July 22, 1952 J. A. MURNANE ET AL 2,604,258

AIR PUMP CYLINDER

Filed Aug. 23, 1949

Fig. 1.

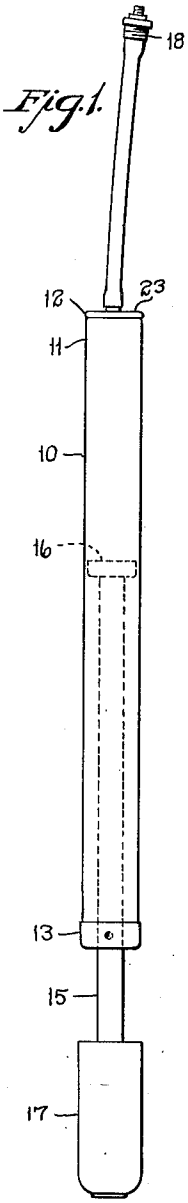


Fig. 3.

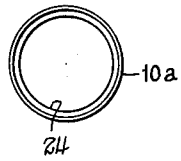


Fig. 2.

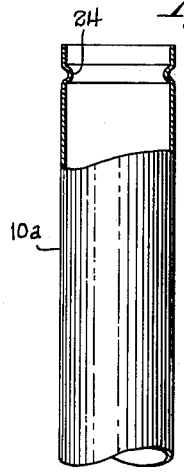


Fig. 5.

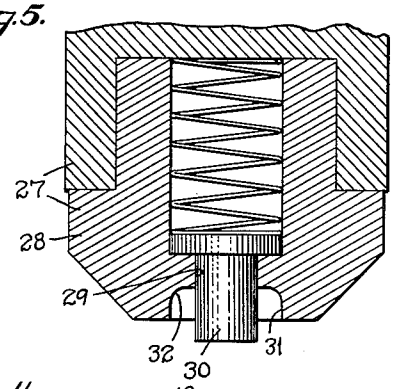
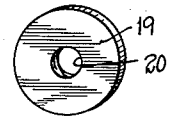


Fig. 4.



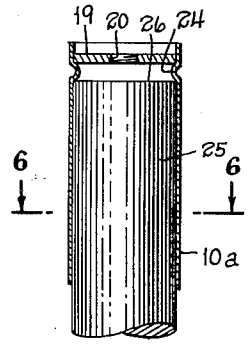


Fig. 6.

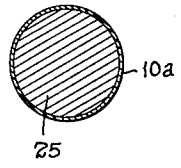


Fig. 8.

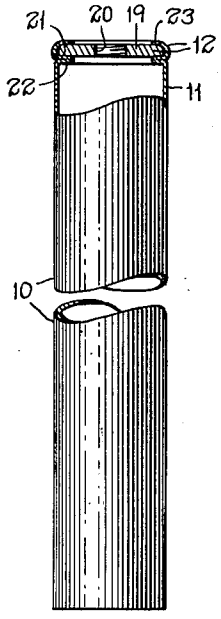


Fig. 7.

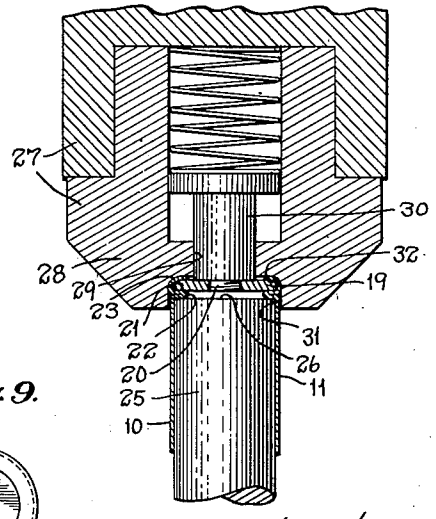
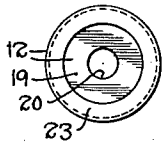


Fig. 9.



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AIR PUMP CYLINDER

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1 Claim. (Cl. 230—238)

1

The present invention relates in general to pneumatic pumps and more especially to an improved method and means of providing an end-closure in a manually-operated air pump of the type used for inflating bicycle tires, footballs, and articles of an equivalent nature.

