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2,936,787

LOCKING RING FOR PRESSURE ACCUMULATOR

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FIG. 1.

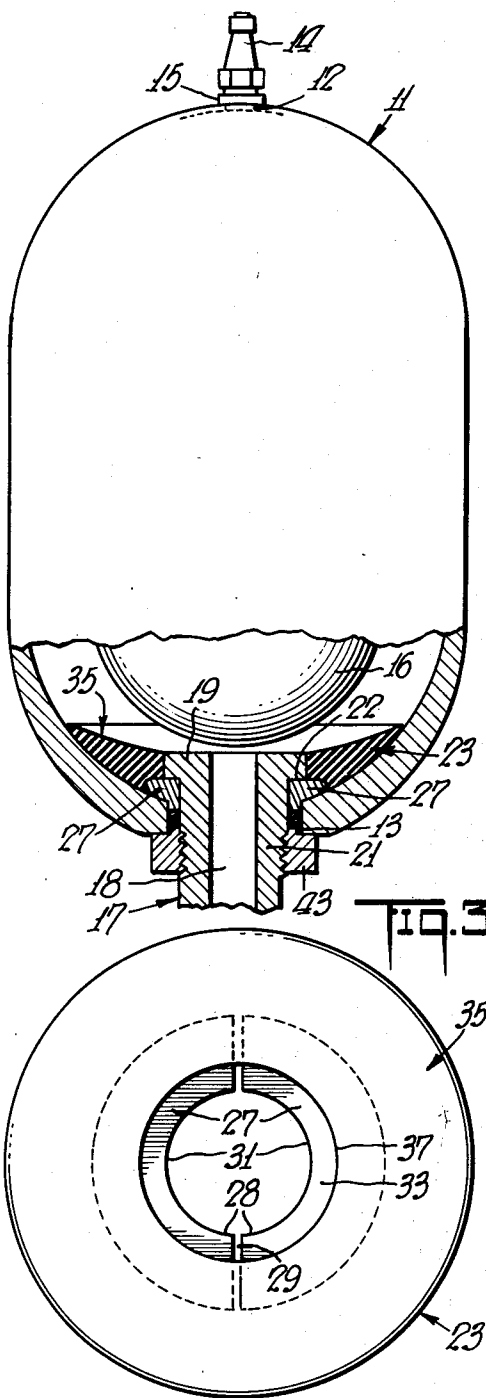


FIG. 2.

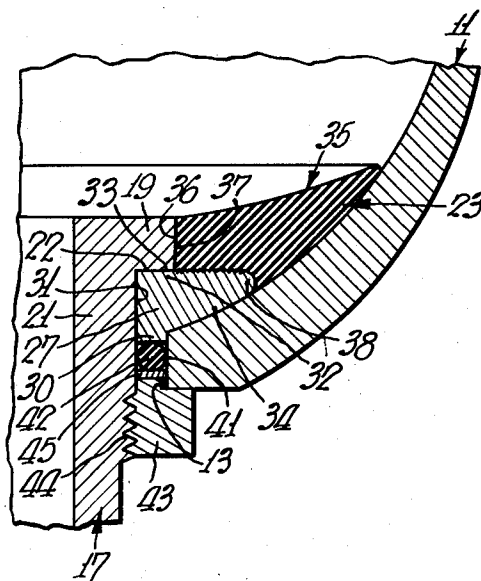


FIG. 4.

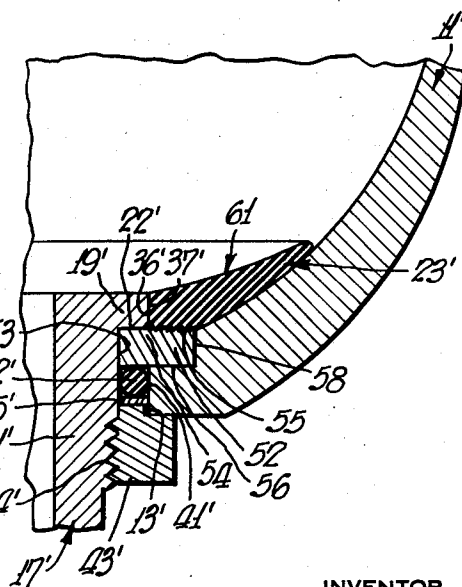


FIG. 3.

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LOCKING RING FOR PRESSURE ACCUMULATOR

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1 Claim. (Cl. 138—30)

This invention relates to a locking ring for a shell or container for storing fluid under pressure and more particularly to the locking ring for the closure plug of a pressure accumulator having a deformable bag therein.

