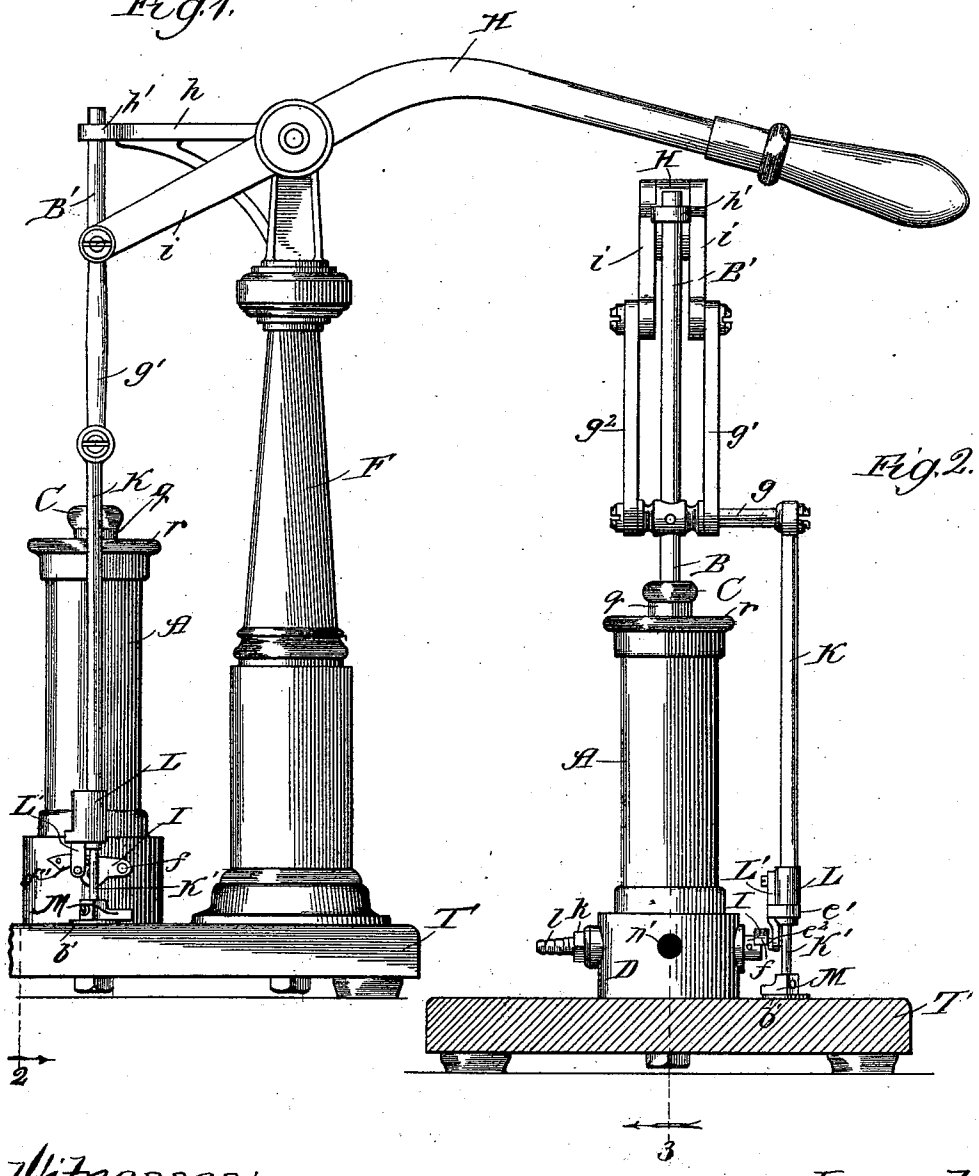
(No Model.) 2 Sheets—Sheet 1.

F. ARONSON.

AIR PUMP.

No. 539,602. Patented May 21, 1895.



