

Feb. 22, 1949.

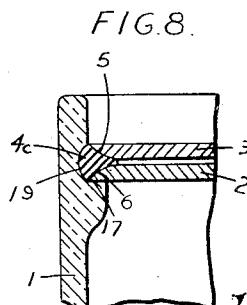
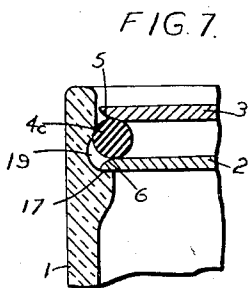
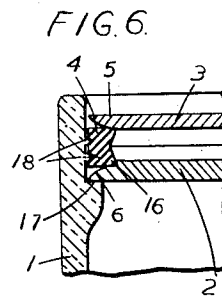
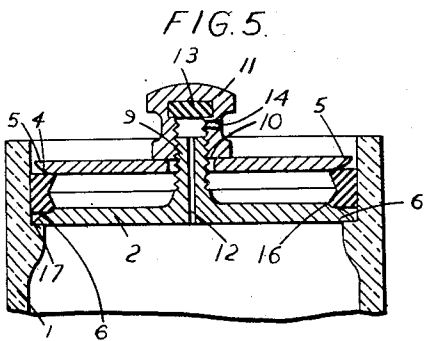
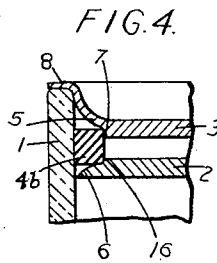
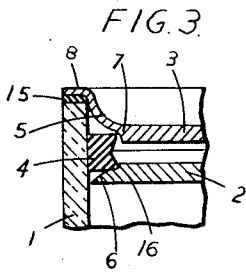
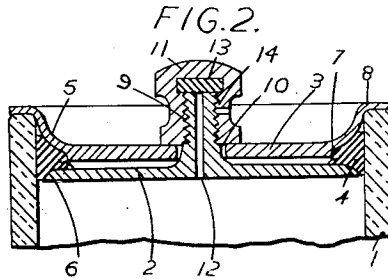
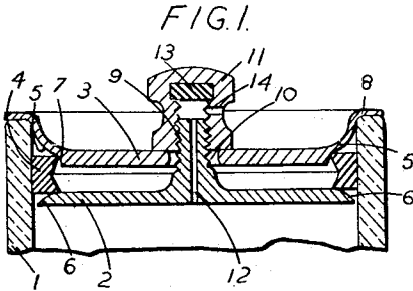
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2,462,445

AIRTIGHT LID FOR CONTAINERS

Filed Sept. 25, 1945

2 Sheets-Sheet 1



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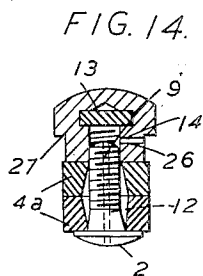
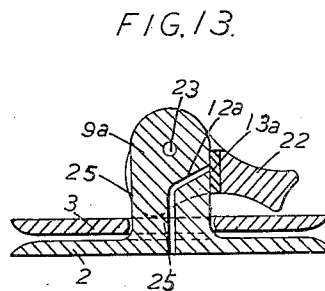
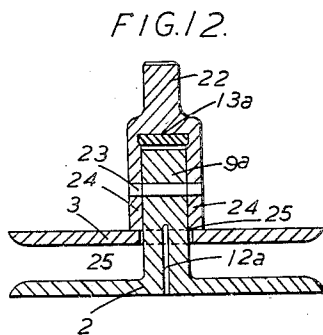
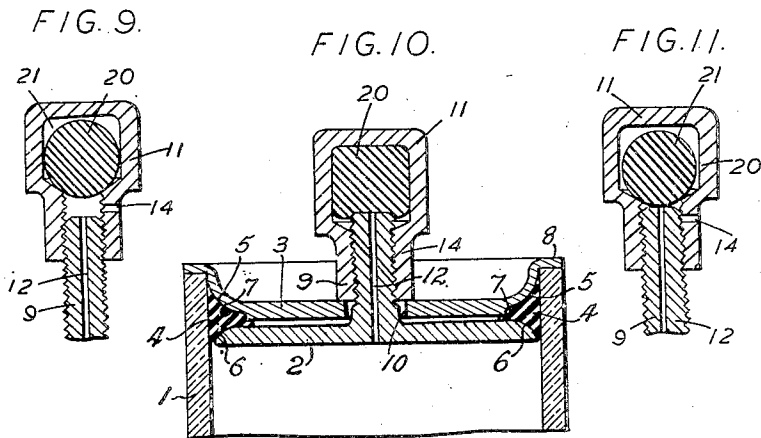
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AIRTIGHT LID FOR CONTAINERS

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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AIRTIGHT LID FOR CONTAINERS

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10 Claims. (Cl. 215—54)

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This invention relates to air-tight closures for containers of all kinds, in which solid, liquid or gaseous substances can be stored. The invention is especially applicable where the contents of the container should be stored in vacuo.

