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3,133,656

STRETCH CAP

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Fig. 1

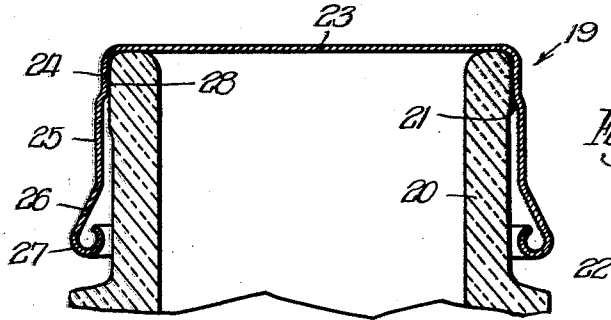
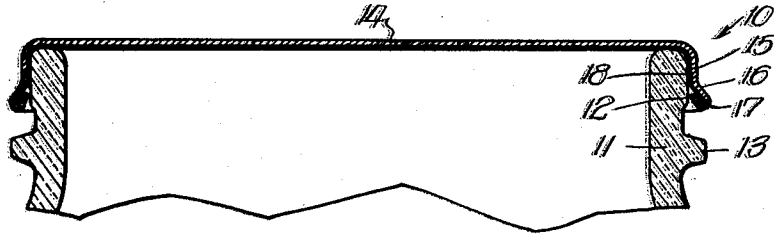


Fig. 3

Fig. 2

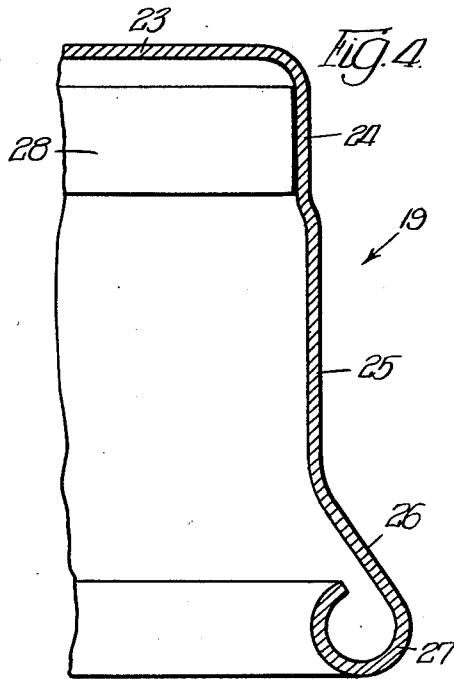
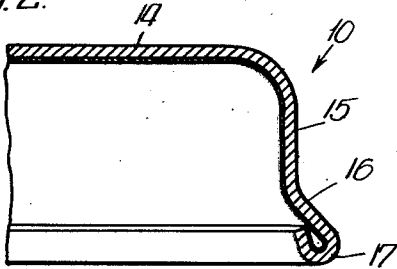


Fig. 4

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STRETCH CAP

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6 Claims. (Cl. 215-40)

The present invention relates generally to a new and improved closure cap for use in hermetically sealing container openings of substantially cylindrical shape. More specifically, the present invention is directed to a new and improved stretchable closure cap particularly adapted for use with a cylindrical surface of a container opening to provide a hermetic seal in side sealing relation therewith, which cap is removable and replaceable on the container for resealing therewith.

In order to seal a glass container such as a bottle or jar with a closure cap, it is necessary to bring a portion of the closure cap into intimate contact with a continuous area of the finish which surrounds the opening of the container in a specified relation thereto. The types of sealing contact most generally used are a top seal, a side seal or a combination of a top and side seal. The closure cap is provided with an internally carried gasket which functions as a sealing means to bring about at least one of the types of sealing contact. Where it is desired to eliminate metal contact with the contents of the container the inner surface of the cap is coated with a protective composition prior to the insertion of the gasket.

It has generally been found that a closure means which seals the top edge of the container will not normally perform as a resealing medium upon removal and replacement thereof unless mechanical means such as lugs, snaps or threads are employed in the resealing operation. It has further been experienced that a top sealing arrangement cannot be hermetically sealed unless there is a vacuum at all times in the container. In addition, reliance on mechanical means to maintain a hermetic seal necessitates the employment of considerable care or the provision of additional security means to insure maintenance of the seal during normal handling of the container for shipment or merchandising purposes.

