

March 18, 1947.

T. H. RISK

2,417,703

SEALING SCREW CLOSURE

Filed March 19, 1945

2 Sheets-Sheet 1

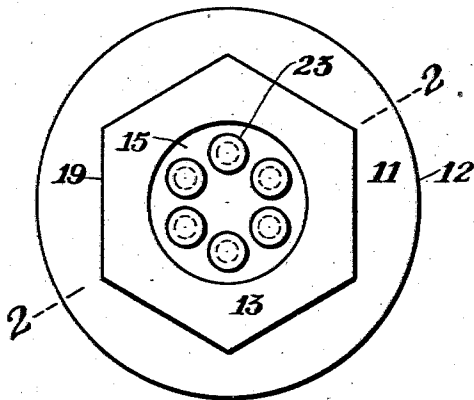


Fig. 1

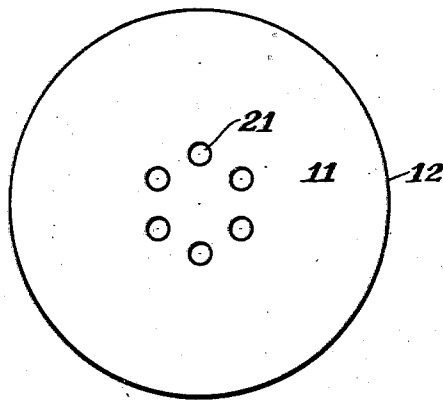


Fig. 4

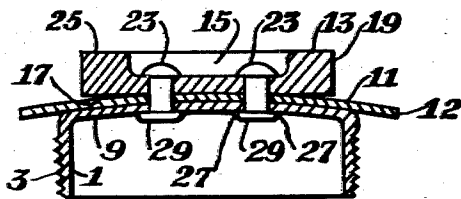


Fig. 2

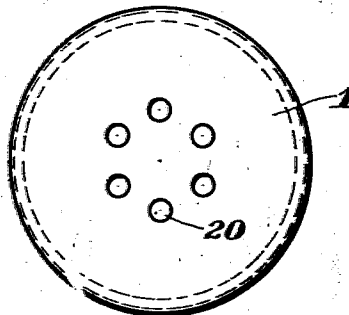


Fig. 5

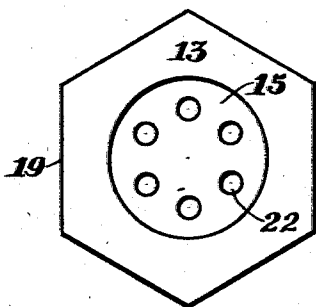


Fig. 3

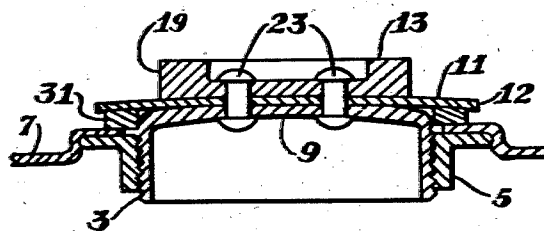


Fig. 6

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2 Sheets-Sheet 2

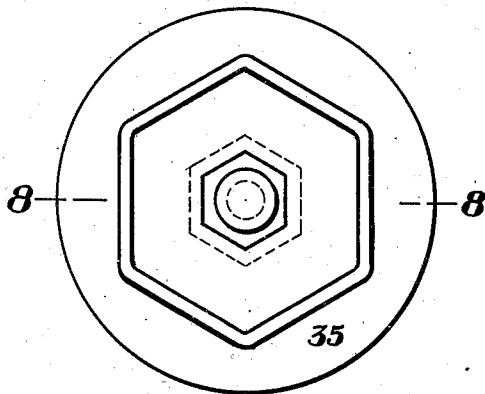


Fig. 7

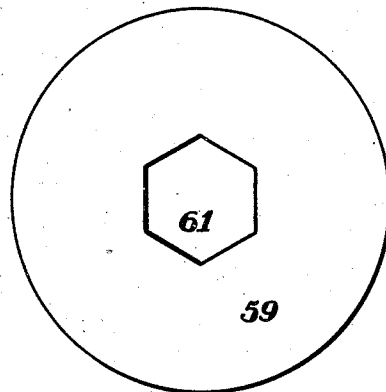


Fig. 10

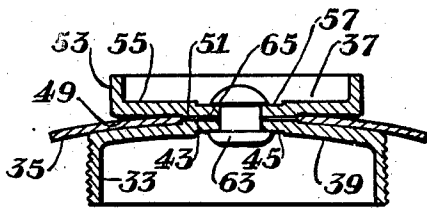


Fig. 8

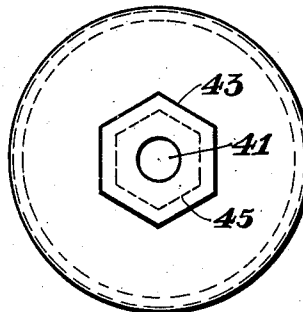


Fig. 11

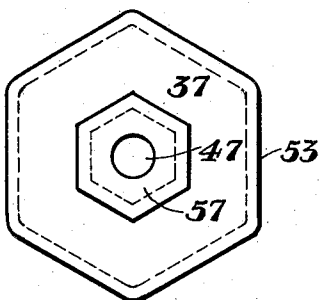


Fig. 9

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SEALING SCREW CLOSURE

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5 Claims. (Cl. 220—39)

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This invention relates to an improved bung or closure for receptacles such as drums, cans, and the like.

One of the objects of the invention is to provide a bung or closure for receptacles that will prevent leakage of liquid from the receptacle.

Another object of the invention is to provide a bung or closure that can be easily applied to an opening in a receptacle and can be easily removed therefrom.

Still another object of the invention is to provide a closure of sufficiently great structural strength to withstand usage to which receptacles equipped therewith are subjected.

A further object of the invention is to provide a closure which does not destroy or render unusable the gasket customarily used in conjunction with a removable closure.

Other objects of the invention will become manifest from the following description and accompanying drawing of which

Figure 1 is a plan view looking at the top of my novel closure;

Figure 2 is a vertical cross-sectional view of the closure taken on the line 2—2 of Figure 1;

Figure 3 is a plan view of a nut forming an element of the novel closure;

Figure 4 is a plan view of a spring plate forming an element of novel closure;

Figure 5 is a plan view of a plug forming an element of the novel closure;

Figure 6 is a vertical cross-section of the top of a receptacle with the closure tightly screwed in place;

