April 30, 1963 A. M. FISCHER 3,087,639

CONTAINER CLOSURE

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Fig. 1.

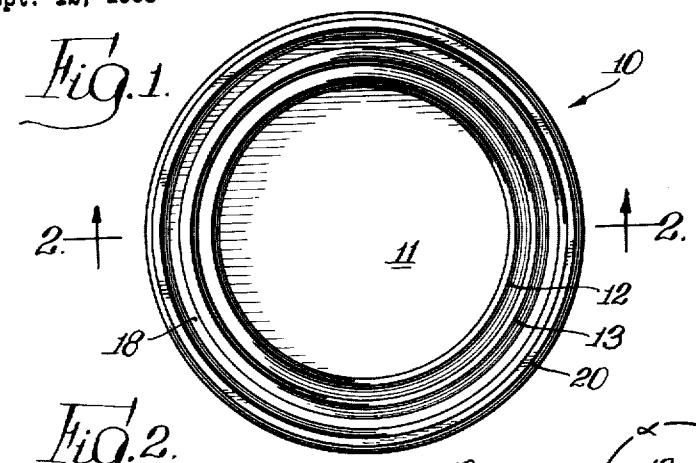


Fig. 2.

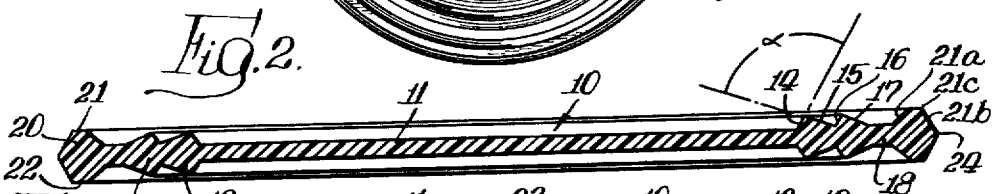


Fig. 3.

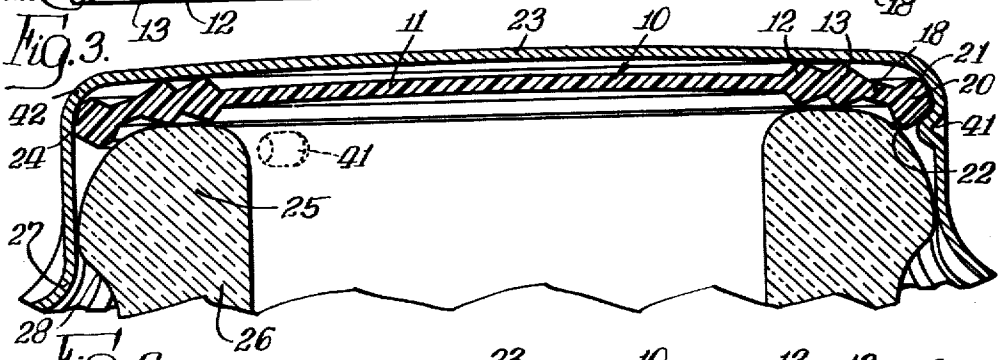
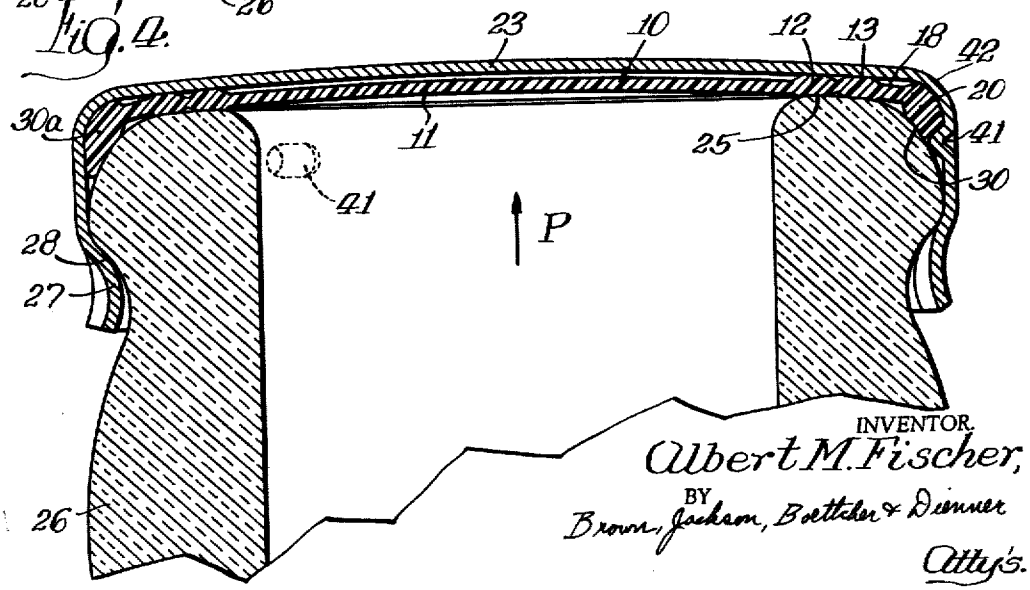


Fig. 4.



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Fig. 5.



Fig. 6.



Fig. 7.



Fig. 9.



Fig. 8.

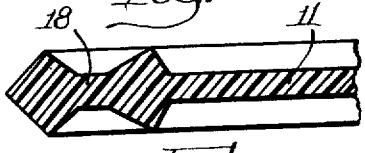


Fig. 11.

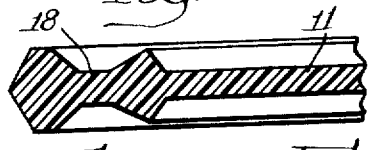


Fig. 10.



Fig. 12.



Fig. 13.

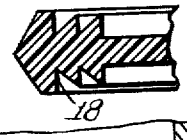


Fig. 14.