For purposes of initially providing and maintaining a hermetic seal under varying conditions, which include the sealing of containers under atmospheric as well as vacuum conditions, the use of a side sealing arrangement has been found particularly promising. A closure means may be initially applied in hermetic side sealing relation with a cylindrical surface without the necessity of relying upon mechanical means to insure proper maintenance of hermetic conditions. With side sealing greater surface areas may be utilized and a hermetic seal may be initially obtained without the necessity of promoting vacuum conditions within the container. If adhesion between the surfaces of the container and the closure cap in sealing relation is present the container may be subjected to internal pressure. Known forms of top sealing closure means are incapable of properly maintaining hermetic conditions under these circumstances.

In order to maintain hermetic conditions in side sealing arrangements it has been the general practice to provide the internal surface of the closure cap with a pliable sealing gasket which will adequately fill and seal the clear-

ances between the inner surface of the closure cap and the cylindrical surface to be sealed. Because of circumferential variations in cylindrical sealing surfaces it has been found necessary to provide for greatly varying conditions existing between a number of similar containers in order to promote proper hermetic sealing with respect to any one of the containers. One approach to this problem has been the provision of gaskets of considerable thickness on the inner surface of the closure cap. The great bulk of pliable sealing material present insures proper filling of the varying spaces existing between the inner surface of the closure cap and the outer surface of the container. In using relatively thick gaskets it has been found difficult to maintain hermetic conditions as the thick gasket material exhibits permeable characteristics with respect to air and other gases and provides a means for transferring such gases either from the interior of the container to the surrounding atmosphere or in the reverse direction. This problem with respect to side sealing arrangements is particularly severe.

Attempts have been made to overcome the foregoing problem by making use of closure caps which are capable of being resiliently stretched when placed in sealing engagement with a cylindrical surface thereby placing the sealing gasket carried by the cap under constant resilient compression in an effort to reduce the permeability thereof. Closure caps of this nature have taken many different forms, as for example being fluted so as to allow an elastic-band type increase in diameter of the skirt portion of the cap upon the application of the cap to the container. Another form of cap includes the use of a smooth cylindrical skirt portion formed from a metal which is inherently resiliently stretchable under the action of internally positioned expanding forces. The skirt is of a diameter slightly less than the outer diameter of the portion of the container to be sealed and upon application of the cap to the container, the metal of the skirt portion is expanded.

Caps of this nature, however, have been designed to maintain the stretching of the skirt portion within the elastic limit of the metal of the cap. In this way the skirt portion of the cap constantly exerts compressive action with respect to the sealing gasket carried internally thereby and the cylindrical surface of the container. These caps have been unable to completely answer the problem as, due to the irregularities in the cylindrical surface of the container to be sealed, the cap is incapable of exerting uniform sealing pressure throughout the entire area of the container surface under sealing engagement. As a result, the sealing gasket carried internally of the cap has a tendency to flow toward and fill the areas of low pressure thereby creating thickened areas of sealing material exhibiting a higher gas permeability as well as high pressure areas where little if no sealing material exists between the opposed surfaces of the closure cap and the container. Under such circumstances uniformity of sealing conditions is impossible to establish and an efficient hermetic seal is not consistently obtained.

It is an object of the present invention to provide a stretchable closure cap which is capable of promoting and maintaining a hermetic seal with a cylindrical side surface of a container when the cap is applied thereto.

Another object is to provide a closure cap having a smooth cylindrical skirt portion formed from thin sheet

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metal, the internal surface of which is supplied with a very thin coating of sealing composition, the metallic skirt portion being selected to stretch beyond its elastic limit in conformity with variations in circumferences of cylindrical surfaces to be sealed to thereby allow uniform application and maintenance of sealing composition throughout the entire surface area to be sealed.

Still another object is to provide a stretchable closure cap carrying internally thereof an adherent thin coating of sealing composition, the cap being provided with a depending skirt at least a portion of which is adapted to be stretched beyond its elastic limit in side sealing relation with a cylindrical sealing surface, the cap thereby being permanently deformed and in effect tailored to the contour of the cylindrical surface to which it is applied.

A further object is to provide a closure cap of the type above described which is interiorly thinly coated with a sealing composition capable of establishing a hermetic seal in cooperation with the cap when the same is placed in side sealing relation with a cylindrical sealing surface of a container, the coating being adapted not only to perform a sealing function but in addition being adapted to serve as a protective lining to eliminate contact between the metal of the cap and the contents of the container.

