March 9, 1954 R. C. WOLFE 2,671,574

RELEASABLE SEALING CLOSURE

Filed Dec. 4, 1950

Fig. 1.

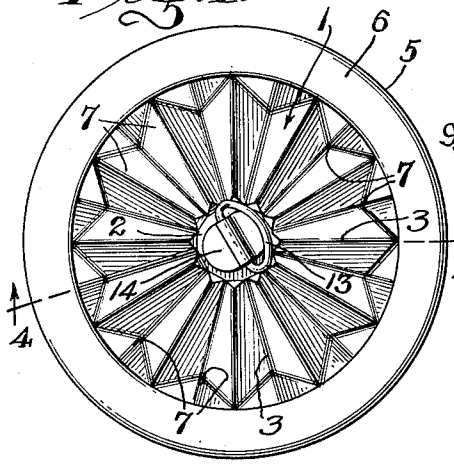


Fig. 4.

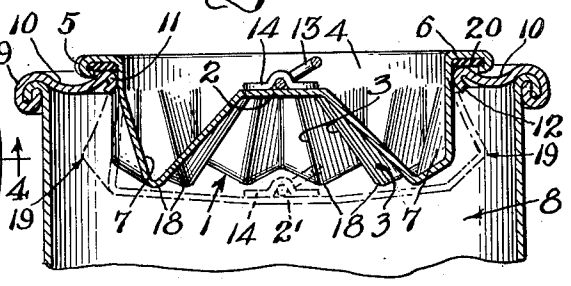


Fig. 2.

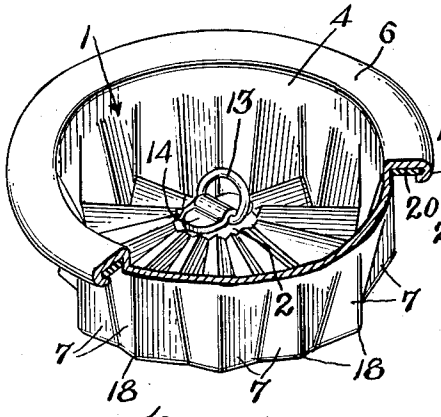


Fig. 5.

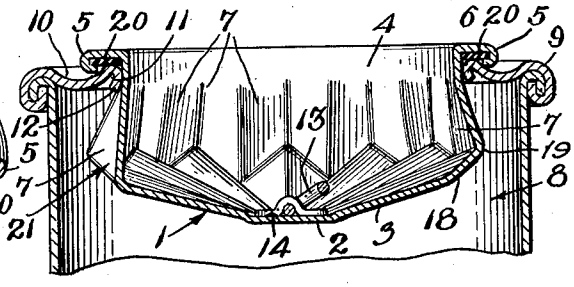


Fig. 3.

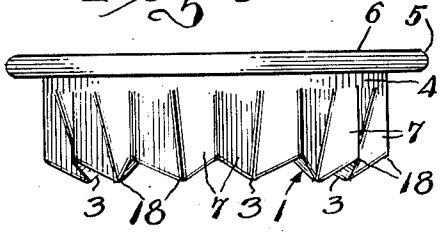
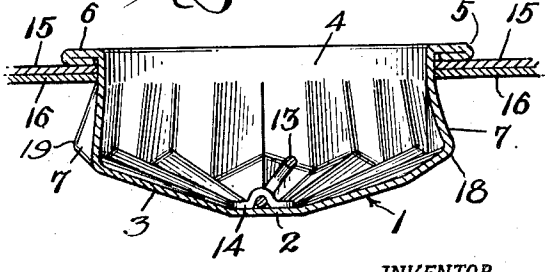


Fig. 6.



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RELEASABLE SEALING CLOSURE

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4 Claims. (Cl. 220—24.5)

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This invention relates to closures, plugs, fastenings and the like, usually imperforate and metallic in character, adapted to be secured into or to seal an opening or aperture in a vessel, shell, partition, bulkhead, container or the like. A typical application is as a cap for a conventional tin can. This invention is an improvement on that disclosed in my U. S. Patent Number 2,024,495 of December 17, 1935. The design of this closure as revealed in the patent was basically correct but did not indicate the best form for the radial beads, ribs or corrugations on the cone shaped or flat central head part or those around the lower portion of the cylindrical skirt. It has now been determined that when the form illustrated in the patent is employed, there is insufficient flexibility of the expanding skirt, with the result that the pressure required to flex the conical body or head sometimes results in deformation of the head without expansion of the skirt. It has also been determined that an outward tension applied to the central portion of the head may be equally or more desirable as a means of contracting the inner or lower locking portion of the skirt, as against inward pressure, for the purpose of applying or removing the closure.

