

[54] **WATERPROOF, AIRTIGHT CLOSURE**

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3,747,541 7/1973 Reese ..... 109/64 X

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[52] **U.S. Cl.** ..... **109/64; 138/89; 220/235**

[51] **Int. Cl.<sup>2</sup>** ..... **E05G 1/026**

[58] **Field of Search** ..... 109/64, 50, 75; 138/89; 220/24.5, 234, 235; 217/78, 79; 277/102, 113, 117, 205; 285/162, 196, 338, 346; 215/359; 166/124

[56] **References Cited**

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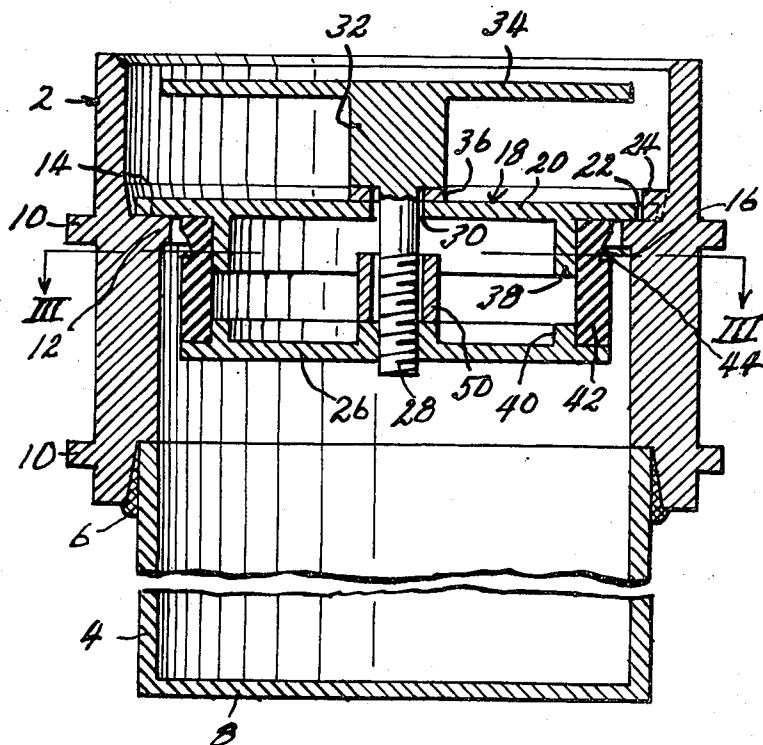
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[57]

**ABSTRACT**

A waterproof, airtight closure assembly consisting of a cylindrical door frame having an internal peripheral flange, and a door including a circular plate adapted to engage the flange and inwardly of the plate, a compressible rubber collar normally insertable through the flange, the door including mechanism operable to expand the collar radially to engage the flange, and to engage the frame inwardly of the flange, the collar having a specially preformed groove therein for insuring proper engagement thereof with the flange.