Other objects not specifically set forth will become apparent from the following detailed description made in conjunction with the drawing wherein:

FIG. 1 is a fragmentary section of the top portion of a jar neck having one form of the improved stretch cap of the present invention applied thereto;

FIG. 2 is an enlarged fragmentary section of the form of stretch cap shown in FIG. 1;

FIG. 3 is a fragmentary section of the top portion of a bottle neck having applied thereto another form of stretch cap incorporating the principles of the present invention; and

FIG. 4 is an enlarged fragmentary section of the form of stretch cap shown in FIG. 3.

FIGS. 1 and 2 illustrate one form of stretch cap incorporating the principles of the present invention, this form being particularly adapted for use with a glass jar or the like, the upper neck portion of which is shown in FIG. 1 and identified by the numeral 11. A vertical sealing surface or finish 12 is provided on the jar 11 adjacent the top edge thereof and it is this vertical surface portion of cylindrical shape which cooperates with the stretch cap 10 to provide therebetween a hermetic side seal. Below the vertical sealing surface 12 the outer surface of the jar 11 is provided with a conventional shoulder 13 which may be used as a base for an implement used in prying or removing the cap 10 from the top of the jar 11.

The cap 10 is formed from a one-piece shell of thin sheet metal provided with a top panel 14 and a depending cylindrical skirt portion. The skirt portion includes a vertically directed side sealing portion 15 being provided at its lower edge with an outwardly flared skirt portion 16 the bottom edge of which is rolled inwardly about the entire circumference thereof to form a bead 17. The flared skirt portion 16 and bead 17 impart requisite strength to the bottom edge of the thin metal shell to allow prying of the shell upwardly to remove the same from the jar 11. As particularly shown in FIG. 2, the inner surface of the cap 10 is coated with sealing material which contacts the vertical sealing face 12 of the jar 11 when the cap 10 is applied thereto.

The thin sheet metal used in forming the stretchable cap 10 must be inherently stretchable to an extent that its elastic limit is exceeded and the inherent resiliency of the metal is materially reduced. To exceed the elastic limit of the metal the inside diameter of the vertical portion 15 of the skirt is less than the outside diameter of the jar 11 at the point of location of the vertical sealing face 12. In applying the cap 10 the vertically extending

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portion 15 of the cylindrical skirt is thereby stretched and the cap 10 is tightly received about the circumferentially continuous vertical sealing face 12 of the jar 11. Any irregularities or variations in the cylindrical sealing surface 12 act independently to permanently deform the vertically extending portion 15 of the cap 10 as the thickness of the sheet metal used in forming the cap 10 and the relation of the respective sealing diameters are such that the metal of the vertically extending portion 15 of the skirt is expanded beyond its elastic limit. As a result, the portion 15 of the skirt molds itself to the shape and size of the cylindrical sealing surface 12 and places all areas of the latter under uniform sealing pressures. As the elastic limit is substantially overcome no high spots in sealing pressures exist throughout the circumferential sealing area. Consequently, the sealing material 18 carried by the inner surface of the vertical portion 15 is applied evenly throughout the entire circumferential sealing area and an efficient hermetic sealing condition is established and maintained.

With the deforming of the vertical sealing portion 15 of the cap 10 a very thin film of sealing material is used between the sealing surfaces of the cap and jar. Actually the thickness of the adherent film of sealing material may be but a small fraction of the thickness of the sheet metal of the cylindrical skirt. The metal of at least the skirt portion 15 is selected, as well as the initial inner diameter thereof relative to the outer diameter of the surface finish of the container to be sealed, to be expanded or deformed beyond its elastic limit upon application. With this basic design parameter in mind, the film thickness of the sealing material 18 will preferably range from about 0.001 to 0.017 of an inch at least throughout the area of the skirt portion 15 which has been subjected to the aforesaid deformation. Initial film thickness in this portion of the cap, as well as in other relatively unaffected portions, may be considerably greater. From a practical standpoint the film of sealing material will normally be uniformly applied throughout the cap.

Caps incorporating the permanent stretch principle of the invention may be made of aluminum, steel, or any metal exhibiting sufficient elongation before break and which can be drawn into a shell-like shape. For example, aluminum plate having a thickness of from about 0.007 to 0.014 of an inch, or steel plate having a thickness of from about 0.004 to 0.011 of an inch will preferably be used. Based on commonly used metal plate the preferred general range of thickness is from about 0.004 to 0.014 of an inch. A specific example involves the use of terneplate having a thickness of about 0.0085 of an inch and a coating of sealing material having a thickness of about 0.002 of an inch prior to stretching. The total thickness of metal and coating will preferably be about 0.0105 of an inch within a variance of about plus or minus 0.0015 of an inch. From this it can be seen that the thickness of the coating of sealing material is about $\frac{1}{4}$ the thickness of the metal of the shell. A coating of sealing material of a thickness of this nature is highly efficient in maintaining a hermetic seal.