The device is of course imperforate so as to function as a sealing closure or cap.

With the foregoing in mind, the invention has as its object to provide an imperforate closure including a generally cylindrical skirt portion and a central body portion, so indented and shaped that the body will, under axial pressure, change shape in a manner to transmit radial movement to the skirt and the skirt will freely expand or contract radially in response to such movement, so as to lock or unlock the cap in a container opening.

Other objects and advantages of the present invention will become apparent in the ensuing specifications and appended drawings in which:

Fig. 1 is a plan view of a container cap showing the preferred embodiment of the invention.

Fig. 2 is a perspective view of the same, partially in section.

Fig. 3 is a side view of the cap.

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 1, and showing the closure inserted into a container, in the unlocked condition;

Fig. 5 is a sectional view showing the closure within an opening in a container, and illustrating the locking of the skirt in the opening; and

Fig. 6 is a view showing the cap in a modified environment.

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Referring in detail to the several figures of the drawing:

1 indicates the head of the cap which is cone-shaped and preferably has the configuration of a truncated cone with the central portion thereof flattened as at 2. Said head is provided with a series of radially disposed ribs, beads or corrugations 3 of V section preferably continuous circumferentially and of equal size at any given radius and extending from the lower or inner circumferential edge of said head or body to the flattened portion 2. The head is provided with an integral axially extending annular flange-like sleeve or skirt 4 which terminates in an outwardly extending annular flange 6 having a free edge or bead 5. Bead 5 may function to retain a gasket 20 against the underside of flange 6. The lower or inner side of the skirt 4 is preferably provided throughout its circumference with V section corrugations 7 projecting inwardly. These corrugations at the lower edge of the skirt are of the same dimensions circumferentially as those on the head at its outer circumference, and are so spaced that the apices of the inwardly projecting skirt corrugations intersect the roots or bottoms of the troughs defined between the downwardly extending corrugations 3 of the head. The ends of corrugations 3 are integrally joined to the ends of corrugations 7 by bends 18 which, as best illustrated in Figs. 3 and 4, are inclined upwardly and outwardly at approximately 45 degrees to the plane of rim 6. In the expanding action, described more fully hereinafter, the corrugations 3 and 7 pivot relative to each other along axes disposed at bends 18, so as to accommodate any change in the angle subtended between them which may be required by the flattening of the corrugations hereinafter referred to. Such pivotal movement, which will be slight magnitude, will be provided for by a slight bending at bends 18. In this manner the flexibility required for the expansion of the lower portion of the skirt is obtained.

The body of the container or receptacle to which the cap is to be applied in order to close the same, is indicated at 8. Said receptacle has secured thereto, in any manner, an upper wall 9 channeled as at 10, the inner side of said channel having a bead 11 which terminates in a downwardly extending annular flange 12 forming an annular opening in the top of the container or receptacle. To apply the cap of the invention to said opening in said upper wall 9 of the container the cap is slipped therein so that the upper, uncorrugated portion of skirt 4 of the cap

will engage the downwardly extending annular flange 12 of the container all as shown in Fig. 4. To lock the cap within said opening so as to seal the contents of the container, pressure is applied downwardly against the cap and preferably to the flattened central portion 2 of the frusto-conical head 1 so as to bend or expand said head until it passes through dead center and assumes the shape of a cone that is inverted with reference to its initial condition, as shown in Fig. 5. The cone may approach more nearly a flat plane, as indicated in dotted lines at 2', than in the released position shown in full lines in Fig. 4. When expanded downwardly, the beads or corrugations expand and flatten to an extent, as do the corrugations 7 in the skirt which in turn force the lower periphery of the skirt or flange 4 to expand radially outward so that it will engage beneath the lower edge or minor diameter of the annular flange 12 of the head of the container as illustrated in Fig. 5 and thus prevent removal or loosening of the cap or closure. At the same time there is created sufficient pressure of the flange 6 against the bead 5 to hermetically seal its gasket 20 against bead 11.

