Oct. 20, 1942. W. E. GREENE 2,299,695

CYLINDER CAP LOCKING AND SEALING MEANS

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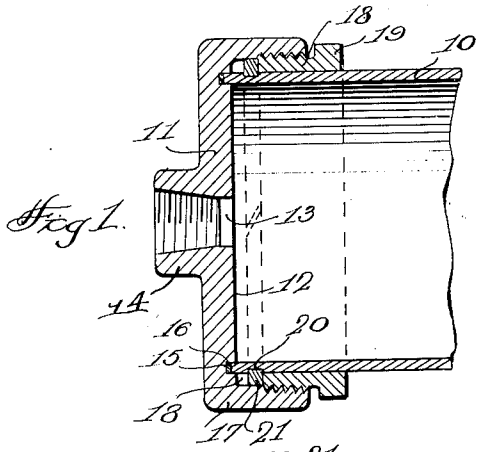


Fig 1.

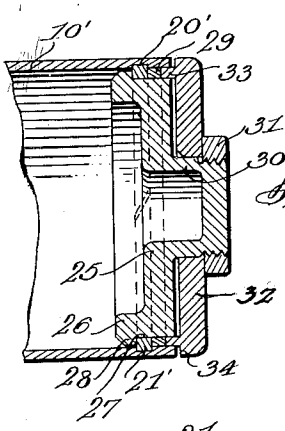


Fig 2.

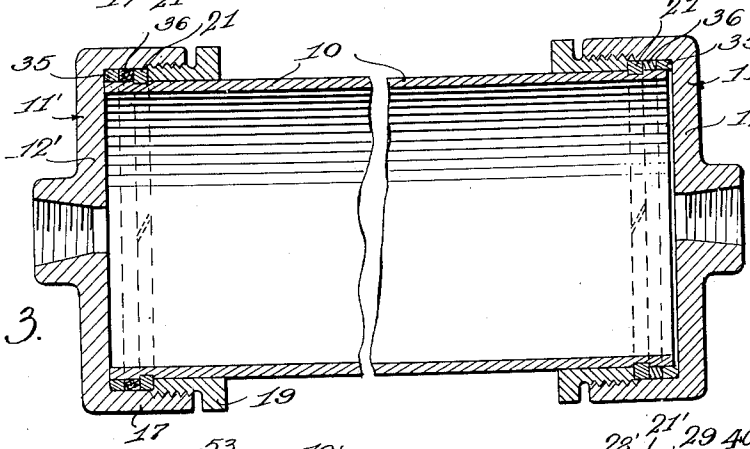


Fig. 3.

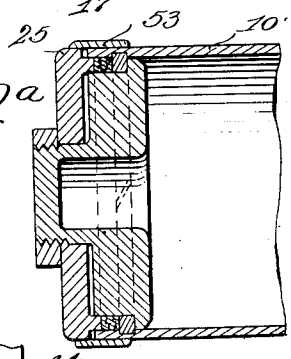


Fig 2a

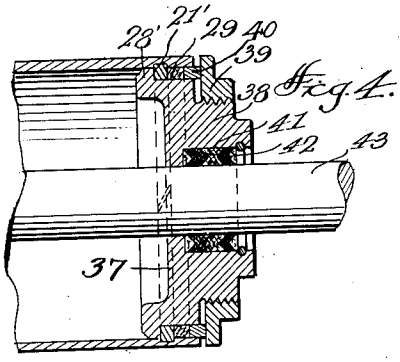


Fig 4.

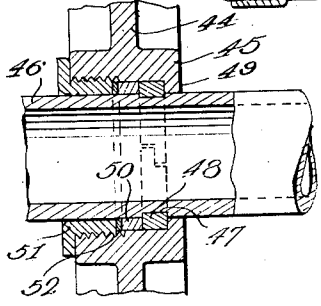


Fig. 5.

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CYLINDER CAP LOCKING AND SEALING MEANS

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2 Claims. (Cl. 309—2)

The invention relates to means for securing and sealing caps on cylinders and for securing and sealing cylinder heads, and other closures for the ends of cylinders and the like, and is particularly valuable in forming a seal and securing the heads or caps on hydraulic cylinders, pumps and the like.

