No. 714,342. Patented Nov. 25, 1902.

R. WATSON.

APPARATUS FOR TREATING DISEASES BY VACUUM AND AIR PRESSURE.

(Application filed Mar. 11, 1902.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

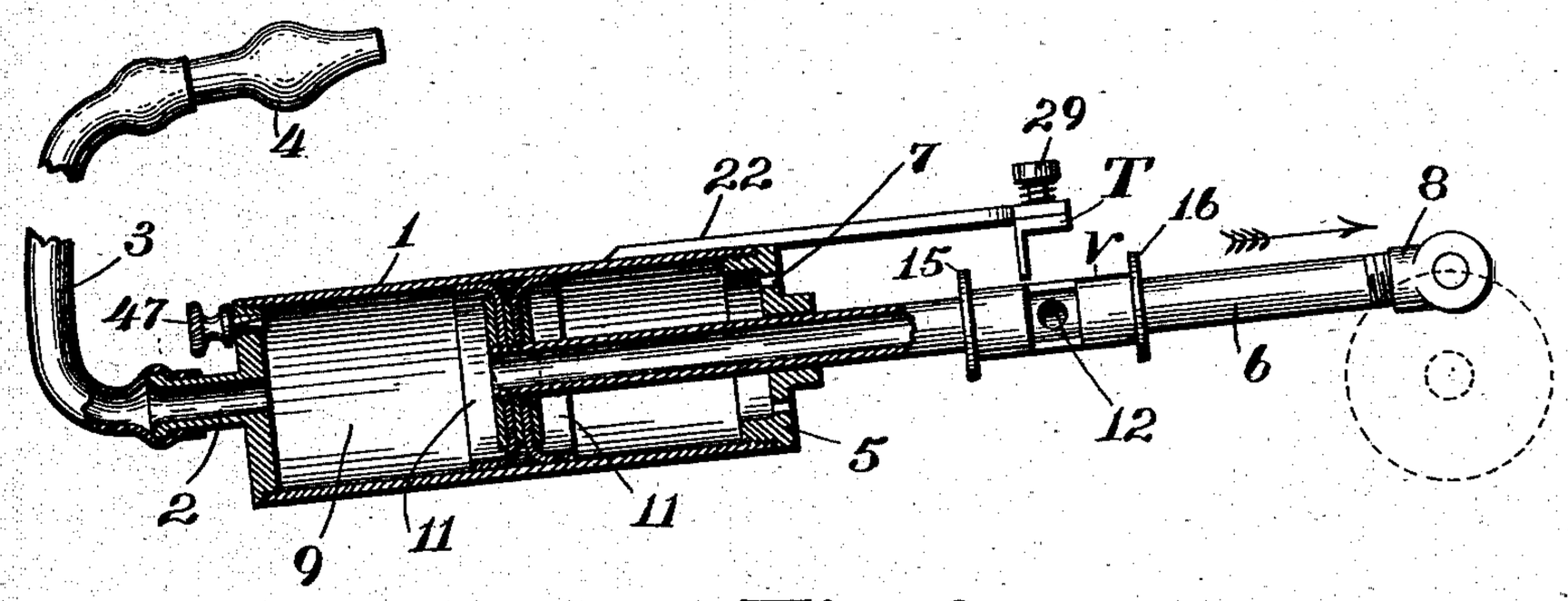


Fig. 2.

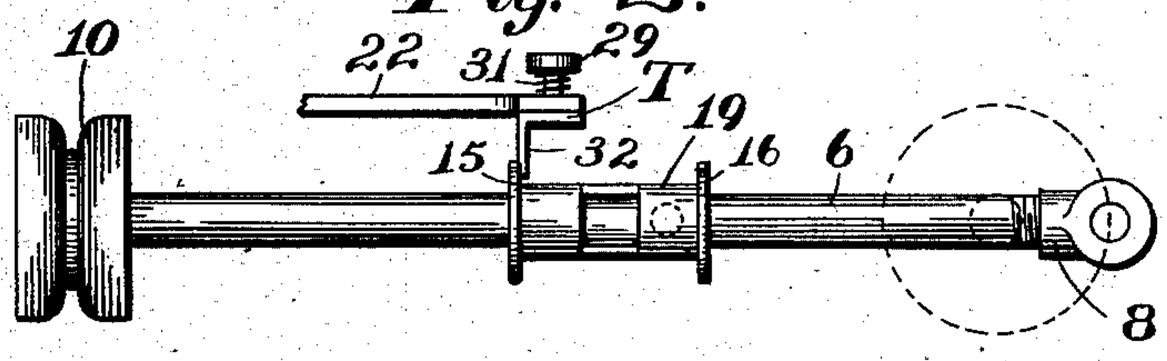


Fig. 3.

