

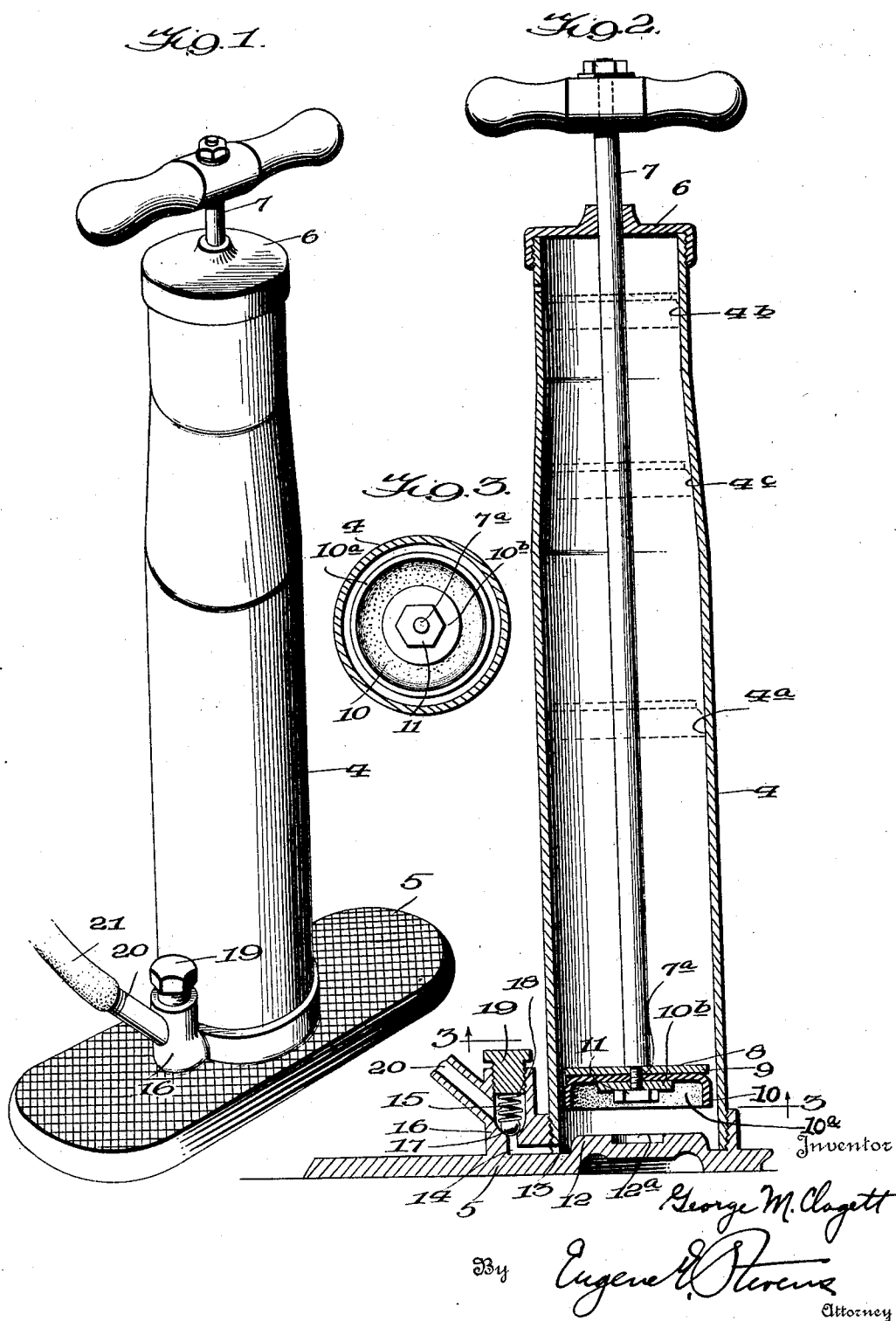
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PUMP

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My invention relates particularly to air pumps such as are used for inflating pneumatic tires but it is to be understood that it is equally applicable to all other varieties of pumps having a reciprocatory piston.