It is an important aim of the invention to present such a means which may be applied to the sealing of cylinders of extremely thin material, with great economy and simplicity in structure, its manner of application and manipulation, and which will be extremely effective and free from liability of derangement or error.

It is an aim of the invention to present such construction in cylinder head locking and sealing means as may be applied to good advantage in steam engines, as well as hydraulic engines, pumps, and other structures.

A particular object is to present a securing means applicable to cylinders cut from drawn and other simple thin tube stock without requiring the threading of the cylinder stock, so that cylinders of engines such as internal combustion engines may be connected to cylinder heads, and water jackets formed therearound with assembled thin walled cylinders.

Another aim of the invention is to present a cylinder head attachment that may be encompassed entirely within a thin tube stock, with adequate security, economizing space and making possible the assembly of machines in extremely confined space and with minimum clearance between mutually adjacent parts.

Additional objects, advantages and features of invention reside in the construction, arrangement and combination of parts involved in the embodiment of the invention, as will be more readily understood from the following description and accompanying drawing, wherein

Figure 1 is a fragmentary sectional view of one end of a cylinder, drum, or the like, embodying my invention.

Figure 2 is a similar view showing a further form of the invention.

Figure 2a is a view illustrating a further form of the invention.

Figure 3 is a similar view showing a still further arrangement.

Figure 4 shows a still further modification of the invention applied to a cylinder head with a piston rod extended therethrough.

Figure 5 illustrates a connection between a piston rod and piston or plunger.

Referring more particularly to the drawing, there is illustrated in Figure 1, a cylinder 10 which may be part of a hydraulically operated machine of any kind, or may be a high-pressure drum, or may be one end of a steam engine cylinder, the details of valve ports and the like being well known and readily embodied without requiring disclosure herein. This cylinder 10 may be a stock steel tubing or may be a portion of tube material of other type suitably produced with simple walls of uniform thickness in the present instance throughout, and for certain uses, as in airplanes and the like, for operating landing gear, the illustration in Figure 1 would be full size. A cylinder head or cap 11 is illustrated, which may be of cast metal such as aluminum alloy, or other appropriate metals, consisting of a planiform circular plate portion 12, which in the present instance has a central port 13 shown therethrough, with an external boss 14 interiorly threaded for the admission of an operating fluid or for such other purposes as required. The adjacent end of the cylinder 10 is finished to a good, flat face at right angles to the axis of the cylinder, and the plate 12 is formed with an annular groove 15 on its inner side, of a width to snugly receive the end edge of the cylinder wall, this groove being of sufficient depth to accommodate a packing material 16, which, for use with cold fluids, may consist of neoprene or other synthetic rubber-like material, or may consist of lead, copper, or soft malleable iron, the metals being especially desirable where any great amount of heat is involved. The plate 12 extends radially beyond the cylinder wall 10 a short distance, and is formed with an annular flange 17 extending longitudinally inwardly beside the cylinder and in spaced relation thereto, affording a clearance between the cylinder and the flange, as indicated at 18, in part. The inner surface of the flange near its edge is interiorly threaded, and receives a gland or sleeve 18, exteriorly threaded and internally finished so as to fit slidably and revolubly upon the cylinder 10, its inner edge being suitably finished to a good plane at right angles to axis of the cylinder, while its outer part is formed with a hexagonal or other head portion 19 adapting the gland to be readily rotated with suitable tools. At a short distance from the end of the cylinder within the head 11, a circumscribing groove 20 is formed on the external face of the cylinder 10, this groove having a flat bottom and parallel sides, and being of comparatively slight depth but its depth properly proportioned to the

nature of the seal in the cylinder 10, for the use to be described.

Set in this groove there is a contractile thrust ring 21, preferably fitting snugly between the sides of the groove, and of hard steel, adapted to snap into the groove and fit closely against the bottom of the groove, the ring being of such radial thickness that when so fitted in the groove it will have a sliding fit within the flange 17 of the head 11, near the plate portion 12. This ring may correspond in form to the usual packing ring employed in engine cylinders, with a usual stop joint.

