No. 817,538. PATENTED APR. 10, 1906.

H. WIXON.

COMPOUND AIR PUMP.

APPLICATION FILED JULY 1, 1904.

2 SHEETS—SHEET 1.

Fig. 1

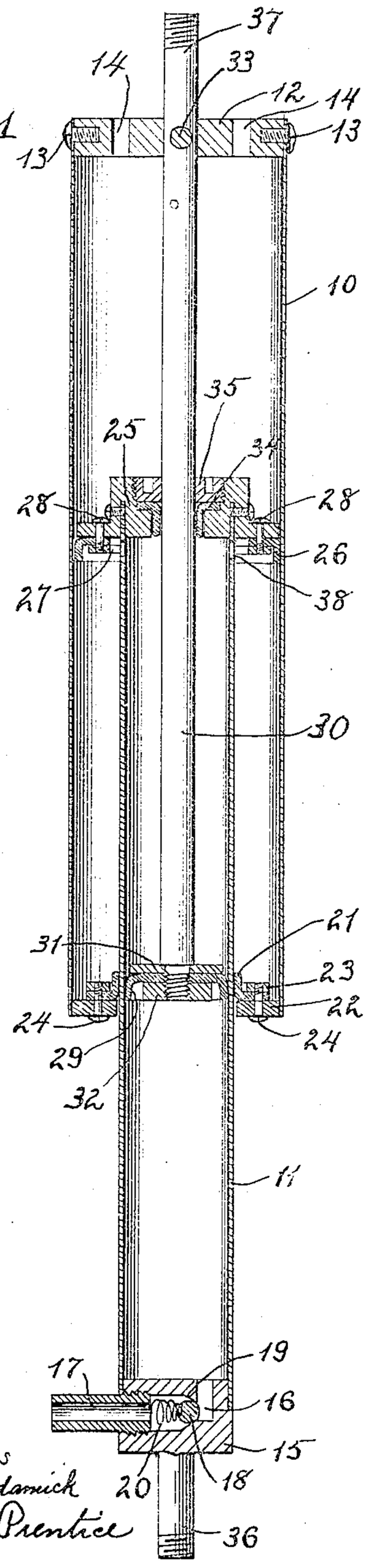
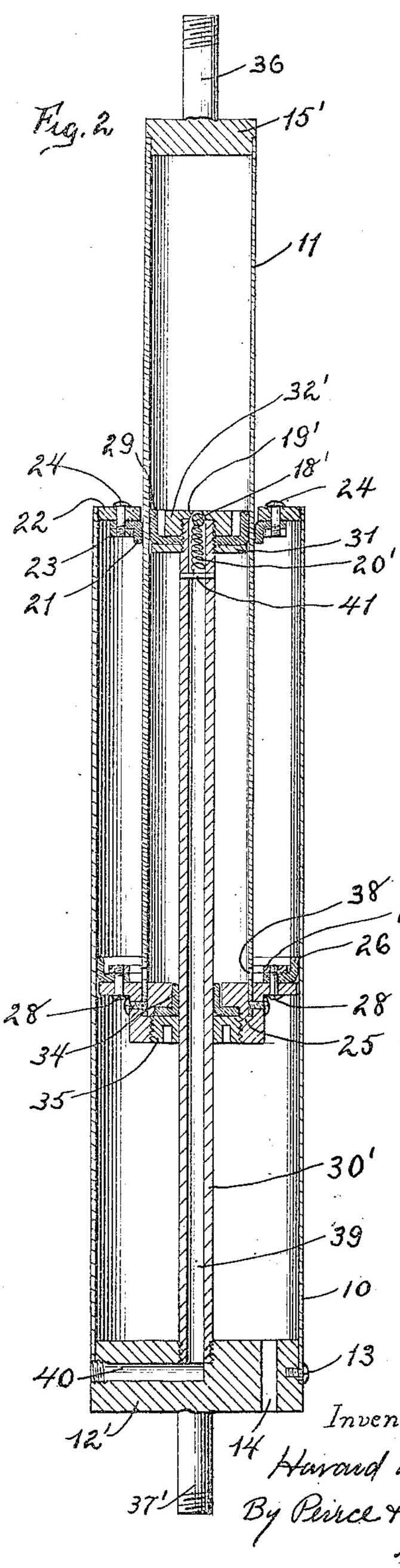