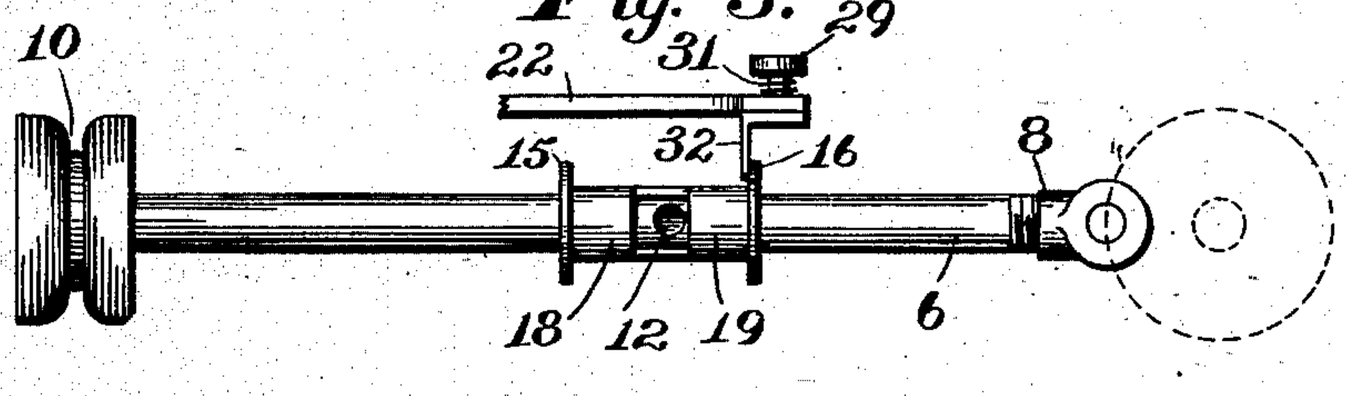


Fig. 9.

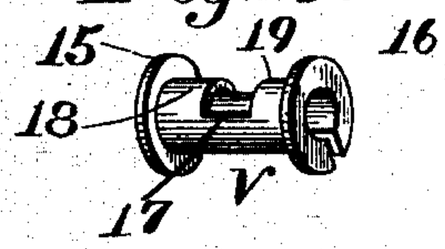


Fig. 10.

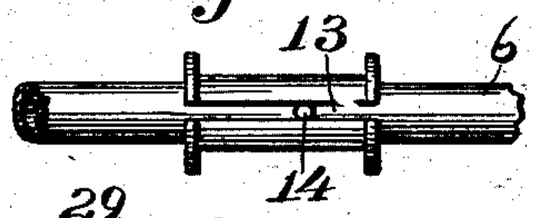


Fig. 11.

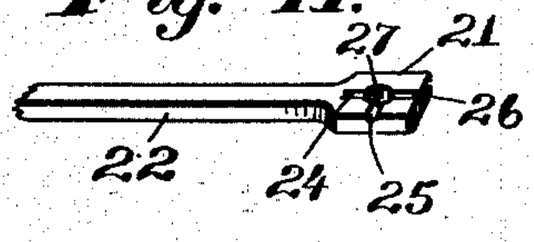
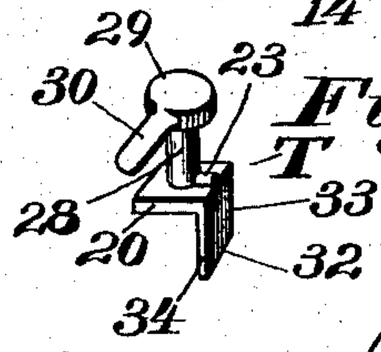


Fig. 12.



Witnesses
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Fig. 4.

