J. ROBERTSON.

AIR PUMP.

APPLICATION FILED APR. 1, 1911.

1,004,906.

Patented Oct. 3, 1911.

2 SHEETS—SHEET 1.

Fig. 1

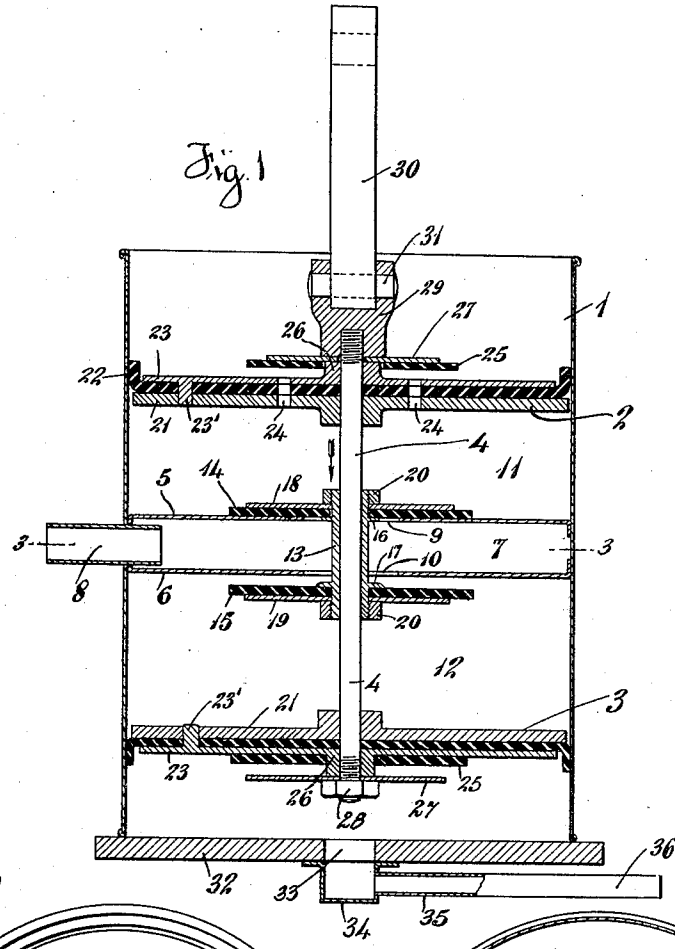


Fig. 4

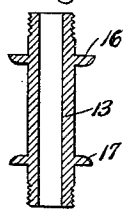


Fig. 2

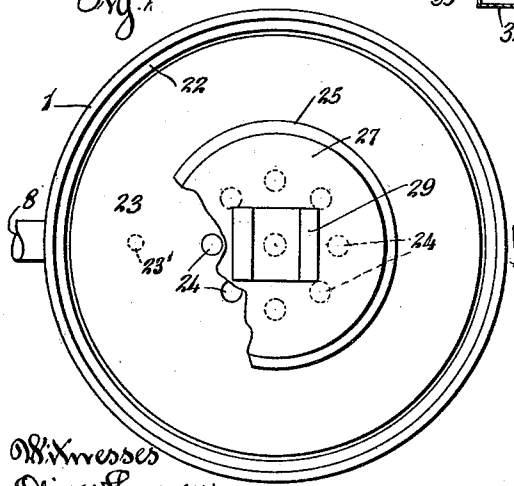
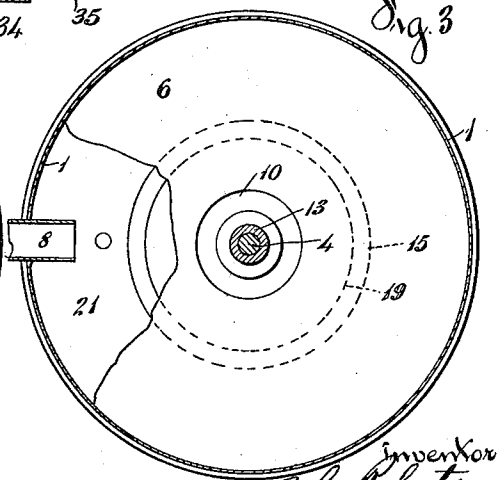


Fig. 3



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2 SHEETS—SHEET 2.

