

No. 756,630.

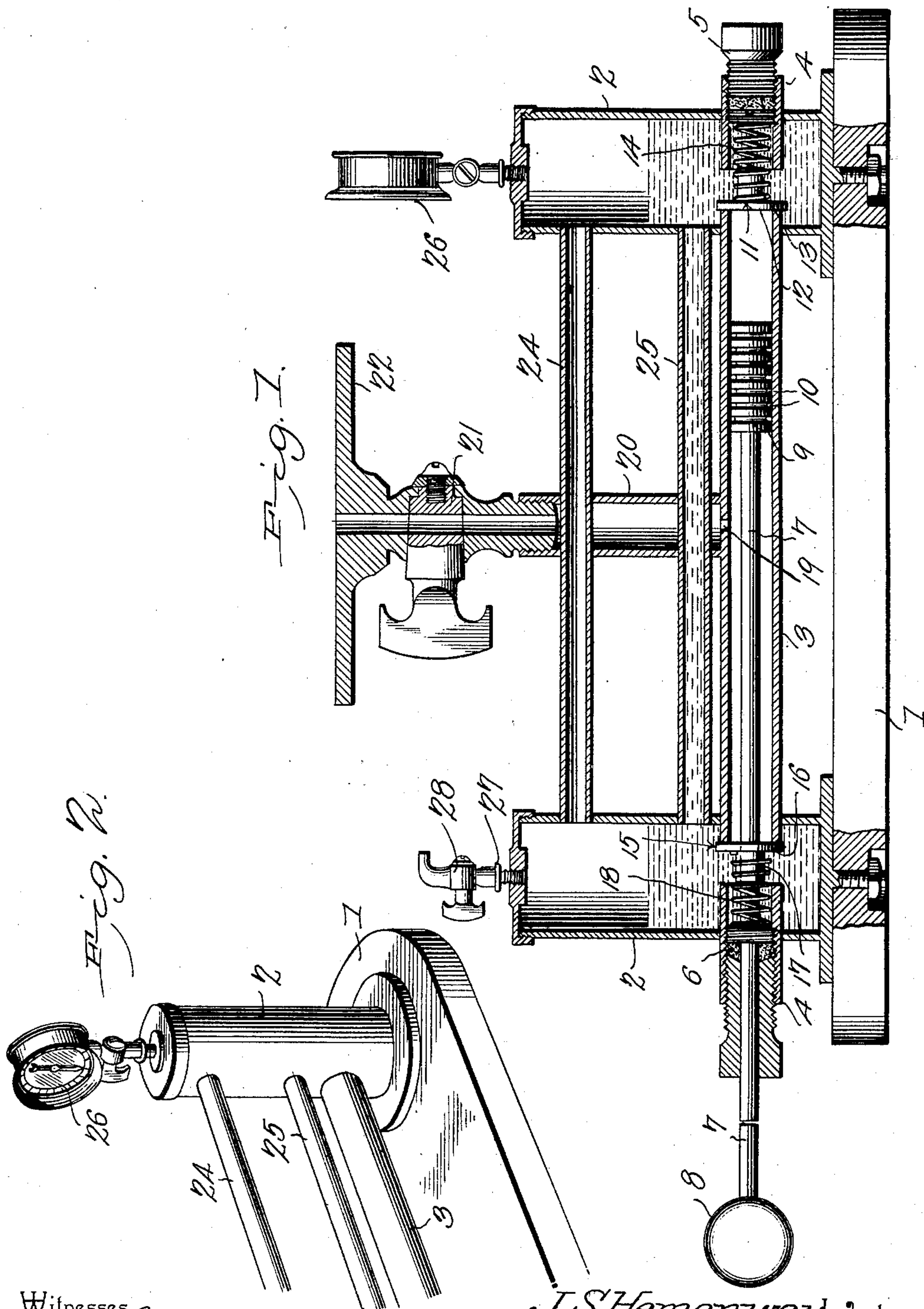
PATENTED APR. 5, 1904.

J. S. HEMENWAY.

AIR PUMP.

APPLICATION FILED JUNE 12, 1903.

NO MODEL.



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AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 756,630, dated April 5, 1904.

Application filed June 12, 1903. Serial No. 161,246. (No model.)

To all whom it may concern:

Be it known that I, JUSTIN SAMUEL HEMENWAY, a citizen of the United States, residing at River Falls, in the county of Pierce and State of Wisconsin, have invented a new and useful Air-Pump, of which the following is a specification.

This invention relates to air-pumps.

The principal object of the invention is to provide an air-pump of simple and durable construction by means of which an almost perfect vacuum may be readily produced and maintained as long as may be desired.