Fig. 2



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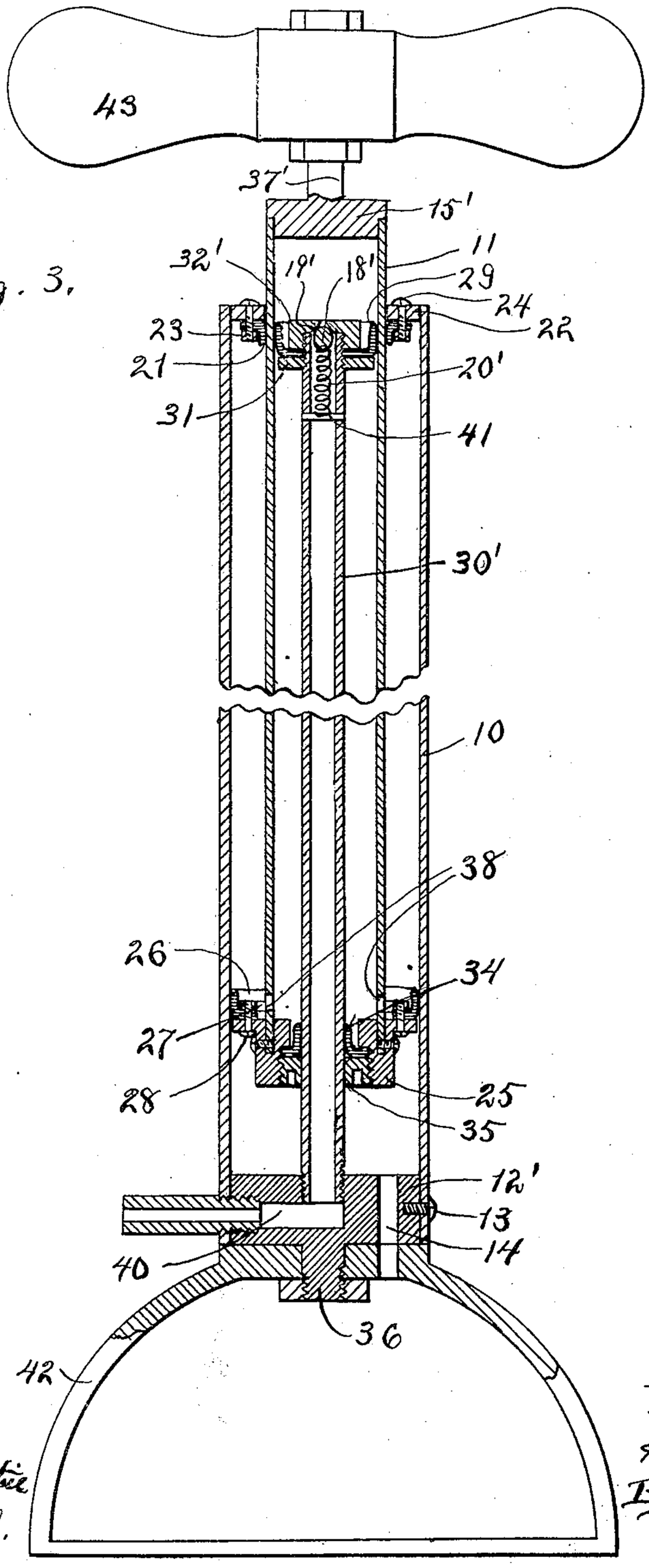
2 SHEETS—SHEET 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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COMPOUND AIR-PUMP.

No. 817,538. Specification of Letters Patent. Patented April 10, 1906.

Application filed July 1, 1904. Serial No. 214,920.

To all whom it may concern:

Be it known that I, HOWARD WIXON, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Compound Air-Pumps, of which the following is declared to be a full, clear, and exact description.