In the use of the invention, the packing 16 being in place in the groove 15, the ring or gland 18 is slipped upon the cylinder 10 inwardly of the groove 20, after which the ring 21 is put in position, and the end of the cylinder with the ring in place introduced into the flange 17 of the head. The gland 18 is then screwed into the flange 17 until it engages the ring 21, and presses the latter and the cylinder 10 longitudinally toward the plate 12 until the packing material 16 is suitably compressed by the end edges of the cylinder and fitted thereto.

In Figure 2 a modification of the invention is shown, by which the attaching means is adapted to be located within the cylinder, instead of without, and in this instance, the cylinder 10' may be of the same simple tube stock, with an internal circumscribing groove 20' formed therewithin a short distance from the end to be closed. Engaged within this groove, there is a locking ring 21' similar to the one 21, before described, except that it is an expansive ring, adapted to be compressed for engagement within the cylinder, and to spring outwardly within the groove 20', so as to fit snugly in the groove. In this instance, the principal member of the cap comprises a head body portion 25, of circular form adapted to be set within the end of the cylinder, and having an inwardly and longitudinally projected flange portion 26 at its periphery. The outer peripheral surface of the head body is relieved, as at 27, for a distance from the outer face of the body approximately corresponding to the distance between the end of the cylinder and the inner side of the ring 21', thus affording a shoulder 28 on its periphery at the extreme inner part which is suitably finished to engage snugly against the ring 21' so as to be drawn outwardly thereagainst. A space is in this way left between the head and the inner face of the cylinder outwardly of the ring, and in this space there is engaged a packing material or sealing ring 29, which, as in the case of the material 16 of Figure 1, may consist of neoprene or other compressible material, including leather and metal, appropriate to the uses to which the cylinder is to be applied.

A central external longitudinally projecting circular boss 30 is formed on the head 25, its outer part being externally threaded, and receiving a nut 31 thereon by which a compression collar 32 is confined. The collar 32 extends radially a sufficient distance to lie over the space between the head 25 and end edge of the cylinder 10', and the collar is formed with a projecting flange 33 adapted to fit into said space so as to compress the sealing material 29 when the nut 31 is screwed properly into place, confining the material between the flange 33 and the ring 21'. At the same time, the shoulder 28 is drawn outwardly against the ring 21', affording a good seat for the head and insuring the device against liability of loose movement due to variation of pressure within the cylinder, the pressure of the collar 32 and its flange against the sealing ring 29 being also adequate to maintain considerable pressure from without, as will be readily appreciated.

In the use of the last described device, the head 25 is first introduced within the cylinder and moved a distance inwardly so as to locate the body portion of the head inwardly of the groove 20', after which the ring 21' is compressed sufficiently to be introduced within the end of the cylinder, and is then moved inwardly until it snaps outwardly into the groove 20'. The head may now be drawn outwardly until the shoulder 28 engages the ring 21', after which the sealing ring 29 may be put in place, the collar 32 introduced and the nut 31 applied and tightened.

While a clearance has been shown in Figure 2, between the head 27 and the collar 32, and a shoulder 34 shown at the periphery of the collar 32 and outwardly of the flange 33, adapted to engage the end edge of the cylinder, and also spaced from the end of the cylinder, it will be understood that in practice the nut 31 may be tightened until the shoulder 34 is brought snugly against the end of the cylinder, so that the complete head is securely held against relative movement longitudinally of the shoulder in either direction, without depending upon the compression of the sealing material 29 to oppose this movement in one direction.

In Figure 3, another method of utilizing the structure of Figure 1 is illustrated, and in which the groove and packing 15 and 16 are omitted, and the end of the cylinder is butted against the plate 12', which corresponds to the plate 12 previously described, the flange 17, the glands 18—19, and the ring 21, being the same as before described. In the space 18, however, there is introduced at the longitudinally outer part a ring 35 which fits snugly between the flange 17 and extreme end of the cylinder 10, but does not extend longitudinally a sufficient distance to occupy the entire space, stopping short of the ring 21 so as to accommodate a compressible sealing ring or gasket 36, which is snugly fitted between the flange 17 and cylinder, and between the rings 21 and 35. Initially, the material 35 is of sufficient bulk to engage the rings 21 and 35, while the end of the cylinder is still spaced from the plate 12', as shown at the right in Figure 3, and when the gland 18 is screwed into the flange 17' the ring 36 is compressed until the end of the cylinder engages the plate 12', so that the head and the cylinder are rigidly fixed against relative longitudinal movement in either direction. Parts in Figure 3 corresponding to those of Figure 1 previously described bear the same reference characters with the addition of a prime mark, except as otherwise designated.

