Nov. 27, 1923. 1,475,826

L. F. HOFFMAN

VALVE FOR AIR PUMPS AND MEANS FOR ACTUATING SAME

Filed Dec. 5, 1922 2 Sheets-Sheet 1

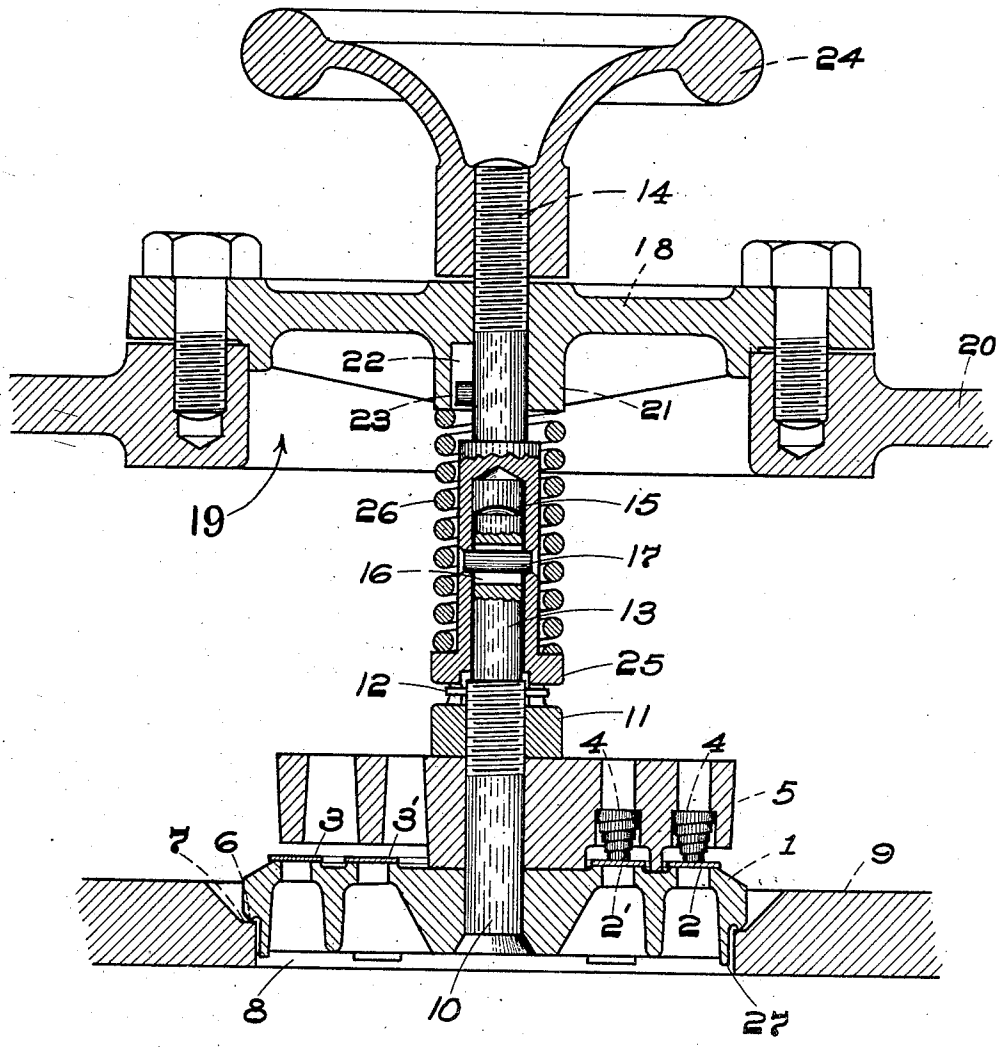


FIG. 1.