It has been customary in the manufacture of air pumps of the type hereinabove referred to, to form the end-closure at the outlet-end of the pump-cylinder by externally threading this end of the cylinder and applying thereon an internally-threaded cap to which the flexible outlet-tube of the pump is connected. With this construction, it has usually been necessary to use a gasket between the inner face of the cap and the adjacent end of the cylinder to form an airtight seal; and in some instances, the cap is soldered or brazed in place so as to insure an airtight joint.

The present invention relates to an improved end-closure for air pumps of this type, an object of the invention being to provide an end-closure which is of durable construction, relatively inexpensive to manufacture and dependable in operation.

A further object of the invention is to provide an air pump of the type hereinabove referred to, wherein the end-closure at the outlet-end of the pump-cylinder is formed by a metal blank sealed in this end of the cylinder between an internal substantially-solid peripheral bead and an external peripheral flange.

A further object of the invention is to provide an improved method of forming an end-closure in one end of a pump-cylinder.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the accompanying drawings, in which certain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a side elevation of an air pump embodying the improved end-closure of this invention, the hose of the pump being secured to the outlet-end of the pump-cylinder;

Fig. 2 is an enlarged fragmentary elevation of the air-pump cylinder, partly in section, showing an open peripheral bead extending inwardly radially from the inner wall of the cylinder and formed inwardly of the outlet-end thereof;

Fig. 3 is a plan elevation of the outlet-end of the cylinder shown in Fig. 2;

Fig. 4 is a perspective view of the end-closure disk of the air-cylinder;

Fig. 5 is a vertical sectional view of a fragmentary portion of the outlet-end of the internally-beaded cylinder of Fig. 2, including a mandrel inserted therein and engaged against the inner face of its peripheral bead; an end-closure disk mounted on the outer face of the bead and a fragmentary portion of a forming-die arranged above the outlet-end of the cylinder in axial alignment therewith, preparatory to crushing the open peripheral bead of the cylinder and forming a flange on the outlet-end thereof for sealing the end-closure disk therein;

2

Fig. 6 is a plan view of the cylinder and internal mandrel on section-line 6—6 of Fig. 5;

Fig. 7 is a view similar to Fig. 5 but showing the relative positions of the cylinder, its internal mandrel, its end-closure disk and the forming-die, following engagement of the latter with the outlet-end of the cylinder to crush the inner peripheral bead thereof and form a flange on its outlet-end;

Fig. 8 is a broken elevation, partly in section, of the cylinder of the air pump, showing the completed end-closure at the outlet-end thereof; and

Fig. 9 is a top plan view of the completed end-closure of the cylinder of Fig. 8.

In its broadest aspects, the invention relates to a method and means for forming an airtight end-closure at one end of a cylinder, an embodiment of which is exemplified in a manually-operated air pump such as shown in Fig. 1. The latter comprises a sheet-metal cylinder 10 provided at its outlet-end 11 with the improved end-closure of this invention, indicated generally at 12; and at its opposite end with a metal ferrule 13 fastened on the corresponding end of the cylinder by any suitable means. The ferrule 13 is provided with a central aperture for guiding a piston-rod 15 which constitutes a hollow metal tube secured at its inner end to a piston 16 slidable longitudinally within the cylinder 10; and at its opposite end to an elongated cup-shaped sheet-metal cap 17, the internal diameter of which is slightly larger than the external diameter of the ferrule 13 so as to engage thereover and over the corresponding end of the cylinder 10 when the piston is at the lower end of its stroke. The outer end of the hollow piston-rod 15 is threaded internally to accommodate the externally-threaded thumb-nut 18 of an air-hose which is adapted to extend down into the hollow piston-rod 15 for storage therein. When the pump is to be used, the air-hose is removed from the upper end of the hollow piston-rod and attached by a threaded connection to the end-closure 12 of the cylinder, as shown in Fig. 1, whereupon by reciprocating the cap-and-piston-rod assembly relative to the cylinder, air may be pumped into an inflatable object to which the air-hose is connected.

Referring especially to Figs. 8 and 9, the improved end-closure 12 of this invention constitutes a metal disk 19 having a central internally-threaded aperture 20 in which the aforesaid air-

hose is adapted to be secured. The metal disk 19 is adapted to be secured in the outlet-end 11 of the cylinder with an airtight seal, and to this end is seated on the outer face 21 of a substantially-solid peripheral bead 22. The latter is located inwardly of the outlet-end of the cylinder, is substantially rectangular in cross section and extends inwardly substantially radially from the inner wall of the cylinder, the disk 19 being permanently secured against the outer face 21 of the substantially-solid peripheral bead 22 by a peripheral flange 23. The flange 23 is formed by swaging over the outlet-end of the cylinder against the outer face of the closure-disk 19, the resulting joints between the closure-disk 19, the inner peripheral bead 22 of the cylinder, and the outer swaged peripheral flange 23 thereof being substantially airtight. The end-closure 12 thus constitutes an airtight seal of relatively-inexpensive, durable and dependable construction, in the outlet-end of the cylinder.

