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2,989,227

PNEUMATIC PUMP

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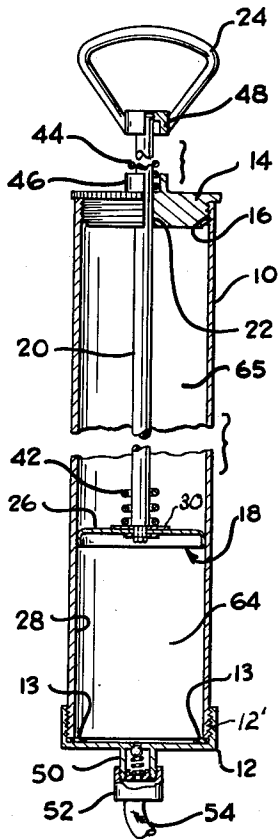


FIG. 1

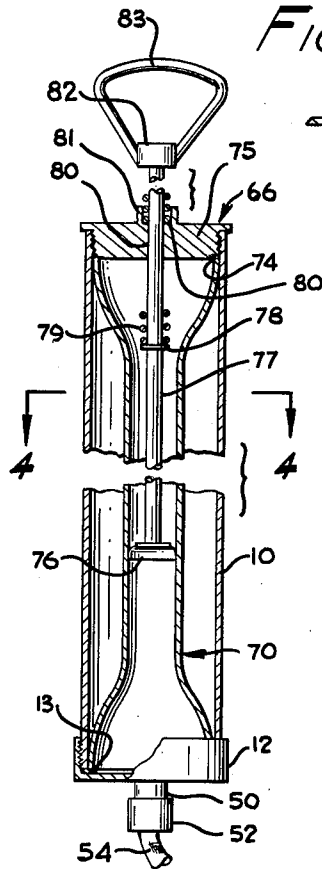


FIG. 2

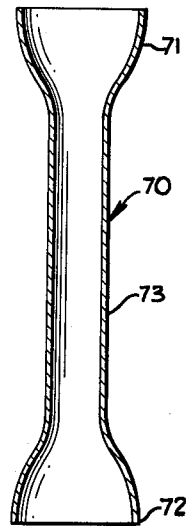
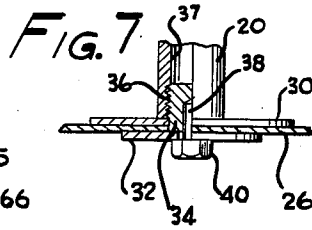


FIG. 3

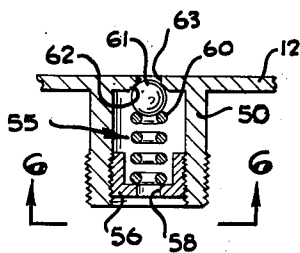


FIG. 5

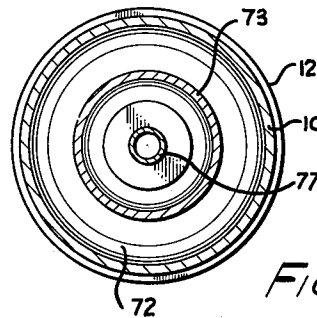


FIG. 4

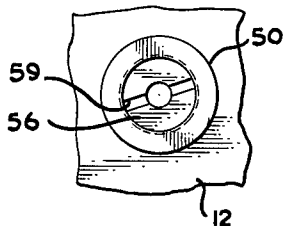


FIG. 6

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2,989,227

PNEUMATIC PUMP

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2 Claims. (Cl. 230—1)

This invention relates to pneumatic pumps, and is particularly concerned with a hand type pneumatic pump designed to be easily operated for inflating an inflatable member with air.

When employing conventional pneumatic hand pumps for inflating inflatable articles with air, e.g., bicycle tires, air mattresses, and the like, after a certain amount of air has been pumped into the article and before it has become fully inflated, the back pressure rises to a point where considerable force is required to pump additional air into the article to complete its inflation to the desired extent.

It is an object of this invention to provide a pneumatic hand pump having means embodied therein to minimize the force required to complete inflation of an inflatable article after the article has been partially inflated.