Figure 7 is a plan view of a modified closure constructed in accordance with my invention;

Figure 8 is a vertical cross-sectional view taken on the line 8—8 of Figure 7;

Figure 9 is a plan view looking at the bottom of a nut forming an element of the closure shown in Figure 7;

Figure 10 is a plan view looking at the top of a spring plate forming an element of the closure shown in Figure 7; and

Figure 11 is a plan view looking at the top of a plug forming an element of the closure shown in Figure 7.

Referring now to Figures 1 to 6 of the drawings, the numeral 1 indicates a round hollow plug with the outside of the side wall 3 threaded in order to enable it to be screwed into the threaded opening 5 in the top 7 of a receptacle such as a metallic drum. The top 9 of the plug is preferably gently curved so that its upper sur-

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face is convex and forms a section of the surface of a sphere.

A circular spring plate 11 also having a gentle curvature so that its upper face is convex, is mounted on top of the plug. The spring plate 11 has a greater circumference than the plug 1 so that the circular edge 12 thereof extends beyond the edge of the plug. The spring plate 11 is essentially a Bellville spring, the load characteristics of which can be made to be essentially constant after the first initial deflection. The spring plate is of sufficient thickness to withstand deflection unless considerable pressure is applied thereto. I have found that a plate which requires a tightening torque of 25 to 40 foot pounds to bring the plate to its fully deflected position is satisfactory for the size closure herein shown and described, for use on a standard 55 gallon drum. The tightening torque can be varied to suit any particular application by varying the spring plate thickness and/or the spherical radius of the spring plate. The diameter of the spring plate when varied to adapt the closure to different size openings will also affect the tightening torque. The curvature of the top 9 of the plug is preferably the same as the curvature of the plate 11 although the curvature of the top may be somewhat greater than the curvature of the plate without departing from my invention.

