Sept. 11, 1962 J. W. WANDELL 3,053,406

SCREW CAP

Filed June 14, 1960

Fig. 1.

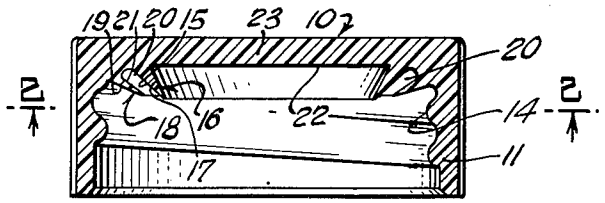


Fig. 2.

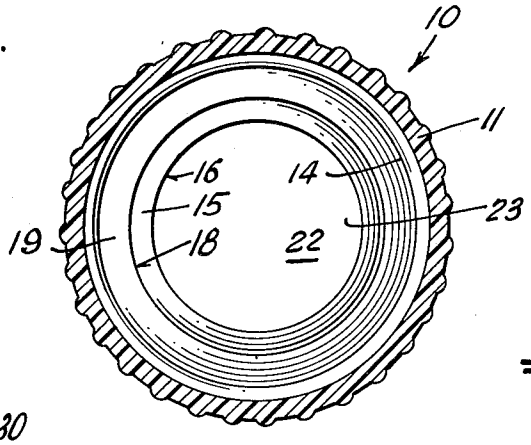


Fig. 4.

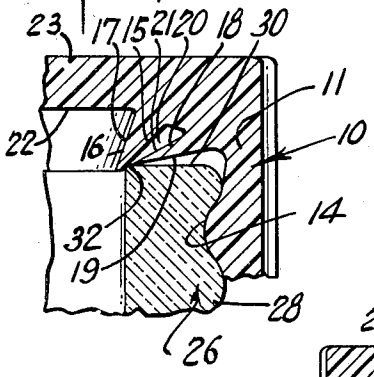


Fig. 5.

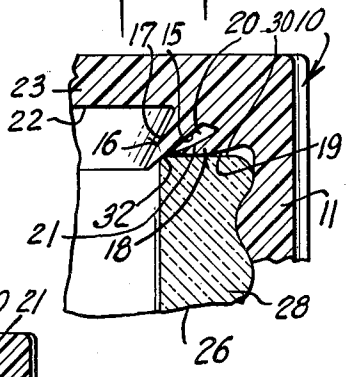
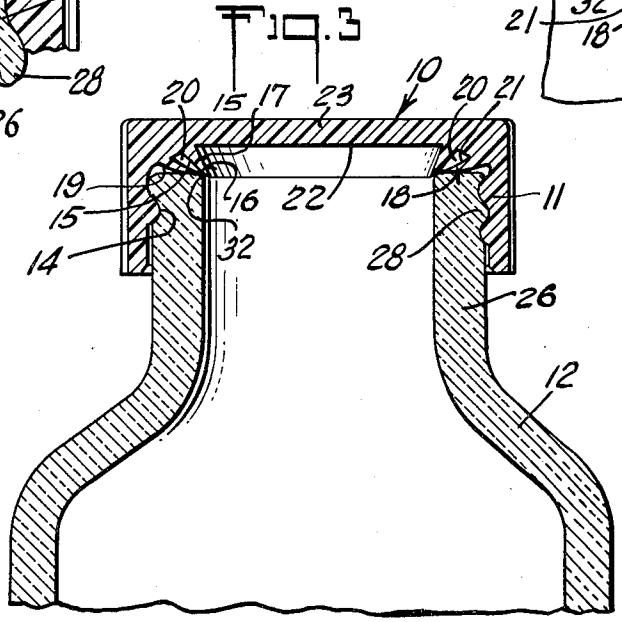


Fig. 3.



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SCREW CAP

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This invention relates to a screw cap for bottles, cans and similar containers having externally threaded necks and more specifically relates to an improved plastic screw cap which does not require a liner to form a liquid-tight seal when positioned over the mouth of a bottle, can, or similar container.

