Still another object of the present invention is to provide a positive lock and safety means associated with the operating stems of expandable stoppers and which may be used either with a screw operated stem or a cam lever type, whereby the locking and safety means is guarded by the operating means of the stopper.

A further object of the present invention is to provide a new and improved high pressure stopper, wherein means is provided to prevent the loss of the stem and/or rubber body through larger openings.

Still another object of my present invention is to provide a new and improved stopper for high compression use that may be made in different sizes and which is readily adaptable for a variety of uses.

A salient feature of the present invention resides in providing a novel locking and safety means in the nature of a U-shaped locking plate to fit around the operating stem of the stopper which is much simpler and easier to operate than lock bolts, cotter pins, complicated keyways and the like, and thus provides a stopper which is virtually tamperproof, yet can be conveniently operated by properly trained and equipped personnel.

A still further object of the invention is to provide a simple, practical and reliable construction that is economical to manufacture, easy to assemble and positive in its operation.

With the above and other objects in view, which will more readily appear as the nature of the invention is better understood, the same consists in the novel construction, combination and arrangement of parts hereinafter more fully described, illustrated and claimed.

A preferred and practical embodiment of the invention is shown in the accompanying drawings, in which,

FIGURE 1 is a vertical section taken through one form of my improved stopper made in accordance with the present invention, and illustrating the same in its locked and safety position within an aperture;

FIGURE 2 is a horizontal section taken on the line 2—2 of FIGURE 1 of the drawings, looking in the direction of the arrows and clearly illustrating the novel locking plate;

FIGURE 3 is a fragmentary side elevational view of the stopper shown in FIGURE 1 of the drawings but with the handle unit removed;

FIGURE 4 is a fragmentary side elevational view partly in section of a modified means for operating and compressing the body;

FIGURE 5 is a perspective view of the novel locking plate and

FIGURE 6 is a fragmentary end elevational view of the lever operating means shown in FIGURE 4 of the drawings, the view being taken in the direction of the arrow of FIGURE 4.

A clearer understanding of the construction and method of operation of the invention may be had by referring to the drawings which form a part of the present specification, and wherein like reference characters designate the same or similar parts throughout the several views, and the letter C generally indicates one type of the improved closure or stopper.

Closure or stopper C includes broadly a compressible body 10 having an axial longitudinal bore 11 therethrough, a lower plate 12, a top pressure plate 13 through which the stem 14 extends and with which the operating handle unit 15 is associated.

The stopper C is to be associated with an opening or aperture 16 which may be part of any type of tank opening, pressure vessel, drum opening, testing machine etc., and the compressible body 10 is preferably made of a resilient material and has formed on the outer periphery thereof a series of spaced ribs 17 providing spaced annular areas 18. The axial bore formed through the body 10 is preferably of a greater circumference than the cir-
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The circumference of the stem 14 but the lower portion of the body 10 has an opening of the same or slightly greater circumference than that of the stem, and this is indicated by the numeral 19. The upper portion of the compressible body 16 may be provided with an annular flange 20 which terminates well beyond the outer ribs 17 and is formed so as to rest on the upper surface of the article to which it is to be associated to prevent the body from dropping through the aperture or opening. Resting on top of the flange 20 is the top pressure plate 13 and the axial plate 22 is provided with a number of cutouts 21 in the lower shoulders of which rest on an internal washer 24 and this washer rests on the upper surface for lower portion 25 of the rubber body 10.

Thus it can be seen that the stem is firmly held to the rubber body and will not drop through the opening even when the unit and locking plate are removed. The upper end of the stem projects well up above the pressure plate 13 and is provided with a threaded portion 26, as shown. Immediately below the threaded portion, the stem is provided with a series of equally spaced annular grooves 27 to provide a series of equally spaced ribs 28. When it is desired to seal or close off an opening or aperture, such as 16, it is merely necessary to insert the rubber body into the opening and then compress the body between the plate 12 and pressure plate 13. To accomplish this, I provide the handle unit 15 and this unit includes a cylindrical body provided with a longitudinally extending axial bore 29 which is internally threaded to mate with the threaded portion 26 of the stem. The lower portion of the handle unit is provided with a pair of spaced arcuate shaped depending feet 30 and these feet are spaced so that access can be had to the stem portion between the pressure plate 13 and the upper section 31 of the cylindrical body. Positioned above the feet 30 are the outwardly extending handles 32 and 33 respectively.

From the description so far, it can be seen that rotation of the handle unit 15 by means of the handles 32 and 33 in one direction will draw the stem upwardly and the resilient body will be compressed between the pressure plate 12 and pressure plate 13 to firmly seal the opening 16. In this manner the closure or stopper is firmly held in place in the aperture and seals the same entirely and in fact areas 16 aid in making a better seal by creating a slight vacuum with the walls of the aperture. When the closure is being tested it is often subjected to relatively high pressures such as thirty to fifty pounds per square inch, and it can be seen therefore that if handles 32, 33 were accidentally rotated so as to release the resilient body 10, the stopper would blow or shoot from the aperture 16 forcibly, and with such force that serious injury and damage could be inflicted. To prevent this accidental release of the compression of the body 10 by rotating handles 32 or 33, a novel locking and safety means is provided and this means is in the shape of a flat locking plate 22. Preferably, the locking plate is U-shaped or horseshoe shaped, and is of such thickness to be snugly received in any one of the grooves 27 and thus, is of a size and configuration to be snugly received about the reduced portions and between the ribs 28. Accidental rotation of the handle unit in one direction would stop movement of the stem and could not release the compression on the body 10.