As conducive to an understanding of the invention, it is noted that where the container has an opening or port with a removable closure plug therein, the use of a threaded plug is undesirable in that the threads may become worn and stripped with likelihood of blowing out of the plug when high pressures are attained in the container. In addition, if such plug can be removed before substantially all of the pressure is relieved in the container, when the mechanic disassembling the container has partially released the plug it may suddenly blow out and cause severe injury.

To overcome such difficulties, a plug may be utilized having a reduced neck defining a shoulder and forming an enlarged inner end portion of smaller outside diameter than the port so that it may be inserted therein. A locking member in the form of a ring encompassing the reduced neck portion of the plug, has an outer diameter greater than that of said port and an inner periphery overlapped by the shoulder of the enlarged end portion of the plug and is seated in position with rigid portions of the locking member intervening between the inner rim of the port and said shoulder. By means of any suitable retaining element, such as a nut screwed on the externally threaded neck of the plug, which protrudes from the port, the plug may be releasably, yet securely affixed to said container. As the locking member is of greater diameter than the port, in order that it may be inserted therethrough into the accumulator container, it is made deformable as by having portions thereof relatively displaceable. Where, to permit such deformation, the locking member is of resilient metal having one or more splits through the circumference thereof, such as a conventional split ring which may be of hardened spring steel, the accumulator bag as it expands to expel liquid from the accumulator will come in contact with the portion of the surface of such ring which extends laterally outward from the shoulder of the plug and especially at high pressures, extrude through such split, thereby pinching or cutting the bag with resultant destruction of the latter and failure of the pressure accumulator.

It is accordingly among the objects of the invention to provide for the outlet plug of a pressure accumulator, an annular locking member which may readily be deformed for insertion into the accumulator container through one of the ports thereof, yet which has no splits or discontinuities into which the accumulator bag might extrude with resultant injury to or destruction of such bag.

According to the invention, the locking member desirably comprises a plurality of arcuate segments arranged substantially in a ring with the adjacent ends of said segments being spaced from each other. The segments are desirably of hardened metal such as steel which will withstand the shearing action against the inner

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periphery of the locking member caused by the pressure of the enlarged end of the plug when the bag is bearing thereon, and the shearing action caused by the pressure of the locking member against the rim of the port. The segments are connected together by resilient means so that the top of the locking member will present an uninterrupted surface to the accumulator bag, said resilient means permitting relative displacement of portions of the locking member so that it may be deformed for insertion into the port, said locking member being self-restoring to its original shape.

This application is a continuation-in-part of co-pending application Serial No. 268,827, filed January 29, 1952, now abandoned.

In the accompanying drawings in which are shown one or more of various possible embodiments of the invention:

Fig. 1 is a longitudinal sectional view of an accumulator embodying the invention herein,

Fig. 2 is a fragmentary detail view on a greatly enlarged scale of one of the ports of the accumulator,

Fig. 3 is a plan view with parts broken away of one embodiment of the locking member, and

Fig. 4 is a view similar to Fig. 2 of another embodiment of the invention.

Referring now to the drawings, the pressure accumulator desirably comprises a pressure vessel illustratively a rigid container 11 having opposed ports 12 and 13 therein, one of said ports, illustratively port 12 being of smaller diameter than the other. Desirably the smaller diameter port is designed to receive a standard pneumatic valve 14 affixed to the container as by a nut 15 and the larger diameter port 13, which desirably serves as the liquid port is formed large enough to pass an accumulator bag 16 therethrough, the latter desirably being of rubber, synthetic or natural, and having the valve 14 molded into one of the ends thereof.

The port 13 desirably has a cylindrical outlet plug 17 positioned therein, the latter having a longitudinal bore 18 therethrough and having a flange at its inner end 19, defining an annular shoulder 22 and a reduced neck portion 21. The outer diameter of the flange is slightly less than the diameter of the port 13 so that it may readily be inserted therethrough, and the neck 21 is of length such that it may protrude from port 13.