In my experience with the pumps of the prior art a number of difficulties have manifested themselves. In the first place the piston fails to take hold or catch the air until after the compression stroke is well started. In other words there is a lost motion at the beginning of the compression stroke. Also when it is sought to withdraw the piston after completing a compression stroke, I have found that a vacuum is created in the outlet end of the piston chamber and this vacuum, of course, resists movement of the piston on its return stroke until sufficient air has leaked past the piston to overcome the vacuum. This situation is particularly objectionable in pumps which involve a spring for effecting the return of the piston to starting position after a compression stroke. I have also observed that the leather piston washers or cups have a tendency, as a result of heat generated by reciprocations of the piston, or otherwise, to become "set",—that is to lose their flexibility and shrink away from the chamber walls. This, of course, permits air to pass around the piston on a compression stroke and the pump will not generate any pressure. In an attempt to overcome this tendency to shrink or "set", considerable oil is kept on the piston cup or washers as the case may be but even this fails to effectively remedy the condition. The presence of lubricant in the piston chamber of an air pump is manifestly objectionable due to the likelihood of the lubricant being forced from the pump into the valve of the tire or other receptacle.

It is therefore the object of my invention to overcome the foregoing and other objections which manifest themselves in the pumps of the prior art and to produce a

pump of simple, inexpensive and durable construction which will give efficient service over a long period of time with but little or no attention.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. However, in order that the invention may be better understood, reference should be had to the accompanying drawing illustrating what I now regard as the preferred embodiment. It is to be understood, of course, that I am in nowise limited to the illustrated form of the invention and that I may make such changes and modifications therein as fairly fall within the spirit and scope of the claims.

In the drawing,

Figure 1 is a perspective view of a pump embodying my improvements;

Fig. 2 is a central longitudinal section, and

Fig. 3 is a cross section of the line 3—3 of Fig. 2.

Referring specifically to the drawing, 4 indicates a tubular casing having one end threaded and screwed into a base 5. The other end of the casing 4 is closed by means of a screw cap 6. A piston rod 7 working through the cap 6 carries at its end a piston generally denoted at 8 and which comprises a backing disc 9, a leather piston cup 10 and a relatively smaller disc 10^b. The assembly is held together by means of a nut 11 screwed upon the end of the extension 7^a of the piston rod 7, the said extension passing through central openings in the elements of the piston as clearly shown in Fig. 2.

The major portion of the piston chamber is denoted by 4^a and Fig. 2 clearly illustrates that the upper end 4^b of the chamber is diametrically reduced. From the lower end of the reduced part 4^b, the walls of the chamber taper outwardly throughout a sub-

stantial portion of the length of the cylinder as indicated in 4°. Thus, the piston chamber 4^a may be said to comprise three sections,—first a diametrically reduced section, next an outwardly tapered section, and lastly an unreduced section the latter extending throughout the major portion of the length of the chamber, and at the end of which last named section a fluid outlet is provided. The major portion 4^a of the chamber is relatively oversize as compared to the diameter of the piston,—while the restricted part 4^b is relatively smaller in diameter than usual as compared with the diameter of the piston 8.

It is also to be noted from Fig. 2 that the diameter of the backing disk 9 and the normal diameter of the piston cup 10 is such as to snugly fit in the reduced end 4^b of the piston chamber. Thus, at the start of a compression stroke the piston cup 10 will immediately catch the air,—that is to say there will be no initial escape of air around the periphery of the cup 10 as is true in common forms of pumps after slight use. As the piston 8 is forced downwardly the air pressure against the bottom of the cup 10 increases and when the outwardly tapered section 4^c of the chamber is reached the pressure beneath the cup 10 will be sufficient to cause the wall 10^a thereof to flex circumferentially outward and be maintained in air-tight bearing engagement with the chamber wall. Manifestly this bearing engagement will be continued throughout the remainder of the compression stroke through the unreduced or slightly oversize part 4^a of the chamber. However, when the charge of air has been forced through the chamber there will be no pressure beneath the cup 10 and the depending wall 10^a will either assume the full-lined position of Fig. 2 spaced from the cylinder wall, or will remain in an outwardly flared state in but very light engagement with the cylinder wall. Thus the instant the piston 8 is started on its upstroke the pressure of air above will act upon the outwardly flared area of the wall to move it inwardly to the full line position of Fig. 2. With the wall 10^a of the piston cup clear of the chamber wall it will be evident that the commencement of the air-intake or return stroke of the piston 8 will be unretarded by any suction condition in the lower end of the chamber.

In the construction illustrated and described it is obvious that but a minimum amount of heat will be generated by reciprocations of the piston 8 for the reason that the cup wall 10^a is, broadly speaking, in engagement with the cylinder wall only during the compression stroke. As heretofore pointed out, in pumps of the prior art such heat as is generated by the piston rubbing against the cylinder wall while the pumps are in use does much to cause the piston cup or washers to become “set”, that is to lose their resiliency

and remain shrunk away from the chamber wall, also frequent lubrication fails to adequately remedy the condition. With my construction not only is the heat reduced as heretofore pointed out, but in addition the movement of the piston through the restricted, tapered, and enlarged parts of the cylinder in the normal operation of the pump, causes the effective part of the piston cup, namely the wall 10^a, to be repeatedly flexed. The wall 10^a of the piston cup is thus “exercised”, so to speak, and is prevented from becoming stiffened, or “set”. Little or no lubrication is required to keep the cup wall 10^a in a flexible state owing to this “exercising” to which it is subjected, and also in a lesser degree to the fact that its tendency to stiffen or “set” is greatly reduced owing to the absence of that high degree of heat which is generated by pistons which constantly engage the walls of their cylinders.