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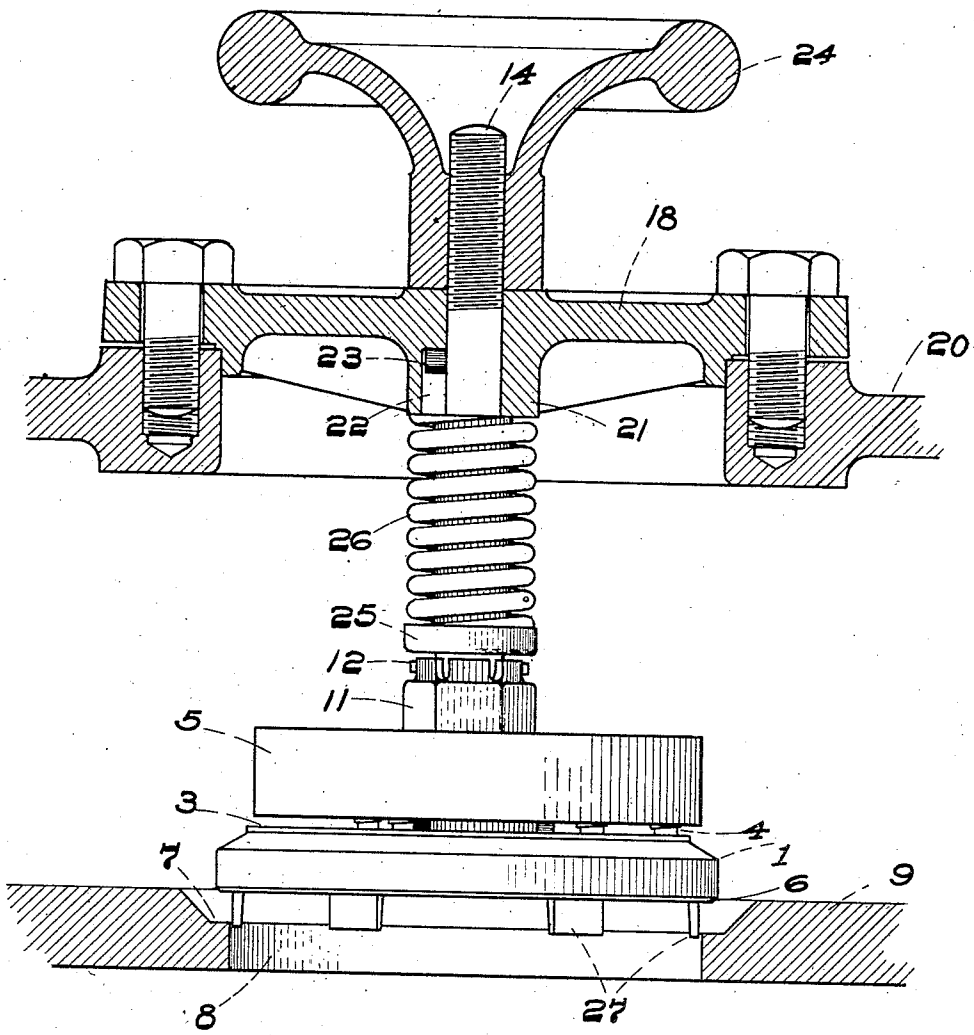


FIG. 2.

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Patented Nov. 27, 1923. 1,475,826

UNITED STATES PATENT OFFICE.

LEON F. HOFFMAN, OF FRANKLIN, PENNSYLVANIA, ASSIGNOR TO CHICAGO PNEUMATIC TOOL CO., OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

VALVE FOR AIR PUMPS AND MEANS FOR ACTUATING SAME.

Application filed December 5, 1922. Serial No. 605,061.

To all whom it may concern:

Be it known that I, LEON F. HOFFMAN, citizen of the United States, residing at Franklin, in the county of Venango and State of Pennsylvania, have invented certain new and useful Improvements in Valves for Air Pumps and Means for Actuating Same, of which the following is a specification.

This invention relates to a valve organization for air pumps and compressors, and more especially to such a valve organization that is adapted to be both automatically and manually unseatable or removable from the port with which it is associated in the wall of such pump or compressor.

The objects, and construction of my improved valve organization are herein set forth with sufficient clearness to enable others skilled in the arts to which its construction and use respectively relate to make and use the same.

This invention has for its primary object the provision of a discharge valve organization for air pumps and compressors, which is adapted to be automatically unseated or removed from the port with which it cooperates in the cylinder wall of the pump so that any non-compressible fluid which may be drawn into said cylinder may be discharged through said port instead of through the valve organization, as in the normal operation of the pump.

Another object of this invention is, to provide a valve organization which may be manually unseated or removed from the port with which it is associated, for the purpose of unloading the pump.

Still another object of this invention is, to provide a discharge valve organization for vacuum pumps which may be manually unseated from its port in the wall of the cylinder before the pump is started, thus permitting the pump, immediately upon starting to run idle, and thereafter, by a certain manipulation of said valve organization to cause the pump to gradually assume its full load.