A still further object is to afford a pneumatic hand pump of the aforementioned character which is easily and relatively inexpensively manufactured.

The above objects are accomplished by providing a pneumatic hand pump in which the piston is removable and replaceable with an adapter which fits into the cylinder. The adapter is in the form of an elongated hollow member which can be positioned axially within the cylinder and has an internal diameter substantially less than the internal diameter of the cylinder. A piston having a diameter about equal to that of the internal diameter of the adapter is mounted for slidable movement in the adapter.

Thus, when an article is to be inflated, the conventional large piston is employed in the pump cylinder until the back pressure generated raises the force required to operate the piston to a value when it becomes tiresome to manually operate the pump. The conventional piston is removed, and the aforementioned adapter with its smaller cooperating piston is incorporated in the pump cylinder. Due to the substantially decreased area of the smaller piston as compared to the large piston which was removed, a correspondingly smaller force is required to operate the piston, thus making it much easier to pump the remaining air into the article to fully inflate same.

The invention will be more clearly understood from the following description of a preferred embodiment taken in connection with the accompanying drawing, wherein:

FIG. 1 is a section of the pump employing therein the conventional type of piston;

FIG. 2 is the pump of FIG. 1 with the conventional piston replaced by the adapter and smaller piston of the invention;

FIG. 3 is a sectional view of the adapter;

FIG. 4 is a section taken on line 4—4 of FIG. 2;

FIG. 5 is an enlarged section of the valve of FIG. 1;

FIG. 6 is a view taken on line 6—6 of FIG. 5; and

FIG. 7 is a sectional detail, partly in elevation, of the rod and piston structure of FIG. 1.

Numeral 10 represents the pump cylinder which is closed at its forward end by an end member 12 threaded at 12' over the end of the cylinder, a sealing gasket 13 being provided between the end of the cylinder and the end member 12. The opposite end of the cylinder

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is closed by a cap 14 threaded into the end of the cylinder at 16.

A piston 18 is positioned for slidable movement in cylinder 10 by means of a rod 20 connected to the center of the piston, the rod being slidably received in an aperture 22 in the end cap 14, and having a handle 24 connected to its outer end exteriorly of cylinder 10. The piston 18 is composed of a flexible disc 26 of a diameter about equal to or slightly greater than the internal diameter of the bore 28 of the cylinder. The disc 26 is clamped between a washer 30 and a washer 32, and supported on rod 20 by means of a stud 34 which is threaded at 36 into a bore 37 of rod 20. A bolt 38 is threaded into the lower end of stud 34, which passes through the center of washer 30 and disc 26 and abuts washer 32. The bolt 38 passes through the center of washer 32, and thus washers 30 and 32 and the disc 26 are clamped as a unit between the lower end of rod 20 and the head 40 of bolt 38, as seen in FIG. 7.

A spring 42 is carried at the lower end of rod 20 and resting on washer 30 to act as a shock absorber and make contact with end cap 14 on reverse stroke when disc 26 is drawn upward, as seen in FIG. 1. A spring 44 mounted about rod 20 in a housing 46 on cap 14, acts as a shock absorber and makes contact with the ring 48 at the base of handle 24, when the piston 26 is pushed downward, as seen in FIG. 1.

End member 12 carries a depending housing 50 which threads into the end 52 of a hose 54. Housing 50 carries a ball check valve 55 comprising a support 56 threaded into housing 50, said support having a central aperture 58. A spring 60 rests on support 56 and mounts a ball 61 at its upper end which is normally urged against a seat 62 formed at the periphery of an aperture 63 in end member 12. A groove 59 is formed in the lower surface of the member 56 for adjusting the position thereof and the compression of spring 60.

It will thus be seen that when piston 26 is pushed down toward end member 12, the air in the forward portion 64 between piston 26 and end member 12 will be forced out through valve 55 and via hose 54 which is connected to an article being inflated (not shown), but air cannot pass from hose 54 back into the cylinder 10. The disc 26 forming the piston is in tight engagement with the wall of cylinder 10 on the downstroke, but on the upstroke air from the upper portion 65 of cylinder 10 will leak past the outer periphery of disc 26 into the lower portion 64 of cylinder 10 to be compressed and forced through valve 55 on the downstroke as above described. The slidable fit between rod 20 and the aperture 22 in end cap 14 provides sufficient clearance for air to leak through the aperture 22 into the upper portion 65 of cylinder 10 to provide the air which is to be subsequently compressed and pumped through hose 54.