It will be understood that in many cases the locking and sealing position of the cap may be effected even though it does not assume the position shown in Fig. 5, it being necessary merely that the metal be flattened and the corrugations 3 and 7, or either of them, be expanded to an extent sufficient to force the lower circumferential edge of the head of the cap beneath the lower edge of the flange 12 of the upper wall of the container. It will be further understood that it is not necessary to provide the container with an upper wall as such, it being necessary merely in some cases that it be provided with a bead or other projection at or adjacent its upper edge beneath which the cap may engage when in locking position.

After the cap has been expanded into locking position, in order to remove the same, an upward or outward pull is applied by means of the lifting ring or piece 13 shown pivotally connected to the flattened portion 2 of member 2 by means of a yoke 14 secured to head 1 by any suitable means. Yoke 14 in turn acts to stiffen and prevent deformation of member 2. The exact design of this lifting means is not necessarily limited to that shown. The upward or outward pull, which may be applied either manually or by means of any common and convenient implement such as a screwdriver or a common beer-can opener, will reform the closure or cap to the condition shown in Fig. 4 permitting its removal. As a variation of the above method of removal, and according to the temper of the metal and details of the design, the head of the enclosure may be deformed by means of pressure applied downward or inward by any suitable implement or manually into an inverted cone of greater taper than that of the locked condition, as indicated by dotted lines at 2' in Fig. 4 or as illustrated in Fig. 5. In this manner the expanded lower periphery of the skirt is drawn in to a diameter that will permit removal of the cap or closure.

It is important that the metal be of such a temper and gauge as to give the necessary pliancy to permit the cap or closure to function in the manner herein before described. Attention is drawn to the fact that, with the skirt in the contracted state, the cap or closure may be used in much the same manner as the conventional single friction closure.

In a modification of the invention wherein the cap would be produced initially in the condition as illustrated in Fig. 5 the metal of the closure is of such a temper or nature as to make it appreciably more resilient or springy than the metal of the closure in the just described form of the cap or closure. It will be noted that the cap is produced and applied in the already expanded form with the diameter of the bulged portion 21 of the cap or closure of a larger diameter than the opening in the container. This expanded or bulged portion of the closure skirt 21 is contracted on application of the closure to the container either directly as a result of the radial component of the pressure of the annular flange 12 against it or by means of pressure or tension applied to the center 2 of the head of the closure or cap. When the cap is in place, and the center 2 of its head is relieved of any applied force, the lower portion 21 of the skirt will again expand to its original diameter due to its inherent resilience and engage underneath and tightly against the lower edge of the flange 12 of the container flange. This action likewise tends to draw the closure flange 6 down against the bead 11 of the container resulting in pressure on gasket 20 thus providing an hermetic seal where a gasket is used. Fig. 2 shows a gasket under the lip, which may be rubber or any suitable material for those applications where an hermetic or moisture resistant seal is required. When a gasket is not used the upper portion of the annular skirt or flange 4 of the cap may be of such a diameter as to engage securely with the annular flange 12 of the container when the cap is in place thus forming the same degree of sealing that is provided by the conventional single friction cap. In the preferred form of this modification, removal would be accomplished by upward tension on the lifting piece 13. In this case such tension would, as in the first described modification, contract the expanded portion 19 of the skirt of the cap until its reduced diameter permitted removal.

It will be apparent that the construction above described may be applied with advantage to other than closures or caps for tin cans or other containers. A few such applications are: blanking caps for openings in electrical apparatus, and wiring devices especially, where an explosion or moisture proofing is desired; blanking plates for unthreaded "inspection" holes or other apertures; easily applied "hermetic patches" for repairing holes in aircraft skin in which case a variation in design could provide smooth outer fairing; blind fasteners and particularly hollow blind fasteners in the application of which some degree of sealing is desirable. Such a fastener is shown in Fig. 6, the two sheets 15 and 16 being secured together by the fastener. In the latter connection it can be pointed out that there are in current usage fasteners usually described as "blind rivets" which are produced from wire or bar stock and are functionally practicable in small diameter only, also "snap type" fasteners which are applied blind by virtue of a principle somewhat similar to that herein described except that the expansion of the end portion is in general obtained by virtue of slotted perforations instead of corrugations.