The application and utilization of my improved valve organization for the accomplishment of this latter object is fully set forth in an application for Letters Patent of the United States filed by me on the 19th day of January, 1921, Serial Number 438,367, for vacuum pumps and method of operating same.

One form of construction whereby I am enabled to secure said objects is clearly illustrated in the accompanying drawings in which:

Fig. 1 is a central, longitudinal section through said valve organization and adjacent portion of the cylinder wall showing said valve organization in its seated position and operative relation to the port in the cylinder wall with which it is associated, as when in normal operation.

Fig. 2 is a view partly in longitudinal section and partly in side elevation showing said valve organization unseated or removed from the port with which it is associated, as when the pump is manually unloaded also when a non-compressible fluid is being discharged through the cylinder port, instead of through the organization.

The valve illustrated in said drawings is of the so-called plate type and comprises the following elements:

A circular base 1, which is sometimes termed the valve seat, having as features thereof one or more concentric annular ports 2, 2′, which extend through said base, with which are associated annular plate valves 3, 3′ respectively; said valves are composed of sheet steel, or at least, a thin annulus of steel formed in any suitable manner; they are cooperatively associated to their respective ports in such manner as to control the direction of flow of air through the port with which the organization is associated, in this case the discharge of air from the cylinder.

Said plate valves 3, 3′ are yieldably retained in their operative relation to their respective ports by means of the volute springs 4. Said springs 4 are carried within suitable sockets which are provided in an element 5 termed the valve keeper.

About the periphery of said base 1 is formed an annular flange or lip 6, the lower edge of which is adapted to seat upon the wall seat 7 formed about the outer side of a port 8 which extends through the wall of the pump or compressor, which wall is indicated by the numeral 9.

Said base 1 and valve keeper 5 are secured rigidly together by means of a stud 10 which is positioned centrally of and extends in an axial direction through said base and keeper; a nut 11 operably associated with said stud serves to secure said

elements 1 and 5 rigidly together. Said nut 11 is a lock nut of the type termed a "castle" nut and a locking pin 12 passes through said stud 10 between the castellated projections of said nut to non-revolubly lock the same in position.

The outer end of said stud projects beyond said nut and the portion 13 so projecting is termed a tang.

It will be conducive to a clearer understanding of this specification and the appended claims to here indicate that the construction thus far described, with the exception of the cylinder wall 9, is what is contemplated by the term valve organization.

In order to attain the desired functions of said valve organization, it is necessary that it be yieldably retained upon the wall seat 7, that is, in its cooperative relation to said port 8 so that it may be manually removed from said cooperative relation, as in the unloading of the pump or compressor, and also automatically actuated out of said cooperative relation, as in the expulsion of a non-compressible fluid from the cylinder directly through port 8 instead of through the base ports 2, 2', by way of valves 3, 3'. Said functions are attained in the following manner:

A lifting stem 14 is connected to said tang 13 by means of what may be termed a universal joint connection as follows:

Said stem 14 is provided adjacent its inner end, adjacent to the valve organization, with a socket 15 to loosely receive said tang 13; said tang is provided with a longitudinally-elongated slot 16, and a pin 17 which is rigidly carried by the walls of said socket 15 passes through said slot thus loosely connecting said stem to said tang in such a manner that a limited amount of relative universal movement of said tang and the thereto connected organization is provided for. Said stem 14 passes non-revolubly through a fixed guide, as a cover 18, which serves to close a port or hand hole 19 in a casing 20 of the pump or compressor cylinder. Said cover or guide 18 is centrally provided with a boss 21 through which said stem extends and in which it has longitudinal movement. Said boss is provided with longitudinally-extending slot 22 at one side of and intersecting the guide hole through which said stem passes, said slot being for the purpose of receiving a laterally-extending pin 23 which is rigidly associated with said stem, and whereby said stem is non-revolubly carried by said guide in which it has longitudinal movement. The outer end of said stem is provided with a screw-thread for the reception of a hand-wheel 24 which is operable to actuate said stem longitudinally in one direction, which actuation is transmitted to said organization to move the same in one direction, in this case, to unseat said organization for said wall seat 7.