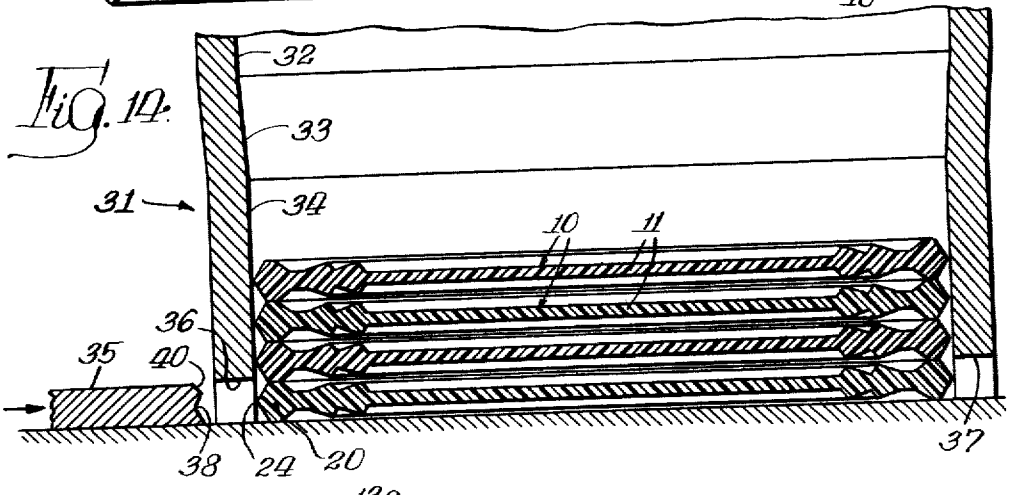
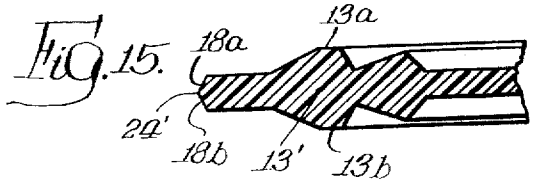


Fig. 15.



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Fig. 16.

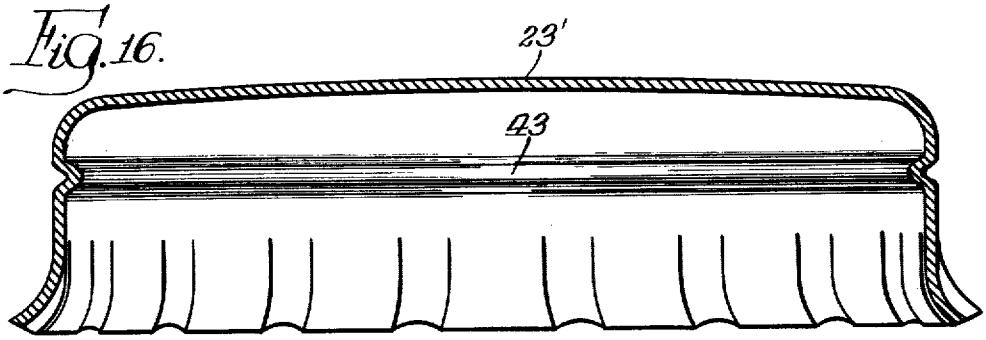


Fig. 17.

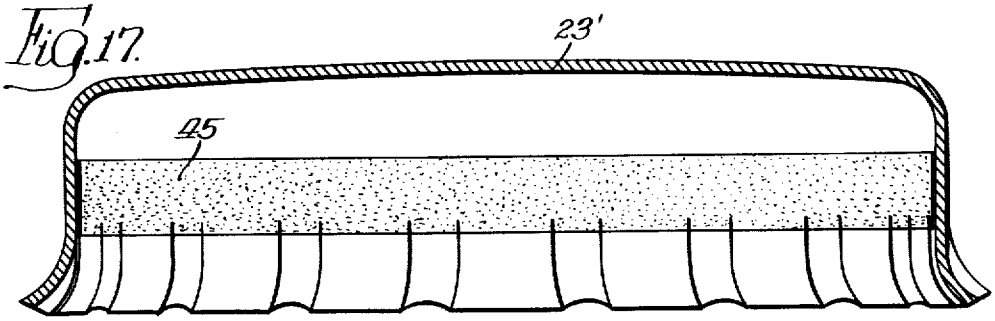
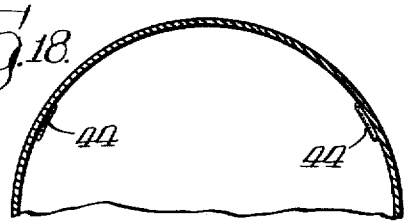


Fig. 18.



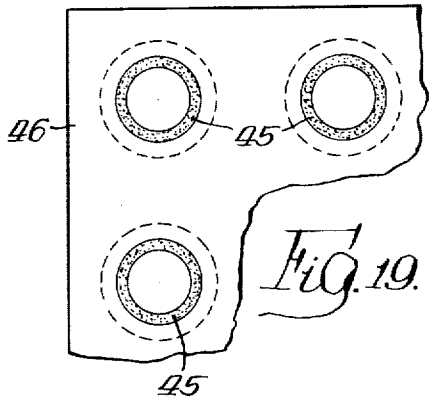


Fig. 19.

Fig. 20.

