Jan. 16, 1962 D. K. MITCHELL 3,017,053

CLOSURE DEVICE

Filed May 15, 1959 2 Sheets-Sheet 1

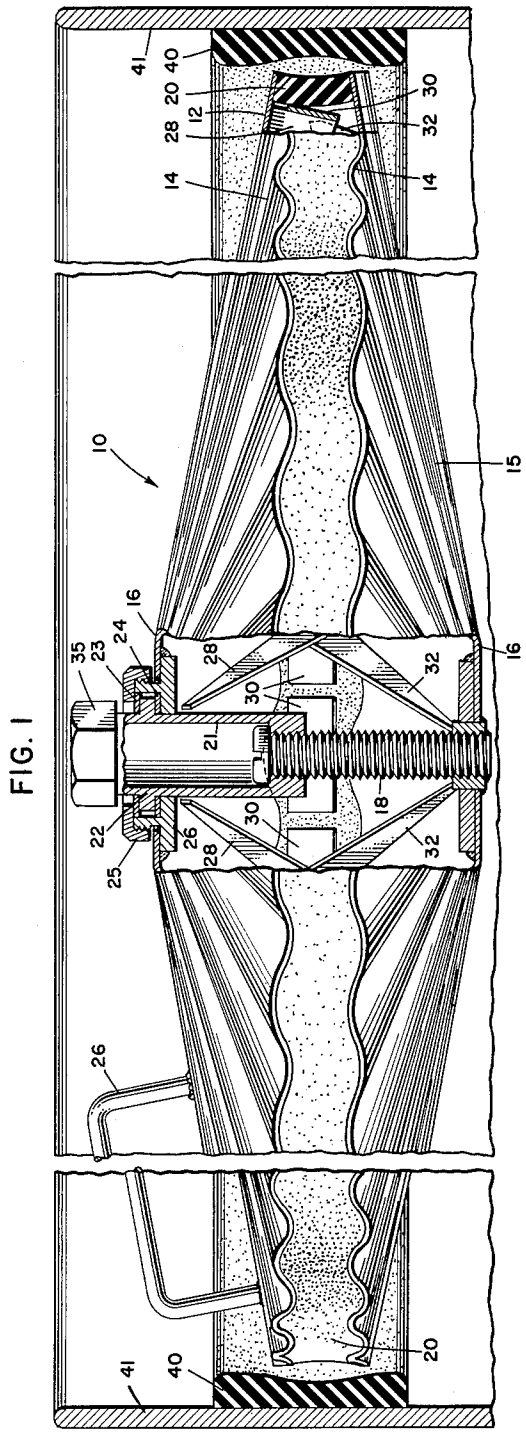


FIG. 1

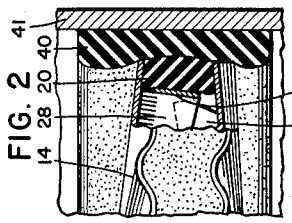


FIG. 2

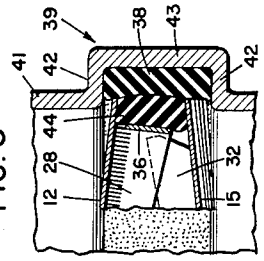


FIG. 8

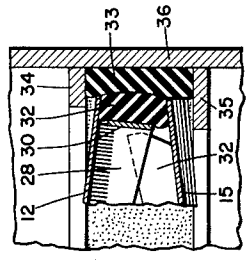


FIG. 7

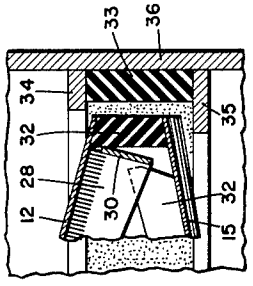


FIG. 6

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FIG. 3

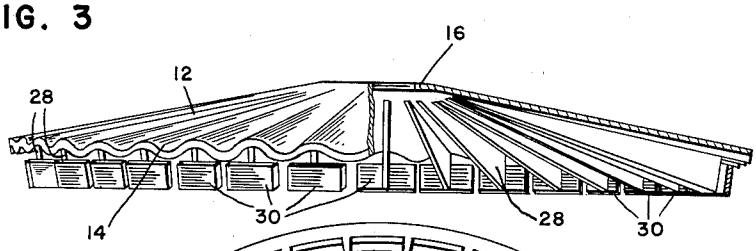


FIG. 4

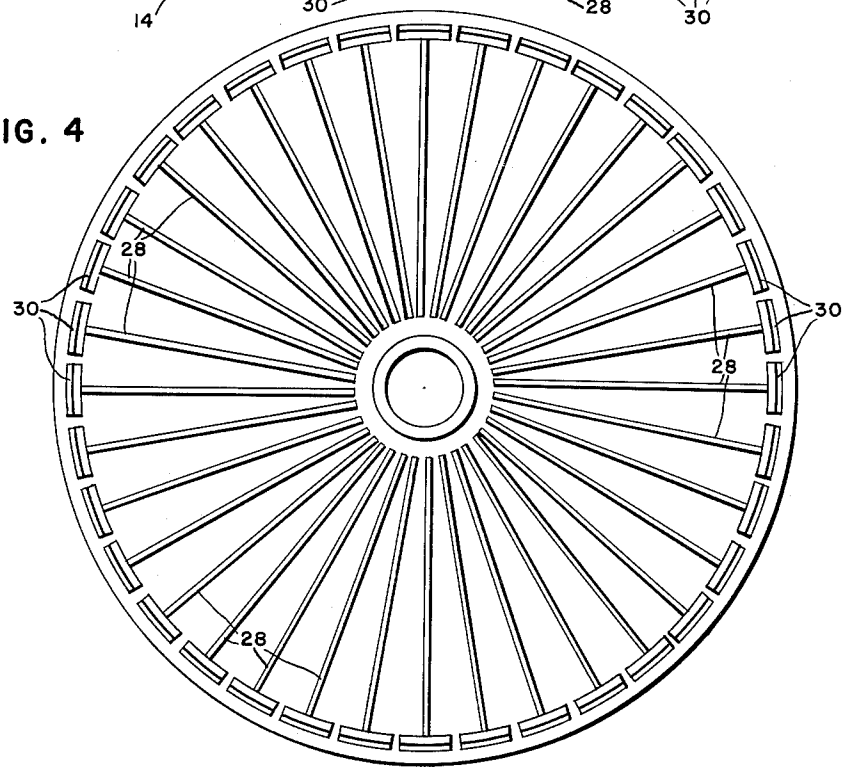
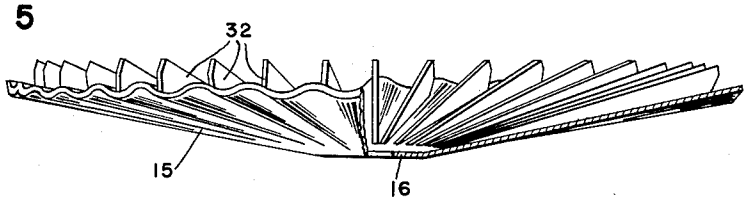


FIG. 5



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United States Patent Office 3,017,053 Patented Jan. 16, 1962

3,017,053

CLOSURE DEVICE

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Filed May 15, 1959, Ser. No. 813,609
2 Claims. (Cl. 220—24.5)

The present application is a continuation-in-part of copending application Patent No. 2,959,319 for closure device.

This invention relates to closures and more particularly to an improved fluid and gastight closure.