The object of the invention is the provision of improvements in such lids, and the invention consists broadly of a closure for containers, comprising a flexible sealing ring, an outer and an inner pressure element located on the two sides thereof, and means for alternatively pressing said pressure elements towards one another or releasing them apart, said sealing ring and pressure elements, when the latter are released apart, being adapted to fit into the mouth of the container with said sealing ring lying just within the inner periphery of said mouth, and the arrangement being such that when said pressure elements are then pressed towards one another said sealing ring is squeezed and deformed, and the outer periphery thereof is forced into sealing relation against the inner periphery of said container mouth.

In order that the invention shall be the more clearly understood a number of closures and containers in accordance therewith will now be described, reference being made to the accompanying drawings, wherein:

Figure 1 is a sectional elevation of the upper part of a container together with a closure therefor, the closure being in the non-sealing position;

Figure 2 is a similar view of the same, with the closure in the sealing position;

Figure 3 is a portion of a similar view to Figure 1 illustrating a variant;

Figure 4 is a similar view to Figure 3 illustrating another variant;

Figure 5 is a similar view to Figure 1 illustrating a further variant;

Figure 6 is a portion of a similar view to Figure 5 illustrating a further variant;

Figure 7 is a similar view to Figure 6 illustrating a further variant;

Figure 8 is a similar view of the same with the closure in the sealing position;

Figure 9 is a sectional elevation of an alternative, the closure being in the non-sealing position;

Figure 10 is a similar view of the same, with the closure at the fully sealing position;

Figure 11 is a similar view of the same, with the closure at an intermediate position whose purpose will be described;

Figure 12 is a sectional elevation of the principal

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elements of an alternative form of closure, shown at the non-sealing position;

Figure 13 is a similar view of the same, shown at the sealing position;

5 Figure 14 is a sectional elevation of a small stopper in accordance with the invention.

Referring first to Figures 1 and 2, a container 1, which may take the form of an ordinary jar, is adapted to be closed and sealed by means of a closure comprising a circular under plate 2 and a circular over plate 3 with a rubber sealing ring 4 between their outer edges. Means are provided for pressing said under plate 2 and over plate 3 together, or, alternatively, permitting them to separate. In operation they are first permitted to separate as in Figure 1 so that the sealing ring 4 is undistorted and, in their separated state, they are inserted into the mouth of the container. The under plate and over plate fit easily into the mouth of the container and the outer periphery of the sealing ring fits fairly close to the inner periphery of the container mouth as indicated. The under plate and over plate are then pressed together as in Figure 2, and this causes the sealing ring to be distorted and squeezed outwardly in the manner shown so that it seals tightly against the inner periphery of the container mouth, and also against the adjacent surfaces of the under plate and over plate as shown.

It will be seen that the under surface 5 of the over plate 3, where it engages the sealing ring 4, is bevelled on a convex curve, and that, the upper surface 6 of the under plate 2, where it engages the sealing ring, is also bevelled on a convex curve. This is found to be the most satisfactory way of squeezing the sealing ring 4 in the required manner. Also one of the plates, in the case of Figures 1 and 2 the over plate 3, has its under surface formed with a shoulder 7 just within the bevelled surface 5. This shoulder lies within the sealing ring 4 and helps to locate the same when the plates are in the separated state of Figure 1.

Means are provided for locating the plates a suitable distance within the mouth of the container. In the case of Figures 1 and 2, these means comprise a marginal extension 8 of the over plate, which extends outwardly from the outer, and therefore the upper, edge of the surface 5, and which overhangs, and rests on, the rim of the container mouth. In practice, therefore, the closure is pressed into the container mouth until this marginal extension 8 rests on the rim of the container mouth, and the plates

are pressed together, this producing a lifting of the under plate.