**4 Claims, 5 Drawing Figures**



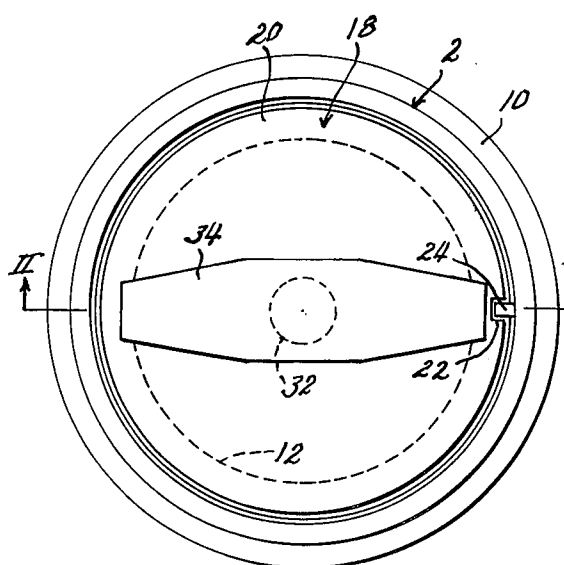


Fig. 1

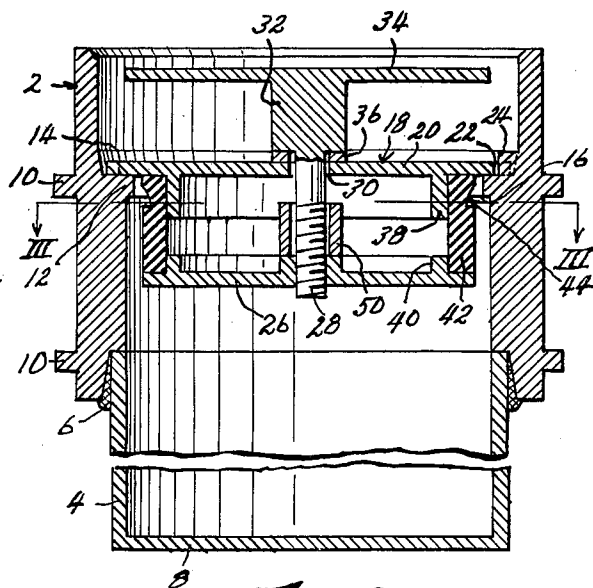


Fig. 2

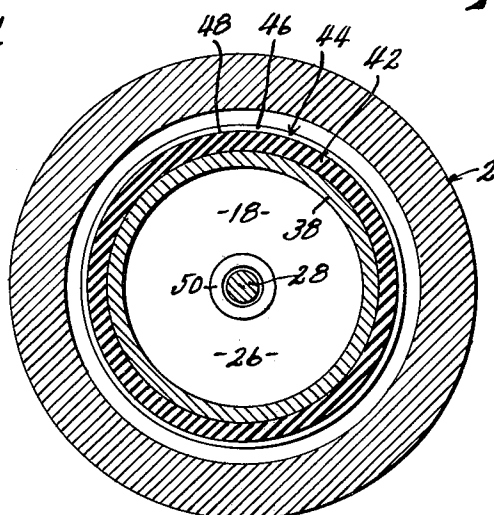


Fig. 3

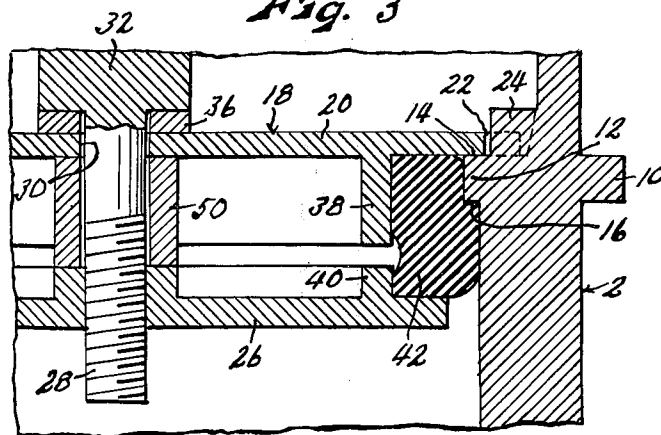


Fig. 4

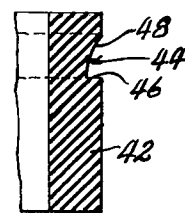


Fig. 5

## WATERPROOF, AIRTIGHT CLOSURE

This invention relates to new and useful improvements in watertight, airtight closures, and constitutes an improvement in the structure shown in my own U.S. Pat. No. 3,747,541 issued July 24, 1973 and entitled WALL OR FLOOR SAFE.

The primary object of the present invention is the provision of a closure door including an outwardly expandible rubber sealing ring around its edge, and mechanism carried by said door for expanding said sealing ring, or "collar" outwardly into tight engagement with the door "frame" around the entire periphery of said door to render it watertight and airtight.