The inner end of said stem 14 is provided with a head or annular flange 25 and between this head and the inner opposing face of said boss 21 is interposed a spiral compression spring which surrounds said stem, said spring being indicated by the ordinal 26. The office of said spring is to effect the yieldable seating of said valve-organization upon said wall seat 7, the compressive stress of said spring being such that, in the normal operation of the pump or compressor, the lip 6 of base 1 will be maintained in hermetic contact with said seat 7. Under abnormal pressure, however, such as may be caused by the presence of a non-compressible fluid within the cylinder, said valve organization will be automatically, momentarily unseated so as to permit the expulsion of such fluid directly through the port 8 without undue strain or damage to said organization or any element thereof. In such automatic unseating of the valve organization, as well as when the organization has been manually unseated by means of the hand-wheel 24, said spring serves to restore said organization to its operative relation to said port 8, in this latter case, of course, said hand wheel being actuated to permit such restoration.

It is contemplated that the respective functions of said spring and said hand-wheel may be reversed, depending upon whether my inventive idea is applied to a discharge or an inlet valve.

Referring now to the matter of providing a certain amount of relative universal movement between said tang and the thereto connected organization, and said stem 14, such movement is provided for the purpose of assuring that the valve organization will always be free to seat truly and firmly upon said wall seat 7, even though the cover or guide may not be positioned in exact axial, concentric alinement with the cylinder port 8. The elongation of the slot 16 is employed in order that no shearing stress upon the pin 17 will be produced by the compressive action of the spring, thereby assuring that all compressive action of said spring will be transmitted by the end of said stem 14 at its bearing point upon the nut 11, or upon the keeper 5 should said nut be dispensed with. This universal joint provision eliminates the necessity of employing difficult and expensive machine work, which would otherwise be required.

Guide lugs 27 are provided upon the port face of the base 1 and arranged to cooperate with the wall of the port 8 by a sliding contact therewith and thus to maintain the valve organization in its proper concentric position and relation to said port; the

length of said guide-lugs is such that they will not be withdrawn from said port when said organization is removed from its cooperative relation thereto. The extent of such removal is determined and limited by the pin 23 as it contacts with the outer wall of its slot 22, as shown in Fig. 2.

I claim the following:

1. The combination with the cylinder of an air pump having a valve-port formed through the wall thereof and a valve-seat formed upon said wall surrounding said port, of a valve organization arranged to be actuated into cooperative relation to said port by being seated upon said seat so as to be yieldably retained in said relation, also to be both automatically and manually actuated out of said relation; actuating means for said organization comprising in combination, a universal joint carried by said organization, a compression spring arranged to actuate said organization into said cooperative relation to said port through the medium of said universal joint and to yieldably retain said organization in said relation, a stem connected to said organization through the medium of said universal joint for the purpose of actuating said organization out of said cooperative relation, and manually-operable means carried by said stem to effect the actuation of said organization out of said cooperative relation to said port.

2. The combination with the cylinder of an air pump having a valve port formed through the wall thereof and a valve-seat formed upon said wall surrounding said port, of a valve organization arranged to be actuated into cooperative relation to said port by being yieldably seated upon said seat and to be both automatically and manually unseatable therefrom; means for actuating said organization and yieldably retaining the same in said cooperative relation to said port and for manually actuating said organization out of said relation comprising in combination, a compression spring arranged to actuate said organization into said cooperative relation to said port, a universal joint carried by said organization, a stem connected to said organization through the medium of said universal joint for the purpose of actuating said organization out of said cooperative relation, manually-operable means carried by said stem to effect the actuation of said organization out of said cooperative relation to said port, and means carried by said organization in association with the wall of said port maintaining said organization in concentric, axial alinement with said port.

3. The combination with the cylinder of an air pump having a valve port formed through the wall thereof and a seat for a valve organization formed upon said wall surrounding said port, of a valve organization arranged to be actuated into cooperative relation to said port by being yieldably seated upon said seat so as to be both automatically and manually unseatable therefrom; means for actuating and retaining said organization as above stated comprising, in combination, the following: a compression spring arranged to actuate said organization into said cooperative relation to said port and to yieldably retain the same in said relation, a universal joint carried by said organization, a stem connected to said organization through the medium of said universal joint, arranged to actuate said organization out of said cooperative relation, manually operable means carried by said stem to effect the actuation thereof, guide lugs carried by said organization in slidable relation to the walls of said cylinder port retaining said organization in concentric axial alinement with said port, and means preventing the withdrawal of said lugs from said port.