It is commonly known and understood that the screw caps now being used for the purpose of closing a container such as a bottle or can having an externally threaded neck over which the screw cap is adapted to fit, require a liner inside the cap in order that a liquid-tight seal be provided by the top of the bottle or can neck and the inside of the cap. It has been customary to utilize cork, metal foil and the like as materials from which acceptable liners may be fabricated. The mechanized insertion of liners into the domes of screw caps in the conventional manner requires the use of expensive equipment and results in additional labor costs.

One of the objects of the present invention is to provide an improved screw cap of the character indicated which eliminates the necessity for a liner and provides a liquid-tight seal when the cap is positioned over the externally threaded neck of a container such as a bottle or can.

It is another object of this invention to provide an improved one-piece, plastic screw cap which may be tightly seated on an externally threaded neck of a container, such as a bottle or can, to provide a liquid-tight seal.

It is still another object of this invention to provide an improved, plastic screw cap having internal rings integrally formed with and protruding from the inner surface of the cap and positioned so as to come in contact with and be compressed by the inner edge and top surface of an externally threaded bottle neck when the cap is fully seated on the bottle neck.

Other objects and advantages of this invention will be apparent from the following description when taken in connection with the drawing in which similar characters of reference indicate similar parts throughout the several views.

Referring to the drawing:

FIGURE 1 is a view in section of the cap showing the positions of the internal rings and their relation to each other;

FIGURE 2 is a view in section of the cap taken along the line 2—2 of FIGURE 1, showing the arrangement of the internal rings and their relation to each other;

FIGURE 3 is a view in section of the cap and a bottle neck showing the cap fully seated on the bottle neck;

FIGURE 4 is an enlarged fragmentary view in section of the cap and a portion of a bottle neck in section showing the cap incompletely seated on the bottle neck; and

FIGURE 5 is an enlarged, fragmentary view in section of the cap and a portion of a bottle neck showing the cap fully seated on the bottle neck.

Referring to the drawing, the cap, which is indicated generally at **10**, has a side wall **11** and threads **14** on the inner surface of the side wall, an end wall **23** with an inner surface **22**, inner internal rings **16** and **18** integrally formed with and protruding from the inner surface of the top of the cap a distance substantially less than the internal depth of the cap. Inner ring **16** has an outer surface **15** and an inner surface **17** which are flat and incline inwardly from the base and uniformly around the

circumference of the ring. In the preferred form the inner surface of the inner ring is positioned at an angle with respect to the inner surface of the cap top of less than 90 degrees. Outer ring **18** has an outer surface **19** and an inner surface **21** which are flat and inclined inwardly from the base and uniformly around the circumference of the ring. Inner surface **21** of the outer ring is preferably positioned at an angle with respect to the inner surface of the cap top of less than 90 degrees. The base of the outer ring joins the inner surface of the cap approximately at the juncture of the inner surface of the end wall and the inner surface of the side wall of the cap. In the preferred form, the outer surface of the outer ring is positioned at an angle with respect to the inner surface of the cap top within the ring less than the angle with which the outer surface of the inner ring is positioned with respect to the inner surface of the cap top within the ring and the outer ring extends from its base a distance less than the distance to the outer surface of the inner ring. The inner surface of the base of the outer ring is positioned away from the outer surface of the base of the inner ring so that there is a space **20** between the inner and outer rings and in the preferred form of the spatial relationship of the inner and outer rings, there is an air space between the inner and outer rings when the cap is fully seated on a bottle neck. The preferred spatial relationship of the inner and outer rings is preferably obtained by having the inner and outer surface of the inner ring positioned at angles with respect to the inner surface of the cap top of about 75 degrees and 60 degrees, respectively, and the inner and outer surfaces of the outer ring positioned at angles with respect to the inner surface of the cap top of about 45 degrees and 30 degrees, respectively, and in this preferred form the outer ring extends from its base a distance such that when the inner and outer rings are depressed by pressure exerted thereon by the inner edge **32** and end **30** of a bottle neck **26** of a bottle **12**, the tip of the outer ring comes in contact with the outer surface of the inner ring just below the tip thereof. In the spatial relationship of the inner and outer rings of the preferred form of the cap illustrated in the drawing, the outer ring is positioned so that its inner surface joins the inner surface of the cap approximately at the juncture of the end and side walls of the cap and both inner and outer rings are substantially thicker at the base than at the tip and are undercut with respect to the inner surface of the end wall of the cap. Rings which have the undercut configuration illustrated in the drawings have sufficient flexibility so that they may be compressed when the cap is fully seated on the neck of a bottle and thereby provide an excellent seal by conforming closely to and compensating for any irregularities of the bottle neck, particularly any irregularities in the inner edge and top surface of the bottle neck. Relatively thin inner and outer rings with undercut conformation also require less pressure of the rings on the surfaces of the bottle neck with which they come in contact to be compressed and form a liquid-tight seal. Because of the reduced pressure required, the tendency for the bottle neck to crack is substantially reduced.