Fig. 5

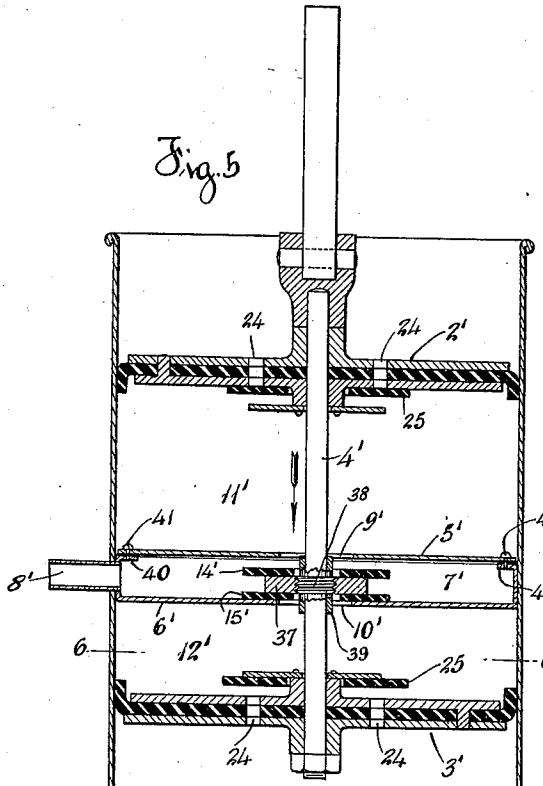


Fig. 7

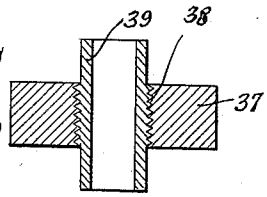
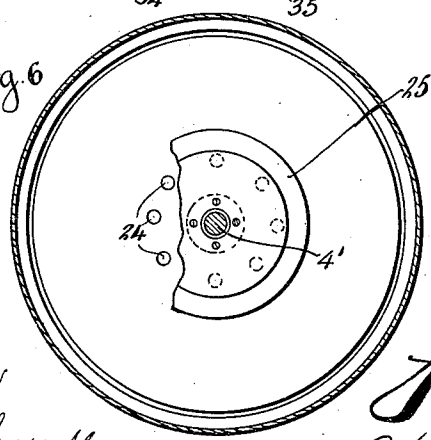


Fig. 6



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AIR-PUMP.

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Application filed April 1, 1911. Serial No. 618,339.

To all whom it may concern:

Be it known that I, JOHN ROBERTSON, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Air-Pumps, of which the following is a specification.

My invention relates to air pumps adapted for both vacuum and pressure, and more particularly to those of the double action type.

The object of my invention is to produce a pump of simple construction, inexpensive to manufacture, and one which is more efficient in comparison to size than those now in use.

Another object of my invention is to produce a pump with an exhaust port, to which a hose or other suitable tube may be attached for the purpose of using the exhaust air blast as a blower, said blower being used to blow dust from crevices and surfaces.

My invention is particularly adapted to be used in connection with a vacuum cleaning machine, the pump being used to create a vacuum or suction. It is a well-known fact that a suction pump is more efficient than an exhaust fan when used to create a vacuum; therefore it is essential to construct a pump which is simple, light in weight and efficient, in order that it may be suitably mounted and connected to the cleaner mechanism.

My invention consists in a cylinder, an intake chamber dividing said cylinder into two compartments, a piston rod adapted to carry two piston heads, apertures in said intake chamber communicating with the compartment of the cylinder, valves covering said apertures, openings in said piston heads, and valves covering the openings, said valves all adapted to operate in conjunction with the piston rod and piston heads of the pump.

My invention also consists in the novel combination and arrangement of parts set forth and claimed.

In the accompanying drawing which serves to illustrate my invention: Figure 1 is a vertical section taken through the center of the pump constructed in accordance with my invention. Fig. 2 is a plan view of a pump shown in Fig. 1, part of the upper valve being broken away for the sake of clearness. Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1. Fig. 4 is a section of the sleeve. Fig. 5 is a vertical section of a pump adapted to be used as a pressure pump. Fig. 6 is a cross section taken on the line 6—6 of Fig. 5, and Fig. 7 is an enlarged detail cross section of the sleeve and annular ring employed in the outlet chamber of the pressure pump, shown in Fig. 5.

