

[54] **TAMPER-PROOF BOTTLE CLOSURE**
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[52] **U.S. Cl.** 215/252
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 [58] **Field of Search** 215/42, 38, 16, 56, 31, 215/252

[57] **ABSTRACT**

A tamper-proof closure for a container in which the container has a transfer ring formed with notches and the closure skirt wall has a shroud which fits over the transfer ring with seals being made by ultrasonic energy between the closure and the container in the area of the notches, a portion of the shroud breaking away when the sealed closure is removed. A method and apparatus are also disclosed for sealing such closures to the container.

[56] **References Cited**
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7 Claims, 7 Drawing Figures

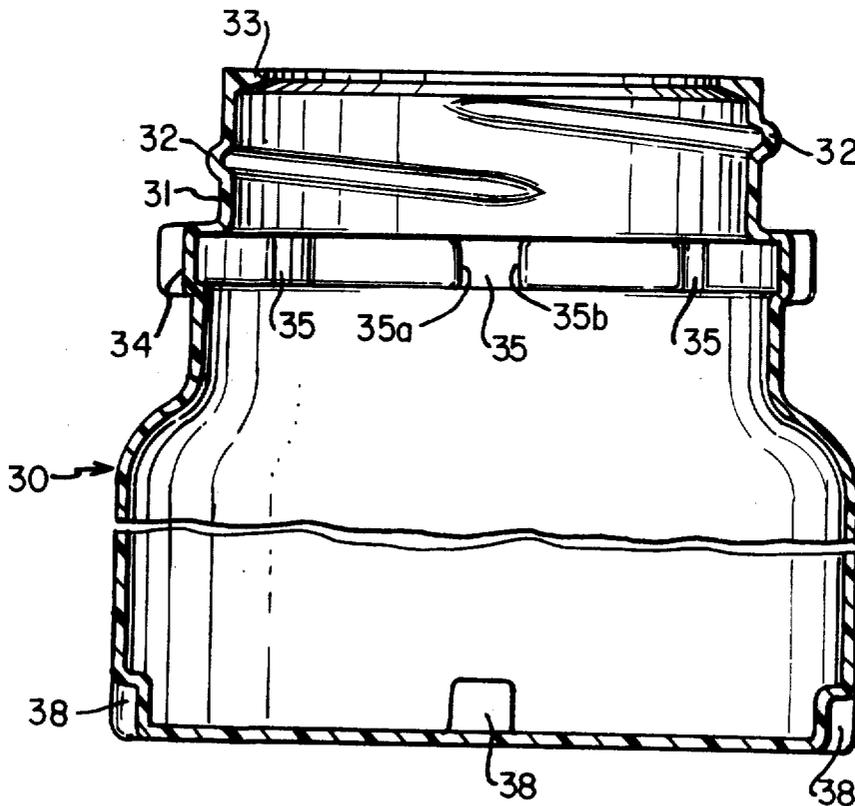


FIG. 1

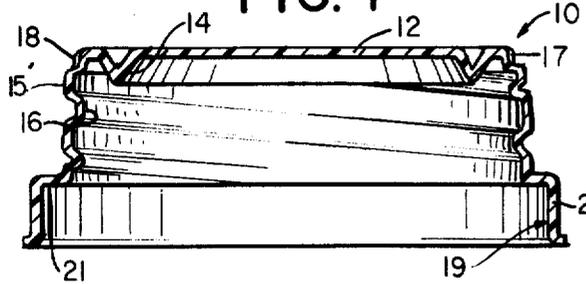


FIG. 2

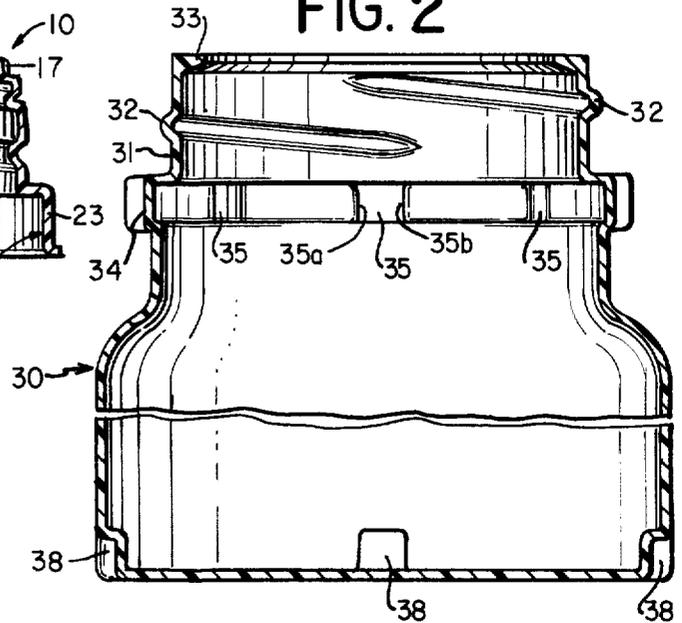


FIG. 3

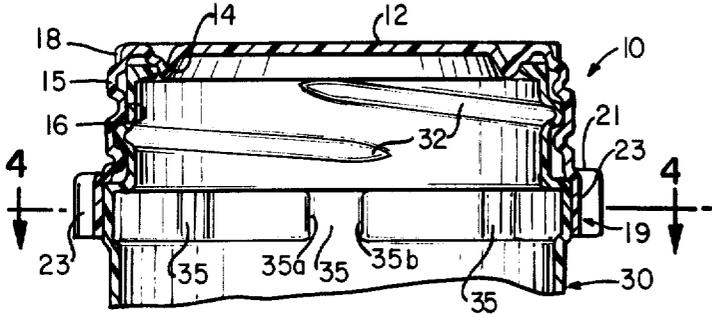
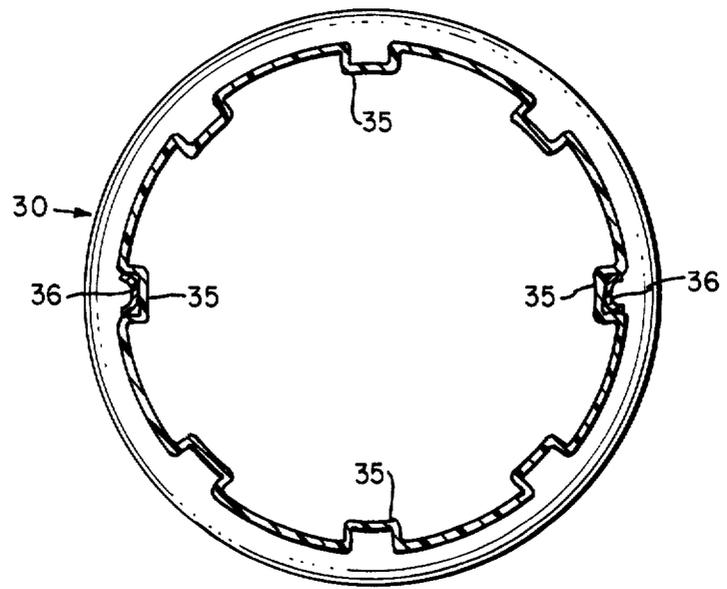


FIG. 4



TAMPER-PROOF BOTTLE CLOSURE

FIELD OF THE INVENTION

This invention relates to containers and "tamper-proof" closures therefor which are sealed to the containers by ultrasonic energy with portions of the closure capable of being broken away to indicate to the purchaser that the contents of the bottle are as originally packed.

DESCRIPTION OF THE PRIOR ART

Tamper-proof closures of various types have been employed to provide an indication of when the closure has previously been removed from the container. A closure of this type is shown, for example, in Crisci et al U.S. Pat. No. 3,504,818, granted Apr. 7, 1970. In that patent, both the closure and a ring on the container are formed with ratchets. The closure is made by injection molding and includes an annular ring which is integrally connected to the lower part of the closure skirt wall by frangible elements. The closure has sufficient flexibility so that when it is tightened onto the bottle the ratchets of the closure and the bottle snap together and mate. When the closure is unscrewed, the ratchets on the closure and container lock-up and the frangible elements break. This leaves the ring on the container as the closure is taken off, providing an indication that the closure has been removed at least once.

Although the closure of the aforesaid patent is operative, it is relatively costly to produce on a mass-production basis. It also requires a substantial modification of the bottle-making machinery so as to be able to make the ring with the ratchet on the container.