As a cap such as is illustrated in the drawing, is positioned on the neck of a bottle and rotated, the threads **14** on the inner surface of the cap engage with the threads **28** on the outer surface of the bottle neck and as the cap is given additional rotation about the neck of the bottle, the inner edge of the bottle neck which is usually slightly rounded or beveled comes in contact with the outer surface of the inner ring and approximately simultaneously the top surface of the bottle neck which is usually irregular comes in contact with the outer surface of the outer ring approximately at the tip thereof. FIG-

URE 4 illustrates the relative positions of the inner and outer rings with respect to the inner edge and the end of the bottle neck at the moment the cap is rotated on the bottle neck to such an extent that first contact is made between the inner and outer rings of the cap and the inner edge and top surface of the bottle neck. As the cap is given additional rotation from the position illustrated in FIGURE 4, the inner edge and top surface of the bottle neck are forced against and compress the inner and outer rings of the cap so that when the cap is fully seated, as illustrated in FIGURES 3 and 5, the inner ring is compressed by the inner edge of the bottle neck and the outer ring is compressed by the end of the bottle neck. In the preferred form of the cap, as illustrated in FIGURE 5, the tip of the outer ring touches the outer surface of the inner ring slightly below the tip thereof when the cap is fully seated on the bottle neck with the result that the air space 20 becomes a sealed chamber between the inner and outer rings which is compressible. When the cap is fully seated the air within the sealed chamber formed between the inner and outer rings is under pressure greater than atmospheric pressure. This assists materially in holding the outer ring firmly against the end surface of the cap neck and this has the effect of adding to the liquid-tight character of the seal provided by the cap when it is fully seated on the bottle neck.

Although all of the figures of the drawing and the description above illustrate a screw cap adapted for use as a closure for a bottle, it is to be understood that the screw caps of my invention are not limited to use as a closure for bottles but are suitable for use as closures with any container, such as a metal can or plastic container having an externally threaded neck.

In general, any synthetic plastic material having a relatively low elasticity and a relatively high stiffness is suitable for use in fabricating the screw caps of my invention. Such materials include but are not limited to polymers of ethylene, polymers of propylene, copolymers of ethylene and propylene, nylon and polystyrene. It is preferred that the synthetic plastic materials have a stiffness within the range of from about 50,000–150,000 pounds per square inch, as determined according to ASTM test method D747–50. Long-chain high density polyethylenes having mainly terminal vinyl groups, essentially no trans structure, essentially no branched vinyl groups, a relatively high degree of crystallinity, a relatively large molecular weight, and a relatively high density, softening temperature and tensile strength are particularly suitable for use in fabricating the screw caps of my invention. Still more particularly, the preferred materials for use in fabricating the screw caps of my invention are long-chain polyethylenes having mainly terminal vinyl groups, essentially no branched vinyl groups, essentially no trans structure, a crystallinity of at least about 93 percent, a density of about 0.95 to 0.97 gram per cubic centimeter, a softening temperature of about 230° F. to 260° F., and a stiffness within the range of from about 50,000–150,000 pounds per square inch, as determined by ASTM test method D747–50.

The screw cap of this invention may be fabricated by the use of conventional injection moulding equipment and, because of the above-defined physical characteristics of the plastic substance, may be ejected from the mould without mutilation of the internal threads of the cap.

Although the construction of the screw cap of this invention has been described in some detail, it is to be understood that the description is solely to illustrate concrete and preferred embodiments thereof and that the invention is not to be limited to the exact description and drawing except as such limitations may appear in the appended claims.