Another object of the invention is to produce an air-pump in which no valve need be opened to permit the passage of air from the receiver or bell into the cylinder.

A further object of the invention is to provide an air-pump with parts so designed that the piston need not fit closely within the barrel of the cylinder.

A further object of the invention is to provide in an air-pump an improved form of valve at the end of each cylinder and a liquid seal in connection with the valves to prevent the return of air to the cylinder after having once been forced out.

With the objects above stated and others in view, which will appear as the invention is more fully disclosed, the same consists in the construction and novel combination and arrangement of parts of an air-pump hereinafter described, illustrated in the accompanying drawings, forming part of this specification, in which corresponding parts are designated by the same characters of reference in the several views in which they appear, and having the novel features thereof specifically pointed out in the appended claims.

In the drawings, Figure 1 is a view in longitudinal median section through the pump structure above the base and with portions of the base broken away to show the mode of attaching the superstructure thereto. Fig. 2 is a detail view in perspective of one end of the pump, showing the pressure-gage attached thereto.

Referring to the drawings by reference characters, 1 designates a base, which may be of

any suitable form and which will preferably be made of wood. Near each end of the base is provided a hollow standard-tube 2, attached to the base in any suitable manner. Extending between the tubes 2, near the bottom thereof, is the cylinder 3 of the air-pump, which is open at each end for reasons that will afterward appear. In alinement with the cylinder and projecting out from the side of each standard-tube 2 is a tubular extension 4. One of the extensions 4 is closed by a screw-plug 5, having a knurled or milled head and fitting tightly into the end of said extension. The other extension carries in the end thereof a stuffing-box 6, extending through which is a piston-rod 7, having at the outer end a handle 8 of suitable form and at the inner end a piston-head 9 of substantially cylindrical form, but provided on the surface thereof with a plurality of circumferential grooves 10, the utility of which will hereinafter appear. In the extension closed by the plug 5 is a valve 11, comprising a disk 12, a solid stem 13, which is rigidly secured to the disk, and a spring 14. The stem 13 is slidably mounted in the extension 4 of the cylinder, and the disk 12 is ground to fit smoothly against the adjacent end of the cylinder, in contact with which it is normally held by means of the spring 14, which encircles the stem 13 and abuts at one end against the extension 4 and at the other end against the disk 12. In the other extension 4 of the cylinder there is mounted a valve 15, comprising a disk 16, a hollow stem 17, through which passes the piston-rod 7, and a spring 18. The spring 18 abuts at one end against the extension 4 and at the other end against the disk 16, serving to keep the disk normally in contact with the end of the cylinder, which is ground to form perfect contact with said disk. The cylinder has a small opening 19 in the upper surface thereof about midway between the ends, and extending upward from the cylinder about midway between the ends, where it encircles the opening 19, is a tube 20, disposed at right angles to the cylinder and having at the upper end thereof a valve 21 and a disk 22, provided with a central opening for the passage of air and adapted to support a bell-glass or

other suitable vessel to form an exhaust-chamber. Extending through the tube 20, but having no communication with the interior thereof, are two transverse tubes 24 and 25, the ends of which open into the standard-

tubes 2. At the top of one of the standard-tubes 2 is preferably provided a pressure-gage 26, and at the top of the other standard-tube 2 is preferably provided an extension 27, having a stop-cock 28, which may be closed to prevent the ingress or egress of air at any time.

When the pump is to be put into use, oil is poured into one of the standard-tubes 2 until it rises above the level of the transverse tube 25. This oil serves to keep all the working parts lubricated and also forms a liquid seal around each of the valves provided at the ends of the cylinder, thus making their action entirely certain and preventing the return of air to the cylinder.

In using the air-pump as an exhaust-pump the procedure is similar to that ordinarily employed in air-pumps. The vessel to be exhausted of its contents is placed with its mouth in contact with the disk 22 and so that the mouth thereof may be over the opening 19. Oil having been introduced into the standard-tubes in sufficient quantity and the margin of the vessel to be exhausted having been brought into suitable contact with the surface of the disk 22, the piston-rod 8 is rapidly reciprocated within the cylinder. As each stroke of the piston leaves a vacuum behind it, air is drawn down tube 20 through the opening 19 into the cylinder to fill the space behind the piston, and on each return movement a portion of the air returns to the receiver and a portion of it is carried out by the piston-head. During the first half of a stroke of the piston in either direction there is no tendency for air to pass downward into the cylinder, because the air remaining in the cylinder is compressed thereby; but after the piston-head passes the opening in the cylinder which communicates with the interior of tube 20 air is drawn downward from the receiver to fill the space behind the piston, and the air imprisoned between the piston and the valve at the end of the cylinder which the piston is approaching is of necessity carried forward by the piston and is forced through the valve and allowed to escape into one of the standard-tubes.