The use of a coating of sealing material to completely cover the inner surface of the cap 10 results in the coating performing dual functions. The portion of the coating covering the vertically extending sealing portion 15 of the cap 10 functions to fill any voids or spaces between the cap and the glass finish to thereby establish a hermetic seal. The entire coating acts as a protective lining in eliminating contact between the metal of the cap 10 and the contents of the container. Thus, the coating 18 not only provides security against contamination of the product in the container by contact with the metal of the shell but in addition acts as a gasket, thereby eliminating the necessity of using a separate sealing gasket at added cost in fabrication to promote proper sealing conditions. In the event it is desired to have the metal of the shell, such as tin, exposed to the product, the coating

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may be applied to the interior of the shell in the form of a circumferentially continuous strip covering the inner face of the vertically extending sealing portion 15. This modification will be described in connection with FIGS. 3 and 4.

Different compositions of sealing materials may be used as long as such compositions exhibit adequate adhesiveness as well as low permeability properties. Compositions which have been found to be highly efficient and which are considered to be preferable are as follows:

Composition A

Solids:	Parts by wt.
VAGH -----	100
BR-18774 -----	25
Uformite F-240 -----	20
Titanox RA -----	75
GP-261 -----	5
	<u>225</u>
Solvent:	By wt. percent
Comsolv #150 -----	40
Xylene -----	20
Methylisobutyl ketone -----	10
Isophorone -----	30

VAGH is approximately 91% vinyl chloride, 3% vinyl acetate and 6% vinyl alcohol polymer resin, manufactured by Bakelite Co., New York, New York. BR-18774 is an epoxy type resin, manufactured by Bakelite Co. and Uformite F-240 is an urea formaldehyde resin, manufactured by Rohm and Haas Co., Philadelphia, Pennsylvania. Titanox RA is a titanium dioxide pigment, manufactured by Titanium Pigment Corp., New York, New York, and GP-261 is a dioctyl phthalate plasticizer, manufactured by B. F. Goodrich Chemical Co., Cleveland, Ohio. The solvent Comsolv #150 is a high boiling aromatic solvent available from Commerce Petroleum Co., Chicago, Illinois. The coating composition is prepared by utilizing 225 parts solids and approximately 450 parts solvent, the solvent being present during the coating of the inner surface of the cap and being evaporated from the composition during the baking cycle of the process described below.

Composition B

Solids:	Parts by wt.
VMCH -----	200
Chemigum N3NS -----	100
Titanox RA -----	100
A-5 -----	3
C-2 -----	3
Maleic acid -----	1
	<u>407</u>
Solvent:	By wt. percent
Comsolv #150 -----	50
Isophorone -----	50

With respect to the solids of this composition the VMCH is a vinyl composition formed from approximately 86% of a tripolymer of vinyl chloride, 13% vinyl acetate and 1% maleic acid, manufactured by Bakelite Co. Chemigum N3NS is a Buna N synthetic rubber with a butadiene-acrylonitrile ratio of 55-45%, manufactured by Good-year Chemical Division, Akron, Ohio. A-5 and C-2 are stabilizers manufactured by Bakelite Co. In this particular composition the solids form 407 parts by weight while the solvent is utilized in a quantity of approximately 1,500 parts by weight.

When using Compositions A and B above, it is preferred to apply to the metal an initial coating of Composition A of 50 mgs. per each 4 square inches of surface followed by baking for approximately 10 minutes at 350° F. A second coating of Composition A of 50 mgs. per 4 square inches follows and this coating is baked for 10 minutes at 350° F. The outermost coating is then provided by applying 40 to 50 mgs. per 4 square inches of Composition B and baking the same for 10 minutes at approxi-

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mately 325° F. This coating process results in a total initial thickness of coating of approximately 0.002 inch. The parts by weight of solvent used in the coating compositions A and B will vary depending on the roller coating requirements and, as previously described, the solvent does not remain in the final coating of sealing material in the cap and therefore is not present during the use of the cap.