What is claimed is:

1. An internally threaded cap adapted to fit over the neck and close the mouth of a container having an externally threaded neck, composed of a plastic material of relatively low elasticity and relatively high stiffness, having an inner ring integrally formed with and protruding from the inner surface of the cap top a distance substantially less than the internal depth of the cap, with its outer surface inclined inwardly and uniformly around its circumference; and an outer ring integrally formed with and protruding from the inner surface of the cap slightly below the juncture of the end and side walls a distance less than the distance to the outer surface of the inner ring, with its outer surface inclined inwardly and uniformly around its circumference and positioned at an angle with respect to the surface of the cap within the ring less than the angle at which the outer surface of the inner ring is positioned with respect to the surface of the cap within the ring; the size and configuration of the inner and outer rings being such that as the cap is positioned on an externally threaded neck of a container and rotated, the threads of the cap engage with the threads of the container, the inner edge of the container neck comes in contact with the outer surface of the inner ring and the end surface of the container neck comes in contact with the outer ring before the cap is fully seated and both the inner and outer rings are compressed when the cap is fully seated on the container neck.

2. An internally threaded cap adapted to fit over the neck and close the mouth of a container having an externally threaded neck, composed of a plastic material of relatively low elasticity and relatively high stiffness, having an inner ring integrally formed with and protruding from the inner surface of the cap top a distance substantially less than the internal depth of the cap, with its outer surface inclined inwardly and uniformly around its circumference; and an outer ring integrally formed with and protruding from the inner surface of the cap slightly below the juncture of the end and side walls a distance less than the distance to the outer surface of the inner ring, with its outer surface inclined inwardly and uniformly around its circumference and positioned at an angle with respect to the surface of the cap within the ring less than the angle at which the outer surface of the inner ring is positioned with respect to the surface of the cap within the ring; the size and configuration of the inner and outer rings being such that as the cap is positioned on an externally threaded neck of a container and rotated, the threads of the cap engage with the threads of the container, the inner edge of the container neck comes in contact with the outer surface of the inner ring and approximately simultaneously the end surface of the container neck comes in contact with the outer surface of the outer ring before the cap is fully seated and both the inner and outer rings are compressed when the cap is fully seated on the container neck.

3. An internally threaded cap adapted to fit over the neck and close the mouth of a container having an externally threaded neck, composed of a plastic material of relatively low elasticity and relatively high stiffness, having an inner ring integrally formed with and protruding from the inner surface of the cap top a distance substantially less than the internal depth of the cap, with its outer surface inclined inwardly and uniformly around its circumference; and an outer ring integrally formed with and protruding from the inner surface of the cap slightly below the juncture of the end and side walls a distance less than the distance to the outer surface of the inner ring, with its outer surface inclined inwardly and uniformly around its circumference and positioned at an angle with respect to the surface of the cap within the ring less than the angle at which the outer surface of the inner ring is positioned with respect to the surface of the cap within the ring; the size and configuration of the inner and outer rings being such that as the cap is positioned on an externally threaded neck of a container and rotated, the threads of the cap engage with the threads of the container, the inner edge of the container neck comes in contact with the outer

surface of the inner ring and approximately simultaneously the end surface of the container neck comes in contact with the outer surface of the outer ring before the cap is fully seated and both the inner and outer rings are compressed when the cap is fully seated on the container neck with the tip of the outer ring touching the outer surface of the inner ring.

4. An internally threaded cap adapted to fit over the neck and close the mouth of a container having an externally threaded neck, composed of a plastic material of relatively low elasticity and relatively high stiffness, having an inner ring integrally formed with and protruding from the inner surface of the cap top a distance substantially less than the internal depth of the cap, its inner surface positioned at an angle with respect to the surface within the cap of less than 90 degrees and with its outer surface inclined inwardly and uniformly around its circumference; and an outer ring integrally formed with and protruding from the inner surface of the cap slightly below at the juncture of the end and side walls a distance less than the distance to the outer surface of the inner ring, with its inner surface positioned at an angle with respect to the surface within the cap of less than 90 degrees and its outer surface inclined inwardly and uniformly around its circumference and positioned at an angle with respect to the surface of the cap within the ring less than the angle at which the outer surface of the inner ring is positioned with respect to the surface of the cap within the ring; the size and configuration of the inner and outer rings being such that as the cap is positioned on an externally threaded neck of a container and rotated, the threads of the cap engage with the threads of the container, the inner edge of the container neck comes in contact with the outer surface of the inner ring and the end surface of the container neck comes in contact with the outer surface of the outer ring before the cap is fully seated and both the inner and outer rings are compressed when the cap is fully seated on the container neck.