SUMMARY OF THE INVENTION

The present invention relates to a container and closure of the tamper-proof type, and a method of apparatus for sealing the closure to the container so as to make it tamper-proof, and also to substantially reduce the probability that the closure will pop off in the case that the container is dropped accidentally.

Plastic containers of relatively large size, such as one-half gallon or one-gallon, which are blow molded or otherwise molded of flexible plastic material, are currently in widespread use. It is desirable to provide such containers with a closure of relatively inexpensive construction which can provide an indication that the closure has once been removed from the bottle to show that the contents therein may not be as originally packed. In addition, it is desired that the closure be sealed to the container so as to resist the likelihood of popping off in the event the container is accidentally dropped.

In the prior U.S. Pat. Nos. of Norman T. Exton, 3,482,725, granted Dec. 9, 1969, and Edmund Childs and Ostrowski, 3,606,063, granted Sept. 20, 1971, both of which are assigned to the assignee of this application, plastic closures which are made by a thermoforming process of either male or female molding, are disclosed. Such closures are relatively inexpensive and the closure of the latter patent has found widespread use in the dairy industry.

The present invention relates to a thermoformed closure of the same general type such as disclosed in one or both of the aforesaid patents which is modified to accomplish the objectives of providing the tamper-proof indication and also the sealing to reduce the possibility

of closure pop-off. In accordance with the invention, the closure is provided with a shroud ring portion which extends downwardly from the skirt wall to cover the transfer ring of the container. The transfer ring of the container is modified to have one or more notches. In fastening the closure to the contents after it has been filled with its contents, a tool is applied to the closure to distort a portion of the notches of the transfer ring and to weld it to the container. The tool deforms and weakens the portions sealed to the container. Therefore, when the closure is unscrewed these portions break away from the closure to provide the tamper-proof indication. In a preferred form of the invention, the tool is an ultrasonic transducer which applies ultrasonic energy to the closure to both deform the closure and also to make the weld.

In still another embodiment of the invention, the shroud ring attached to the closure skirt wall is weakened, so that when the closure is unscrewed the entire shroud breaks away to provide the tamper-proof indication.

It is therefore an object of the present invention to provide novel closure and method of sealing the same to a bottle to provide a tamper-proof indication.

It is a further object to provide a closure which is fastened by ultrasonic sealing techniques to a bottle.

An additional object is to provide a closure made by thermoforming sheet material of substantially uniform thickness, the closure having a shroud ring attached to the skirt wall.

A further object is to provide a container having a transfer ring and index marks to operate with the method and apparatus of the subject invention.

Still another object is to provide a system for sealing closures to a container by ultrasonic energy in which the ultrasonic welds are made at predetermined locations.

Other objects and advantages of the present invention will become more apparent upon reference to the following specification and annexed drawings in which:

FIG. 1 is a cross-section of a preferred form of closure of the subject invention;

FIG. 2 is an elevational view, shown partially broken away, of a preferred container used;

FIG. 3 shows a cross-section of a closure assembled to the container with the ultrasonic seals;

FIG. 4 is a transverse section taken along the line 4-4 of FIG. 3 showing the container notches and the material of the closure that remains left therein;

FIG. 5 is a view partly in schematic form, showing a system for fastening the closures to the containers;

FIG. 6A is a cross-section of a closure made in accordance with another embodiment of the invention; and

FIG. 6B shows the closure and the container of FIG. 6A after they have been separated.

FIG. 1 shows a preferred form of closure 10. The closure is made by thermoforming techniques from a sheet of plastic material of substantially uniform thickness by drawing the same over a male mold or into a female mold. As described in the two aforesaid patents to Exton and Ostrowski et al, the closure formed is of relatively thin material, for example, on the order of 0.040 inches thickness, so that it has substantial flexibility or resiliency in all directions. The materials for forming the closure are any suitable plastic materials such as, for example, polystyrene, polyethylene, polypropylene, ABS, etc. The closure is preferably formed from the

same material as the container to which it is to be sealed for the purpose of providing a better ultrasonic weld, as described below.