As shown, sealing ring 4 is of square or rectangular cross section with a V channel cut in its inner surface.

The means for pressing the plates together consist of a screwed post 9 which upstands integrally from the centre of the under plate 2 and passes freely through a hole 10 in the centre of the over plate 3, and a nut 11 which screws on the outer end of said screwed post and accordingly presses down on the over plate.

In practice, if no provision were made beyond what has been heretofore described, it might be difficult to break the seal by simply unscrewing the nut 11, particularly when there is a vacuum in the container. To ensure the easy breaking of the seal, a small bore hole 12 passes completely through the post 9 from the under surface of the under plate 2 to the upper end of said post. When the nut 11 is screwed fully down for squeezing the sealing ring 4 into the sealing position, a rubber pad 13, located in an enlarged recess at the upper end of the tapped hole of said nut, presses down on the upper end of said post 9, thereby closing said hole 12 and completing the seal. When said nut 11 is loosened said pad 13 is lifted clear of said post 9, owing to its being in said enlarged recess, and the hole 12 communicates with the atmosphere by way of a small radial hole 14 through the wall of the nut. Thus the seal is positively broken. The provision of the enlarged recess for the pad 13 is necessary. Otherwise, under conditions of vacuum in the container, atmospheric pressure would hold said pad down on the top of the post 9, and the nut 11, when unscrewed would leave it behind.

The sealing ring 4, as well as effecting a seal in the manner described, fixes the closure tightly in the mouth of the container so that it is impossible or extremely difficult to pull it out while in the sealing condition.

Figure 3 shows a modification according to which a rubber gasket 15 is provided on the under surface of the marginal extension 8 so that a second seal is effected between said marginal extension and the rim of the rubber mouth. In Figure 3 also a shoulder 16 is formed on the upper surface of the under plate 2 for helping to locate the sealing ring 4 in the same manner as the shoulder 7.

Figure 4 shows a modification according to which the sealing ring 4b is of square or rectangular section, without a V channel in its inner surface.

Figure 5 shows a modification according to which, instead of the marginal extension 8 on the over plate 3 for locating the closure the correct distance within the container mouth, the inner periphery of the container mouth is formed with a shoulder or ledge 17 on which the under plate 2 rests. In Figure 5 also, the shoulder 7 is omitted, the shoulder 16 being alone relied on for locating the sealing ring.

Figure 6 shows a modification in which the inner periphery of the container mouth is formed with a plurality of annular projecting ribs 18 which bite into the sealing ring 4 when the same is squeezed to the sealing position. Thereby enhancing the sealing effect and securing the closure the more firmly against withdrawal when in the sealing state.

Figures 7 and 8 show a modification in which the sealing ring 4c is of circular section. Also the inner periphery of the container mouth is formed

with a circumferential groove 19 just above the shoulder 17, into which the sealing ring 4c is squeezed when the plates 2 and 3 are pressed together, as in Figure 8. By this means again the closure is secured the more firmly against withdrawal when in the sealing state. Also, in the arrangement of Figures 7 and 8, neither the shoulder 7 nor the shoulder 16 is provided.

Referring now to Figures 9 to 11, these figures show an alternative means for sealing and unsealing the upper end of the hole 12.

In this alternative, in place of the rubber pad 13, a small rubber ball 20 is located in an enlarged recess 21 at the upper end of the tapped hole of the nut 11, which ball can move up and down through a distance of about two millimeters more-or-less in said recess. The aforesaid fine radial hole 14 joins the tapped hole of the nut 11 just below the bottom of said recess. Said ball 20 is too large to pass into the tapped hole of the nut.

With this arrangement, if the nut 11 is screwed right down as in Figure 10, the ball 20 is pressed down in a deformed condition on top of the post 9 as shown and the upper end of the bore hole 12 is effectively sealed under all conditions. If said nut is screwed up as shown in Figure 9 so that the ball 20 is well clear of the upper end of the post 9, the upper end of the bore hole 12 is effectively unsealed under all conditions. If, however, the nut 11 is unscrewed to the position of Figure 11 such that the ball 20 is clear of the top of the recess 21 but is able to engage the top of the post 9, a valve is formed which acts to permit the outflow, but to prevent, at least temporarily, the inflow, of air to the container. Thus it will be clear that, when the pressure in the container is higher than that outside, air will flow out of the bore hole 12, through the clearance between the upper turns of the screw threads, and out through the hole 14. When, on the other hand, the pressure outside is greater than that within the container air will pass in through the radial hole 14, and, before an appreciable quantity has flowed down the bore hole 12 into the container, some will have flowed up past the ball and will have raised the pressure in the top of the recess 21 and accordingly pressed the ball down on to the top of the post 9, with sufficient pressure to form at least a temporary seal of the hole 12.