A hexagonal-shaped nut 13 is mounted above the plate 11. The nut has a circular recess 15 on the upper surface centrally thereof. Although I have shown a hexagonal-shaped nut it should be understood that the shape of the nut is immaterial provided it is shaped or formed in such manner as to enable it to be tightened or loosened by means of a wrench or similar device or by hand. The bottom surface 17 of the nut 13 slopes slightly upwardly from the edge to a point intermediate the edge and center thereof for reasons hereinafter explained. The nut 13 extends over a substantial area of that portion of the spring plate 11 subject to being deflected, but preferably the edge 19 of the nut does not extend beyond the edge 12 of the plate.

The top 9 of the plug 1, the spring plate 11 and the recessed portion of nut 13 each have a plurality of spaced holes 20, 21 and 22, respectively, drilled or punched therethrough and arranged in a small circle around the center. As is apparent from the drawings, each of the aforesaid elements has six equally spaced holes, the holes in each element being in alignment with those of each of the other two elements. The nut,

plate and plug are held rigidly together by means of rivets 23. The recess 15 of nut 13 is preferably of sufficient depth so that the heads of the rivets do not extend above the top surface 25 of the nut. The joint 27 between the heads 29 of the rivets and the top 9 of the plug is soldered to make it leak-proof.

Any other suitable leak-proof means, such as spot or projection welding, for uniting the plug and nut to the plate may be used instead of rivets. Where welding is used, it will be unnecessary to punch holes through the plug, plate and nut to accommodate the rivets. Regardless of the means used to unite the elements of the closure, a portion of the plate 11 extending from the edge 12 inward a substantial distance beyond the edge 19 of the nut must be free to undergo deflection when pressure is applied to the underface thereof adjacent its edge.

As shown in Figure 6, the closure is adapted to be screwed into a threaded opening in a container with a composition, rubber or other suitable gasket 31 placed between the outside wall of the container surrounding the opening, and the spring plate 11. This gasket is of slightly smaller circumference than the spring plate. When the closure is tightened, the pressure exerted by the gasket against the underface of the spring plate causes it to deflect upwardly. As the spring deflects upwardly the upper face thereof abuts the underface of the nut which acts as a spring stop. Because of the slight downward slope of the underface of the nut toward the edge thereof, the spring plate is prevented from being deflected to a substantially flat position and thereby is prevented from going over center. When the spring plate is deflected against the nut, the tightening torque increases tremendously thereby indicating that the closure is tight and the receptacle properly sealed.

Because of the structure of the closure the spring cannot go over center when the closure is tightened. Thus, full pressure is maintained on the gasket at all times unless the gaskets take a set or shrinks to such an extent that the spring deflects to the position shown in Figure 2 with the lower face of the spring plate flush against the top surface of the plug.

Another advantage of the closure is that instead of spreading the gasket as the closure is tightened, it retains and centers the gasket against the plug as pressure is applied.

The drawings represent a full scale closure made to fit standard I. C. C. drums. The plate 11 is made from 18 gauge spring steel. It has a diameter of three inches and is curved on a nine-inch radius. The holes through which the rivets pass are $\frac{3}{8}$ inch from the center of the plate and each hole has a diameter of $\frac{5}{32}$ inch.

The nut measures two inches between opposite sides and the angle of slope of the lower surface 17 from the edge of the circle bounding the hole 22 to the edge 17 is 1 degree 30 seconds. The plug has a diameter of $2\frac{3}{8}$ inches.

It should be understood that although these relative dimensions give excellent results they may be departed from without departing from the invention. In the closure shown and described, the spring plate can be deflected upwardly about $\frac{1}{32}$ of an inch and therefore the closure will remain tight and leak-proof although the thickness of the gasket shrinks as much as $\frac{1}{32}$ of an inch.

The closure shown in Figures 7 to 11, inclusive, comprises a plug 33, a spring plate 35 and a nut 37

37 corresponding to the same elements described in connection with the closure shown in Figures 1 and 2. The plug 33 differs from plug 1 in that the top wall 39 has a single hole 41 punched through the center thereof and the upper surface of wall 39 immediately surrounding the hole 41 is slightly raised in the shape of a hexagon as shown at 43. The lower surface of the wall 39 is slightly depressed immediately surrounding the hole 41 in the form of a hexagon as shown at 45. The upper surface of the raised portion 43 is substantially flat. Otherwise the plug 33 is similar to plug 1.