The base 5, as shown in Fig. 2, has a medial bosslike part 12 with a central recess 12^a in alinement with the nut 11 and of a size to accommodate the latter. The height of the boss 12 is less than the width of the wall 10^a of the cup 10 and surrounding the boss is a groove 13 designed to receive the cup wall 10^a. Since the depth of the groove 13 is less than the width of the cup wall 10^a,—the latter acts as a cushion and prevents the piston 8 from being banged against the boss. Furthermore, the pressing of the piston so as to engage the edge part of the piston cup wall 10^a in the bottom of the groove 13 further flexes or exercises said wall to keep it in flexible condition.

Outlet from the pump is had through a port in the end of the casing 4 which establishes communication between the piston chamber 4^a and a duct 14 which is formed in the base and has communication with a valve chamber 15 which is formed in an enlargement 16 of the base. A ball valve 17 backed by a spring 18 and a screw plug 19 normally acts to seal the mouth of the duct 14. The screw plug 19 is also the closure for the valve chamber 15. The forcing of the air into the duct 14 raises the ball valve 17 and permits the air to pass out through the nipple 20 into the hose connection 21.

Having thus described my invention, what I claim is:

1. A pump having a compression chamber restricted at its intake end and enlarged throughout the major portion of its length and at its outlet end, the portion of said chamber intermediate said restricted and enlarged portions having its walls tapered, a piston working in said chamber and of a normal diameter to snugly fit in the restricted end of said chamber, a flexible peripheral part carried by said piston responsive to fluid pressure on the compression stroke to move radially outward and engage the walls of said

chamber whereby to effect a seal thereat as the piston moves through the tapered and enlarged part of the chamber, and said peripheral part on completion of said compression stroke and the discharge of said fluid assuming its normal position clear of said chamber walls.

2. A pump having a piston chamber and a reciprocating piston working therein, a circumferentially expansive element carried by said piston, said chamber having a constricted part of substantial length to cause said element to snugly engage the chamber wall at the commencement of a working stroke to prevent escape of fluid, the normal diameter of said piston being less than the diameter of the major portion of said chamber, and the pressure of the fluid after the piston has moved from the constricted part of said chamber acting upon said circumferentially expansive element to cause the same to bear against the chamber wall throughout the remainder of its stroke.

3. A pump having a piston chamber and a flexible piston element working therein, said chamber having a diametrically reduced piston receiving portion extending from an end of the chamber to a point well within the maximum stroke limit of the piston.

4. A pump having a piston chamber and a flexible piston element working therein, said chamber having a portion of its bore adjacent one end diametrically reduced within the maximum stroke limit of the piston and in unbroken continuity with the remainder of the chamber bore.

5. A pump having a piston chamber and a flexible piston element working therein, said chamber having a continuous unbroken bore from end to end and having a diametrically reduced portion within the maximum stroke limits of the piston.

6. A pump having a piston chamber and a flexible piston element working therein, said chamber having a continuous smooth bore from end to end within the maximum stroke limits of the piston, and a portion of said bore being reduced in cross-sectional area over a considerable longitudinal extent of the piston chamber but terminating at a point short of the position occupied by the piston at the completion of its compression stroke.

7. In a reciprocating piston pump, a flexible piston and a working chamber therefor, said chamber having an unbroken wall and being formed with a cross-sectionally reduced piston confining area, a piston release area of unreduced cross-section, and a flared intermediate piston expansion limiting area.

8. In a reciprocating piston pump, the combination with a flexible reciprocating piston, of a chamber therefor having a smooth continuous and unbroken working bore from end to end, said bore being diametrically reduced

at the end of the chamber from which the compression stroke of the piston is begun.

9. In a reciprocating piston pump, a flexible piston and a working chamber therefor, said chamber having an unbroken continuous bore from end to end within the maximum stroke limits of the piston, said bore being diametrically reduced at one end, and the chamber walls being gradually flared between said reduced end and the remainder of the chamber.

In testimony whereof I affix my signature.
GEORGE M. CLAGETT.

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