If the arrangement is such that, when the nut is screwed down to the position of Figure 11, the under plate and the over plate are sufficiently pressed together to effect an at least temporary seal, the container can be easily evacuated in the following way:

The container 1, with the closure in place therein and the nut 11 screwed to the position of Figure 11, is placed in a chamber which is then closed and evacuated of air. The container 1 also becomes evacuated, since, as above described, the air is free to flow through the holes 12 and 14. The chamber is then opened in order that the container can be removed, but this does not immediately destroy the vacuum in said container, since, as above described, the ball 20 acts as a valve and the sealing ring 4 is effecting an at least temporary seal. The container is therefore rapidly removed and the nut 11 screwed down to the fully sealing position.

If the arrangement is as in Figures 5 to 8, a ledge 17 being provided for the under plate 2, the above operation can take place even if the sealing ring 4 is not making a seal when the nut 11 is

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at the position of Figure 11. This is because when the outer chamber is opened and the vacuum therein is broken, the rise in pressure will hold the under plate 2 down on the ledge 17 thereby creating a temporary seal which will serve until the nut 11 is screwed fully down. The temporary seal effected by forcing the under plate down on to the ledge as described will obviously depend for its effectiveness on the accuracy with which the engaging surfaces of the under plate and ledge are formed. A sufficiently accurate fit can be obtained under conditions of mass production for maintaining the vacuum for a few minutes, hours or even days without the over plate being closed down and thereby forcing the rubber outwards as stated to form the permanent seal.

It will be seen from the above it is possible to put a number of containers into a chamber which is then evacuated, and, when the vacuum in the chamber is broken, and the containers removed, the nuts can be screwed up at leisure, and, in the meantime, the containers will retain their vacuum.

Referring now to Figures 12 and 13, these illustrate another embodiment of the invention in which the screwed nut 11 is dispensed with, and the pressing together of the under plate and the over plate is effected by means of a lever 22. In this case, the post 9a extending up from the under plate 2 through the over plate 3 is flattened so as to form a plate. The said lever 22 is bifurcated at one end and is pivoted, about a horizontal pivot pin 23 to this plate 9a with its branches of bifurcation 24 on each side thereof. The said two branches of bifurcation 24 have their edge surfaces 25 formed as cams, in such a way that when the lever 22 is rotated about said pivot pin, said edge surfaces act to press downwards (as in Figure 13), or release upwards (as in Figure 12), the over plate 3. Thus said lever 22 functions in the same way as the screwed cap 11 to press the two plates together or permit them to separate.

A fine hole 12a, corresponding to the axial hole 12 in the screwed post 9 of the preceding embodiments, extending up through the under plate 2 and into the vertical plate 9a and turns sideways and breaks out at the edge of said vertical plate. A pad 13a is mounted in the crutch portion of the bifurcated lever and this pad is so arranged, and the plate 9a is so shaped, that, when the lever 22 is turned to the sealing position of Figure 13, said pad 13a closes the outer end of said hole 12a, thereby completing the seal in the same way as the pad 13 of the preceding embodiments.

As will be clear from Figure 13, when the lever 22 is moved fully down until the pad 13a closes the hole 12a, the surfaces 25 are just past the dead centre position, and thus the pad 13a will be kept pressed against the end of the hole 12a.

Referring now to Figure 14 this illustrates a simple embodiment of the invention in which the closure takes the form of a stopper suitable for closing a bottle. In this case the reference 2 designates the under plate and the reference 9 the screwed post as before. No separate over plate is however provided, but the screwed nut 26, which screws down on the post 9, also assumes the functions of the over plate, the sealing ring being located directly between the upper surface of the under plate 2 and the under surface of said nut 26.

For purposes of manufacturing convenience, the sealing ring is made up of two equal com-

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ponent rings 4a arranged coaxially together. The bore hole of each component ring increases in diameter from its outer to its inner face (that is the face which abuts against the other component ring) so that the cross section of the composite ring is somewhat similar to that of the ring of Figure 1. The nut 26 is cylindrical and is formed with a head at its outer end whose under surface 27 abuts against the rim of the bottle mouth. The component rings 4a, when in their normal or uncompressed state, have cylindrical outer surfaces of a slightly larger diameter than that of the lower portion of the nut 26.