A problem experienced with doors of this general type, both that shown in my own prior patent identified above, and others, is that for tight sealing, it is generally desirable that the door frame be provided with flanges, grooves or the like around the door, into which the sealing collar is expanded to conform to their contour, coupled with the fact that compression and expansion of the collar is nearly always inevitably accompanied by movement of at least portions of said collar in a direction normal to the door plane, as well as outwardly from its edges in a direction parallel to the door plane. This movement of the collar normally to the door plane, while at the same time it is being expanded parallel to the door plane, often results in faulty engagement of the collar with the grooves or flanges of the frame. That is, around portions of the door edge the collar, as said collar moves normally to the door plane, may slip through or past the frame grooves, while other portions of the periphery of the collar may not. Not only does this unequal movement of different parts of the collar, with its resultant localized deformations thereof, create the possibility of small gaps between the collar and frame through which air and water may leak, but also it may cause localized tearing, cutting or other damage to the collar itself, thereby shortening its useful life, particularly if edges of the frame flanges or grooves are sharp. Therefore, the primary object of the present invention is carried out by the use of a door frame including only a single internal sealing flange, and the use of a special sealing collar so shaped that it will engage said flange uniformly around the entire periphery of the door, with no possibility that it will move non-uniformly relative to the flange as it is compressed normally to the door plane.

Another object is the provision of a closure of the general character described which is extremely secure, so that in many cases it may be used where safe-like protection is desired.

Still another object is the provision of a closure door of the general character described which in some installations, as when used as doors for vaults or safes embedded in concrete, is virtually fireproof.

Other objects are simplicity and economy of construction, and efficiency and dependability of operation.

With these objects in view, as well as other objects which will appear in the course of the specification, reference will be had to the accompanying drawing, wherein:

FIG. 1 is a top plan view of a closure embodying the present invention,

FIG. 2 is a sectional view, with portions broken away, taken on line II—II of FIG. 1, showing the door positioned but not tightened or sealed in its frame,

FIG. 3 is a sectional view taken on line III—III of FIG.

2.

FIG. 4 is an enlarged, fragmentary view similar to FIG. 2, but showing the door sealed in place,

FIG. 5 is an enlarged, fragmentary view of the sealing collar only, in the condition thereof shown in FIG. 2.

Like reference numerals apply to similar parts throughout the several views. The particular embodiment of my invention shown is as it might be used in connection with a floor or wall safe adapted to be embedded in concrete. The device includes a heavy cylindrical steel body member or tube indicated generally by the numeral 2, which also forms the frame of the door. A safe or vault enclosure 4, which may constitute a heavy cylindrical steel pipe, has its open end affixed in the lower end of body member 2 as by welding 6, and is closed at its opposite end by end wall 8. Enclosure 4 may of course be of any desired length and cross-sectional configuration. The entire assembly of body member 2 and enclosure 4 is adapted to be embedded in a poured concrete floor or wall, with the open end of body member 2 flush with the exposed floor or wall surface. Body member 2 is provided with external flanges 10 (two shown) for assisting in securing the assembly very securely in the concrete structure. Intermediate its ends, body member 2 is provided with an integral internal peripheral flange 12, the upper face 14 and lower face 16 of said flange being normal to the body member axis. The internal diameter of the body member above the flange 12 is substantially greater than its internal diameter below said flange.

Body member 2 is adapted to receive therein a closure door indicated generally by the numeral 18. Said door includes a circular top plate 20 of such diameter as to be freely insertable into the top end of body member 2, normally to the axis of said body member, to rest on top face 14 of body flange 12. Rotation of said top plate about the body member axis is prevented by engagement of a notch 22 formed in its edge with a lug 24 formed integrally with the body member. The door 18 also includes a circular bottom plate 26 disposed parallel to and beneath top plate 20, in spaced apart relation therefrom, and being of smaller diameter than the internal diameter of flange 12 so as to be freely insertable downwardly through the latter. A screw 28 disposed coaxially with the door is threaded at its lower end portion in bottom plate 26, and extends upwardly through a loosely fitting hole 30 provided therefor centrally in top plate 20, being provided upwardly of said top plate with an enlarged section 32 having a T-handle 34 at its upper end. Enlargement 32 bears against the top plate, a washer 36 being inserted therebetween, both to provide an anti-friction bearing, and also to provide a seal against the leakage of water and air through hole 30.

Top plate 20 of the door is provided with an integral cylindrical skirt 38 depending concentrically therefrom, and lower plate 26 is provided with a corresponding upstanding skirt 40 rising therefrom. Skirts 38 and 40 are concentric and of equal external diameters, but of substantially smaller external diameter than the internal diameter of body flange 12. Encircling skirts 38 and 40 is a normally cylindrical collar 42 formed of rubber or other suitable compressibly elastic material.