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Att'ys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

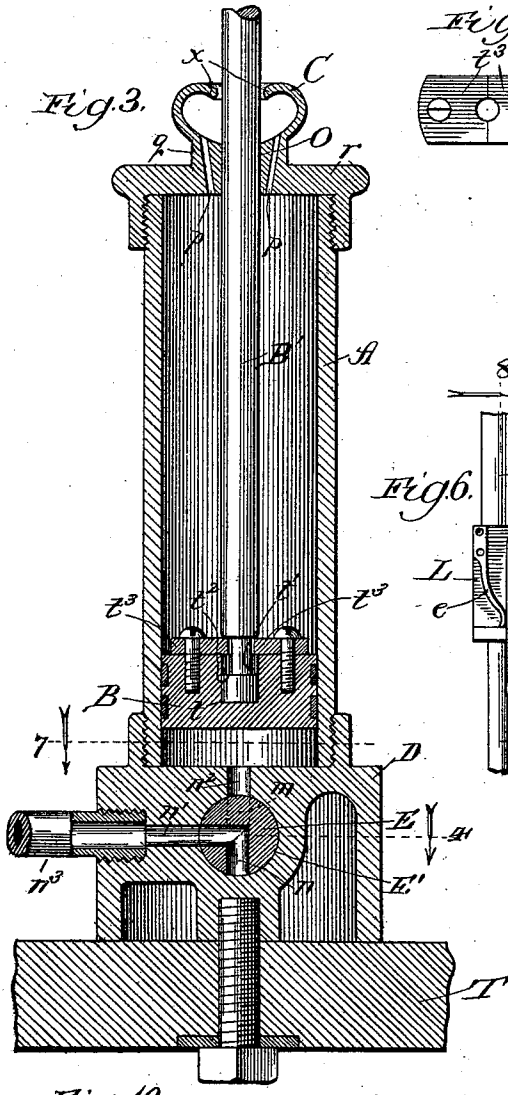


Fig. 11.

Fig. 4.

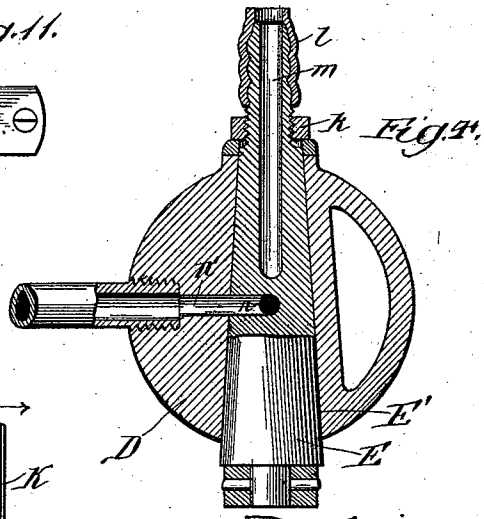


Fig. 6.

Fig. 5.

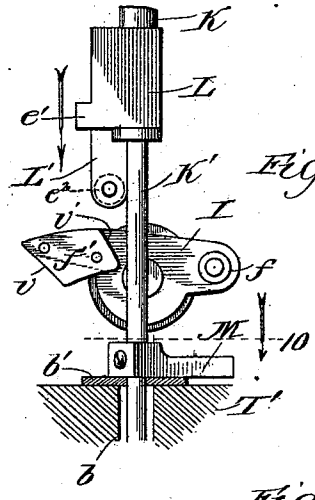


Fig. 7.

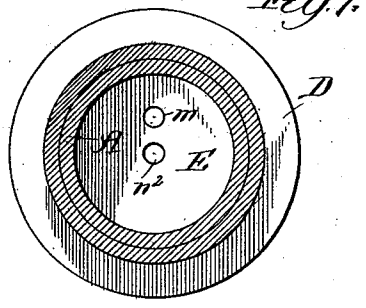


Fig. 10.

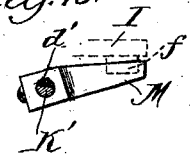


Fig. 9.

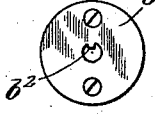
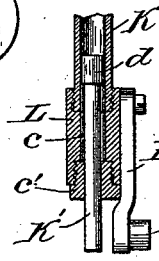


Fig. 8.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FRANS ARONSON, OF EVANSTON, ASSIGNOR TO THE WALMSLEY, FULLER & COMPANY, OF CHICAGO, ILLINOIS.

AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 539,602, dated May 21, 1895.

Application filed January 23, 1895. Serial No. 535,876. (No model.)

To all whom it may concern:

Be it known that I, FRANS ARONSON, a citizen of the United States, residing at Evanston, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Air-Pumps, of which the following is a specification.

The primary object of my invention is to provide an air-pump, in which the valve shall not be dependent, to actuate it, upon the air in the pump-cylinder or connections, but shall be actuated positively at the proper times through the medium of suitable mechanism operated by working the pump.

My invention is applicable to an air-pump for compressing air equally as well as to one for exhausting air; but inasmuch as I have constructed the first pump with my improvement as an exhaust-pump, I so mainly hereinafter describe it and show that construction in the accompanying drawings, in which—

Figure 1 represents my improved air-pump by a view in elevation. Fig. 2 is a section taken at the line 2 on Fig. 1 and viewed in the direction of the arrow; Fig. 3, a section taken at the line 3 on Fig. 2, viewed in the direction of the arrow, and showing the piston near and approaching its lowest position; Fig. 4, a section taken at the line 4 on Fig. 3 and viewed in the direction of the arrow; Fig. 5, a broken view in elevation, partly sectional, of the valve-actuating mechanism, showing the relative positions of the parts while the piston is approaching its lowest position, as indicated by the arrow; Fig. 6, a broken view in elevation of a portion of the valve-actuating mechanism presenting the side opposite that presented by Fig. 5; Fig. 7, a section taken at the line 7 on Fig. 3 and viewed in the direction of the arrow; Fig. 8, a section taken at the line 8 on Fig. 6 and viewed in the direction of the arrow; Fig. 9, a plan view of a guide-washer detail; Fig. 10, a section taken at the line 10 on Fig. 5, viewed in the direction of the arrow, and showing by dotted lines a broken portion of the valve-operating head; and Fig. 11, a plan view of stop-plate details.

A is the cylinder or receiver having screwed upon its upper end a cap r through which the piston-rod B′ works. The cap has a boss q extending from its outer side about the opening o, through which the piston-rod passes, and it forms on its upper side the concave base of an oil-cup C of rounded or, and preferably, of the general elliptical shape illustrated, with the upper edge slightly turned inward, as indicated at x in Fig. 3; and from the base of the cup extend downward, inclining toward each other, the ducts p, which lead through the cap r into the cylinder. This construction of the oil cup prevents loss of the lubricating oil and also insures its return to the cylinder, owing to the concavity afforded by its turned-in edge, at x, about the opening through which the piston-rod passes.

The cylinder A is fastened, at its lower end, as by screwing, to the housing D for the valve E, hereinafter described.

B is the piston fastened to the inner end of the rod B′ which enters a socket t in the center of the piston and, above its inner extremity, is recessed circumferentially at t' to afford the upper and lower shoulders t^2. Into the recess t', from opposite sides of the piston rod, extend stop-plates t^3, t^3, fastened to the top of the piston to project beyond the edge of the socket t into the recess t' and afford stops against withdrawal from the piston of the piston-rod while affording to the latter slight play or lost motion, for a purpose hereinafter described.

The housing D has a tapering opening formed diametrically through it to afford a seat E′ for the oscillatory tapering plug-valve E. The valve has a V-shaped transverse inlet-port n to register at its opposite ends, respectively, with an opening n' leading into the valve-seat E′ from one side of the housing, at which an inlet-tube n^3 is inserted, and with an opening n^2 leading from the valve-seat into the cylinder A at its base; the openings n' and n^2 being shown at right-angles to each other. The valve also contains a port m extending from its tapered extremity longitudinally of the plug inward short of the port n, where it is turned at a right-angle to adapt it to register with an opening m' leading upward through the housing into the cylinder A at its base.