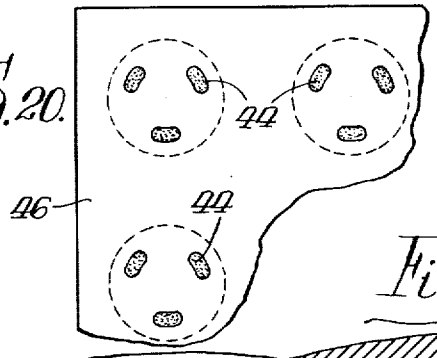
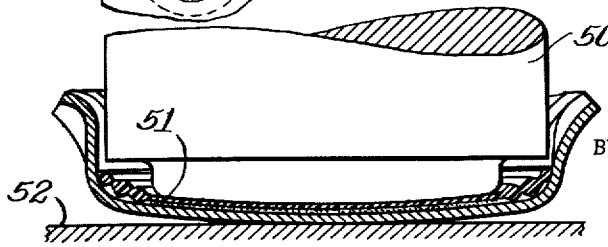


Fig. 21.



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United States Patent Office 3,087,639 Patented Apr. 30, 1963

3,087,639

CONTAINER CLOSURE

Albert M. Fischer, Dowagiac, Mich., assignor, by mesne assignments, to Union Carbide Corporation, New York, N.Y., a corporation of New York

Filed Sept. 12, 1958, Ser. No. 760,692
9 Claims. (Cl. 215—40)

The present invention relates, in general, to closures such as crown closures, metallic cap closures, screw-on closures and the like, and, in particular, to a new and improved cap closure and plastic sealing means therefor, which can be assembled with substantially conventional crown essembling machines.

Bottle caps, also referred to as crown closures, generally comprise a metallic crown cap, preferably formed of cold rolled tin plate, having a corrugated rim or skirt within which a sealing means is placed; the latter usually being cemented or otherwise secured to the crown cap. Of recent innovation, in the crown closure industry, has been the use of sealing means made of plastic, such as polyethylene. Further development of plastic sealing means to further increase their usefulness as crown cap sealing means, brought about the provision of marginal rings or rims and flex-rings as well as inner sealing rings, as for example, the plastic sealing means disclosed and claimed in the U.S. Patent No. 2,829,790 to Alfons Isele-Aregger, issued April 8, 1958 and entitled "Bottle Closures," and the application for U.S. patent of Alfons Isele-Aregger, Serial No. 559,445, filed January 16, 1956, entitled "Sealing Disc for Metallic Cap Closures, Crown Closures and the Like," issued on August 25, 1959 as U.S. Patent 2,901,139, to which reference is made for a full and complete description thereof.

However, some embodiments of prior art plastic sealing means could not too successfully be used in conventional crown assembling machines because of their tendency to nest with each other, i.e., the interlocking of the respective annular marginal rims and seal rings when stacked in the seal feed tube in such machines. When such nesting took place, the machine's shuttle or ejector mechanism for ejecting would cause tearing of the seals and/or would insert more than one seal in any one crown cap. On the other hand, those embodiments of prior art sealing means which did work reasonably successfully in crown assembling machines did not have good sealing qualities in use—very undesirable features.

Still another disadvantage in existing plastic sealing means for crown caps is that they could not be positively retained in the crown cap prior to the capping operation, which was due chiefly to the insufficient frictional retention characteristic between the marginal seal rim and the crown cap.

Accordingly, it is a general object of my invention to overcome the generad disadvantages found in prior art closures.

Briefly, my invention comprises a sealing means of relatively thin material, such as polyethylene or other suitable plastic material, having an outer marginal peripheral ring or rim, an inner relatively thin flex-ring, and one or more inner sealing rings, which surround a relatively thin diaphragm. In some embodiments of my invention, the outer marginal ring is thicker in median plan than the inner sealing rings, is preferably provided with a substantially flat top and bottom so as to form a substantially trapezoidal configuration, and the inner sealing rings are preferably provided with sides of a certain angularity with respect to each other. These features function as an anti-nesting measure in the crown assembly machines as will be understood hereinafter, and the radially outer periphery of the marginal ring

is preferably pointed or provided with a sharp corner in median plan and is somewhat larger than the diameter of the inside of the metallic crown cap, whereby the marginal ring together with the flex-ring will cooperate to be frictionally retained in the crown cap as will be understood hereinafter.

In other embodiments of my invention, wherein the outer marginal ring is omitted and the flex-ring is retained, the outer seal ring is thicker than the inner seal ring or rings and provided with substantially flat surfaces to facilitate stacking as an anti-nesting measure in crown assembly machines as will be understood, and in all the embodiments of my invention, the outer marginal sealing ring and the inner sealing ring or rings are preferably symmetrical in median plan so as to facilitate their sorting in the hopper of conventional crown assembly machines in which the sealing means are normally placed.

With my new and improved sealing means, I have found that I can use a minimum of plastic material and a minimum of metal in the crown cap itself by use of shorter skirts on the crown cap and by using thinner gauge metal. I have found also that with my sealing means, aluminum may be used as well as conventional tin plate for crown caps.

As to the crown cap, where desirable or necessary in certain applications and as an added feature to my present invention, I provide my crown cap with a retaining means for positively retaining the sealing means therein. This retaining means for my crown cap comprises a plurality of inwardly extending projections, or an inwardly extending peripheral band, which will cooperate with the radially outer periphery of the marginal ring or the flex-ring, as the case may be, of my sealing means to positively retain the sealing means within the crown cap. In one embodiment these projections or the band are formed of a special friction producing lacquer.

In certain other applications where the projections or bands are not desired, I have provided still another manner of retaining the sealing means in the crown cap by the provision of means such as the addition of suitable quantities of bentonite, magnesium silicate, etc., to the conventional lacquer used to coat the inside of the crown cap. The purpose of the addition of this material is to increase the frictional qualities of the coating, thus assuring an improved frictional retention of the seal in the crown cap.

Another important feature of my invention is the provision of a new and improved shuttle mechanism and a new and improved seal feed tube for crown assembly machines. The working edge of my shuttle mechanism has a configuration which conforms with the particular configuration of the periphery of my sealing means and I have improved the seal feed tube of conventional crown assembling machines to cooperate with the stacking of the plastic sealing means, as will be explained in detail hereinafter.