As shown in FIG. 1, closure 10 incorporates features of both of the aforesaid patents. That is, it includes a top wall 12 having an annular internal sealing ring 14 formed therein and extending downwardly. Sealing ring 14 is generally U or V-shaped. A skirt wall 15 depends downwardly from the top wall 12 and is formed with a plurality of threads 16 which are to mate with corresponding threads on the bottle. In addition, an indented ring 17 is formed on the skirt wall adjacent the point where it joins top wall 12. The ring 17 is shown as being knurled at 18 to form a number of inwardly extending projections.

As described in the two aforesaid patents, the deformed portions of the closure, such as the sealing ring 14 and the knurls 18, are somewhat thinner than the original sheet material, since they have been stretched into the desired shape during the thermoforming process. The closure is constructed with respect to the container to which it is to be fastened so that the outer edge of the sealing ring 14 will contact the inner edge of the container's sealing lip. In addition, the diameter across the knurled section 18 of ring 17 is slightly less than the diameter of the corresponding area of the bottle neck. Thus, as the closure is fastened to the container, the sealing ring 14 makes a seal on the internal edge of the lip of the bottle by deforming thereover. The knurled section 18 also deforms around the top of the neck of the container to provide a tighter and more secure fit, and also to prevent doming of the top wall. Neither of the functions of the knurl 18 of sealing ring 14 are necessary to the invention.

In addition to the foregoing, the closure is formed with a shroud ring 19 at the bottom of the skirt wall 15. The shroud ring is of somewhat greater diameter than the top portion of skirt wall 15 and has an outwardly extending shoulder 21 which is joined to the skirt wall and a downwardly extending wall 23.

FIG. 2 shows a container 30 with which the closure of the subject invention is to be utilized. The container is formed of plastic material by any conventional means, for example, blow molding. The bottle includes a neck 31 having threads 32 thereon below a sealing lip 33. A transfer ring 34 is formed beneath the threads 32.

As heretofore described, the bottle is of conventional construction. However, it is modified in the following two respects. First of all, transfer ring 34 is formed with one or more notches 35 in the wall thereof. In the preferred embodiment of the invention described, there are eight such notches spaced equally 45° around the ring 34. In addition, a number of index marks, such as tabs 38, are formed on the bottle. Tabs 38 are illustratively shown on the bottom of the bottle as being projections. However, it should be understood that the index marks can be located on any suitable part of the bottle and could be indentations as well as projections. In addition, instead of using projecting tabs as the index marks, any other suitable markings can be made on the bottle for indexing purposes, for example colored marks. The use of the index marks is described below.

As shown in FIG. 3, when the closure 10 is fastened to the container 30, the shroud ring 19 covers the container transfer ring 34. Welds are formed between the vertical wall 23 of the shroud ring and the bottle transfer ring 34 in the area of one or more of the notches 35.

That is, a tool is applied to the shroud ring vertical 23 in an area opposite a notch 35. In a preferred form of the invention the tool is an ultrasonic transducer which supplies energy in the ultrasonic range, i.e., generally from about 1Khz to 100khz. The energy supplied by the tool deforms the wall and sets up vibrational motion at the interface of the deformed portion and the notch 35. The vibrational motion produces heat to provide an ultrasonic weld. Depending upon the shape of the tool, the ultrasonic weld will occur at various areas of the notch 35, that is, on the wall of the bottle itself or on the walls 35a and 35b of the notch which are substantially transverse to the outer surface of the transfer ring. Where an ultrasonic weld is used, it is preferred that the closure and container be of the same plastic material or from the same family of materials. This provides a better weld.

Other types of energy can be used to form the welds. For example, a hot iron can be used and the combination of heat and pressure will deform the closure and produce the weld. The tip of the iron would be suitably coated so that the plastic would not stick. In general, however, it has been found that ultrasonic energy is the best overall type of energy to use.

The welded portion of the shroud ring vertical wall 23 which is deformed by the ultrasonic energy is substantially weakened. The depth of the transfer ring notch 35, which determines the extent of the deformation of wall 23, and the strength of the weld, are made so that each deformed portion of the wall 23 will hold fast when the closure is unfastened. Thus, the closure will break away when unscrewed, leaving the welded portion, or portions, of wall 23 attached to the bottle.