The problem of closing a passageway at a point intermediate its length has always been fraught with difficulties. In the building trades, for example, where a vessel or canal with a diameter of several feet or more may have to be obturated to effect repairs, some effective way of closing that aperture is needed. Again, in sealing containers it is often necessary to insure that the closure will provide an airtight, watertight barrier between the interior of the container and the outside conditions of the atmosphere. Particularly in instances where the material being stored is susceptible to damage from either air or moisture, some closure must be used which will effectively isolate the interior of the container from the ambient atmospheric conditions. Preferably the closure used will provide an airtight and watertight seal, should be light enough for ready handling, strong enough to perform the necessary sealing function, and readily insertable into and removable from the container. Additionally, a practical closure should be rugged enough to withstand repeated use while still retaining its sealing characteristics. As is known, modern guided missiles are desirably stored as unassembled components in airtight and watertight containers. The instant invention, while possessing desirable characteristics which make it suitable for a great variety of uses, is particularly adaptable to the sealing of containers utilized for storage of guided missile components.

Accordingly, it is an object of the instant invention to provide an improved gas and fluid tight closure seal for obturating a passage.

Another object of the instant invention is to provide a reusable closure which is rugged enough to withstand repeated usage while retaining its improved sealing properties.

Still another object of the instant invention is to provide an improved obturating device adapted to close large apertures but which, due to its unique construction, can be fabricated into a light, readily handled structure.

Still another object of the instant invention is to provide an improved airtight lid or cover which due to its unique arrangement of structural parts provides an improved sealing action for a missile container.

A further object of the instant invention is to provide an improved container sealing lid which is readily inserted into the container opening and easily removed when desired.

A still further object of the invention is the provision of a new and improved adjustable container lid or closure which is readily inserted into the container opening and releasably locked in sealing engagement with the container in a manner to prevent accidental displacement of the lid such, for example, as by an external or an internal force exerted thereon.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is an elevational view of the completely assembled cover of the instant invention with parts shown in section to more readily illustrate features of the construction showing a wall and bearing gasket of a container and the manner in which the cover is inserted thereinto;

FIG. 2 is a fragmental view of the edge of the cover after it is tightened in position showing the sealing action of the cover gasket under pressure;

FIG. 3 is a reduced elevational view, with parts in section, of the outer plate of the improved container cover;

FIG. 4 is a view of the outer plate of the instant invention as seen from the interior of the container lid;

FIG. 5 is an elevational view with parts broken away to illustrate the construction of the inner plate of the improved container lid;

FIG. 6 is a fragmentary view similar to FIG. 2, illustrating a modified construction of the device thereof with the cover or closure inserted into a container, in the unlocked condition;

FIG. 7 is a view similar to FIG. 6, illustrating the cover in a locked condition; and

FIG. 8 is a view similar to FIG. 6, illustrating another modification of the device of FIG. 2.

While the illustrated embodiment is particularly adapted for the closure of a cylindrical container opening and will be described as such, it is to be understood at the outset that other shape containers and container openings may be sealed utilizing principles disclosed herein and this disclosure is intended to cover all such modifications within the scope of the appended claims.

Referring now to the drawings wherein like reference numerals indicate like parts throughout the several views and more particularly to FIG. 1, the watertight closure 10 of the instant invention comprises a pair of frustoconical shape plates 12 and 15, arranged with the conical axes of the plates coincident and the bases of the conical plates adjacent each other. A resilient sealing ring or gasket 20 of neoprene rubber or a similar material may be positioned between the plates and may be cemented or otherwise suitably connected to either the outer plate 12, or the inner plate 15, or both of them adjacent their outer circumferences. In the embodiments illustrated and as best shown on FIGS. 1, 3 and 5, the plates have their surfaces radially corrugated or deformed to form a plurality of radially extending alternating ridges and grooves or corrugations 14. In the illustrated embodiments, it is desirous that approximately 10° be left between the center line of each crown or trough, however no particular number of corrugations is required as long as the frequency of the ripples is the same on the two plates. The corrugations 14 in each plate may extend from a flat circular area 16 surrounding the axis of the cover to the outer periphery of the plates gradually becoming wider and deeper as the periphery is approached. The corrugations, as arranged in the plates, perform an important sealing function, as will become clear as the description proceeds. As more clearly shown on FIG. 1, the closure is assembled with the crowns of the corrugations of the outer plate 12, opposite the troughs of the corrugations of the inner plate 15, so that the distance between the plates is substantially constant around the periphery of the closure and the sealing gasket 20 may be readily attached to both plates.