Thus, a more particular object of my invention is to provide a new and improved plastic sealing means for crown closures and the like.

Still another object of my invention is to provide a new and improved plastic sealing means for crown closures and the like useable in conventional crown assembling machines now in general use in the crown closure producing industry, but having my new and improved seal feed tube and shuttle ejector mechanism.

Still another object of my invention is to provide a new and improved plastic sealing means having improved frictional retention characteristics in the crown cap.

Another object of my invention is a new and improved metallic crown cap which will cooperate with my new and improved plastic sealing means to retain the plastic

sealing means in the crown cap prior to the capping operation.

Still another object of my invention is to provide a new and improved plastic sealing means and a new and improved metallic crown which can be manufactured with a minimum of plastic material and which will provide a means of reducing the metal required of the crown cap when made of conventional tin plate, or to use aluminum for the crown caps.

Still another and further object of my invention is the provision of a new and improved seal feed tube and a new and improved shuttle mechanism in conventional crown cap assembling machines which will cooperate with my new and improved plastic sealing means.

Other and more particular objects of my invention will be apparent to those skilled in the art from the following description and drawings forming a part hereof and wherein:

FIG. 1 is a top plan view of a plastic sealing means, constructed in accordance with the teachings of my invention, having an outer annular marginal ring and inner annular seal rings of a vertical thickness less than the vertical thickness of the marginal ring;

FIG. 2 is a vertical, cross-sectional view of the plastic sealing means shown in FIG. 1;

FIG. 3 is a vertical, cross-sectional view of the sealing means shown in FIGS. 1 and 2 and inserted in a crown cap, illustrating how my sealing means cooperates with a known form of an indentation for holding the sealing means positively in the caps, and resting on the top of a bottle lip prior to the crowning operation;

FIG. 4 is a vertical, cross-sectional view of the sealing means, crown cap and bottle lip, shown in FIG. 3, after the crowning operation;

FIG. 5 is a partial, vertical, cross-sectional view of a plastic sealing means, constructed in accordance with my invention, having an outer annular marginal ring and inner annular rings of various vertical thicknesses but less than the vertical thickness of the marginal ring;

FIG. 6 is a partial, vertical, cross-sectional view of plastic sealing means of a type similar to that shown in FIG. 5 but showing the outer or marginal ring with a flat top and bottom portion similar to the marginal ring of FIG. 2;

FIG. 7 is a partial, vertical, cross-sectional view of a plastic sealing means similar to that shown in FIG. 5 except that the inner annular sealing rings are vertically narrower than the outer annular marginal ring but of the same vertical thickness as to each other, similar to the sealing means of FIG. 2;

FIG. 8 is a partial, vertical, cross-sectional view of my plastic sealing means having only one annular sealing ring of the same vertical thickness as the outer marginal ring;

FIG. 9 is a partial, cross-sectional view of my plastic sealing means, similar to that shown in FIG. 8 except that the outer marginal ring has the same vertical thickness as the inner sealing ring and is provided with a flat top and bottom portion;

FIG. 10 is a partial, cross-sectional view of my plastic sealing means, similar to that shown in FIG. 8, except that the inner sealing ring has a vertical thickness less than the vertical thickness of the marginal ring;

FIG. 11 is a partial, vertical, cross-sectional view of my plastic sealing means, similar to the sealing means shown in FIG. 10, except that the marginal ring is provided with a flat top and bottom portion;

FIG. 12 is a partial, vertical, cross-sectional view of another form of marginal ring for my sealing means;

FIG. 13 is a partial, vertical, cross-sectional view of my plastic sealing means in which the space between the outer marginal ring with a flat top and bottom and the inner sealing rings is reduced to a minimum;

FIG. 14 is a vertical, cross-sectional view of a part of an improved feed tube of a substantially conventional

crown assembling machine with a new and improved shuttle or ejector mechanism, in which plastic seals, constructed in accordance with the teachings of my invention, are vertically aligned or stacked in such a tube;

FIG. 15 is a partial, vertical, cross-sectional view of another form of my plastic sealing means wherein the marginal ring is omitted, the flex-ring extended, and the radially outer sealing ring is provided with flats to prevent nesting;

FIG. 16 is a vertical, cross-sectional view of one embodiment of a crown cap, constructed in accordance with the teachings of my invention, showing to advantage a peripheral rim formed in the metal of the cap to positively hold the sealing means in the cap prior to the crowning operation;

FIG. 17 is a vertical, cross-sectional view of still another embodiment of my crown cap having another type of rim or band formed of improved lacquer for positively retaining the sealing means in the crown cap;

FIG. 18 is a vertical, cross-sectional view of still another embodiment of a crown cap showing to advantage another form of projections or dots formed of improved lacquer for retaining the sealing means positively in the crown cap;

FIG. 19 is a partial, enlarged, plan view of a blank from which the crown caps are blanked in a conventional manner and illustrating to advantage the means of forming the lacquer retaining rim or band for the crown cap as shown in FIG. 17;

FIG. 20 is a partial, enlarged, plan view of a blank, such as illustrated in FIG. 19, but showing to advantage the lacquer retaining projections or dots for the crown cap as shown in FIG. 18; and

FIG. 21 is a vertical, cross-sectional view of the elements of the crown assembly machine for suitably adhering the sealing means to the crown cap in applications where the use of adhesive is thought necessary.