5. An internally threaded cap adapted to fit over the neck and close the mouth of a container having an externally threaded neck, composed of a plastic material of relatively low elasticity and relatively high stiffness, having an inner ring integrally formed with and protruding from the inner surface of the cap top a distance substantially less than the internal depth of the cap; with its inner and outer surfaces positioned at angles with respect to the surface of the cap within the ring of about 75 degrees and 60 degrees, respectively; and an outer ring integrally formed with and protruding from the inner surface of the cap slightly below at the juncture of the end and side walls a distance less than the distance to the outer surface of the inner ring; with its inner and outer surfaces positioned at angles with respect to the surface of the cap within the ring of about 45 degrees and 30 degrees, respectively; the size and configuration of the inner and outer rings being such that as the cap is positioned on an externally threaded neck of a container and rotated, the threads of the cap engage with the threads of the container, the inner edge of the container neck comes in contact with the outer surface of the inner ring and the end of the container neck comes in contact with the outer surface of the outer ring before the cap is fully seated and both the inner and outer rings are compressed when the cap is fully seated on the container neck.

6 An internally threaded cap adapted to fit over the neck and close the mouth of a container having an externally threaded neck, composed of a plastic material of relatively low elasticity and relatively high stiffness, having an inner ring integrally formed with and protruding from the inner surface of the cap top a distance substantially less than the internal depth of the cap, its inner surface positioned at an angle with respect to the surface within the cap of less than 90 degrees and with its outer surface inclined inwardly and uniformly around its circumference; and an outer ring integrally formed with and protruding from the inner surface of the cap a distance less than the distance to the outer surface of the inner ring; with an inner surface joining the inner surface of the cap approximately at the juncture of the end and side walls and its inner surface positioned at an angle with respect to the surface within the cap of less than 90 degrees and its outer surface inclined inwardly and uniformly around its circumference and positioned at an angle with respect to the surface of the cap within the ring less than the angle at which the outer surface of the inner ring is positioned with respect to the surface of the cap within the ring; the size and configuration of the inner and outer rings being such that as the cap is positioned on an externally threaded neck of a container and rotated, the threads of the cap engage with the threads of the container, the inner edge of the container neck comes in contact with the outer surface of the inner ring and the end surface of the container neck comes in contact with the outer surface of the outer ring before the cap is fully seated and both the inner and outer rings are compressed when the cap is fully seated on the container neck.

7. An internally threaded cap adapted to fit over the neck and close the mouth of a container having an externally threaded neck, composed of a plastic material of relatively low elasticity and relatively high stiffness, having an inner ring integrally formed with and protruding from the inner surface of the cap top a distance substantially less than the internal depth of the cap; with its inner and outer surfaces positioned at angles with respect to the surface of the cap within the ring of about 75 degrees and 60 degrees, respectively; and an outer ring integrally formed with and protruding from the inner surface of the cap a distance less than the distance to the outer surface of the inner ring; with an inner surface joining the inner surface of the cap approximately at the juncture of the end and side walls and its inner and outer surfaces positioned at angles with respect to the surface of the cap within the ring of about 45 degrees and 30 degrees, respectively; the size and configuration of the inner and outer rings being such that as the cap is positioned on an externally threaded neck of a container and rotated, the threads of the cap engage with the threads of the container, the inner edge of the container neck comes in contact with the outer surface of the inner ring and the end surface of the container neck comes in contact with the outer surface of the outer ring before the cap is fully seated and both the inner and outer rings are compressed when the cap is fully seated on the container neck.

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