I claim:

1. In a device of the character described, an obturating device comprising a head member having radially extending corrugations of V-shaped

circumferential section, a skirt member having a horizontally extending flat peripheral flange projecting outwardly from one end thereof, and a plurality of bends integrally joining the other end of said skirt member to the periphery of said head member, said skirt member having axially extending corrugations likewise of V-shaped circumferential section, the respective corrugations, externally, having alternate apex ridges and trough roots, and being arranged with the ridges of one of said members intersecting adjoining extremities of said bends and the roots of the other of said members, and vice-versa said corrugations having flat side walls and the side walls of the one member being joined to those of the other member through the respective bends, said bends being disposed diagonally in both axial and radial directions, whereby axial movement of the inner area of said head will, by toggle action, radially expand or contract the adjoining area of the skirt, and whereby angular displacement between the side walls of the head and the adjoining side walls of the skirt will be accommodated by bending action in said bends, without deforming said obturating member.

2. In a device of the character described, an obturating device comprising a normally conical head member having radially extending corrugations of V-shaped circumferential section, a skirt member having a peripheral flange projecting generally radially outwardly from one end thereof, and a plurality of bends integrally joining the other end of said skirt member to the periphery of said head member, said skirt member having axially extending corrugations, likewise of V-shaped circumferential section, the respective corrugations, externally, having alternate apex ridges and trough roots, and being arranged with the ridges of one of said members intersecting adjoining extremities of said bends and the roots of the other of said members, and vice-versa, said corrugations having flat side walls and the side walls of the one member being joined to those of the other member through the respective bends, said bends being disposed diagonally in both axial and radial directions, whereby axial flattening movement of the head will effect radial expansion of the adjoining marginal area of the skirt and whereby angular displacement between the side walls of the head and the adjoining side walls of the skirt will be accommodated by bending action in said bends, without deforming said obturating member.

3. An obturating device comprising a head having radially extending corrugations; a skirt having axially extending corrugations and having a peripheral flange projecting generally radially outwardly from one axial extremity thereof; and a plurality of straight-line bends integrally joining the other axial extremity of said skirt to the periphery of said head whereby said obturating device is generally cup-shaped; all of said corrugations being of V-shaped circumferential section, and the respective corrugations, externally, having alternate apex ridges and trough roots, both of straight-line longitudinal contour, and

being arranged with the corrugations of the head joining the corrugations of the skirt in staggered relation such that the apex ridges of the head intersect the trough roots of the skirt and vice versa, each such intersection occurring at adjoining extremities of said bends; said corrugations having side walls that are substantially flat, the side walls of the head being joined to the side walls of the skirt through said bends; and said bends being disposed diagonally in both axial and radial directions, whereby axial movement of the inner area of said head will, by toggle action, radially expand or contract the adjoining area of the skirt, and whereby angular displacement between the side walls on respective sides of said bends will be accommodated by bending action in said bends, without deforming said corrugations longitudinally; and a gasket attached to the under face of said peripheral flange.

4. An obturating device comprising a head having radially extending corrugations; a skirt having axially extending corrugations and having a peripheral flange projecting generally radially outwardly from one axial extremity thereof; a plurality of straight-line bends integrally joining the other axial extremity of said skirt to the periphery of said head whereby said obturating device is generally cup-shaped; all of said corrugations being of V-shaped circumferential section, and the respective corrugations, externally, having alternate apex ridges and trough roots, and being arranged with the corrugations of the head joining the corrugations of the skirt in staggered relation such that the apex ridges of the head intersect the trough roots of the skirt and vice versa, each such intersection occurring at adjoining extremities of said bends, said corrugations having side walls that are substantially flat in the areas thereof adjacent said bends, the side walls of the head being joined to the side walls of the skirt through said bends; and said bends being disposed diagonally in both axial and radial directions, whereby axial movement of the inner area of said head will, by toggle action, radially expand or contract the adjoining area of the skirt, and whereby angular displacement between the side walls on respective sides of said bends will be accommodated by bending action in said bends, without deforming said corrugations longitudinally; and means attached to the center of the head for imparting axial movement thereto.

RICHARD C. WOLFE.

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