When uncompressed, as in FIGS. 2 and 5, the inner surface of said collar snugly engages skirts 38 and 40, and its outer surface is substantially cylindrical, being of sufficiently small diameter that it can pass freely through body flange 12. The upper and lower end surfaces of said collar engage top plate 20 and bottom plate 26 respectively. Formed in the external surface of collar 42 is a peripheral groove 44 the normal contour of which is best shown in FIG. 5. It includes a bottom surface 46 constituting a shoulder normal to the door axis and facing toward top plate 20, and an inner surface 48 rising from the inner edge of shoulder 46 and merging with the normally cylindrical outer surface of the collar at a line intermediate shoulder 46 and the top end of said collar. Shoulder 46 is spaced below the upper end of the collar by a distance somewhat greater than the axial thickness of body flange 12, while inner surface 48 of groove 44 extends to a spacing from the top end of the collar less than the axial thickness of flange 12, as shown in FIG. 2.

To place and secure the door in body member 2, screw 28 is first turned by means of handle 34 until door plates 20 and 26 are spaced apart sufficiently to allow collar 42 to assume its normal configuration. The door may then be inserted into the body member to allow top door plate 20 to rest on upper face 14 of body flange 12, during which insertion bottom door plate 26, and a portion of collar 42, pass freely through body flange 12. The parts then have the relative positions shown in FIG. 2, notch 22 of top door plate 20 being engaged over body lug 24. Handle 34 is then manually turned to cause screw 28 to elevate bottom door plate 26 relative to top plate 20, lug 24 preventing rotation of the door with the handle. Elevation of bottom plate 26 compresses collar 42 axially of the door, and said collar bulges or expands radially outwardly to engage the inner surface of flange 12, its lower surface 16, and the interior surface of the body member below said flange, as shown in FIG. 4. As the collar is compressed axially, any given point on its external surface tends to move in some degree toward top plate 20, and hence moves axially relative to flange 12. It is this movement which has heretofore resulted in some malfunction. As this axial movement occurs, after the collar has expanded sufficiently to engage flange 12, it has been found that in the absence of groove 44, some portions of the periphery of the collar will slip through the flange, while other portions of the periphery will not, but will "hang up" on the edge of the flange. Tearing or cutting of the rubber hence can occur, particularly at the "change over" points at the junctures between the slipping and non-slipping portions of the collar periphery, as a result of the unequal axial movement of different portions of the collar. Also, severe distortion of the rubber can occur at these juncture points. Both the cutting or tearing of the rubber, and also the deformation thereof, can result in the leakage of both water and air past the seal desirably provided by the collar, thus defeating the basic purpose of the door. However, with groove 44 formed as shown, it will be seen that as the collar is expanded, the first portion thereof to engage the body member will be its shoulder 46, as said shoulder moves axially toward top plate 22 and engages the lower face 16 of flange 12. The recessed position of inner wall 48 of the groove, relative to the normal outer periphery of the collar, prevents it from engaging the inner cylindrical surface of the flange until the de-

scribed contact of groove shoulder 46 with lower face 16 of the flange is substantial and complete around the entire edge of the door. Thereafter, axial compression and radial expansion of the collar may be completed with no danger that any portion at all of its periphery can slip or slide through the body flange, so that the cutting, tearing and localized deformation as discussed above does not occur, and the seal provided by the collar is rendered both efficient and reliable. For these purposes, it has been found that if the axial thickness of flange 12 is about one-half inch, the normal spacing of groove shoulder 46 below the upper end of the collar should be about five-eighths of an inch, so as to normally be positioned before compression of the collar, about one-eighth inch below the lower face 16 of the flange, with other parts being proportionately sized as shown, but these specific figures are exemplary only. Washer 36, loaded by the axial tension of screw 28, provides an air and water seal at the central hole 30 of top plate 20.