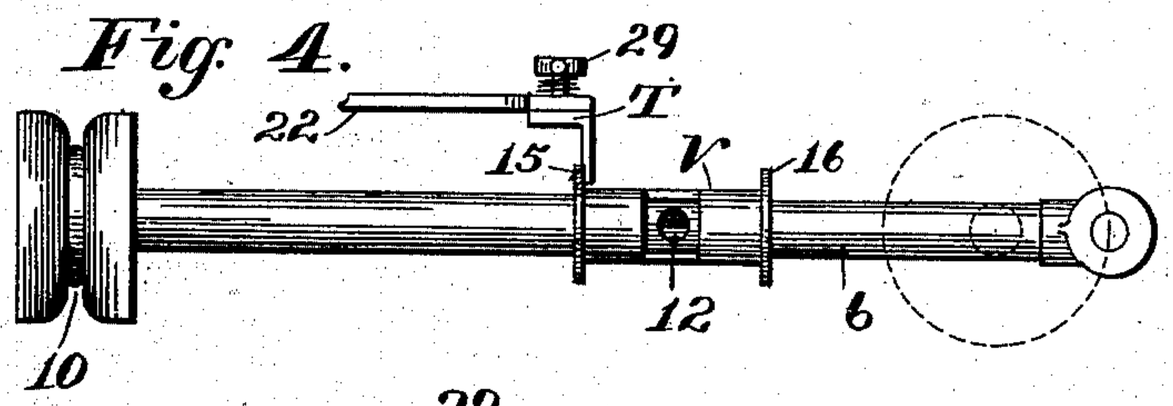


Fig. 5.

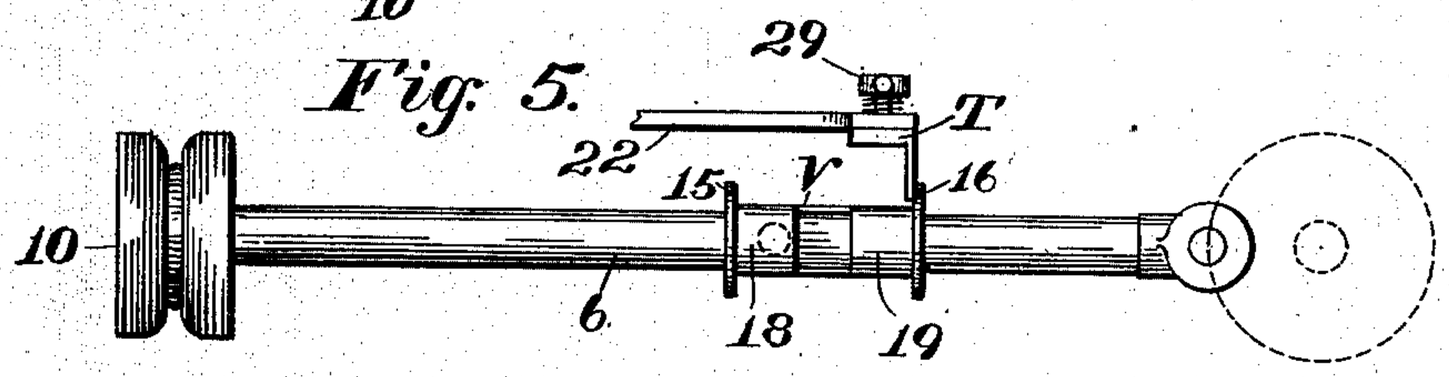


Fig. 6.

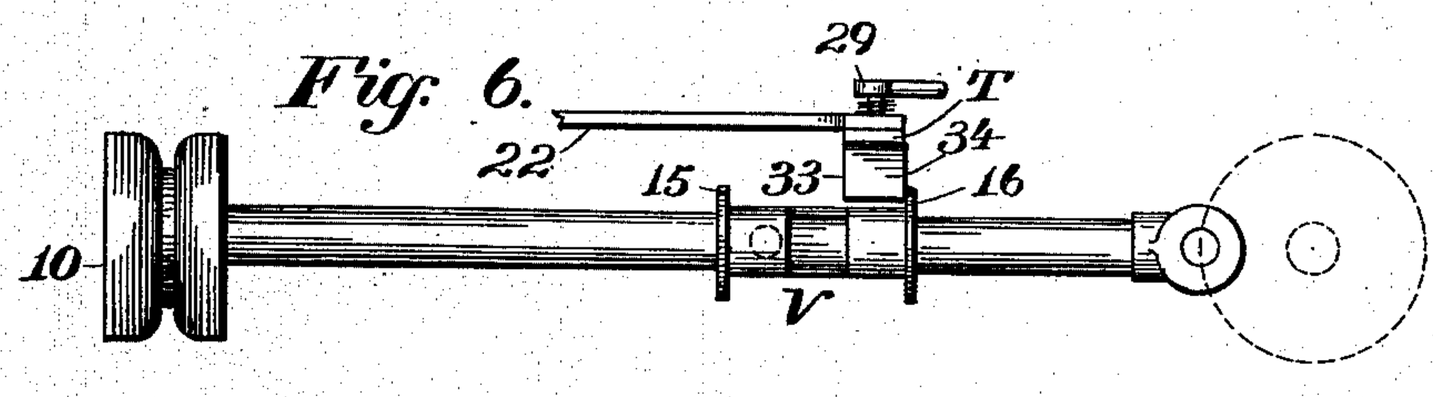


Fig. 7.