4. The combination with the cylinder of an air pump having a valve-port formed through the wall thereof, a valve-seat formed upon said wall surrounding said port, a guide plate carried by said cylinder spaced from said valve-seat and having a guide-hole positioned in concentric axial alinement with said port, of a valve organization arranged to be actuated into cooperative relation to said port by being seated upon said valve seat and yieldably retained in said relation also both manually and automatically actuable out of said relation; actuating means for said organization comprising in combination, a compression spring bearing at one of its ends upon said guide-plate and at its other end exerting actuating pressure upon said organization so as to actuate same into said cooperative relation and yieldably retain same therein, a stem extending through said guide-plate connected at its inner end to said organization so as to permit a universal movement of said organization relative to said stem, and manually operable means carried by said stem to effect the actuation of said organization out of its cooperative relation to said port.

5. The combination with the cylinder of an air pump having a valve-port formed through the wall thereof, a valve-seat, formed upon said wall surrounding said port, a guide-plate carried by said cylinder spaced from said valve-seat and having a guide-hole positioned in concentric axial alinement with said port, of a valve-organization arranged to be actuated into cooperative relation to said port by being seated upon said valve seat and yieldably retained in said relation, also both manually and automatically actuable out of said relation; actuating means for said organization com-

prising in combination, a compression spring bearing at its outer end upon said guide-plate and at its inner end exerting actuating pressure upon said organization so as to actuate same into said cooperative relation to said port and yieldably retain same therein, a stem extending through said guide-plate connected at its inner end to said organization so as to permit a limited amount of universal movement of said organization relative to said stem, manually-operable means carried by said stem to effect the actuation of said organization out of its cooperative relation to said port, and means maintaining said organization in its concentric, axial alinement with said port.

6. The combination with the cylinder of an air pump having a valve-port formed through the wall thereof, a valve-seat formed upon said wall surrounding said port, a guide-plate carried by said cylinder spaced from said valve-seat and having a guide-hole positioned in concentric axial alinement with said port, of a valve organizatiton arranged to be actuated into cooperative relation to said port by being seated upon said valve-seat and yieldably retained in said relation, also both automatically and manually actuable out of said relation; actuating means for said organization comprising in combination, a compression spring bearing at its outer end upon said guide-plate and at its inner end exerting an actuating pressure upon said organizatiton so as to actuate same into said cooperative relation to said port and yieldably retain same thereat, a stem extending through said guide-hole, connected at its inner end to said organization so as to permit a limited amount of universal movement of said organization relative to said stem, manually-operable means carried by stem operable to effect the actuation of said organization out of its cooperative relation to said port, guide-lugs carried by said organization in slidable contact with the walls of said port to maintain said organization in concentric alinement with said port, and means preventing the actuation of said lugs out of said contact with said port walls.

7. The combination with the cylinder wall of an air pump having a valve-port formed through the wall thereof, a valve-seat formed upon said wall surrounding said port, a guide-plate carried by said cylinder spaced from said valve-seat and having a guide-hole posititoned in concentric axial alinement with said port, of a discharge-valve organization arranged to be actuated into cooperative relation to said port by being seated upon said valve-seat and yieldably retained in said relation thereto also both automatically and manually actuable out of said relation, actuating means for said organization comprising in combination, a compression spring bearing at one of its ends upon said guide-plate and at its other end exerting actuating pressure upon said organization so as to actuate same into said cooperative relation to said port and yieldably retain same therein, a stem extending through said guide hole connected at its inner end to said organization so as to permit a limited amount of universal movement of said organization relative to said stem, and manually-operable means carried by said stem operable to effect the actuation of said organization out of said cooperative relation to said port.

8. The combination with the cylinder wall of an air pump having a valve-port formed through the wall thereof, a valve-seat formed upon said wall surrounding said port, a guide-plate carried by said cylinder spaced from said valve-seat and having a guide-hole positioned in concentric, axial alinement with said port, of a discharge-valve organization arranged to be actuated into cooperative relation to said port by being seated upon said valve-seat and yieldably retained in said relation thereto, also both automatically and manually actuable out of said relation, actuating means for said organization comprising in combination, a compression spring bearing at one of its ends upon said guide-plate and at its other end exerting actuating pressure upon said organization so as to actuate same into said cooperative relation to said port and yieldably retain same therein, a stem extending through said guide-hole connected at its inner end to said organization so as to permit a limited amount of universal movement of said organization relative to said stem, manually-operable means carried by said stem operable to effect the actuation of said organization out of cooperative relation to said port, and means maintaining said organization in concentric, axial alinement to said port.