In FIGURE 2 the exact position of the locking plate can be seen and the two legs 40 and 41 cooperate with the rounded bight portion 42 to hold the stem firmly in position. In actual use, it would be advisable to rotate handle unit 15 so that the depending legs 30 thereof are in the dotted position and this would provide locking means so that the locking plate could not be tampered with or accidentally pushed out of the grooves. Also it is advisable to form the locking plate 22 of such a size that it will be received entirely within the inner arcuate peripheral edge 44 of each depending leg 30 so that the handle is not rotated without turning or effecting the locking plate. It is also possible, if desired, to completely remove the handle unit 15, as shown in FIGURE 3 of the drawings, and it can be seen that locking plate will still hold the stem in its proper operating position with body compressed and sealed against aperture or opening 16.

As indicated the novel locking means can be associated with almost any type of compressible bottle stopper or closure, and in FIGURES 4 and 6 of the drawings, I have illustrated the same being associated with the cam lever type of closure, such as shown and described more particularly in Patent 2,315,538 and in accordance with this patent, if desired stem 14 can have an initial adjustment and be made in two parts. In any event, for the purpose of illustration, closure C' is constructed identically to that shown in FIGURES 1 and 3 of the drawings, except that the upper threaded portion 26 is eliminated. In lieu thereof, the upper section 26 is smooth and provided with a slot 46 opening outwardly and downwardly as shown. Otherwise, the stem is provided with the ribs 28 and spaced grooves 27 and is also provided with the novel locking piece 22. The cam lever 47 is preferably stamped from sheet metal to include an open top portion 48, parallel side cam walls 49 and the right angularly extending finger piece 50. Between the walls 49 I provide a pivot pin 51 and this pin is of a size and configuration to be received within the slot 46. Thus when the stopper C' is placed within an aperture or opening the cam lever is in a position wherein the surface 52 rotates on the pressure plate 13' and then the lever is rotated to draw the stem upward and compress the body 10'. Further downward motion as explained in the aforementioned patent, slightly releases the compression and creates a vacuum in the areawhich aids in sealing the opening. Thus it can be seen that I may provide a stopper constructed in accordance with the above, in different size for various and different uses, and that the same may be readily tested in machines without the danger of anyone accidentally causing the decompression of the bodies 10 or 10' with the result wherein the lower portion of the same may blow from the aperture with great force.

In FIGURE 4 it should be again noted that the locking and safety plate 22 is received between the parallel walls 49 and thus cannot be removed unless it is the exact intention to do so, and accidental removal is held to a minimum.

While I have shown and described certain specific embodiments of this invention, it will be understood that these are merely for the purpose of illustration and description, and that various other forms may be devised and that changes may be made in the proportions and minor details of construction, without departing from the spirit of the invention or scope of the appended claims.

What is claimed as new is:

1. A safety and locking means for expandable stoppers of the type having an elongated compressible body, a stem slidably received through the axial center of said body and means for actuating said stem to compress said body longitudinally, said safety and locking means including spaced ribs on said stem intermediate its ends defining spaced grooves certain of said grooves adapted to be aligned with the upper surface of said body upon longitudinal movement of said stem, and a U-shaped flat locking
plate of a size and configuration to be received in a respective aligned groove and under a respective rib.

2. In an expandible stopper for high pressure use, an elongated compressible body having an axial bore extending therethrough, means for compressing the body longitudinally and expanding the same circumferentially including, a stem slidably received within said axial bore, a portion of said stem extending above the upper end termination of said body, means for actuating said stem to compress said body, and means for locking said stem in its operative position with the body compressed against movement and accidental release of said stem actuating means, including spaced annular ribs on said stem defining spaced grooves therebetween, said ribs and grooves being so positioned intermediate the ends of the stem so that certain of said grooves may be aligned with the upper surface of said body, and a flat U-shaped locking plate of a size and configuration to be received in a respective aligned groove and under a respective rib.

3. In an expandible stopper for high pressure use, an elongated compressible body having an axial bore extending therethrough, means for compressing the body longitudinally and expanding the same circumferentially including, a stem slidably received within said axial bore, a portion of said stem extending above the upper end termination of said body, means for actuating said stem to compress said body, said stem actuating means including, means for locking said stem in its operative position with the body compressed against movement and accidental release of said stem actuating means, including spaced annular ribs on said stem defining spaced grooves therebetween, said ribs and grooves being so positioned intermediate the ends of the stem so that certain of said grooves may be aligned with the upper surface of said body, and a flat U-shaped locking plate of a size and configuration to be received in a respective aligned groove and under a respective rib, a threaded upper end on said stem, a rotating handle body having an axial bore carrying mating threads therein, depending feet on said handle body engaging the upper end termination of said body, whereby rotative movement of said handle body in one direction will move said stem longitudinally to compress said body, said locking plate being positioned between said depending feet.

4. In an expandible stopper for high pressure use, an elongated compressible body having an axial bore extending therethrough, means for compressing the body longitudinally and expanding the same circumferentially including, a stem slidably received within said axial bore, a portion of said stem extending above the upper end termination of said body, means for actuating said stem to compress said body, said stem actuating means including, means for locking said stem in its operative position with the body compressed against movement and accidental release of said stem actuating means, including spaced annular ribs on said stem defining spaced grooves therebetween, said ribs and grooves being so positioned intermediate the ends of the stem so that certain of said grooves may be aligned with the upper surface of said body, and a flat U-shaped locking plate of a size and configuration to be received in a respective aligned groove and under a respective rib, a cam lever having spaced parallel walls forming said cam and adapted to ride on the upper surface of said body, said locking plate being positioned in an aligned groove between said walls.

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