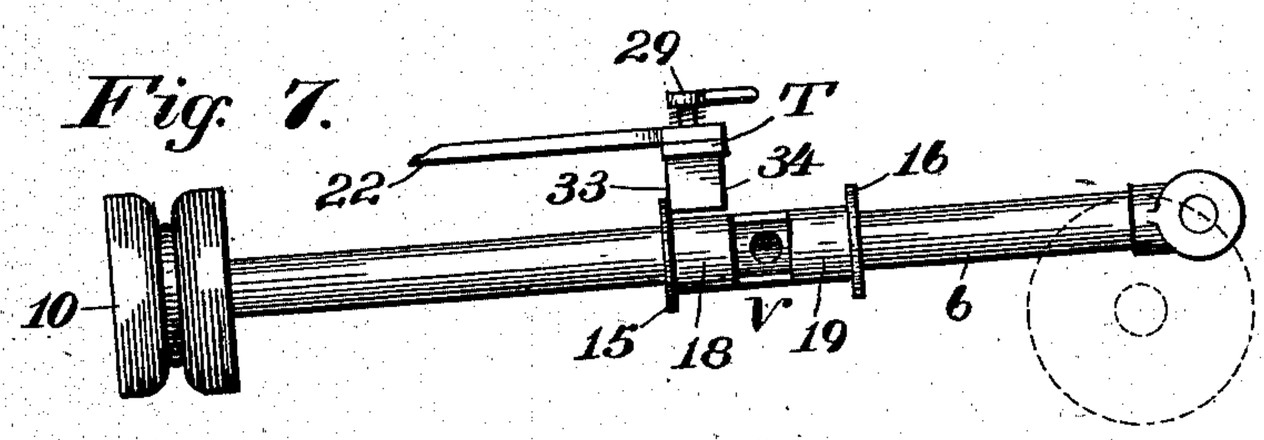
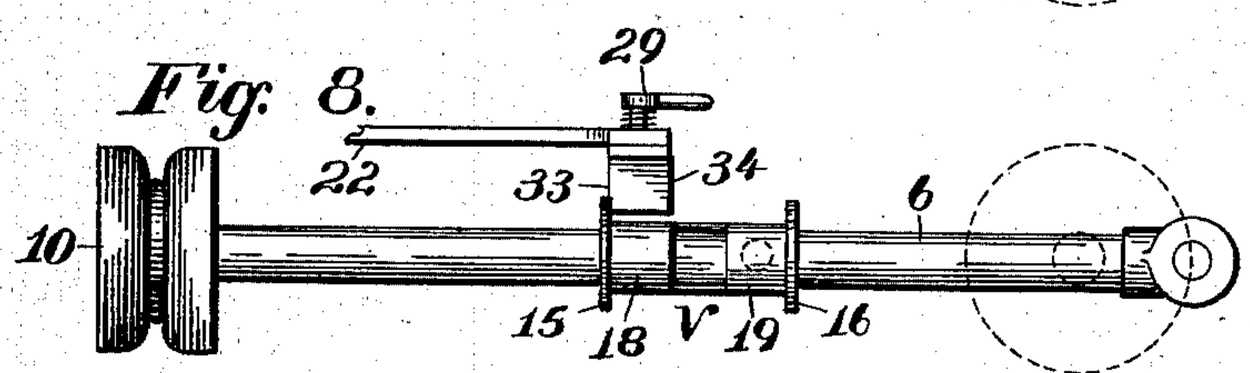


Fig. 8.