9. The combination with the cylinder wall of an air pump having a valve-port formed through the wall thereof, a valve seat formed upon said wall surrounding said port, a guide-plate carried by said cylinder spaced from said seat and having a guide-hole positioned in concentric, axial alinement with said port, of a discharge-valve organization arranged to be actuated into cooperative relation to said port by being seated upon said valve-seat and yieldably retained in said relation thereto also both automatically and manually actuable out of said relation, actuating means for said organization comprising in combination, a compression spring bearing at one of its ends upon said guide-plate and at its other end exerting actuating pressure upon said organization so as to actuate same into said cooperative relation to said port and yield-

ably retain same therein, a stem extending through and having longitudinal, non-revoluble movement in said guide-plate connected at its inner end to said organization so as to permit a limited amount of universal movement of said organization relative to said stem, manually-operable means carried by said stem operable to effect the actuation of said organization out of cooperative relation to said port, and guide-lugs carried by said valve-organization in association with the walls of said port maintaining said organization in concentric, axial alinement with said port.

10. The combination with the cylinder wall of an air pump having a valve-port formed through the wall thereof, a valve seat formed upon said wall surrounding said port, a guide-plate carried by said cylinder spaced from said seat and having a guide-hole positioned in concentric, axial alinement with said port, of a discharge-valve organization arranged to be actuated into cooperative relation to said port by being seated upon said valve-seat and yieldably retained in said relation thereto also both automatically and manually actuable out of said relation, actuating means for said organization comprising in combination, a compression spring bearing at one of its ends upon said guide-plate and at its other end exerting actuating pressure upon said organization so as to actuate same into said cooperative relation to said port and yieldably retain same therein, a stem extending non-revolubly through said guide-hole and having longitudinal movement therein connected at its inner end to said organization so as to permit a limited amount of universal movement of said organization relative to said stem, manually-operable means carried by said stem to effect the actuation of said organization out of cooperative relation to said port, guide-lugs carried by said organization in slidable contact with the wall of said port maintaining said organization in axial alinement with said port, and means preventing the withdrawal of said lugs from said port.

11. The combination with an air pump cylinder having a valve-port formed through the wall thereof, a seat for a valve organization formed upon said wall surrounding said port, and a guide carried by said cylinder in axial alinement with said port and spaced from said seat; of a valve organization arranged in axial alinement with said port actuable into cooperative relation to said port, also actuable out of said relation, said organization comprising a circular, annularly-ported base having a seating lip formed upon its periphery, annular valve-plates cooperatively associated with said annular ports so as to govern the passage of air therethrough, a valve-keeper rigidly secured to said base maintaining said valve-plates in their said cooperative association, a centrally-located, axially-extending stud passing rigidly through said base and said keeper and projecting therefrom to form a tang; said valve organization being in said cooperative relation to said valve-port when said seating lip is seated upon said seat; a compression spring bearing at one of its ends upon said guide and at its other end upon said organization whereby said organization is actuated into said cooperative relation, an actuating stem extending non-revolubly, longitudinally-movably through said guide, connected at its inner end to said tang so as to permit a limited amount of universal movement of said organization relative to said stem, means carried by said stem manually-operable to actuate said organization out of said cooperative relation, and means maintaining said axial alinement of said organization with said valve-port.

12. The combination with an air pump cylinder having a valve-port formed through the wall thereof, a seat for a valve organization formed upon said wall surrounding said port, and a guide carried by said cylinder having a guide-hole positioned in axial alinement with said port; of a valve organization arranged in axial alinement with said port and actuable into cooperative relation thereto, also actuable out of said relation; said organization comprising a circular, annularly-ported base having a seating lip formed upon its periphery, annular plate valves cooperatively associated with said annular ports so as to permit the passage of air outwardly therethrough, a valve-keeper rigidly secured to said base maintaining said plate valves in their said cooperative association, a centrally-located, axially-extending stud passing rigidly through said base and said keeper and projecting therefrom to form a tang; said valve organization being in said cooperative relation to said valve-port when said seating lip is seated upon said seat; a compression spring bearing at one of its ends upon said guide its other end exerting actuating pressure upon said organization whereby it is actuated into said cooperative relation to said valve-port, an actuating stem extending non-revolubly, longitudinally-movably through said guide-hole, connected at its inner end to said tang so as to permit a limited amount of universal movement of said organization relative to said stem, means carried by said stem manually operable to actuate said organization out of said cooperative relation to said valve-port, means maintaining said axial alinement of said organization with said port, and means limiting the extent of said manual actuation.