At the center of the completed assembly, FIG. 1, is an actuating mechanism which comprises a threaded stud 18 which may be welded or otherwise suitably mounted on the inner plate 15, and extends toward the outer plate. A sleeve nut 21 is rotatably mounted inside the outer plate 12 and is adapted to threadedly engage the stud. The sleeve nut 21 is secured in place by a flange 22 which runs between two bearing surfaces 23

and 24 and which are in turn secured by a locking collar 25 to a threaded boss 26 secured so as to be integral with outer plate 12. The arrangement of the actuating mechanism in the embodiment illustrated, in FIG. 1, is also employed with the arrangement of FIGS. 6 and 8, the threaded stud 18 being rigidly secured to the inner plate 15, and the sleeve nut 21 is prevented from moving axially with relation to the outer plate 12, but is free to rotate. The sleeve nut may be made of proper length to form a mechanical stop effectively preventing the centers of the inner and outer plates from moving closer together than a pre-established distance. A handle 26 may be attached to one of the plates to facilitate handling of the cover, as for example, to position it adjacent the bearing gasket 40 within a container 41 while the cover is tightened into sealing engagement.

Referring more particularly to FIGS. 3 and 4 a plurality of radially extending pressure transmission members in the shape of triangular gussets 28 may be mounted on the interior surface of the outer plate and may extend radially along a line slightly offset from the center line of the trough of the corrugations provided in the plate surface. The gussets preferably extend substantially from the flat circular area 16, surrounding the closure axis, to a position somewhat inside of the outer periphery of the plate 12. A segmental pressure shoe 30 is suitably fastened, as by welding, like a T across the outer edge of each gusset 28. These pressure members 30 may be cemented or otherwise fastened to the inner surface of the sealing gasket 20.

Referring to FIG. 5, the triangular gussets 32 of the inner plate 15, are shown attached along a line slightly offset from the crowns of the corrugations of the inner plate and also may extend from the central flat surface 16 to a place near the periphery of the plate. The direction of the offset of the gussets 32 of the inner plate is opposite to that of the gussets 28 of the outer plate to an amount sufficient to allow both sets of gussets to lie side by side to act on the pressure shoes 30 when the center lines of the corrugations are aligned to assemble the closure, as shown in FIG. 1. The outer edges of the gussets 32 maybe chamfered to provide an effective surface to exert a uniform radial pressure on the interior surface of pressure shoes 30.

When assembled, as shown in FIG. 1, the centers of the frustums of the cones formed by the inner and outer plates are moved toward and away from each other by the actuating mechanism. The outer extremity 35 of sleeve nut 21 is preferably shaped to cooperate with a wrench so that a rotational movement may be readily applied. This action increases and decreases the axial dimension of the cover and inversely affects the diameter of the assembly, i.e., as the axial dimension of the cover is decreased, the diameter of the cover is increased.

In use, the centers of the plates are forced apart the maximum distance, which will be determined by the length of the threaded stud and sleeve nut, and the device is moved into the position desired in the opening or passage to be closed. The centers of the inner and outer plates are then pulled together by rotating the sleeve nut and the gasket is forced out radially against the passage wall. In the illustrated application in FIG. 1, a container wall 41 is shown fitted with a U-shaped bearing gasket 40 into which the cover is inserted before tightening. It will be understood that axial contraction of the closure by the actuating mechanism causes an increase in its diameter. An interaction of the outer and inner plates causes a deformation of the corrugations tending to flatten out both the inner and outer plates and thus causes an increase in diameter of the complete assembly. Simultaneoulsy with the deformation of the corrugated inner and outer plates, the triangular shaped gussets fixed along the corrugations of both plates are pressed outwardly because of the flattening of the cones. This radially outward pressure is transmitted through the pressure shoes to force the gasket band outwardly into a tight sealing engagement with the wall or bearing gasket, if the container is so equipped. Because of the unique construction of the sealing closure it should be noted that an increase in pressure on the face of either plate will automatically cause a further deformation of the corrugations with the resultant increase in sealing pressure around the entire periphery of the gasket thus enhancing the sealing action of the cover. This feature is important in that pressure differential across the closure in either direction serves to improve the seal.