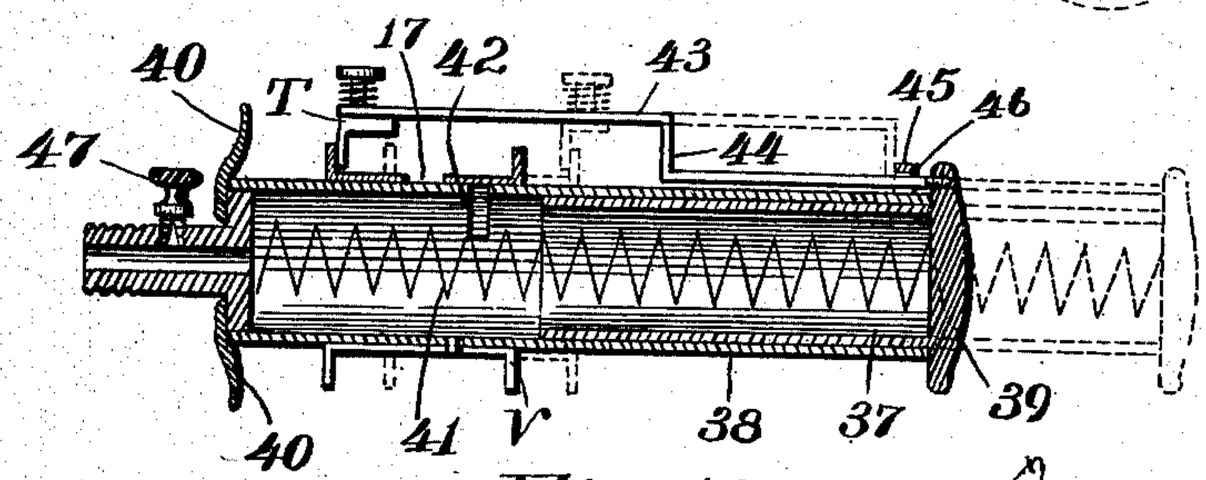


Fig. 13.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR TREATING DISEASES BY VACUUM AND AIR PRESSURE.

SPECIFICATION forming part of Letters Patent No. 714,342, dated November 25, 1902.

Application filed March 11, 1902. Serial No. 97,681. (No model.)

To all whom it may concern:

Be it known that I, ROBERT WATSON, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Apparatus for Treating Diseases by Vacuum and Air Pressure, of which the following is a specification.

The purpose of the present invention is to provide an apparatus for the local treatment of disease by vacuum and air pressure; and it comprises a cylinder having an opening adapted to be closed by the part of the body to be treated and an air inlet and exit port, a valve adapted to open and close said port, a reciprocative piston and a tappet adjustable relatively to the valve and arranged to engage said valve and move it relatively to the port into the proper positions to cause the apparatus to successively compress, successively rarefy, or alternately compress and rarefy the air within the cylinder, the internal and external air-pressures being permitted to equalize at the completion of each operation of compression and rarefaction.

In the accompanying drawings, Figure 1 shows a pump embodying my improvements, the pump-cylinder being shown in central section and the valve-tappet being adjusted to cause compression of the air within the cylinder. Figs. 2 and 3 are views of the piston, piston-rod, valve, and tappet, showing the tappet in the same position as in Fig. 1 and illustrating the position of the valve at the end of each stroke. Figs. 4 and 5 are similar views showing the tappet arranged to adjust the valve for suction only. Figs. 6, 7, and 8 are similar views showing the tappet arranged to cause alternate compression and rarefaction of the air within the cylinder. Fig. 9 is a perspective view of the valve. Fig. 10 is a view showing the rear side of the valve and a portion of the piston-rod, having a guide-pin thereon for preventing the turning of the valve upon the rod. Fig. 11 is a perspective view of the end of the tappet-support. Fig. 12 is a similar view of the tappet; and Fig. 13 is a longitudinal section through a pump, in which the tappet is movable with the piston instead of being fixed relatively thereto.

Referring to Fig. 1 of the drawings, 1 indicates a cylinder having a tubular projection 2 at one end, to which may be connected a flexible tube 3 and a tubular part 4, adapted to be applied to and closed by the ear or other part of the body which is to be treated. A cap 5 is fitted to the opposite end of the cylinder and serves as a bearing for a tubular piston-rod 6. Openings 7 are formed in this cap in order to permit the air to circulate freely therethrough. The outer end of the piston-rod is closed by a head 8, which, as shown in the drawings, is suitably formed for attachment to a driving-crank. The inner end of the piston-rod is open and communicates with the space 9 in the forward part of the cylinder. A piston 10 is secured to the piston-rod, this piston being conveniently formed by arranging a pair of leather cups 11 back to back and securing them around the rod. An air inlet and exit port 12 is formed in the rod exteriorly to the cylinder 8. This vent is adapted to be opened and closed by a valve V, which is arrested at different points in the movement of the piston-rod by means of an adjustable tappet T. The valve, as shown in Figs. 9 and 10, consists of a sleeve having an internal bore of the same diameter as the piston-rod and having a slot 13 extending longitudinally through it. The sleeve thus has sufficient elasticity to cause it to be frictionally held upon the rod in any position, and the sleeve is prevented from turning upon the rod by a pin 14, projecting from the rod into the slot. Flanges or projections 15 and 16 are formed at the opposite ends of the sleeve and adapted to be engaged by the tappet, and the central part of the sleeve on the side opposite to the slot 13 is cut away, as shown at 17, in order that the air may escape or enter through the port 12 when said port is in register with the opening 17. The valve is a double one, having two valve portions 18 and 19 at the opposite ends of the opening 17, adapted to close the port 12. The piston-rod has a fixed range of movement, and the valve V, which is arrested by