When the pump is used as a compression-pump, a suitable vessel to receive the compressed air may be attached to the end of the extension 27, or the valve 28 may be closed and the air compressed in the space in the upper part of the standard-tubes 2. In either case the action of the pump is substantially the same as that already described in explaining the use of the pump as an exhaust-pump. The piston is reciprocated in exactly the same manner and air is drawn down from the tube 20 through the opening 19 by the action of

the piston, which at each stroke forces a certain quantity of air through one of the valves at the end of the cylinder into one of the standard-tubes 2. As the upper parts of the standard-tubes 2 are connected by a pipe 24, the pressure of the air in each standard-tube will always be exactly equal to that in the other, so that the pressure-gage 26 will indicate the degree of compression of the air in both of the standard-tubes 2, and in case a vessel is attached to the extension 27 the compression of the air in the vessel will also be indicated by the pressure-gage 26. As each of the valves at the end of the cylinder is completely covered by oil or some other suitable liquid, it is obvious that no air can return from the standard-tubes into the cylinder, but will at once pass upward through the oil or other liquid to the surface thereof when forced through either of the valves. The circumferential grooves 10 on the piston-head 9 are filled with oil at the end of each movement of the piston, and being so filled as the piston recedes and the valve closes behind it the oil in the grooves in the piston-head fills the space between the sides of the piston-head and the wall of the cylinder, forming an air-tight joint and making the use of any packing on the piston-head unnecessary. The action of the oil in forming an air-tight joint between the piston-head and the cylinder-wall is so effective that the piston-head may be preferably smaller in diameter than the interior of the cylinder, and thus be caused to reciprocate more readily within the cylinder than in air-pumps of different type of construction in which the piston-head has to make a tight fit within the cylinder. As all the valves of the cylinder are completely sealed with oil at all times, this oil may leak into the cylinder; but no air can pass in until enough oil has entered the cylinder to have the valves unsealed, and as the valves are air-tight the pump will maintain whatever vacuum has been produced for an indefinite time.

Some of the special advantages possessed by this form of air-pump are that as the valve covers the entire end of the cylinder it furnishes a large opening for the escape of air when the valve is opened; second, it allows the end of the piston to pass out of the cylinder into the oil, thus making it impossible for any air to be left in the cylinder, and, third, the arrangement of the spring-pressed valves in alignment with the bore of the cylinder provides at either end of the cylinder a cushion for the piston to strike against as it comes to the end of a stroke.

As all the working parts of the pump are kept at all times in a quantity of clean oil, they are at all times in the same general condition and repairs are extremely seldom required. As all the parts of the pump are made of metal, they form an exceedingly durable structure and remain always in order.

Having thus described the construction and

operation of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination in an air-pump, of an open-ended cylinder having an inlet-opening intermediate of its ends, oil-receptacles within which the ends of said cylinder are located, a pipe connecting said oil-receptacles, valves within said oil-receptacles to keep the ends of said cylinder normally closed, and a piston mounted for reciprocation within said cylinder.

2. The combination in an air-pump, of a cylinder having open ends and provided with an inlet-opening intermediate of its ends, oil-receptacles within which the ends of said cylinder are located, a pipe connecting said oil-receptacles near the bottom, a second pipe connecting said oil-receptacles near the top, valves within said oil-receptacles to keep the ends of said cylinder normally closed, and a piston mounted for reciprocation within the cylinder.

3. The combination in an air-pump, of a cylinder having open ends and an inlet-opening intermediate of its ends, oil-receptacles within which the ends of the cylinder are located, tubular members fitted in the sides of

said oil-receptacles opposite the ends of the piston, plugs closing the outer ends of said tubular members, springs seated in said tubular members, valve-disks, having stems encircled by said springs, held normally in contact with the ends of said cylinder, and a piston mounted for reciprocation within said cylinder.

4. The combination in an air-pump of a horizontally-disposed, open-ended cylinder having intermediate of its ends an air-inlet opening, vertical oil-receptacles within which the ends of said cylinder are located, valves keeping the ends of said cylinder normally closed, a piston mounted for reciprocation within said cylinder, pipes disposed parallel with said cylinder and connecting said oil-receptacles near the bottom and near the top thereof, caps on said receptacles, and pressure-measuring means associated with one of said receptacles.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

JUSTIN SAMUEL HEMENWAY.

Witnesses:

OSCAR HEMM,
FRED KNOBEL.