Turning now to the drawings and in particular to the FIGS. 1 through 4, I have illustrated a plastic sealing means, indicated in its entirety as **10**, constructed in accordance with the teachings of my invention in its preferred form which comprises a relatively thin imperforate disc having a relatively thin diaphragm **11** in its central portion, adjoined by or encircled by one or more annular seal rings **12**, **13** (two shown) each of which comprises axially or vertically extending ribs of triangular cross-section terminating in not smaller than a right angle and preferably an obtuse angle defined by sides **14**, **15** and **16**, **17**, respectively, with the sides **15** and **17**, facing the outer periphery of the sealing means, being provided with a flatter incline than sides **14** and **16** for a purpose hereafter to be described. Sealing rings **12** and **13** are surrounded on their peripherally outer end with a relatively thin, flexible, membrane-like area or flex-ring **18**, and which is provided to give the sealing means **10** the necessary flexibility in this area for the purpose hereinafter to be described.

Adjoining the flex-ring **18** and encircled thereby, is an outer marginal ring **20**, which forms the outer periphery of the sealing means and in its preferred form has a substantially flat top and bottom side **21**, **22**. It is to be noted that my sealing means in its preferred form is symmetrical or substantially symmetrical in cross-section (or, otherwise stated, is symmetrical or substantially symmetrical in median plan), and that the vertical thickness of the marginal ring **20** is greater than the vertical thickness of the seal rings **12**, **13** to be advantageous for a crown assembling machine.

It can be appreciated that with the sealing means symmetrical in cross-section, both sides are useable and, when a plurality of these sealing means are disposed in a hopper for eventual use by the crown assembly machine, any sorting that will otherwise be required if there was non-symmetry, has been eliminated.

While I have shown the marginal ring **20** as having a flat top and bottom with the sides, such as **21***a* and **21***b*, actually forming angles therewith, as for example at **21***c*, with the angle **21***c* being defined by sides **21** and **21***d* (FIG. 12) whereby side **21***d* is merely a curve with a suitable radius to blend the substantially flat top with the sides; the important point being that the top and bottom sides are substantially flat so that the top will cooperate in a stacking manner with the bottom side of a like sealing means, such as illustrated in FIG. 14.

The outside diameter of the sealing means **10** is preferred to be slightly larger (at least 0.005 inch) than the standard inside diameter of a crown such as **23** so that it permits the seal, when pressed into the crown **23** during the crown assembling operation, to align itself, more or less, with the contour of the inside of the crown as more fully illustrated in FIG. 3. In this position, the flex-ring **18** exercises a radial force against the inside of the crown skirt due to its tendency to straighten out, which force is transmitted to the outer edge **24** of the marginal ring **20**, which presses against the crown skirt thereby establishing the frictional retention of the sealing means **10** in the crown **23**.

This tendency of the seal **10** and especially the flex-ring **18** to straighten out has another advantage in the crown assembly operation. It is a well known fact that the tolerance of a plastic sealing ring can be kept very close when produced by injection molding or other suitable methods, yet on the other hand, the crowns or cups such as **23** (see FIGS. 3 and 4) due to the wear of the blanking dies, may have slightly varying inside diameters deviating from standard.

By way of explanation of the operation of my seal means, the plastic material selected must meet certain standards of the beverage, food and drug industries and it also must have required physical properties, i.e., sufficient tensile strength, elasticity, resiliency and a minimum of cold flow. While any suitable plastic materials may be employed, I prefer a low density polyethylene wherein, due to the particular configuration of my sealing means, the resiliency of the polyethylene is fully utilized. While plastic materials, such as a low density polyethylene are not readily resilient and compressible in items having substantial cross-sectional areas, it has been found that narrower cross-sectional areas, such as employed in the sealing means of my invention, show remarkable resiliency as demonstrated by their compressibility, provided their molecular structure is not overstrained. Due to this resiliency, the sealing means is able to compensate for imperfections in the bottle lip and also for the difference in the coefficients of thermal expansion between glass and steel as in the case of crowned bottles. As outlined herein, the degree of resiliency, and therefore, the ability to effect a gas-tight seal, is directly related to the shape of the cross-section of the rings or rims of seals.

As illustrated in FIG. 4, the sealing effect is obtained by compressing the annular sealing rings **12**, **13** and the marginal ring **20**, of the preferred form of my invention, illustrated in FIG. 2, when the crown cap **23** is pressed on a bottle lip **25** of bottle **26** and the crown skirt **27** is crimped onto a bottle locking ring **28**. In this crowning operation, the sealing ribs **12**, **13** are compressed and align themselves with the contour of the bottle lip **25**, and, as usual, in this type crowning operation, the greatest pressure per square inch is applied in the area **30** of the bottle lip **25**, however, with the configuration of my marginal seal ring **20** it can be forced into the angular space **30***a* without overstrain in the molecular structure of the plastic material and thus the resiliency of this section is also retained. From the foregoing description it can be seen that the marginal seal ring of my invention has two functions, namely: (1) to retain the seal in the crown cap before crowning, and (2) to act as an additional sealing area; this

latter feature being very important in the function of the preferred embodiments of my invention, for example, where bottle imperfections are found. Too, the pressure necessary to affect a tight seal is not high enough to overstrain the molecular structure of other parts of the sealing means participating in the sealing action and, therefore, all parts of the sealing means retain their resiliency resulting in a gas-tight closure. I have found, under exhaustive tests on a crown closure employing my invention, that the sealing ability was not impaired when repeated temperature changes ranging from 33° F. to 150° F. were produced during an extended test period of several weeks. These tests also produced pressures which were quite high, viz., in a test with five (5) volumes of gas, at an elevated temperature of 110° F., a pressure of 135 lbs. per square inch is produced and it was found out that, with the sealing means, such as described herein, pressures of 200 lbs. per square inch were retained.