the tappet before the completion of the piston-stroke, has a shorter range of movement. If the stroke of the piston, for instance, is one inch, the length of the valve-sleeve between the flanges may be conveniently three-fourths of an inch, and by making the opening 17 one-fourth of an inch long the valve portions 18 and 19 of the sleeve will each be of the same length. The tappet T consists of a flat piece of metal having a part 20 adapted to seat against the under side of the end 21 of a tappet-arm 22, which, as shown, is secured to the cylinder. The part 20 has a rib 23, adapted to fit into any one of three grooves 24, 25, and 26 upon the end of the tappet-arm and radiating from an opening in said arm, through which a stud 28 upon the tappet projects. This stud is provided at its upper end with a head 29, to which is attached a handle 30. A spring 31, arranged between the head and the tappet-arm, draws the tappet against the lower face of the arm and holds the rib 23 within any particular groove in the arm. The depending part 32 of the tappet projects downwardly between the flanges of the valve-sleeve and is adapted to engage said flanges, thereby arresting the movement of the sleeve. For a piston-rod having a movement of one inch and a valve-sleeve having valve portions of the dimensions above given the part 32 of the tappet should be approximately one-quarter of an inch wide, and the center of the stud 28 should be about one-eighth of an inch removed from the depending portion 32, so that the depending part of the tappet may be swung into two positions one-quarter of an inch apart, as shown in Figs. 1 and 4, and it may be turned so that its opposite sides 33 and 34 will be one-quarter of an inch apart longitudinally of the piston-rod, as shown in Figs. 6, 7, and 8. These dimensious are merely given for the purpose of illustration.

The operation of the pump illustrated in Figs. 1 to 12, inclusive, is as follows: When the tappet is turned into the position shown in Figs. 1, 2, and 3, the rib 23 upon the tappet enters the groove 24, and the tappet is thus locked in position. While the piston-rod is moving outward, the port 12 registers with the opening 17 in the sleeve and air may freely enter through the tubular rod into the cylinder, thus preventing the formation of a partial vacuum therein. When the piston reaches the three-quarter stroke, the flange 15 upon the sleeve engages the tappet and is arrested thereby until the completion of the stroke. The port 12 therefore passes under and is closed by the valve portion 19 of the sleeve, as shown in Fig. 2, and upon the ensuing inward stroke of the piston-rod compression takes place within the cylinder, assuming, of course, that the tubular end piece 4 is closed by application to the part of the body to be treated. When the piston-rod has completed three-quarters of its inward movement, the flange 16 is engaged and held by the tappet until the completion of the stroke, thus permitting the port 12 to pass out under the valve portion 19, as shown in Fig. 3. The air therefore after having been compressed within the cylinder is released and air can again flow into the cylinder during the outward movement of the piston-rod. When the tappet is turned into the position shown in Figs. 4 and 5, this depending portion 32 is in advance of the position shown in Figs. 1, 2, and 3, and it will therefore arrest the sleeve at points a quarter of an inch in advance of the points where the sleeve is arrested by the tappet in Figs. 1, 2, and 3. This will cause the port 12 to move under the valve portion 18 of the sleeve on the inward stroke and to move from said position into register with the opening 17 at the completion of the outward stroke. The port will thus remain closed during the outward stroke of the piston, causing a partial vacuum within the cylinder, and will remain open during the return stroke, thus preventing compression of the air within the cylinder. When the tappet is turned into the position shown in Figs. 6, 7, and 8, with the rib 23 resting in the groove 25 of the tappet-support, the sleeve will have a movement equal to about one-half the stroke of the piston-rod instead of three-quarters, as in the previusoly-described figures. Fig. 6 represents the position of the sleeve at the completion of the inward stroke, wherein the port 12 is covered by the valve portion 18 of the sleeve. This port will remain closed during the first half of the outward stroke, causing suction. The flange 15 then engages the side 33 of the tappet and is arrested thereby, so that the port 12 moves into register with the opening 17, as shown in Fig. 7, thus permitting air to rush into the cylinder, and as the piston-rod completes its stroke the port 12 passes under the valve portion 19 and is closed thereby, as shown in Fig. 8. Compression of the air will then take place upon the return stroke of the piston during the first half of its movement and until after the flange 16 engages the side 34 of the tappet, when the port 12 will move across the opening 17, permitting the compressed air to escape, and said port will then pass under the valve portion 18 of the sleeve, thus closing the port for the ensuing outward stroke. It will be apparent, therefore, that when the tappet is arranged as shown in Figs. 6, 7, and 8 the air within the cylinder will be rarefied upon the outward stroke of the piston-rod and will be compressed upon the inward stroke, the internal and external air-pressures being equalized at the completion of each operation through the registering of the port 12 with the opening 17 in the sleeve.