The tapering form of the valve is preferred for my improved air-pump, as it is easy of adjustment to take up wear and reduces liabil-

ity to leakage; and the tendency to leakage by wear of the valve is further reduced by providing the ports at points in the valve not directly opposite each other. As shown, the valve is threaded near its tapering end where it projects beyond the housing, to receive a nut k by which to tighten it; and a corrugated nipple l is applied to the projecting end of the valve for connection with it of an outlet tube in case the pump should be employed for compressing air through such tube into a receiver.

The pump may be fastened at its base affording the valve-housing D, directly upon a table T, as the construction avoids any necessity for standing it upon legs.

F is the fulcrum-post for the operating handle H; and it carries on its upper end, to project forward between the prongs i of the bifurcated end of the handle, a rigid guide-arm h for the piston-rod, which works through an eye h' in the extremity of the guide-arm. On the piston-rod, between its ends, is firmly, but adjustably fastened a cross-head g connected by links g' and g^2 with the bifurcated ends i of the operating handle. On the projecting flaring end of the oscillatory valve E it carries a trip-device shown as a head I carrying near one end an outward projecting bearing, represented as an anti-friction roller f, and beveled, as shown at v, at its opposite end, near which, on the same side with the bearing f it carries a plate f', having its edge adjacent to the anti-friction roller inclined, as shown at v'. If desired, the head I and plate f' may be integral. A hollow rod K depends, pivotally, from the end of the cross-head extended beyond the link g' and carries at its lower end a head L having pivotally fastened on its inner side a finger L′ controlled by a spring e (Fig. 6) to bear normally against a rigid stop e' projecting from the head, the finger having a stud e^2 extending at a right-angle from its lower end. A rod K′ telescopes with the hollow rod K, in which it is provided with a head d; and the rod K′ passes through a vertical opening c in the head L, into the upper end of which opening the rod K is screwed while the lower end is stopped with a nut c' which confines the rod K′ at its head d against withdrawal from the tubular rod K.

M is a rigid foot extending at a right-angle from the rod K′ below and into line with the stud f; and below this foot the rod K′ enters a guide-opening b through the table T, surrounded at its upper end by a washer b' fastened to the table and having a tongue b^2 (Fig. 9) projecting inward part way across the washer-opening to enter a longitudinal groove d' in the lower portion of the rod K′, thereby to prevent the latter from turning.

The operation is as follows, to work the pump for exhausting air from a receiver, not shown, but from which the tube n^3 is supposed to lead into the opening n', the valve-port m leading to the outer air at the tapered extremity of the valve: With the parts in the relative positions represented in Fig. 3, the piston B being at the end of its inner stroke, the port n is closed to the opening n^2, while the port m registers with the opening m' leading into the cylinder. This will be the condition of the parts initially, and at the end of each down stroke of the piston, below which there is then no space in the cylinder. Then, also, the spring-finger L′ will be in the position represented in Figs. 1 and 2, wherein, in the descent of the rod K, the stud e^2 on the finger will have engaged the incline v' and been thereby directed, against the resistance of its controlling spring e till, having passed the lower end of the incline, the spring will have forced the stud e^2 under the lower edge of the plate f'. Downward pressure on the handle H thereupon, first, raises the piston-rod B′ sufficiently to take up the lost motion between the shoulders t^2, and, at the same time, raises the rod K and head L sufficiently to engage the stud e^2 with the head I at the lower edge of the plate f' (thus at one side of the center about which the head oscillates) to tip the head in the direction to eventually register the V-shaped port n with the openings n' and n^2 by the time the stud has cleared the plate f' by passing upward along its inclined outer edge v. Meantime, and while the port n is being brought to the described position of registration, the port m is closed and the piston B is being raised and a vacuum is accordingly being formed underneath it in the cylinder; so that when the port n opens the passage from the opening n' to the opening n^2 air, from the receiver to be exhausted through the tube n^3, rushes in to fill the vacuum, and fills the cylinder A as the piston is raised therein. While the piston-rod is rising the hollow rod K rises with it without moving the telescoping rod K′ till the piston is about to reach the upper end of its stroke, when the nut c' engages the head d on the rod K′ and lifts the latter and with it the foot M against the projection f on the head I, (thus at the opposite side of the aforesaid center) thereby tilting the latter to turn the valve E to bring the port n into its closed position represented in Fig. 1 and produce registration of the port m with the outlet-opening m' in the base of the cylinder. The air in the cylinder is thereupon forced out through the port m by raising the handle H to lower the piston B; and when the piston has reached its lowest position the finger L′ will again have slipped underneath the head I ready, on working the handle to raise the piston, to tilt the head and turn the valve to open the port n.

