner mouths of said ducts arranged to register with the orifices in said piston-rod, and a handle secured to said piston-rod, substantially as described.

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

HORATIO SEYMOUR BILLS.

Witnesses:

FRED H. HENRISCH,  
JESSIE L. MITCHELL.