The improvement relates to air-pumps, and particularly to portable hand-pumps designed for the inflation of pneumatic tires of bicycles, automobiles, and other vehicles, and seeks to provide a simple and efficient form of compound pump by which the necessary high pressure may be obtained with little effort.

A further object of the invention is to provide an inexpensive form of compound pump which will obviate the necessity of employing costly valves and complicated packings and piston constructions.

The invention consists in the features of construction, combination, and arrangement of parts hereinafter set forth, illustrated in the accompanying drawings, and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a longitudinal section through one form of the improved pump. Fig. 2 is a corresponding view of a modified construction. Fig. 3 is a view similar to Fig. 2, showing the pump in position for operation.

The improved pump comprises an outer low-pressure cylinder 10 and an inner concentrically-arranged high-pressure cylinder 11. These cylinders are relatively movable—*i. e.*, either one may be held stationary while the other is shifted to effect the operation of the pump.

The outer end of the low-pressure cylinder 10 may be freely opened to form an air-inlet or provided with a head 12, held in place at the outer end of the cylinder 10 by screws 13, and having unobstructed air-inlets 14. The head 15, however, at the outer end of the inner high-pressure cylinder forms an air-tight joint with the wall of the cylinder 11 to seal its outer end. In the form shown in Fig. 1 the head 15 is provided with a discharge-passage 16, communicating with a nipple 17, threaded into the body of the head 15, and the nipple 17 is arranged to receive the end of the flexible pipe leading to the tire or other receptacle for the compressed air. Preferably an outwardly-opening check-valve 18 in the form of a metal ball, as shown, is held against a conical seat 19 within the discharge-passage 16 by a spring 20.

An inturned flanged packing-ring 21 is secured to the inner head 22 of the outer cylinder 10 and is arranged to engage the outer wall of the inner cylinder 11. The packing-ring 21 is held in place upon the inner face of the head 22 by a metal ring 23 and screws 24, as shown. The inner head 25 of the inner cylinder 11 is laterally extended, as shown, and an inturned flanged or cupped packing-ring 26, mounted thereon, is arranged to engage the inner face of the outer cylinder 10. Packing-ring 26 is held in place upon the inner face of the cylinder-head 25 by a metal ring 27 and screws 28.

A piston in the form of a flanged cup-like packing ring or disk 29 is arranged within the inner high-pressure cylinder 11 and is held in place upon the end of a piston-rod 30 between a disk or washer 31 and a nut 32. Piston-rod 30 extends outwardly through the inner head 25 of cylinder 11 and is connected to the head 12 of the outer cylinder 10 by a pin 33. An inturned flanged packing-ring 34, of leather, rubber, or other suitable material, is mounted upon the head 25 and engages the piston-rod 30. The flanged packing-ring 34 is held in place within a recess in the head 25 by an annular screw-plug 35.

The head 15 of the inner cylinder is provided with an extended projection 36, and the piston-rod 30 has a projecting portion 37. As stated, the inner and outer cylinders are relatively shiftable. Either one may be stationary and the other shifted to operate the pump—that is to say, a foot or mount may be secured to either one of the projections 36 or 37 and an operating-handle secured to the other projection, or the pump could be held in the operator's hands and used by moving both cylinders together and apart.

The flanged packing-rings 21 and 26 are formed of rubber, leather, or other suitable yielding material, and either one or both of these packing-rings is arranged to yield in one direction to admit air to the space between the cylinders. Similarly the cupped piston 29 in the inner cylinder is formed of rubber, leather, or other suitable flexible material and is arranged to yield in one direction to permit air to pass from the inner end of the high-pressure cylinder to the outer end thereof. An unobstructed passage 38 af-

fords communication between the inner cylinder and the space between said cylinders and is preferably arranged, as shown, in the wall of the inner cylinder adjacent its inner end.