13. The combination with the cylinder of an air pump having a valve-port formed

through the wall thereof, a seat for a valve-organization formed upon said wall surrounding said port and a guide carried by said cylinder having a guide-hole therein in axial alinement with said port and spaced therefrom; of a discharge-valve organization adapted to be actuated into cooperative association with said valve-port comprising in combination, an annularly-ported valve base adapted to be removably seated upon said wall seat, guide lugs carried by said base projecting into said valve port so as to maintain said base in axial alinement with said port, annular plate-valves associated with said annular ports in said base, a valve-keeper rigidly secured to said base maintaining said valves in their operative relation to said annular ports, a centrally-positioned, axially-extending stud extending rigidly through said base and said keeper securing them together and projecting therefrom to form a tang, a compression spring bearing at one of its ends upon said keeper and at its other end upon said guide whereby said valve organization is actuated to and yieldably retained in said cooperative relation to said valve-port, an actuating stem extending through and having longitudinal movement in said guide-hole connected at its inner end to said tang, and manually-operable means carried by said stem to actuate said organization out of said cooperative relation to said valve-port, so as to permit the passage of air freely through said port in both directions.

14. The combination with the cylinder of an air pump having a valve-port formed through the wall thereof, a seat for a valve-organization formed upon said wall surrounding said port and a guide carried by said cylinder having a guide-hole therein in axial alinement with said port and spaced therefrom; of a discharge valve organization adapted to be actuated into cooperative relation to said valve-port and removed therefrom comprising in combination; an annularly-ported valve base adapted to be removably seated upon said wall seat, guide lugs carried by said base in slidable relation to the wall of said valve-port maintaining said base in axial alinement with said port, annular plate-valves associated with said annular ports in said base, a valve-keeper rigidly secured to said base maintaining said valves in their cooperative relation to said annular ports respectively, a centrally-positioned, axially-extending stud extending through said base and said keeper securing them together and projecting therefrom to form a tang, a compression spring bearing at its outer end upon said guide and at its inner end upon said organization whereby said organization is actuated to and yieldably retained in said cooperative relation to said valve-port, an actuating stem extending through and having longitudinal movement in said guide-hole connected at its inner end to said tang, manually operable means carried by said stem operable to actuate said organization out of said cooperative relation to said port, and means positively limiting the extent of said actuation so as to prevent the withdrawal of said guide-lugs from said valve-port.

15. The combination with the cylinder of an air pump having a valve port formed through the wall thereof, a seat for a valve-organization formed upon said wall surrounding said port and a guide carried by said cylinder spaced from said seat and having a guide-hole positioned in axial alinement with said port, of a valve-organization adapted to be actuated into cooperative relation to said port so as to insure the passage of air through said organization in one direction only and to be actuated out of said relation to said port so as to permit the passage of air from said port freely in both directions, said organization comprising in combination; a circular, annularly-ported valve-base having a seating lip formed upon its periphery, guide lugs carried by said base in slidable relation to the wall of said valve-port so as to maintain said base in concentric relation thereto, annular plate valves associated with said annular ports in said base, a valve-keeper rigidly secured to said base maintaining said valves in their associated relation to said ports, a centrally-positioned, axially-extending stud extending through said base and keeper securing them together and projecting therefrom to form a tang; said cooperative relation between said valve-port and said valve-organization being attained when said seating lip is seated upon said wall seat; actuating means for said valve comprising a centrally positioned compression spring bearing at one of its ends upon said organization and at its other end upon said guide whereby said organization is actuated to and yieldably retained in said cooperative relation, means for actuating said organization out of said relation comprising a longitudinally movable stem extending non-revolubly through said guide hole, provided upon its outer end with a screw thread and connected at its inner end to said tang, a hand-wheel cooperating with said screw-thread and said guide, and means carried by said stem limiting the extent of said actuation.

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

LEON F. HOFFMAN.

Witnesses:
S. P. COWIN,
VIRGINIA J. HOCKMAN.