The nut 37 is hollow and shaped in the form of a hexagon. A hole 47 is punched through the center thereof of the same size as the hole 41 in plug 33. The bottom face 49 of the nut has a depressed area 51 immediately surrounding the hole 47, in the form of a hexagon of the same size as the raised area 43 of the plug. The face of the depressed area 51 is substantially flat. The remainder of the face 49 slopes slightly downwardly from the edge of the depressed area 51 to the edge 53 of the nut. The surface 55 of the nut is slightly depressed at 57 in the shape of a hexagon immediately surrounding the hole 47.

The raised and depressed areas of the plug and of the nut are made simultaneously by a stamping operation.

The spring plate 35 has a hexagonal-shaped hole 61 in the center thereof of such size as to enable the hexagonal areas 43 and 51 of the plug and nut, respectively, to fit snugly therein. The substitution of the hexagonal center hole of plate 35 for the plurality of circularly arranged holes of plate 11 constitutes the only difference between the two.

The plug 33, spring plate 35 and nut 37 are held rigidly together by means of a rivet 63 passing through hole 41 in the plug and hole 47 in the nut. By virtue of the fact that the shoulders of the areas 43 and 51 project into the hole 61 of the spring plate, all elements of the plug turn as a unit when turning torque is applied to the nut.

A gasket or other suitable sealing means 65 is placed between the spring plate and nut around the rivet in order to prevent leakage.

The dimensions of the closure shown in Figures 7 to 11 are the same as those for the closure shown in Figures 1 to 6 except that the diameter of the hole in the plug and nut through which the rivet passes is $\frac{5}{16}$ of an inch and the distance from one side to the opposite of the hexagonal hole in the spring plate is 0.875 of an inch.

It should be understood that the elements of the closure shown in Figures 7 to 11 may be fastened together by means other than by a rivet as for example, spot welding. If welding is used it will be unnecessary to punch holes through the plug and nut to accommodate the rivet.

It should be further understood that although the spring plate must be made from material which has a high degree of elasticity, I prefer to make the entire closure of steel, although the portions of the closure other than the spring plate may be made of other metals or materials, such as plastics, which have sufficient strength to withstand breakage during opening and closing and during shipping of the receptacle or container. Likewise, the closure may be applied to containers made of material other than steel.

The whole closure, if made of steel, is preferably treated to make it rust proof. One way to accomplish this is by cadmium plating the closure.

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It will be seen, therefore, that I have succeeded in providing a closure which is of simple construction and which automatically indicates when it is sufficiently tight and is capable of remaining tight and leak-proof when shrinkage of the gasket occurs.

It is claimed:

1. A closure comprising a threaded plug, a spring plate and a nut fastened together as a unit adjacent the centers thereof in face contacting relation with the plate between said plug and nut, the peripheral unfastened portion of the plate being normally in spaced relation to the nut throughout the peripheral portion of the nut, said spring plate having a circular periphery extending beyond the periphery of said plug a sufficient distance to form a solid edge portion to accommodate a gasket thereunder, the peripheral portion of said plate sloping away from the nut toward the plug, said nut having a lower edge portion extending below the center of the upper face of the plate and being adapted to contact said plate in operative position as a result of said plate being flexed upwardly against said lower edge of said nut, the relation between the said peripheral portion of said plate and said lower edge portion of said nut being such as to prevent said plate from going over center when in operative position.

2. A closure in accordance with claim 1 in

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which the spring plate has a convex surface adjacent said nut and a concave surface adjacent said plug.

3. A closure in accordance with claim 1 in which the periphery of the spring plate extends beyond the periphery of the nut.

4. A closure in accordance with claim 1 in which the spring plate is a circular section of the surface of a sphere having a radius of about 9 inches.

5. A closure in accordance with claim 1 in which the spring is a circular section of the surface of a sphere, the plug has an outside thread and the periphery of said plate extends beyond the periphery of said nut.

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