By way of explanation for the results of the tests on my sealing means, reference is made to FIG. 4 where it can be seen that the internal bottle pressure indicated as P in a bottle **26**, tends to lift the crown cap **23**. However, due to the configuration of the sealing means **10**, the pressure does not act, as in the case of a cork seal or other sealing means, over the entire area of the sealing means, but only over the area defined or circumscribed by the inside diameter of the innermost sealing ring **12**, which in one specific embodiment of my invention is about 0.70 inch. Consequently, an internal bottle pressure of 135 lbs. per square inch acting against such a seal, equals 51.30 lbs. It can be seen that if my sealing means did not have the annular sealing ring **12** and would depend on the marginal seal ring **20** only, the pressure acting against the crown would be 118.80 lbs. which is based on the seal outside diameter of 1.060 inches.

The construction and operation of my sealing means in the crown cap as pressed on the bottle **26** has still other additional advantages. It is well known that a low density polyethylene is permeated by water vapors, CO_2, etc., and, therefore, can normally only be used under special conditions for the sealing of a vacuum or pressure packed liquids containing CO_2 or other gases. According to my invention, a seal made of low density polyethylene is rendered effectively impermeable to gases when the sealing rings are compressed in the sealing area as in FIG. 4. In this crowning operation, there is created a relative high specific pressure in the narrow contact zones formed between the bottle lip **25** and the seal ring **12**, **13**, the marginal ring **20** on one side and the crown cap **23** on the other.

While I have explained the operation of my invention in connection with my preferred form of sealing means, as illustrated in FIG. 2 of the drawings, wherein the sealing rings **12** and **13** each have the obtuse angle α, formed by sides **14**, **15** and **16**, **17** and have explained the operation thereof in connection with the marginal sealing ring **20** of greater vertical or transverse thickness, it can be appreciated from a study of FIG. 13, that different angles on the sealing rings may be employed. Furthermore, it is not necessary that two such sealing rings as **12** and **13** be employed as illustrated in FIGS. 8, 9 and 10 nor is it necessary that the sealing rings have a thickness less than the marginal ring, as illustrated in FIGS. 8 and 9; the important point is that one of the sealing rings or the marginal ring should be thicker and preferably with a flat top and bottom side so as to permit stacking of the seals in a seal feed tube without nesting. Furthermore, in certain other applications, the flex-ring **18** may be narrowed down to a minimum, as illustrated in FIG. 13, or the marginal ring itself may be eliminated as illustrated in FIG. 15 leaving only an extended and modified flex-ring with flat sides **13***a* and **13***b* being provided on the relatively thick seal ring **13'**.

Also, while it is preferred that the marginal ring be trapezoidal and have flat top and bottom surfaces, such as illustrated in FIGS. 2, 6, 9, 11, 12 and 13 for the prevention of nesting in a crown assembling machine, the marginal ring or outer seal ring, as the case may be, may be angular at its top and bottom as illustrated in FIGS. 5, 7, 8 and 10 where crown assembling is carried out in machines where stacking is not employed. It will be clearly recognized from a study of FIG. 14, that the flat surfaces **21** and **22** of the preferred form of my invention, as well as the flat surfaces of the other forms as illustrated in FIGS. 6, 9, 11, 12 and 13 facilitate the stacking of the sealing means and prevent nesting in a conventional crown assembling machine utilizing stacking, schematically illustrated in part in FIG. 14.

It can be appreciated that with the large number of crown sealing means being used, any saving of material is important. To accomplish this saving in the sealing means itself, the sides of the marginal ring, such as **21***d* and **21***e*, are curved or concave as illustrated in FIG. 12, or the flex-ring itself is pointed or concave as illustrated at **18***a*, **18***b* in FIG. 15. This feature has the additional advantage of increased retentivity characteristics in the crown cap as can be appreciated from a study of FIG. 3. As to the crown cap itself, the saving is accomplished by the reduction in the thickness of my sealing means as compressed (see FIG. 4) as compared to conventional cork seals or other plastic seals so that the distance from the top of the cap to the locking ring **27** is reduced. Also, I have found with my seal, that thinner gage metal may be used because of the reduced internal bottle pressure acting against the reduced area on my seal and crown. This reduction in area also permits the use of aluminum instead of tin-plate for the cap.

More specifically, in connection with the operation of my sealing means, in production runs it has been experienced that plastic sealing means with annular seal rings tend to nest when seals are stacked in the feed tube of conventional crown assembling machines, i.e., the marginal rims and sealing rings tend to overlap. This results in tearing of the sealing means by a shuttle or ejector and/or causes the shuttle to insert more than one seal into any one crown. By the particular configuration of my invention, such nesting is overcome due particularly to the preferred form of marginal seal rings, as illustrated in FIGS. 2, 6, 9, 11, 12 and 13, where one seal ring is thicker than the other as the case may be, and terminates on both sides by flats, such as **21** and **22**, or **13***a*, **13***b*. As a further aid to prevent nesting it is preferred that the feed tube, indicated schematically in its entirety in FIG. 14 as **31**, and cylindrical section **32** thereof, conventionally designed for feeding cork seals (and customarily has a larger inside diameter than the outside diameter of plastic sealing means), be provided with an intermediate tapering section **33**, which connects the large section **32** to a smaller cylindrical section **34** of the feed tube. The section **34**, being of a smaller inner diameter than the inner diameter of the tube **32**, is only slightly larger, and preferably not more than .010 inch larger, than the outside diameter of the seal. In this manner the sealing means line up and stack automatically, as illustrated in this FIG. 14, and the entire assembly is connected to a vibrator (not shown).

In conventional crown assembling machine, there is provided a shuttle **35** or ejector, in connection to a source of motivating power (not shown) whereby the shuttle is reciprocated to the right and to the left, as illustrated in FIG. 14, in and out of apertures **36** and **37** in the cylinder **34** whereby the shuttle **35** may eject one sealing means at a time. I have improved the conventional crowning assembly machines still further, by providing the shuttle **35** with a V-shaped portion **38** and a chamfer **40**. The V-shaped section **38** conforms, as can be seen, to the outer periphery of the marginal ring **20** to aid in centering the periphery **24** in the ejector and guiding it out of the feed tube and the chamfer **40** prevents its catching or the like with the next sealing means above and in line to be ejected. I have found also in connection with this operation that by providing the sealing rings with the flatest inclined surfaces such as **15** and **17**, facing outwardly, the ejection mechanism **35** functions more successfully.