Collar 42 is constrained to buckle or expand radially outwardly, rather than inwardly, as it is axially compressed, by skirts 38 and 40 of the top and bottom door plates. Said skirts, being spaced apart from each other, do not constitute a complete and unbroken interior sleeve for the collar, but nevertheless are sufficiently continuous to insure against inward buckling to any harmful degree. Also, it will be apparent that extreme over-tightening of screw 28 could cause over-compression of the collar and resultant permanent damage thereto. To prevent this occurrence, skirts 38 and 40 may be of such selected axial lengths that they engage each other, and hence arrest movement of bottom plate 26 toward top plate 20, when the collar has been compressed to a point within an acceptable range, that is, after it has made good sealing contact with body member 2 but before it has been over-compressed and damaged. However, actual contact of the two skirts might pinch and damage portions of the collar therebetween, and it is therefore preferable that compression of the collar be limited by a sleeve 50 carried loosely on screw 28 between the top and bottom plates of the door, as shown. The axial length of said sleeve may be so selected that it engages between said top and bottom door plates to prevent any further compression of the collar, as shown in FIG. 4, at a desired stage of compression of the collar, with skirts 38 and 40 having axial lengths such that they are still spaced apart at this time.

The closure as shown is well adapted for practical use as a vault or safe door due to the extreme friction with which the expanded collar engages body member 2. Even without internal flange 12 in the body member, the outward displacement of the door from the body member has been found to require an outward pull of many tons, well beyond the capabilities of an ordinary burglar working without highly specialized tools and equipment, due entirely to the friction resisting movement of the collar relative to the body member, provided that a rather hard, firm rubber is used for the collar. The presence of body flange 12 further multiplies the force required to pull the door from the body member, since removal of the door is resisted not only by friction, but by the additional force required to shear the collar material between the confronting peripheral edges of bottom door plate 26 and flange 12. Rubber having a durometer hardness of about 60 has been found satisfactory. Of course, the hardness of the rub-

ber used affects the degree to which it can be compressed without damage thereto, and for this reason the length of sleeve 50 should be correlated to the rubber hardness to provide a workable and efficient combination. A safe or vault application of the closure would of course also require some means, such as a padlock, for locking screw 28 against manual rotation when desired. Such screw locking means, however, is not pertinent per se to the present invention, and is not shown.

If body member 2, and of course safe or vault enclosure 4, are completely embedded in concrete to the upper end of said body member as previously described, the closure becomes highly resistant to damage by fire, despite the fact that collar 42 is of course combustible and subject to heat damage. This property of the closure results both from the fireproof nature and excellent heat insulating properties of the concrete itself, and from the fact that the closure door 16 is recessed well below the upper end of the body member, as shown.

While I have shown and described a specific embodiment of my invention, it will be readily apparent that many minor changes of structure and operation could be made without departing from the spirit of the invention.

What I claim as new and desire to protect by Letters Patent is:

1. A closure assembly comprising:

- a. a tubular body member serving as a door frame and having an internal peripheral flange, said flange being provided with inner and outer surfaces parallel to the plane of the door,
- b. a closure door engageable in said body member and including a compressible collar member extending about the periphery of said door, said collar normally being insertable through said body member flange to a position in which it is disposed within and extends inwardly beyond said body member flange, and

c. compressing means carried by said door and operable to compress said collar in a direction normal to the door plane, whereby said collar is bulged outwardly in a direction parallel to the door plane to engage said body member and its flange, said collar having a groove formed peripherally in the outer surface thereof operable to engage said body member flange as said collar is bulged outwardly, said collar groove providing a shoulder of said collar parallel to the door plane facing outwardly relative to said door, said groove being otherwise so configured and positioned that as said collar is bulged outwardly parallel to the door plane by compressive force exerted thereon normally to the door plane, the engagement of said shoulder thereof with said inner surface of said body flange is the sole initial engagement between said collar and body member.

2. A closure as recited in claim 1 wherein said collar has a normally cylindrical outer surface of greater axial length than the thickness of said body member flange, said groove being formed in said external surface and being generally of V-shape, one wall thereof forming said shoulder generally normal to the collar axis and facing outwardly of said door, and the other wall thereof extending at an acute angle to said external collar surface.

3. A closure as recited in claim 2 wherein said groove shoulder is normally spaced apart from the inner surface of said body member flange in a direction inward from said flange, and wherein said other groove wall merges with said external collar surface at a position within the range of the axial thickness of said body member flange.

4. A closure as recited in claim 2 with the addition of means operable to prevent rotation of said door relative to said body member as said collar is bulged outwardly.

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