In the arrangement of FIGS. 6 and 7, it will be noted that a sealing gasket 32 similar to the gasket 20 is disposed between plates 12 and 15, the gasket 32 being bonded to plates 12 and 15 and the segmental pressure shoes 30 in any suitable manner such, for example, as by cement or in any other conventional manner. A gasket 33 is disposed between an outermost flange 34 and an innermost flange 35 carried by the container wall 36, the width of the outermost flange 34 being substantially less than the width of the innermost flange 35. By this arrangement, the cover may be readily inserted into the container opening when the cover is in its initial or unadjusted position, FIG. 6. Upon adjustment of plates 12 and 15 in the manner, as heretofore set forth, shoes 30 force the gasket 32 outwardly into sealing engagement with the wall or bearing gasket 33, FIG. 7. When this occurs the closure is locked between flanges 34 and 35, FIG. 7, and displacement of the cover or closure is prevented in response to either an external or an internal blow or pressure, as the case may be.

In the arrangement of FIG. 8, a sealing gasket 38 is disposed within an annular groove or channel 39 formed on container 41, the gasket 38 being confined therein by mutually spaced walls 42 and a circumferential wall 43. It will be noted that the width of gasket 38 is substantially less than the width of walls 42 to provide locking means for the cover when the cover is attached to the container 41. Thus upon adjustment of the cover, in a manner as heretofore set forth, a gasket 44 carried by plates 12 and 15 and shoes 30 is forced into sealing engagement with gasket 38 and concurrently therewith plates 12 and 15 move into channel 39 an amount sufficiently to be locked therein by walls 42, whereupon accidental displacement of the cover is prevented.

From the foregoing it will be apparent that a new and improved adjustable sealing closure for containers has been devised, which may be readily inserted into the container opening and moved into sealing and locking engagement with the container wall, and which may be readily unlocked and removed from the container when desired.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. The combination of a container having an opening therein, a closure comprising a pair of frusto-conical shaped deformable plates arranged with their concave sides facing each other a sealing member disposed between and secured to said plates at the periphery thereof, a plurality of radially disposed gusset members carried by said plates, a pressure shoe connected to the terminal end of each gusset member on one of said pair of plates and secured to said sealing member, means for axially compressing said plates to increase the diameter thereof and forcibly move the gusset members radially outward thereby transmitting the movement through the pressure shoes to said sealing member, means on the container for receiving and locking the periphery of said plates therein, means on said container cooperating with said receiving and locking means and said sealing member for sealing the closure to the container and within the opening as

said sealing member is forcibly moved outwardly by said gusset members, said receiving and locking means comprising spaced apart walls cooperating with the periphery of said plates as the diameter of the plates has been increased a predetermined amount thereby preventing accidental displacement of the closure.

2. The combination of a receptacle having an opening therein, a closure for closing the opening comprising a pair of frusto-conical shaped deformable plates arranged with their concave sides facing each other, means for axially compressing and deforming said plates to increase the diameter thereof, annular locking means carried by said receptacle, a sealing member carried within said annular locking means, and a resilient sealing gasket disposed between and secured to said plates at the periphery thereof and movable into sealing engagement with

said sealing member as the diameter of said plates is increased, said annular locking means comprising spaced apart annular walls cooperating with the periphery of said plates for locking said closure to the receptacle thereby preventing accidental displacement of the closure.

References Cited in the file of this patent

UNITED STATES PATENTS

38,600	Prosser	May 19, 1863
355,722	Schwab	Jan. 11, 1887
734,047	Crissy	July 21, 1903
905,652	Comings	Dec. 1, 1908
2,462,445	Weiss	Feb. 22, 1949
2,720,893	Foreman	Oct. 18, 1955
2,959,319	Mitchell	Nov. 8, 1960