As hereinbefore mentioned, it is highly desirable that the plastic sealing means be retained in the crown cap prior to the crowning operation. To augment this, I have provided my sealing means with a pointed or narrow rimmed portion **24** or **24'**, for the purpose of increasing the specific pressure of the seal against the crown skirt which together with the flex-ring provides the required frictional rententivity to retain the seal in the crown cap. However, in certain applications, it is desirable to insure that the plastic sealing means will remain positively in the crown cap prior to the crowning operation and I have found that my sealing means cooperates exceedingly well with conventional known dimples or indentations **41** (see FIGS. 3 and 4). These indentationes are usually spaced equidistant about the cap and formed in the metal of the cap slightly below the curved portion **42** and a sufficient distance below the top of the crown cap to permit the sealing means to assume a curvature as illustrated in FIG. 3. The sealing means **10**, being oversize and with a pointed rim **24** or **24'**, will snap over the dimples in the cap when so inserted and brace itself against the top portion of the dimples **41** and thereby be positively retained in the crown cap.

As hereinbefore mentioned, one embodiment of my crown cap comprises a cap **23'** having an improved sealing retaining means therein. Thus, as illustrated in FIG. 16, the dimples **41** may be replaced by a continuous inward protruding rim **43**, formed in the metal of the cap itself. The marginal rim **43** will have the same function and operation as the dimples **41** and in a crown may be located in substantially the same location with respect to the top as the dimples.

As another feature of my invention, the known dimples **41**, such as illustrated in FIG. 3, or the improved rim **43**, such as illustrated in FIG. 16, may be replaced with a plurality of small projections or dots **44** formed of a special lacquer in such a manner as illustrated in FIG. 18 or by a peripheral rim **45**, such as illustrated in FIG. 17. The formation of these lacquer dots and rims will be explained in more detail hereinafter but it is sufficient to say that the lacquer dots **44** and lacquer rim **45** will function to retain the seals in the crown cap **23'**.

In accordance with conventional practice the tin-plate on the side, which will become the inside of the finished crown cap is coated with a lacquer composed of an oleoresinous type of a drying oil and a varnish resin together with a dryer and gold or other color material. This lacquer dries with a glossy surface and usually provides a minimum of friction. As heretofore mentioned, to increase the frictional characteristic of the conventional lacquer and thereby the retentivity of the seal in the crown, I add a small amount of inert material (3%–5%) such as bentonite, magnesium silicate, etc., to the lacquer for the first coating. If preferred, means may be provided to produce brush marks or a texture to the coating, so as to roughen the surface covering the skirt, to improve the frictional retentivity of the crown still further.

Turning now to FIG. 19 wherein I have illustrated a flat sheet of tin-plate **46** used in the conventional crown making operation, after the conventional lacquer has been applied to the tin-plate by the coating machine and has dried.

This improved lacquer, as described above and indicated in FIGS. 17, 18 and 19 may be applied either as concentric rings **45** as illustrated or as plurality of dots **44**, which are relatively thin, yet in the finished product

as illustrated in FIGS. 17 and 18 provide sufficient frictional surface to considerably improve the retention of the sealing means therein. These rings **45** or dots **44** are applied after the first coating of lacquer has dried and can be carried out by running the tin plate through a second coating machine or may be applied after the blanking out of the crown by a spray process or brushing process or any other suitable means.

Where it is not necessary or desirable to provide dots or rims as illustrated, this same modified lacquer may be applied as a first coating the same as present practice of conventional lacquer by the conventional machine and, if preferred, an attachment may be provided to produce brush marks or a texture to the coating to improve the frictional retentiveness of the crown still further.

It may be desirable, where thought to be necessary, that a liquid adhesive be applied into the formed crown to retain the seal. This adhesive may comprise a blend of synthetic rubbers and modifying resinous material dissolved in a volatile solvent such as hexane. This adhesive could be applied to the crown inside thereof in the crown assembling process in a customary manner with a rotary applicator or any other suitable means as is conventional before the seal is inserted. Thus, as in conventional crown assembly operations, when the crown is heated to a temperature of about 230° F. the solvent will be evaporated. In such an operation cam-controlled plungers of the conventional crown assembly machine such as illustrated at **50**, but having a reduced end portion **51** may be used to press the center membrane or diaphragm of the sealing means against the crown top heated by contact with the heated table **52** bringing about a thermo-plastically produced deformation and alignment of the center seal diaphragm with the crown top thereby aiding the spreading of the adhesive between the seal and the crown and consequently accelerating the evaporation of the solvent and resulting in a secure bond. The reduced end portion **51** of the plunger accommodates the sealing rings and/or sealing marginal rim as can be appreciated.

Where herein the various parts of my invention have been referred to as located in a right or left or an upper or lower or an inward or outward position, it will be understood that this is done solely for the purpose of facilitating description and that such references relate only the relative positions of the parts as shown in the drawings.

Also, it is to be understood that many changes and modifications may be made without departing from the scope or spirit of the invention and the invention is defined and comprehended solely by the appended claims which should be construed as broadly as the prior art will permit.