In Fig. 13, which shows a hand-pump, the piston consists of a tube 37, fitting telescopically within the cylinder 38, said tube being open at its inner end and having a cap 39 at

its outer end. Finger-pieces 40 are arranged at the forward end of the cylinder, and the piston is reciprocated by placing the fingers upon the parts 40 and pressing the cap 39 with the thumb. A spring 41 within the cylinder forces the piston outward, as shown in dotted lines, when the pressure of the thumb is relieved from the cap-piece. The port for the cylinder consists of a transverse slot 42, and the sleeve V, which serves as a valve, fits around the cylinder and is similar in construction to the valve-sleeve in the previously-described figures. The tappet also is constructed and arranged as in the previously-described figures; but the tappet-support 43, instead of being fixed relative to the piston, is connected to the cap-piece 39 of the piston and movable therewith. The tappet-support, as shown, has an offset portion 44, which when the piston is in its outermost position (shown in dotted lines) abuts against a stop 45 upon the side of the cylinder. The tappet-arm extends through an opening 46 in this stop projection. The inward movement of the piston is arrested by the abutment of the cap 39 against the end of the cylinder. The piston therefore has a fixed range of movement which is greater than the distance between the flanges upon the valve-sleeve, and the latter is so proportioned that the adjustment of the tappet into its three positions will close and open the port 42 in the proper manner to produce the three results desired—namely, compression only, suction only, or compression and suction alternately—according to the adjustment of the tappet.

The degree of compression or rarefaction of the air may be controlled by a suitable valve 47, as shown in Figs. 1 and 13. By pivoting the tappet at one side of its engaging end to the support and constructing the tappet so that the edges of said engaging end are separated from one another by a distance approximately equal to the diameter of the circle in which it swings the several functions of the apparatus may be performed by simply turning the tappet about its pivotal point into three positions.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an apparatus for treating disease, the combination with an air-chamber having an opening adapted to be closed by the part of the body to be treated, and having an air inlet and exit port, of a valve adapted to open and close said port and arranged to remain in its open position during one stroke of the piston and in its closed position during the succeeding stroke, a piston for compressing or rarefying the air within the chamber, and a tappet arranged to operate the valve so as to close said port at the completion of one stroke of the piston and to open the port at the completion of the succeeding stroke.

2. In an apparatus for treating disease by vacuum and air pressure, the combination with an air-chamber having an opening adapted to be closed by the part of the body to be treated and having an air inlet and exit port, of a valve having two portions adapted to extend over and close said port and an intermediate opening adapted to register with said port, a piston for compressing and rarefying the air within the chamber, and a tappet arranged to engage and operate the valve when the piston is operated.

3. In an apparatus for treating disease by vacuum and air pressure, the combination with an air-chamber having an opening adapted to be closed by the part of the body to be treated and having an air inlet and exit port, of a valve having two portions adapted to extend over and close said port and an intermediate opening adapted to register with said port, a piston for compressing and rarefying the air within the chamber, and a tappet adapted to operate the valve so as to close the port at the completion of one stroke of the piston and to open the port at the completion of the succeeding stroke.

4. In an apparatus for treating disease by vacuum and air pressure, the combination with an air-chamber having an opening adapted to be closed by the part of the body to be treated and having an air inlet and exit port, of a valve having two portions adapted to extend over and close said port and an intermediate opening adapted to register with said port, a piston for compressing and rarefying the air within the chamber, and a tappet adjustable relatively to the valve and adapted to operate the valve so as to close the port at the completion of either the inward or outward stroke of the piston and to open the port at the completion of the succeeding stroke.