The weld provides several advantages. First of all, it provides a positive seal and thereby substantially reduces the likelihood that the closure will pop off in the event the container is accidentally dropped. This has heretofore presented a problem since a closure and container typically have only about one and one-half turns of the thread. In addition, the fact that a portion of the closure is left on the container after it has been unfastened provides a tamper-proof indication. As a further advantage, the shroud ring covers a larger portion of the container neck providing a more sanitary arrangement.

FIG. 4 shows the container 30 and the notches 35 with the portions 36 of the shroud 19 that are left after the closure 10 has been removed from the container. In this preferred embodiment the broken portions 36 provide a visual indication of when the closure has already been removed from the bottle.

FIG. 5 shows a system for applying ultrasonic energy to seal the closure to the container after the closures have been screwed onto the container with the proper amount of torque. The capping machinery is not shown. The system includes an ultrasonic generator 50 of any suitable conventional construction which illustratively supplies energy to two ultrasonic tools 52A and 52B each having a work tip 54. The ultrasonic generator and the tools can comprise any suitable conventional apparatus. The electrical energy supplied by the generator 50 sets up vibrational energy at the tips of the tools 54. A positioning mechanism 60 is provided for tools to move them toward the container at a given time, and also to retract them. The positioning mechanism can be, for example, air-operated cylinders, screw feed, solenoid operated drives, etc.

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The containers 30 are shown being fed down an inclined plane 68, past a roller 70 which is driven by any suitable mechanism such as a motor 72. The roller 70 engages the wall of each container coming down the plane and imparts a slight rotary motion. This rotary motion is not of sufficient force, however, to keep turning the container once one of the index tabs 38 engages a retractable stop 74 which is actuated by a solenoid-type mechanism 76. The location of the index tabs 38 on the container and the stop 74 are such that when correlated with the location of the notches 35 on the transfer ring of the container each tip 54 of the ultrasonic tools 52 will be properly aligned opposite a notch. When energy is supplied from generator 50 and the tools 52 are moved inwardly toward the bottles by mechanism 60, the portion of the shroud ring 19 which will be deformed by the tips 54 will be in the area overlying the notches 35. Thus, the weld will be made in the area of the notch.

It is preferred that at least two welds be made, preferably spaced about 180° from each other, to provide for a more secure sealing. The number of welds and/or the weld area determines the amount of torque needed to unfasten the closure from the container.

It should be understood that any suitable mechanism for feeding the container past the ultrasonic tools can be utilized. For example, instead of using the projections 38 on the bottle as the index marks. A photoelectric sensing mechanism can be used in conjunction with painted index marks. Any suitable mechanism can be provided for stopping the container at the proper angular orientation.

FIGS. 6A and 6B show another form of the invention in which the shroud ring is weakened at 21', such as by cutting or scoring, at the juncture of the skirt wall 15 and the shoulder 21. The welds are made as previously described so that when the closure is unfastened, the

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entire shroud ring 19 will break away as shown in FIG. 6B.

What is claimed is:

1. In combination a container having a preformed ring of plastic material projecting from and extending around a portion of the container neck with at least one notch in the ring, a closure of plastic material having a top wall, a skirt wall depending from said top wall, and a shroud ring extending from said skirt wall, said shroud ring extending over the projecting ring on the container, means for fastening said closure to said container, and at least one area of said closure shroud ring indented into a notch on said container projecting ring with a heat weld made between said closure shroud ring indented area and said container in the area of said notch, at least a portion of the welded area of the closure material remaining with the container when the closure is unfastened therefrom said closure being of substantially uniform thickness except where indented.

2. The combination of claim 1, wherein said projecting ring has a plurality of notches therearound spaced substantially equiangularly.

3. The combination of claim 1, wherein said container has at least one marking indicia thereon at a predetermined location with respect to a said notch.

4. The combination of claim 3, wherein said marking indicia comprises a projection.

5. The combination of claim 1, wherein said closure includes a sealing ring formed in the top wall thereof.

6. The combination of claim 1, wherein said shroud ring has at least one weakened portion.

7. The combination of claim 1, wherein said shroud ring includes a shoulder attached to the closure skirt wall and a wall depending downwardly from said shoulder, and shoulder having at least one weakened portion.

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