I claim:

1. A closure seal for a cap type closure adapted for use on a container having a seal engaging surface on the uppermost extremity thereof comprising a plastic disc including a relatively thin circular central portion, a relatively thick inner concentric sealing rib, a relatively thin flexible annular flex-ring portion extending beyond said inner sealing rib, said sealing rib and said annular flex-ring portion encircling said central portion, the sealing rib being of such a diameter that it will bear approximately against the uppermost portion of the lip of the container to be sealed, an outer marginal rim encircling said flex-ring portion of greater thickness with respect to the radially inner sealing rib, and substantially flat upper and lower surfaces on said outer marginal rim cooperating with said greater thickness whereby said closure seals will crack stack vertically with like closure seals and slide thereover without interlocking, said annular flex-ring portion having sufficient width between said outer marginal rim and said concentric sealing rib to allow a substantial degree of flexure of said marginal rim relatively to said sealing rib and to locate said sealing rib in position to engage the uppermost portion of the lip of the container to be sealed.

2. A closure seal for a cap type closure adapted for use on a container having a seal engaging surface on the uppermost extremity thereof comprising a plastic disc, including a relatively thin circular central portion, a plurality of relatively thick radially spaced inner concentric sealing ribs, a relatively thin flexible annular flex-ring portion extending beyond said inner sealing ribs, said sealing ribs and said annular flex-ring portion encircling said central portion, the radially inner sealing ribs comprising at least one sealing rib of such a diameter that it will bear approximately against the uppermost portion of the lip of a container to be sealed, an outer marginal rim encircling said flex-ring portion of greater thickness with respect to the radially inner sealing ribs, and substantially flat upper and lower surfaces on said outer marginal rim cooperating with said greater thickness whereby said closure seals will stack vertically with like closure seals and slide thereover without interlocking, said annular flex-ring portion having sufficient width between said outer marginal rim and the outermost of said concentric sealing ribs to allow a substantial degree of flexure of said marginal rim relatively to said outermost sealing rib and to locate said outermost sealing rib in position to engage substantially the uppermost portion of the lip of the container to be sealed.

3. A closure seal of the type set forth in claim 2 wherein said sealing disc is symmetrical transversely and said inner sealing ribs comprise upper and lower sealing ribs triangular in cross section each of which comprises a pair of inclined annular surfaces which converge to define an angle of at least approximately 90 degrees and to provide an axially outwardly disposed sealing edge portion, the radially outermost one of said pair of inclined annular surfaces being provided with a flatter incline than the innermost one thereof.

4. A closure seal of the type set forth in claim 2 wherein said sealing disc is symmetrical in relation to both its median plane and its axis.

5. A closure seal for crown type bottle closures comprising a disc made of a plastic material, said disc including a relatively thin circular central portion, relatively thick radially spaced inner concentric sealing ribs and a relatively thin annular flex-ring portion extending outwardly beyond said sealing ribs, said sealing ribs and said annular flex-ring portion encircling said central portion, the radially inner sealing ribs having at least one sealing rib of such a diameter that it will bear approximately against the substantially flat upper portion of the lip of a bottle to be sealed so as to effect substantially straightdown sealing engagement therewith, and a radially outer marginal rim encircling said flex-ring portion, said outer marginal rim being of greater thickness with respect to the radially inner sealing ribs and being provided with a protruding convex outer periphery of sufficiently large diameter so as to effect frictional retention of the sealing disc within the crown closure and also provided with substantially flat top and bottom surfaces cooperating with said greater thickness whereby said closure seals will stack vertically with like closure seals without interlocking.

6. A closure seal of the type set forth in claim 5 wherein said sealing disc is symmetrical in relation to both its median plane and its axis.

7. A closure seal for crown type bottle closures comprising a plastic disc including a relatively thin circular central portion, a plurality of relatively thick concentric sealing means encircling said central portion in radially spaced inner and outer relation, the radially inner sealing means comprising a sealing surface whose innermost diameter is greater than the diameter of the mouth of the container to be sealed, and whose outermost diameter is less than the outer diameter of the lip of said container, the radially outer sealing means being of equal or greater thickness with respect to the inner sealing means and hav-

ing an outer peripheral rim comprised generally of a pair of truncated conical surfaces with their larger end portions converging approximately in the plane of said central portion to provide a radially outwardly directed circumferential wedge shaped rim, said wedge shaped rim having a sufficiently large external diameter to insure frictional retention of the plastic sealing disc within the crown closure, said outer sealing means being symmetrical about said plane and comprising upper and lower sealing ribs having a flat top surface and a flat bottom surface, respectively, and each of said ribs being generally trapezoidal in vertical section.

8. A closure seal of the type set forth in claim 7, in combination with a crown type bottle closure of the type having disc-retaining bead means projecting inwardly of said crown closure in relatively close proximity to the top thereof, whereby in the assembly of the sealing disc within the crown closure said wedge-shaped peripheral rim will act as a cam surface to permit the disc to snap over said disc retaining bead means for securely retaining the sealing disc within said crown closure.

9. A closure seal of the type set forth in claim 7, having a wedge-shaped outer peripheral rim, in combination with a crown type bottle closure of the type having disc

retaining bead means projecting inwardly of said crown closure in relatively close proximity to the top thereof, whereby in the assembly of the sealing disc within the crown closure the upper conical surface of said wedge-shaped peripheral rim facing said disc retaining bead means will act as a cam surface to cause the disc to resiliently snap over said disc retaining bead means so as to permit the lower conical surface to brace itself against the top of said bead means, thereby securely retaining the sealing disc within the crown closure.

References Cited in the file of this patent

UNITED STATES PATENTS

1,377,279	Rosengren	May 10, 1921
1,659,546	Boothman	Feb. 14, 1928
2,681,742	Miller	June 22, 1954
2,752,059	Schneider	June 26, 1956
2,829,790	Isele-Aregger	Apr. 8, 1958
2,901,139	Isele-Aregger	Aug. 25, 1959

FOREIGN PATENTS

499,126	Canada	Jan. 12, 1954
162,427	Australia	Apr. 13, 1955
185,702	Austria	May 25, 1956