The plug 17, which desirably includes a conventional valve (not shown) for closure of the inner end of the bore 18 therethrough, is affixed to container 11 by a locking member, desirably a ring 23 constructed so that it may readily be deformed for insertion through said port 13 into the container 11. The locking member 23, shown in Figs. 1, 2 and 3 desirably comprises a plurality of arcuate segments 27 preferably of hardened metal such as steel. The segments, two of which are illustratively provided, each is slightly less than 180 degrees of arc so that when juxtaposed to form a ring, the adjacent ends 28 thereof may be spaced from each other as at 29. The ring formed by said juxtaposed segments has an inner diameter but slightly larger than the outer diameter of neck 21 of plug 17 so that the inner wall 31 of said segments 27 may snugly encompass neck 21 with shoulder 22 resting on the inner periphery 32 of the flat top 33 of the said segments. The outer diameter of the ring formed by said juxtaposed segments 27 is greater than that of the port 13 so that the curved bottom surfaces 34 of the segments 27 which conform generally to the curvature of the inner surface of container 11 adjacent port 13, may seat thereon.

The undersurface of each of the segments adjacent the inner periphery thereof has an arcuate hub 30 of width substantially equal to the difference between the outer diameter of neck 21 and the diameter of port 13, so that

said hub when positioned between neck 21 and port 13, will center the plug 17 in said port 13.

Bonded to the flat top surface 33 of the segments 27 in any suitable manner such as by cementing or vulcanizing, is an annulus or ring 35 of resilient material such as natural or synthetic rubber. The resilient ring 35 desirably has an inner diameter which exceeds the inner diameter of the ring formed by the juxtaposed segments 27 by an amount substantially equal to the width of shoulder 22 and is coaxial with said ring so that, as shown in Fig. 2 said shoulder 22 will seat on the inner periphery 32 of the segments 27 with the side wall 36 of the enlarged end portion 19 of the plug against the cylindrical inner periphery 37 of said resilient ring 35. Desirably the thickness of ring 35 at its inner periphery is substantially the same as that of the flange 19 of the plug so that the top surface of the ring 35 will be flush with the inner end of the plug.

The outer diameter of the resilient ring 35 is greater than that of the ring formed by the juxtaposed segments 27 so that it will overlap the outer periphery 38 of the latter. The undersurface of the overlapping portion of ring 35 desirably is curved to conform to the contour of the inner surface of the shell 11 about port 13 for seating of such curved portion of the ring thereon, and the top surface of the overlapping portion is desirably concave.

In order to provide a liquid-tight seal between the neck 21 of plug 17 and the wall 41 of port 13, a resilient sealing ring 42, preferably an O ring, encompasses the neck 21 between hub 30 and a nut 43 screwed on the externally threaded portion 44 of neck 21 which protrudes from said port 13, a metal washer 45 desirably being positioned on the outer side of said O ring 42.

In assembling the accumulator, the bag 16 is passed through the port 13 of the empty container 11. The valve 14 is pushed out through the port 12 and secured to the shell as by means of nut 15. The plug 17 is then passed through the port 13 and the locking member 23 is deformed as by folding the two segments 27 toward each other, the portion of the resilient ring 35 over the spaced juxtaposed ends of the segments 27 permitting such folding. As a result, the deformed locking member 23 may readily be passed through the port 13 into container 11. The locking member 23 is then released and by reason of the resilience of the folded ring 35 will assume its original ring-like shape so that it may readily be passed around the neck portion 21 of the plug 17. The plug 17 can then be drawn outwardly until its shoulder 22 seats against the inner peripheries 32 of the segments 27 and the rounded undersurfaces 34 of the segments seat on the inner surface of container 11 about port 13. The sealing ring 42 and washer 45, may then be placed around the neck 21 and moved therealong until the ring is against the hub 30. The nut 43 is then threaded on neck 21 and tightened securely to retain the shoulder 22 of the plug against the inner periphery 32 of the segments and the undersurface of the segments against the curved inner surface of the container 11 about port 13, the O ring 42 providing a dependable seal between the neck 21 and the wall 41 of port 13. The pressure accumulator may then be used in conventional manner.

In the embodiment of Fig. 4 the locking member 51 desirably comprises a plurality of arcuate segments 52 illustratively two in number preferably of hardened metal such as steel. Each of the segments is slightly less than 180 degrees of arc so that when juxtaposed to form a ring the adjacent ends thereof will be spaced from each other, and said segments are desirably rectangular in cross section.

The ring formed by said juxtaposed segments 52 has an inner diameter but slightly larger than the outer diameter of neck 21' of plug 17' so that the inner wall 53 of said segments 52 may snugly encompass neck 21' with shoulder 22' of flange 19' resting on the inner periphery 54 of the flat top of said segments.

The inner surface of container 11' around port 13' is cut away to define an annular shoulder 56 and said cut away portion is of depth substantially equal to the thickness of segments 52 so that when the segments are seated on shoulder 56 their top surface 55 will be substantially flush with the inner surface of container 11'.