The operation is as follows: As the cylinders are telescoped or forced together—*i. e.*, on the instroke the inner ends thereof moved apart—one or both of the packing-rings 21 and 26 yield inwardly and admit air to the space between the cylinders, and since this space is in free communication with the inner cylinder 11 by through-passage 38 the air will also flow into and fill the inner cylinder. On the opposite or out stroke the inner heads 25 and 22 of the inner and outer cylinders, respectively, are moved together and the flanged portions of rings 21 and 26 expand and hug the walls, respectively, of the cylinders 11 and 10, so that the air in the space between the cylinders and in the inner cylinder is initially compressed and forced past the yielding packing-ring or piston 29 into the outer end of the high-pressure cylinder 11. When the stroke is again reversed, the flanged portion of the piston 29 will expand and hug the inner wall of the cylinder 11, and the previously-compressed air in the outer end of this cylinder is further compressed and forced out of the discharge-outlet 17. At the same time one or both of the packing-rings 21 or 26 will yield and admit air again to the inner and outer cylinders. It will be seen, therefore, that the packing-rings 21 and 26, in effect, form one-way yielding pistons for the outer low-pressure cylinder. The pump is adapted to be arranged in vertical position with either end uppermost, and whichever one of the packing-rings 21 or 26 is lowermost is preferably so snugly held in position that it will not yield. The purpose of this arrangement is to prevent dust and dirt upon the ground or floor from being drawn into the pump.

As stated, the pump is designed to be arranged either end uppermost, the lower section being held upon a suitable standard and the upper section connected to a suitable operating-handle. It will be observed that whichever end is uppermost the air is finally compressed in the high-pressure cylinder and the greater part of the work is done upon the downstroke.

The form shown in Fig. 1 is preferably held with the outer end of the low-pressure cylinder 11 and discharge-nipple 17 in lowermost position and fixed to a stationary standard. The form shown in Fig. 2, while it may be held either end uppermost, is particularly designed to be arranged with the outer low-pressure cylinder fixed to a standard or foot and in lowermost position, while the inner cylinder is connected to the operating-handle. The construction of the form shown in Fig. 2 is similar to that shown in Fig. 1, except that the air is discharged from the inner high-pressure cylinder through the bore 39 of the hollow piston-rod 30′, the bore or passage 39 communicating at its inner end with the inner cylinder 11 and at its outer end with a passage 40 in the outer head 12′ of the outer cylinder 10. In this form the nut 32′, which holds the yielding packing-ring or piston 29 in place, is provided with a conical seat 19′, and an outwardly-yielding check-valve 18′ in the form of a metal ball is held in the conical seat by a spring 20′, which extends between the ball-valve 18′ and a pin 41, arranged in the end of the piston-rod 30′. The outer head 15′ of the inner cylinder 11 in this form is solid, as shown, and the outer head 12′ of the outer cylinder is provided with an extension 37′.

In Fig. 3 the pump is shown in position for operation with a foot-piece 42, secured to the projecting lug 36, and a handle 43, secured to the extension 37′.

The operation is similar to that previously described. Upon the downstroke either one or both of the packing-rings 21 and 26 yield and admit air into the space between the cylinders and into the lower end of the inner cylinder 11 through the communicating passage 38. Upon the upstroke the air in the space between the cylinders and in the inner cylinder 11 is initially compressed and forced past the yielding ring or piston 29 into the upper end of the cylinder 11. On the next downstroke the air in the upper end of the cylinder 11 is further compressed, forced past check-valve 18 through the bore 39 of the hollow piston-rod 30′, and out of the discharge 40. On this downstroke a second charge of air is again admitted, as described, to the space between cylinders and to the lower end of the inner cylinder. In this form whichever end is uppermost the air is finally compressed and the greater amount of the work done upon the downstroke, which is, of course, desirable in a portable hand-pump.

It will be seen that a simple and inexpensive form of pump is provided in which only a single valve is employed, and this valve at the discharge-outlet may be dispensed with, if desired, since the check-valve in the nipple of the tire will perform its function. Check-valve 19, however, cuts down the amount of clearance and is preferably employed. The construction of the piston and packing-rings is inexpensive, but efficient. The pump may be easily operated to obtain the high pressures necessary with large tires.