In operation the stopper, with the component rings 4a at the uncompressed state illustrated, is pressed into the mouth of the bottle in the usual way until the surface 27 abuts against the rim. The component rings will engage frictionally within the mouth of bottle. The nut 26 is then turned in the screwing-up direction. Owing to friction with the mouth of the bottle the component rings 4a will not rotate and neither will the under plate 2 and screwed post 9, owing to friction of the under plate with the lower component ring 4a. Therefore the nut 26 will be screwed down and the component rings will be compressed between said nut and the under plate, and will expand outwardly, therefore effecting a complete seal.

As will be seen from the drawing the screwed post 9 is provided with an axial bore hole 12, and the nut 26 is provided with a radial hole 14 and also with a pad 13 at the upper end of its tapped hole. These elements function in exactly the same way as the corresponding elements of Figure 1.

Although the closure has been described as being circular it could obviously be of other shapes such as elliptical or even rectangular.

It will be seen that the invention provides a simple and effective closure for containers whether the latter are adapted to serve as vacuum containers or as ordinary containers. The closure is easy to apply and remove, no tool being necessary for this purpose. The closure does not depend for its effectiveness on accuracy or workmanship, and the ring will form a hermetic seal even if the walls of the container are not even and smooth. The closure can be applied and removed any number of times, making a perfect seal upon each reclosure.

The channels 12 and 14 permit the gases to escape when the contents of the container are heated, and by screwing down the nut 11 when the container is subsequently cooled, a vacuum is produced in a natural way.

It will be seen that in general the rubber ring does not come in contact with the contents of the container.

What I claim and desire to secure by Letters Patent is:

1. A closure for the mouth of a container, said closure comprising a flexible sealing ring, pressure means providing inner and outer pressure members between which said flexible sealing ring is located, tightening means including a post upstanding from the inner pressure member and relatively adjustable in opposite directions to compress said pressure members upon said sealing ring to expand the same radially or alternatively to relax the pressure on the sealing ring, said upstanding post being provided with a vent passage therethrough, and sealing means movable by said tightening means positively to seal or to unseal said vent passage upon adjustment

of said tightening means to compress or to relax the pressure, respectively, on said sealing ring.

2. A closure for the mouth of a container, said closure comprising a flexible sealing ring, an outer pressure element and an inner pressure disc between which said sealing ring is located, a post upstanding from said inner pressure disc and passing freely through an opening in said outer pressure element, a tightening element mounted on said post on the outside of said outer pressure element and adjustable in opposite directions to apply pressure on or alternatively to relax pressure from said outer pressure element, said outer pressure element and inner pressure disc when tightened towards one another exerting pressure upon said sealing ring to squeeze and deform the same to expand radially to seal against the inner periphery of a container mouth, said post being provided with a bore hole terminating at its inner end at the inner face of said inner pressure disc, and sealing means for said bore hole actuated to sealing position by said tightening element when adjusted to tighten said outer pressure element and said inner pressure disc towards one another, said sealing means being actuated to unseal the bore hole when said tightening element is adjusted to relax said outer pressure element and said inner pressure disc away from one another.

3. A closure for the mouth of a container, said closure comprising a flexible sealing ring, an outer pressure element and an inner pressure disc between which said sealing ring is located, a post upstanding from said inner pressure disc and passing freely through an opening in said outer pressure element, a nut threaded on said post on the outside of said outer pressure element and adjustable in opposite directions to apply pressure on or alternatively to relax pressure from said outer pressure element, said outer pressure element and inner pressure disc when tightened towards one another exerting pressure upon said sealing ring to squeeze and deform the same to expand radially to seal against the inner periphery of a container mouth, said post being provided with a bore hole terminating at its inner end at the inner face of said inner pressure disc, and sealing means for said bore hole actuated to sealing position by said nut when adjusted to tighten said outer pressure element and said inner pressure disc towards one another, said sealing means being actuated to unseal the bore hole when said nut is adjusted to relax said outer pressure element and said inner pressure disc away from one another.