5. In an apparatus for treating disease by vacuum and air pressure, the combination with an air-chamber having an opening adapted to be closed by the part of the body to be treated and having an air inlet and exit port, of a valve having two portions adapted to extend over and close said port and an intermediate opening adapted to register with said port, a piston for compressing and rarefying the air within the chamber, and a tappet adapted to operate the valve so as to close the port at the completion of each stroke of the piston and to open the port at an intermediate portion of the stroke.

6. In an apparatus for treating disease by vacuum and air pressure, the combination with an air-chamber having an opening adapted to be closed by the part of the body to be treated and having an air inlet and exit port, of a valve having two portions adapted to extend over and close said port and an intermediate opening adapted to register with said port, a piston for compressing and rarefying the air within the chamber, and a tappet adjustable relatively to the valve and adapted to operate the valve so as to close the port at the completion of either the in-

ward or outward stroke of the piston and to open the port at the completion of the succeeding stroke, and also to close the port at the completion of each stroke of the piston and to open the port at an intermediate portion of the stroke.

7. In an apparatus for treating disease by vacuum and air pressure, the combination with an air-chamber having an opening adapted to be closed by the part of the body to be treated and having a lateral inlet and exit port, of a valve comprising a sleeve having end portions adapted to close said port and having an intermediate opening, a piston adapted to rarefy and compress the air within the chamber, and a tappet adjustable into several positions relatively to the valve and adapted to engage and operate the valve.

8. In an apparatus for treating disease by vacuum and air pressure, the combination with an air-chamber having an opening adapted to be closed by the part of the body to be treated and having an air inlet and exit port, of a piston having a fixed range of movement, a valve comprising a sleeve, having end portions adapted to close said port and having a central opening, said sleeve also having flanges or projections thereon separated from one another by a distance shorter than the range of movement of the piston, and a tappet arranged to engage said projections alternately when the piston is reciprocated.

9. In an apparatus for treating disease, the combination with an air-chamber having an opening adapted to be closed by the part of the body to be treated, of a piston for rarefying or compressing the air within the chamber, a tubular piston-rod to which said piston is connected, said rod having a lateral port, a valve slidingly mounted upon said rod and adapted to open and close said port, and a tappet arranged to engage and operate said valve.

10. In an apparatus for treating disease by vacuum and air pressure, the combination with an air-chamber having an opening adapted to be closed by the part of the body to be treated, of a piston adapted to rarefy and compress the air within the chamber, a tubular rod to which said piston is connected, said rod having a lateral port, a valve comprising a sleeve mounted upon the piston-rod and having two portions adapted to extend over and close said port and having an intermediate opening, and a tappet arranged to engage and operate said valve.

11. In an apparatus for treating disease by vacuum and air pressure, the combination with an air-chamber having an opening adapted to be closed by the part of the body to be treated, of a piston adapted to rarefy and compress the air within the chamber, a tubular rod to which said piston is connected, said rod having a lateral port, a valve comprising a sleeve mounted upon the piston-rod and having two portions adapted to extend over and close said port and an intermediate opening and a tappet adjustable relatively to the valve and adapted to engage and operate said valve.

12. In an apparatus for treating disease by vacuum and air pressure, the combination with an air-chamber having an opening adapted to be closed by the part of the body to be treated and having a lateral inlet and exit port, of a piston for rarefying and compressing the air within the chamber, said piston having a fixed range of movement, a valve having end portions adapted to extend over and close said port and having an intermediate opening adapted to register with said port and shoulders separated from one another by a distance shorter than the range of movement of the piston, and a tappet extending between and adapted to engage said shoulders, said tappet and valve being relatively adjustable.

13. In an apparatus for treating disease by vacuum and air pressure, the combination with an air-chamber having an opening adapted to be closed by the part of the body to be treated and having a lateral inlet and exit port, of a piston for rarefying and compressing the air within the chamber, said piston having a fixed range of movement, a valve having end portions adapted to extend over and close said port and having an intermediate opening adapted to register with said port and shoulders separated from one another by a distance shorter than the range of movement of the piston, and a tappet extending between and adapted to engage said shoulders, said tappet being pivotally connected at one side of its engaging portion to a suitable support, and the edges of said engaging portion being separated from one another by a distance approximately equal to the diameter to the circle in which said tappet swings.

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

ROBERT WATSON.

Witnesses:
C. W. CLEMENT,
L. I. JONES.