In the embodiment of my invention as illustrated and which shows a preferred construction, 1 represents a cylinder in which the piston heads 2 and 3 are adapted to operate. The piston heads 2 and 3 are mounted upon a piston rod 4. The cylinder 1 is provided with partition heads 5 and 6 adjacent to the central part thereof, thus forming a chamber 7 therebetween, said chamber 7 having an intake opening 8 which extends through the wall of the cylinder 1. The intake chamber 7 is also provided with apertures 9 and 10 communicating with the upper and lower cylinder compartments 11 and 12 respectively. The piston rod 4 is provided with a sleeve 13 which is slidably mounted thereon and is adapted to carry valves comprising disks 14 and 15. The sleeve 13 is preferably provided with annular shoulders 16 and 17 respectively, which the disks 14 and 15 are adapted to engage. These disks 14 and 15 are preferably made of leather or some other pliable material and are supported by means of the metal disks 18 and 19 respectively, which are held in place upon the sleeve 13 by means of nuts 20. It is seen by referring to Fig. 1 that the sleeve 13 is of greater length than the thickness of the chamber 7, allowing sufficient opening of the apertures 9 and 10 for the free passage of air, and that the disk 14 is closing the aperture 9 while the disk 15 is a short distance away from the aperture 10 in the partition 6, thus allowing the air to pass from chamber 7 to compartment 12 of the cylinder. Thus the valves for the intake chamber 7 which control the inlet or air to the compartments 11 and 12 of the cylinder move in unison with the piston, but are not dependent upon it for their action, as will be hereinafter shown. Assuming that the piston rod 14 is moving in the direction of the arrow, the movement of the piston rod upon the sleeve 13 will tend to carry the disk valves in the right direction. However, the opening and closing of the valves is not dependent upon this movement of

the rod, but is accomplished positively and almost instantaneously by the pressure of the air on the flat disks, thereby closing the aperture 9 and opening the aperture 10, and vice versa.

The main piston heads 2 and 3 are constructed in an ordinary manner, and comprise a metal plate 21, a disk 22 made preferably of leather or other suitable material adapted to engage the sides of the cylinder 1, and another plate 23 clamping said disk 22 between it and the plate 21, the plates 21 and 23 and the disk 22 being provided with a series of openings 24 all registering with one another to make one continuous aperture connecting the chambers 11 and 12 with the outside of the pump. Leather disks 25 are provided on the outside of said piston heads 2 and 3, and fit loosely around hubs 26 provided on the plates 23 of the piston heads. For the purpose of stiffening said disk 25 which is preferably made of pliable material such as leather, I provide a metal disk 27 thereon, which is adapted to rest upon the hub 26, thus the leather disk 25 is free to move up and down upon the hub 26. The plate 23 on the piston head 3 of the pump is held in place by means of a nut 28. The plates 21, 23 and the disks 22 are held in place relative to one another by means of a pin 23′ or projection on the plates 23 which extends through the disks 22, and plates 21, thereby preventing them from turning relative to each other, and also retaining the openings 24 in proper relation to each other. The plate 23 on the piston head 2 of the pump is held in place by means of a head 29 screw threaded on the piston rod 4, and which is adapted to also clamp the metal disk 27 in position upon the hub 26. The head 29 is bifurcated to receive a connecting rod or link 30 which is preferably pinned by means of a pin 31 to the head 29. This connecting rod may connect the piston rod of the pump by means of a crank or lever to any source of power desired.