As will be seen, the valve necessarily acts however attenuated the air may become in the receiver or connections, thus enabling the piston always to draw a certain quantity of air into the cylinder from the receiver and connections. There is always a vacuum in the cylinder before the valve opens thus preventing any inrush of outer air to the cylinder and lessening the liability to leakage, because the

stroke of the piston is begun and has progressed some distance before the valve opens. Then, no air can return from the cylinder into the receiver toward the end of the downstroke of the piston, because the valve is closed to the receiver while the piston is still in the act of exhausting, and is fully closed before the act of exhausting is completed. Thus after the valve is closed a still further vacuum is created, drawing the air from around the valve, if there be any. Moreover, there is the minimum of lost motion, because while the piston is rising, at the beginning of the stroke the vacuum there created is useful when the valve is opened; and toward the end of the upstroke the vacuum continues while the valve is closing its port *n* and but for a short distance after the valve has become fully closed.

It will also be noticed that by my improved construction only one valve is employed and that stuffing-boxes may be entirely dispensed with.

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

1. In an air-pump, an oscillatory valve controlling the inlet to and outlet from the pump-cylinder and carrying a trip-device, and engaging mechanism for the trip-device, connected with the piston-rod to extend normally at opposite sides of the center about which said trip-device oscillates and engage the trip-device successively at opposite sides of said center in the upstroke of the piston, to open the valve to said inlet and close it to said outlet and, toward the end of the upstroke, to close the valve to said inlet and open it to said outlet, substantially as described.

2. In an air-pump, an oscillatory valve controlling the inlet to and outlet from the pump-cylinder and carrying a trip-device, the piston and piston-rod having a lost-motion connection, and engaging mechanism for the trip-device, connected with the piston-rod to extend normally at opposite sides of the center about which said trip-device oscillates and engage the trip-device successively at opposite sides of said center in the upstroke of the piston, to open the valve to said inlet and close it to said outlet and, toward the end of the upstroke, to close the valve to said inlet and open it to said outlet, substantially as described.

3. In an air-pump, the combination with the cylinder supported on a valve-housing having the inlet opening n' and the openings n^2 and m', of a tapering oscillatory valve seated in said housing and having ports n and m, a trip-device on a projecting end of the valve and engaging mechanism for the trip-device connected with the piston-rod, and operating said trip-device, in the upstroke of the piston, to turn the valve to register the port n with the openings n' and n^2 and close the port m to the opening m' and, toward the end of the upstroke, to turn the valve to close the port n to the opening n' and open the port m to the opening m', substantially as described.

4. In an air-pump, the combination with the cylinder having at one end a valve-housing containing the inlet to and outlet from the pump-cylinder, a piston and the piston-rod, of an oscillatory valve E in said housing, a trip-device on a projecting end of the valve, formed with a head I, a hollow rod K connected with the piston rod and having a head L carrying a pivotal finger L′, and a rod K′ telescopically connected with the hollow rod and carrying a foot K′, substantially as and for the purpose set forth.

5. In an air-pump, the combination with the cylinder having at one end a valve-housing containing the inlet to and outlet from the pump-cylinder, a piston and its piston-rod, provided with an operating handle, of an oscillatory valve E in said housing, a head I on a projecting end of the valve, provided with the inclined edges v and v' and a stop f, a cross-head on the piston-rod linked to said handle, a hollow-rod K depending from the cross-head and carrying a head L provided with a spring-controlled finger L′, and a rod K′ provided with a stop d and telescopically connected with the hollow rod and carrying a foot M, substantially as and for the purpose set forth.

FRANS ARONSON.

In presence of—
J. H. LEE,
J. N. HANSON.