The outer diameter of neck 21' and the width of segments 52 and shoulder 56 are such that when the parts are assembled as shown in Fig. 4 the plug 17' will be accurately centered in port 13' with substantially no transverse play.

Bonded to the flat top surface of the segments 52 in any suitable manner is an annulus 61 of resilient material such as natural or synthetic rubber. The annulus 61 desirably has an inner diameter which exceeds the inner diameter of the ring formed by the juxtaposed segments 52 by an amount substantially equal to the width of shoulder 22' and is coaxial with said ring so that as shown in Fig. 4 said shoulder 22' will seat on the inner periphery 54 of the segments 52 with the side wall 36' of flange 19' of the plug against the cylindrical wall 37' of the annulus 61.

The outer diameter of the annulus 61 is greater than that of the ring formed by the juxtaposed segments 52 so that it will overlap the outer periphery of the latter. The undersurface of such overlapping portion of annulus 61 desirably is curved to conform to the contour of the inner surface of the shell 11' about port 13', for seating of such curved portion of the annulus thereon, and the top surface of the overlapping portion is desirably concave.

In order to provide a liquid-tight seal between the neck 21' of plug 17' and the wall 41' of port 13' a resilient sealing ring 42' preferably an O ring encompasses the neck 21' between segments 52 and a nut 43' screwed on the externally threaded portion 44' of neck 21' which protrudes from said port 13', a metal washer 45' desirably being positioned on the outer side of said O ring 42'.

The accumulator utilizing the locking ring in Fig. 4 is assembled in a manner similar to that shown in Figs. 1 to 3 and hence will not be described.

With the construction of the deformable locking members above described as the entire upper surface thereof contacted by the inflated bag 16 in expansion thereof is the associated uninterrupted resilient ring or annulus 35 or 61, and as the outer periphery of such annulus will be pushed against the inner surface of container 11 or 11' the spaces or discontinuities in the locking member between the segments will be isolated from the bag to prevent extrusion of the latter through such space. As a result there is no likelihood of pinching, cutting and destruction of the bag with resultant failure of the pressure accumulator.

As in disassembling an accumulator utilizing any of the locking members hereinabove described, it is necessary first to push the plug 17 (Figs. 1 and 2) inwardly after the nut 43 has been removed, so that the locking member may be slipped off the neck 21 of the plug and deformed for removal through port 13. If there is any air pressure in the bag 16 the latter will press against such plug 17 and prevent displacement thereof. It is apparent therefore, that in disassembly of the accumulator, a mechanic cannot neglect first to release all of the air pressure remaining in the bag and consequently there is no danger of injury as a result of the plug being blown out of the container. By reason of the fact that plug 17 is retained in place by the coaction of shoulder 22 with the locking member utilized, there is no strain on the coacting threads of the plug 17 and the nut 43 and hence there is no likelihood of stripping of such threads.

As many changes could be made in the above constructions, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claim, it is intended that all matter contained in the above description or shown in the ac-

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companying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

In a pressure vessel of the type having a port with a deformable partition secured therein and adapted to move toward such port and having a hollow flanged plug in said port, said flange defining a shoulder; the combination therewith of a locking member for said plug, said locking member comprising a plurality of rigid arcuate segments defining a ring of inner diameter less than that of the port and of outer diameter greater than that of such port, adjacent ends of said segments being in relatively close juxtaposition to define substantially a continuous surface, the undersurface of said segments adjacent the outer periphery thereof having a configuration complementary to that of the inner surface of the pressure vessel adjacent its port and defining a relatively wide surface adapted to seat directly on said inner surface of said port, an annulus of resilient material bonded to the top surface of said arcuate segments and coaxial with the ring formed thereby, each of said segments having an arcuate hub adjacent its inner periphery remote from the surface to which the annulus is bonded, said hub having a width substantially equal to the difference between the external diameter of the plug and the di-

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ameter of the port in said shell so that it may fit therein, said annulus having an inner diameter greater than the inner diameter of the ring formed by said rigid arcuate segments, whereby the exposed surfaces of said segments adjacent the inner periphery thereof define a retaining shoulder for the shoulder of such plug, and an outer diameter greater than the outer diameter of said ring so as to overlap its outer periphery, whereby said overlapping portion of the annulus, when the expanded partition is thereagainst will prevent extrusion through the spaces between the segments and the shell of the accumulator as well as through the spaces between adjacent ends of said segments.

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