The operation of the device is readily seen and is as follows: Supposing the piston to be moving in the direction of the arrow, it is obvious that the intake of air coming through the inlet 8 into chamber 7 is passing through the aperture 10 into the cylinder compartment 12, owing to the fact that the cylinder head 3 is moving downwardly and thereby drawing the air therein, the apertures 24 in the piston head 3 being closed by means of the disks 25. The aperture 9 in the partition 5 is closed, owing to the fact that the piston head 2 is descending, thereby tending to compress the air in the compartment 11, the air therein escaping through the apertures 24 which are open because of the fact that the disks 25 are unseated or lifted from the surface of the metal plate 23 by the pressure of the escaping air from compartment 11. The device acts in just the opposite way when the piston rod is moving in an upwardly direction. The upper cylinder will then draw the air through the inlet 8 and chamber 7, while the valve in the head 3 will allow the air contained in compartment 12 to pass through the head to be forced out through nozzle 36 on the next downward stroke, it being apparent that when the piston is moving downwardly the air is drawn into inlet 8 and exhausted through the lower end of the cylinder, and that the suction through inlet 8 is continued during the upward movement of the piston by drawing the air into compartment 11 and exhausting it at the upper end of the pipe.

The cylinder 1 is preferably placed upon a base 32, which has an aperture 33 therein. The aperture 33 is covered with a housing 34, having a long neck extension 35 fastened thereto to form a nozzle 36 to which a hose may be attached. Thus when the cylinder head 3 is moving downwardly, it is forcing the air through the aperture 33 and through the nozzle 36, and is producing an air blast at the end of the nozzle 36 which can suitably be used as a blower, thus I use the exhaust of one compartment of the cylinder 1 as a blower. By constructing the pump in this manner, I am enabled to produce a pump at much less expense than those now in use, and cause practically an uninterrupted suction upon an air separator such as is used in vacuum cleaners, and to which a pump of this kind is adapted to be attached.

When it is desired to use my device primarily as a pressure pump I reverse the position of the valves as shown in Fig. 5. In this figure it is seen that I construct the piston heads 2′ and 3′ in the same manner as those constructed and shown in Fig. 1 with the exception that I place the leather disks 25 on the opposite sides of said piston heads, the disks 25 being on the lower side of the piston head 2′ and on the upper side of the piston head 3′. The chamber 7′ which is shown as an intake chamber in Fig. 1, of course will be an exhaust or outlet chamber when the pump is used as a pressure pump.

Referring to Fig. 5, the partition head 5′ is detachably connected to a flange 40 by means of screws 41, for the purpose of inserting or removing or repairing the valves within the chamber 7′. The outlet chamber 7′ is provided with openings 9′ and 10′ which communicate with the compartments 11′ and 12′ respectively in the cylinder. Disks 14′ and 15′ are adapted to cover over their respective openings 9′ and 10′, according to the direction the piston rod 4′ is carrying the piston heads. The disks 14′ and 15′ are adapted to be mounted upon an annular ring 37, which is screw threaded

at 38 upon a sleeve 39, the sleeve 39 being slidably mounted upon the piston rod 4′.

Thus the operation of the device as a pressure pump is as follows: When the piston heads are moving in the direction of the arrow, (Fig. 5) the air in compartment 11′ of the cylinder is being forced downwardly, through the opening 9′ against the disk 14′, thereby unseating said disk, and forming a passage into outlet chamber 7′ into which the air is forced and discharged through the outlet nozzle 8′. As the piston heads descend the sleeve 39 also moves downwardly, and the disk 15′ seats upon partition 6′, thereby closing the opening 10′ as the disk 14′ is unseating from the partition 5′. As the lower piston head 3′ is descending, the air beneath it will unseat the disk 25′ and pass upwardly through the openings 24 into the compartment 12′ of the cylinder. When the piston head 3′ has reached its lowermost position, the compartment 12′ will be full of air, and as soon as the piston head 3′ begins to return in the opposite direction, the charge of air which is filling the chamber 12′ will then be forced into the outlet chamber 7′, while the upper compartment 11′ will be filling in the same manner as the compartment 12′, fills when the piston is descending. Thus practically a continuous air blast is being forced from the nozzle 8′. If desired, the cylinder may be placed upon the same base 32, as shown in Fig. 1, which is provided with the aperture 33, said aperture being covered with the housing 34, and said housing having the long neck extension 35, the same as that shown in Fig. 1. This arrangement of course will provide a nozzle 36 which will be an intake nozzle instead of an exhaust nozzle to create a suction which may be used for any desired purpose. The construction for a pressure pump is exactly the same as for an exhaust pump, with the exception that the valves are inside the piston heads and inside the chamber 7 instead of outside. It will be seen that when constructed as an exhaust pump both pistons act to produce a practically continuous exhaust, while pressure is furnished incidentally by the lower piston. When constructed for a pressure pump, both pistons operate to produce a practically continuous pressure, while suction is furnished incidentally by the lower piston.