Method of making end-closure

Referring especially to Figs. 2, 5 and 7, these figures illustrate one successful method for forming the airtight end-closure 12 of the cylinder 10. A metal tube 10*a* from which the cylinder 10 is to be formed, is provided adjacent one end, corresponding to the outlet-end of the cylinder, with an inner peripheral bead which is inwardly of the outlet-end of the cylinder, and formed by a conventional forming-mandrel and knurling-tool. The inner peripheral bead of the cylinder, indicated at 24 in Fig. 2, is substantially semicircular in cross section and is hereinafter referred to as a substantially-open peripheral bead.

The internally-beaded tube is preferably supported in a substantially-upright position, as shown in Fig. 5, on a mandrel 25 having a substantially-square upper end 26, the mandrel being engaged within the cylinder from the lower end thereof. As a preferred technique, the mandrel 25 is positively held against displacement so that its upper squared end 26 constitutes, in effect, an anvil on which the underside of the substantially-open peripheral bead 24 of the tube rests. The end-closure disk 19, which is preferably a steel washer and only slightly smaller in diameter than the internal diameter of the tube, is inserted into the upper or outlet-end of the tube so as to seat on the outer face of the open peripheral bead 24.

Supported above the assembled tube, washer and mandrel in axial alignment therewith, is a forming-die assembly indicated generally at 27. The latter comprises a head 28 having a central axial aperture 29 provided with a resiliently-mounted hold-down plug 30 and a counterbore 31, the intersection of the walls of the counterbore with its bottom being characterized by a concave annulus 32. Now, when the forming-tool 27 is brought down over the upper end of the tube, the hold-down plug 30 resiliently urges the closure-disk 19 against the outer face of the open inner peripheral bead 24 of the tube and thereafter the counterbore 31 of the forming-tool engages the outlet-end of the tube and swages it inwardly and downwardly over the outer face of the end-closure disk to form the aforesaid peripheral flange 23 substantially in conformity with the concave annulus 32 of the counterbore. Simultaneously with this swaging operation, sufficient pressure is applied to the end-closure disk 19 by the bottom of the counterbore 31 to crush the open inner peripheral bead 24 of the tube transversely, with the result that the open inner peripheral bead 24 is made substantially solid and substantially rectangular in cross section as indicated at 22 in Figs. 7 and 8. The closure-disk 19 is thus permanently sealed in the outlet-end of the cylinder 10 between the crushed peripheral bead 22 and the outer peripheral flange 23 of the cylinder.

Although the preferred technique is to mount the inner mandrel in fixed relationship with respect to the forming-tool, it will be appreciated that the latter may be fixed and the inner mandrel moved toward the latter to swage the flange 23 on the upper end of the tube and to crush the open inner peripheral bead 24 thereof; or that the tube and washer may be supported on the end of the mandrel 25 while the latter and the forming-tool 27 move toward each other simultaneously to crush the peripheral bead 24 of the tube and flange-over the outlet-end thereof.

Furthermore, while other means than those shown may be employed to carry out the series of steps set forth above for permanently securing the end-closure disk in the outlet-end of the cylinder, the means shown and described herein effect a highly satisfactory end-closure with great economy in labor and materials.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claim are intended to be embraced therein.

We claim:

A cylinder for an air pump, comprising a tubular sheet-metal member having near the open air-discharge end thereof an inwardly folded annular portion providing a ring-like seat facing said air-discharge end and lying in a plane at right angles to the longitudinal axis of said tubular member; and a flat apertured disc on said seat, said disc being of a thickness considerably in excess of the wall-thickness of said tubular member, and the length of said tubular member between said seat and said air-discharge end thereof being formed in part around the periphery of said disc in cross-sectionally continuously curved fashion and in part flat against a circular marginal portion of the outer face of said disc, so that said disc is permanently attached to said tubular member in air-tight fashion.

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