It should be noted that the low and high pressure pistons are one-way yielding and oppositely acting—that is to say, the low-pressure piston yields on the instroke to admit air to the space between the cylinders and acts upon the outstroke to compress the air in this space, while the high-pressure piston yields on the outstroke to admit air to the

outer end of the high-pressure cylinder and operates on the instroke to compress the air in the outer end of the high-pressure cylinder. The high-pressure stroke is always the in or down stroke when the pump is used in vertical position, and this arrangement is a decided advantage inasmuch as the operator can, with little effort, exert considerable pressure on the downstroke. It should also be noted that no packings or valves are subjected to the high pressure in the outer end of the high-pressure cylinder, except the cupped piston 29, and here the pressure simply serves to make a tighter joint, so that the pump will not leak and the packings thereof will not soon deteriorate. It should be further noted that all pistons or packings are formed of flanged or cupped rings or disks and are all so disposed that when it is necessary that they should form a tight joint the air under pressure in the different cylinders so acts on these flanged packings as to press the same into engagement with the adjacent surface, and thereby prevent leakage. It should also be noted that the space in the low-pressure cylinder above the piston therein is always in communication with the space in the high-pressure cylinder below its piston. On the downstroke the air is finally compressed, as described, in the high-pressure cylinder and at the same time the low-pressure piston yields to admit air to the space between the cylinders and air is also drawn into the high-pressure cylinder through the communicating ports or passages by the partial vacuum which is formed therein. It will thus be seen that at each stroke an amount of air is compressed sufficient to fill both the annular space between the cylinders and the inner cylinder at atmospheric pressure.

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

1. A compound pump comprising an outer, low-pressure cylinder having an internal packing at its end, a high-pressure cylinder working through said packing and having an external piston working in said outer cylinder, a piston carried by said outer cylinder and working within said inner, high-pressure cylinder, said cylinders being in unobstructed communication at a point between said pistons, substantially as described.

2. A compound pump comprising an outer, low-pressure cylinder provided with an internal packing at its end and carrying a central rod having a piston thereon, an inner, high-pressure cylinder working between said packing and said piston, said high-pressure cylinder having a piston working in said outer cylinder and communicating at its inner end with the annular space between said cylinders, said pistons being one-way yielding and oppositely acting respectively to initially and finally compress air in the annular spaces between said cylinders and in the outer end of said inner cylinder, substantially as described.

3. A compound pump comprising a stationary outer low-pressure cylinder having an inlet at its lower end and an internal packing at its upper end and carrying a central rod with a piston thereon, and an inner, high-pressure cylinder shiftable between said packing and said piston and carrying at its lower end a piston working in said outer cylinder and a packing engaging said rod, said inner, high-pressure cylinder having an unobstructed port in its side wall adjacent its lower end, and said pistons being one-way yielding and oppositely acting respectively to initially and finally compress air in the annular space between said cylinders and in the upper end of said inner cylinder, whereby the initial compression takes place on the upper stroke and the final compression on the downstroke, and said piston-rod having a discharge-outlet passage extending therethrough, substantially as described.

4. A compound pump comprising an outer, low-pressure cylinder having at its upper end a downturned flanged packing-ring and an upturned flanged piston supported upon a central rod and an inner, high-pressure cylinder shifting between said packing and said piston and carrying on its lower end an upturned, flanged piston working in said outer cylinder and an upturned, flanged packing-ring engaging said rod, said inner, high-pressure cylinder having a port opening thereinto from the space between said cylinders, and said pistons and packing-rings being formed of yielding, flexible material, substantially as described.

5. A compound pump comprising a stationary, outer low-pressure cylinder, a reciprocating inner, high-pressure cylinder communicating therewith and provided at its lower end with a one-way yielding piston of flexible material working in said low-pressure cylinder, a rod carried by said outer, low-pressure cylinder and extending through the lower end of said high-pressure cylinder, and an upturned, one-way yielding piston of flexible material fixed to the upper end of said rod and working in said high-pressure cylinder, whereby the air is finally compressed on the downstroke, substantially as described.

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