In Figure 4 there is shown a further modification of the device corresponding to Figure 2, in which a head body 37 is provided, which corresponds to the head 25, before described, and this is peripherally relieved so as to afford a shoulder 28', against which locking and sealing rings 21' and 29 may be introduced as before, the cylinder 10' being as before described. The head 37 is formed with a much larger central boss 38, which is exteriorly threaded, and a compression collar 39 corresponding to the collar 32 before described, consists of an annular member interiorly threaded to screw directly upon the boss 38, having an inner planiform face opposed to the

end of the cylinder, and in place of the flange 33 a ring 40 is introduced against the sealing ring 29, the ring 40 being pressed inwardly by the planiform face of the collar 39. The head 37 is formed with an external packing recess 41, in which any usual packing means 42 may be engaged, as formally represented, although various other packing devices may be substituted, as found desirable. A piston rod 43 is shown engaged through the head, which is suitably apertured for the purpose, with a packing 42 fitted snugly thereto in the recess 41.

In Figure 5, a construction of piston or plunger shown consisting of a piston body 44, having a hub portion 45 suitably bored to receive a piston rod 46 therethrough. The rod has a peripheral groove 47 in which a ring 48 is snapped, as before described, and the bore through the hub is relieved toward one side, affording a shoulder 49 against which the ring 48 may engage within the hub. A sealing ring 50 is engaged with the relieved part of the hub against the ring 48 opposite the shoulder 49, and the packing gland or collar 51 is screwed into the outer relieved portion of the bore, to compress the ring 50, as will be understood. If desired, a wear ring 52 may be interposed between the gland 51 and the ring 50, as shown.

In Figure 2*a*, there is illustrated at 53, an external reinforcing ring or band snugly fitted exteriorly upon the cylinder 10' and also snugly fitting upon the peripheral surface of the head 25 a distance, this band being sweated in place, soldered, welded, or otherwise secured so as to form a tight uniform junction with both the head and the cylinder, the latter two parts being united with the band, which thereby strengthens the joint, especially in case the head 25 is not drawn against the end of the cylinder.

Other modifications of construction, proportions of parts, substitutions of materials and equivalents may be made within the scope of the invention, it being understood that while I have described and illustrated with great detail a specific structure, this is purely exemplary, and limited only by the claims hereto appended.

I particularly wish to note that the rings engaged in the grooves of the cylinder tubing may be soldered in place, if desired, and may be formed in two or three thin parts, or complete rings, if desired, with one or more breaks.

In practice, it has been found possible to use one-sixteenth of an inch thick steel tubing, and the formation of the grooves therein with a depth of .020".

The use of this invention obviates the expense of prior practice in using much heavier tubing on which threads have been formed, in order that they may be screwed into the cylinder cap, the central portions of the cylinders being removed by lathe work, in order to eliminate weight and to gain advantages otherwise.

I claim:

1. A cylinder and head structure consisting of a thin-walled cylinder having a circumscribing groove thereon, a ring of substantially rigid structure engaged in the groove, a cylinder head having a longitudinally projected flange extended beside the cylinder beyond said ring, a compressible seal ring at one side of the first named ring, means on the head to engage the first ring at the inner side, and means contacting the head to engage the seal ring, the two means last named including compression means to draw the first ring toward the head.

2. The structure of claim 1 in which the said seal ring is beside the first ring next the head and between the cylinder and said flange, means being included between the head and said seal ring to compress the latter under relative longitudinal movement of the head and first ring, said means on the head to engage the first ring at the inner side consisting of a compressing device operable to draw the head and first ring toward each other.

WHITNEY E. GREENE.