Now when the force required to operate piston 26 increases as result of back pressure, to a point where it becomes tiresome to push rod 20, the end cap 14 is removed together with rod 20 and piston 26, and this unit is replaced by a unit 66. Unit 66 is composed of an adapter 70 in the form of an elongated hollow member having bell shaped outer ends 71 and 72 and an intermediate portion 73 having an internal diameter substantially smaller than bore 28 of cylinder 10. The diameter at the outer ends of the bell shaped members is about the same or slightly greater than that of bore 28 so that these members fit tightly into cylinder 10, but with insufficient friction so that the adapter 70 can be slid down into the cylinder 10, with the end 72 of the adapter disposed against the seal 13. The upper end 71 of the adapter abuts a seal 74 positioned in a peripheral recess in the

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lower surface of end cap 75 which is threaded into the upper end of cylinder 10.

A flexible disc 76 forming a piston is mounted for slidable movement within the intermediate portion 73 of reduced diameter of adapter 70. The disc 76 is mounted on a rod 77 in a manner similar to the mounting of disc 26 on rod 20. The rod 77 carries a ring 78 on which is seated a spring 79 which is adapted to make contact with end cap 75 on the upstroke. Rod 77 slidably passes through an aperture 80 in cap 75, and a spring 80' is mounted in a housing 81 on cap 75, to make contact with a ring 82 mounted at the base of a handle 83 to prevent shock at the end of the downstroke of rod 77. The stops provided by contact of spring 79 and end cap 75 on the upstroke, and by spring 80' and ring 82 on the downstroke are positioned so that disc 76 is always located in the intermediate portion 73 of adapter 70, and at no time enters the bell shaped end portions 71 or 72 of the adapter.

It will thus be seen that when the adapter unit 70 and its associated mechanism including piston 76, rod 77 and handle 83 are incorporated into cylinder 10 in place of cylinder 26 and its associated structure, since the piston 76 has a substantially smaller area than piston 26, a much smaller force is required to continue the pumping of air into the article partially inflated using piston 26. On the upstroke, air leaks past the periphery of piston 76 from the space above piston 76 to the space below it, and air is furnished to the upper portion of the adapter above piston 76 by leakage through aperture 80, as in FIG. 1.

While I have described a particular embodiment of my invention for the purpose of illustration, it should be understood that various modifications and adaptations thereof may be made within the spirit of the invention as set forth in the appended claims.

I claim:

1. A pneumatic hand pump which comprises a hollow cylinder closed at its front end, a removable closure at its rear end, a removable adapter in the form of an elongated hollow member positioned axially in said cylin-

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der, said adapter being removable through said rear end of said cylinder, said adapter being bell shaped at its opposite ends, the opposite ends of said cylinder being closed, the bell shaped ends of said adapter being positioned adjacent the opposite ends of said cylinder, the outer diameter of said bell shaped end portions being about the same as the internal diameter of said cylinder, so that said bell shaped end portions frictionally engage the opposite internal surfaces of said cylinder to maintain said adapter in axial position in said cylinder, the internal diameter of said adapter intermediate the bell shaped end portions being substantially less than the internal diameter of said cylinder, a piston having a diameter about equal to the internal diameter of said adapter and mounted therein for slidable movement axially of said cylinder, a rod connected to said piston for movement thereof, said rod slidably received in the rear closure of said cylinder, with sufficient clearance to permit air to pass into said cylinder and a check valve in the front end of said cylinder for passage of air from the forward end of said adapter in front of said piston outwardly through said valve.

2. A pneumatic hand pump as defined in claim 1, wherein said piston, adapter and closure are adapted to be replaced by a closure and piston assembly, the latter being of such size as to slidably engage said cylinder.

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