The construction of my device is extremely simple and compact, its action is positive and certain, and the air suction or pressure produced is continuous and effective to the highest degree, the device being adapted to produce the maximum of pressure or suction with the application of a minimum of power. The device being constructed with open ends, permits of ready and easy access to the piston heads and valves for repairing and replacing of parts when necessary.

Some of the advantages of my invention are:

First. By this construction, I am enabled to effect a considerable saving in the cost of manufacture; to make a cylinder of lighter material because I do not have to provide for external piston heads or means for clamping them to the cylinder. Further, I do not have to provide valve chambers, or valve seats; further, I do not have to provide a slide for the connecting rod which communicates the motion of the crank to the pistons. By my construction, the two piston heads on one rod working in one cylinder, form the most efficient kind of slide.

Second. By this construction I am also enabled to make the cylinder out of lighter material without the expense of boring, as the pistons thus constructed adjust themselves to any slight inequality in the cylinders.

Third. By this construction I am enabled to make a pump of very light weight in comparison with its efficiency, which is a very decided advantage in vacuum cleaning machines.

Fourth. By this construction I get far greater efficiency in proportion to the amount of energy used, because the friction on the pistons is reduced to the minimum, and because there is practically no friction or loss of energy in the operation of the valves.

Fifth. By this construction I make a pump that is neat and compact in appearance, the cylinder presenting a smooth, unencumbered exterior, all the valves and mechanism being inside the cylinder.

Sixth. There are no valve seats or valve chambers to make, the heads of the cylinder and the piston heads constituting the valve seats.

All of the valves being inside, the cylinder is not encumbered with any exterior mechanism such as valve seats, anti-chambers, inlets and exhaust ports, etc. The valves being placed on the flat surfaces of the piston heads and cylinder heads, allow for full, free ports and instantaneous opening and closing.

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

1. An air pump of the character described comprising a cylinder 1 open at the ends and having an intake opening near its center, partition heads 5 and 6 fixed upon opposite sides of said intake opening within said cylinder to form an intake chamber 7, said heads having central apertures 9 and 10 respectively, a piston rod 4 carrying piston heads 2 and 3 respectively, said piston rod adapted to operate through said intake chamber, said piston heads comprising a metal plate 21, a flexible disk 22 and a metal

plate 23 adapted to clamp said flexible disk in place, said plates 21, 22 and 23 being provided with a series of openings 24 all registering with one another to make continuous apertures therethrough connecting the chambers 11 and 12 with the outside open ends of the pump, and a pin 23′ projecting from plate 23 through plates 22 and 21 respectively to hold said plates from turning relatively to each other for the purpose of retaining the openings 24 in each plate in alinement with those of the adjacent plates, a hub 26 upon the outer side of each piston head 2 and 3 respectively, a metal disk 27 fixed upon said piston rod 4 against said hub 26 and a flexible valve 25 having a central opening and mounted to slide upon said hub between said disk and its adjacent piston head to open and close said openings 24, and means for reciprocating said piston heads and valves, substantially as set forth and for the purposes specified.

2. An air pump comprising a cylinder 1 open at both ends, and having an intake opening 8 at the center, heads secured to opposite sides of said intake opening within said cylinder forming an intake chamber 7 therebetween, a double valve having a stem extending through said intake chamber and having flexible washers adapted to engage the outer sides of said heads to open and close the same respectively, a base adapted to partially close one end of said cylinder, and having a central aperture therein, a housing adapted to cover said aperture and a neck extension connected to said housing, whereby a reduced outlet is formed to cause the exhaust air to pass out therethrough with greater velocity to utilize said air blast as a blower, and piston heads mounted upon said piston rods upon opposite sides of said intake chamber and between the ends of said cylinder, substantially as set forth and for the purposes specified.

3. An air pump of the character described comprising a cylinder open at one end and partially closed at the other end, with a small central opening near its center, a tube communicating with said central opening, an intake chamber and an intake port, a piston rod, valves for said intake chamber slidably mounted upon said piston rod, and piston heads mounted upon said rod, substantially as set forth and for the purposes specified.

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