4. A closure for the mouth of a container, said closure comprising a flexible sealing ring, an outer pressure element and an inner pressure disc between which said sealing ring is located, a post upstanding from said inner pressure disc and passing freely through an opening in said outer pressure element, a nut screwed on said post on the outside of said outer pressure element and adjustable relatively to said post to apply pressure on or alternatively to relax pressure from said outer pressure element, thereby alternatively to tighten said outer pressure element and inner pressure disc towards one another or to relax them away from one another, said outer pressure element and inner pressure disc when tightened towards one another being adapted to squeeze and deform said sealing ring to expand it radially to seal against the inner

periphery of a container mouth, said post being provided with a bore hole terminating at its inner end at the inner face of said inner pressure disc, and a sealing pad carried by said nut to seal the outer end of said bore hole when said nut is adjusted to tighten said outer pressure element and said inner pressure disc towards one another or alternatively to unseal the outer end of said bore hole when said nut is adjusted to relax said outer pressure element and said inner pressure disc away from one another.

5. A closure for the mouth of a container, said closure comprising the combination with a flexible sealing ring, an inner and an outer pressure member between which said sealing ring is located, tightening means adjustable in opposite directions to compress said pressure members upon said sealing ring to expand the ring radially or alternatively to relax the pressure members, and said tightening means being provided with a vent passage having an inner end below said pressure members and said sealing ring, of sealing means movable by said tightening means to three significant positions with respect to said vent passage, said sealing means being movable to alternate end positions positively to seal or to unseal said vent passage upon adjustment of said tightening means to fully tightened and fully relaxed positions respectively, and said sealing means having an intermediate position in which it seals said vent passage against external pressure and unseals said vent passage to relieve internal pressure.

6. A closure for the mouth of a container, said closure comprising a flexible sealing ring, an outer pressure member having an opening therethrough and an inner pressure member between which said sealing ring is located, a threaded post upstanding from said inner pressure member and passing freely through the opening of said outer pressure member, a nut threaded upon said post and adjustable thereon to engage said outer pressure member and force the same towards said inner pressure member to deform said sealing ring and expand it radially for sealing engagement with circumferential periphery of a container mouth, said post being provided with a vent passage terminating at its inner end at the inner face of said inner pressure member, and sealing means for said vent passage; said sealing means comprising a flexible ball, said nut having a chamber therein for receiving the ball, said chamber having a contracted mouth of less diameter than said ball, whereby said ball is positively moved to unseal said vent passage when said nut is adjusted away from said outer pressure member.

7. A closure as recited in claim 6, wherein said chamber within the nut has an axial length somewhat greater than the diameter of said ball, whereby said ball may rest freely on the end of said post at an intermediate position of said nut to seal said vent passage only against pressure outside said vent passage in excess of the pressure beneath said inner pressure member.

8. A closure for the mouth of a container, said closure comprising a flexible sealing ring, an outer pressure member of annular form and an inner pressure member between which said sealing ring is located, a threaded post upstanding from said inner pressure member and passing freely through the opening of said outer pressure member, a cam lever mounted upon said post and adjustable thereon to engage said outer pressure member and force the same towards said inner

pressure member to deform said sealing ring and expand it radially for sealing engagement with the circumferential periphery of a container mouth, said inner pressure member and said post being provided with a vent passage there-
 5 through, and sealing means for said vent passage; said sealing means comprising a pad carried by said cam lever for movement to seal said vent passage upon adjustment of said cam lever to engage the outer pressure member to deform said
 10 flexible sealing ring.

9. A closure for the mouth of a container, said closure comprising a flexible sealing ring, an outer pressure member of annular form and an inner pressure member between which said sealing ring is located, a threaded post upstanding from said inner pressure member and threaded into said outer pressure member, whereby relative rotation of said pressure members deforms said sealing ring to expand the same into sealing engagement with a container mouth, said inner pressure member and said post being provided with a vent passage therethrough, and sealing means carried by said outer pressure member for sealing said vent passage upon relative adjustment of said pressure members to deform said sealing ring.

10. A closure for the mouth of a container, said closure comprising a flexible sealing ring between inner and outer pressure members, adjustable means movable in one direction to press said pressure members towards each other to press upon said sealing ring and expand it radially, said adjustable means being movable in opposite directions to relieve said sealing ring from pressure

thereon by said pressure members, said pressure members and said sealing ring being provided with a vent passage therethrough, and sealing means for said passage actuated by said adjustable means to seal said passage upon displacement of said adjustable means to one end position and selectively to seal the passage against external but not internal pressure upon displacement of said adjustable means to an intermediate position.
 10 tion.

HUGO WEISS.

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