The additional form of stretchable cap 19 shown in FIGS. 3 and 4 is particularly adapted for use with a bottle being provided with a long neck of a type well known, i.e., catsup bottle. As illustrated in FIG. 3 the upper end of the neck of a glass bottle 20 is provided with a vertically extending cylindrical glass finish sealing surface 21 immediately adjacent the top edge of the bottle 20. Spaced below the cylindrical and circumferentially continuous sealing face 21 is an outwardly directed shoulder 22 used as a fulcrum in prying off the cap 19 from the bottle 20.

The cap 19 is formed from a metal shell having a top panel 23 integral with a depending cylindrical skirt which is provided immediately below the top panel 23 with a vertically extending stretchable sealing portion 24. Extending below the sealing portion 24 is an intermediate skirt portion 25 being provided at the lower end thereof with an outwardly flared flange portion 26 which is provided with a rolled bottom edge 27. The provision of the central portion 25, flange portion 26, and rolled bottom edge 27 imparts the requisite rigidity of the cap 19 to allow the same to be used in accordance with conventional practices.

The inner surface of the vertical sealing portion 24 of the cap 19 is provided with a thinly coated strip of sealing material 28 of similar composition to the coating material 18 described in connection with the cap 10. The vertically extending sealing portion 24 of the cap 19 upon application of the cap to the bottle 20 is stretched beyond its elastic limit and is thereby deformed in conformance with the variations in the outer sealing surface 21 of the bottle 20. The sealing material 28 uniformly completes the seal between the inner surface of the vertical portion 24 and the sealing face 21 thereby producing a hermetically sealed container. The inner surface of the cap 19 above the strip 28 is exposed to the contents of the bottle 20 for purposes well known in the art. As described in connection with the cap 10, the cap 19 is formed from thin sheet metal, such as terneplate, which preferably provides a vertically extending sealing portion 24 of an initial thickness of about 0.0085 of an inch. The coating strip 28 is also preferably applied to the inner surface of the cap 19 to an extent that its initial thickness is about 0.002 of an inch.

From the foregoing description it will be noted that the stretch cap of the present invention is capable of initially providing a hermetic seal without relying on the use of mechanical means such as lugs, snaps or threads. The type of cap described may also be readily removed from the container and re-applied. The cap does not assume its former shape upon removal from the container as, due to the thinness of its skirt wall, it is permanently deformed. In effect, the individual cap upon application becomes tailored to the individual container. This tailoring allows the use of an extremely thin non-permeable film of coating material.

Re-application of the cap may be accomplished by forcing the cap onto the container into sealing engagement therewith followed by a slight twisting of the cap to align the vertical sealing surface of the container with different areas of the vertical sealing portion of the cap. The cap being permanently deformed may be further deformed to conform with its new positioning with respect to the variations of the cylindrical sealing surface of the container. Deformation of the metal of the cap allows molding of the same to the glass. This can be readily demonstrated by removal of a deformed cap from a container and removal of the thin coating within the cap followed by the replac-

ing of the uncoated cap on the container in its original position. The cap will no longer bind to the glass finish and has, in fact, been permanently deformed. As a result of permanent deformation, uniform sealing pressures are maintained throughout the hermetically sealed area regardless of surface variations existing in the cylindrical surface of the container being sealed.

The use of vertical sealing surfaces is preferred as distinguished from tapered sealing surfaces. As a result of the use of vertical surfaces, any accidental upward movement of the closure cap will not result in leakage as would be true in the instance where the sealing surfaces are tapered toward the mouth. The use of thin sheet metal on the order of the thickness set forth above allows the cap to be readily and permanently deformed. The provision of flutes which require the use of a thick coating of sealing material is not necessary to provide the cap with the ability to stretch upon application to the container. Consequently, the cost of forming the cap is greatly reduced and the process followed in shaping the cap is relatively simple. The only factors that limit the thickness of the metal are the strength of the container to which the cap is to be applied and the susceptibility of the metal to tearing. The simplicity of design and ease of manufacture does not result in the provision of a cap which, when applied, must be carefully handled during storage or shipment. The type of cap above described is capable of withstanding normal handling accompanying shipment and it is unnecessary to make special provisions in carrying out the various merchandising procedures.

In coating the entire inner surface of the shell advantage may be also made of a top seal where the inner surface of the top panel of the shell comes into contact with the top edge of the container. While a full coating is preferred, it should be understood that in order to obtain a highly efficient hermetic seal it is necessary merely to provide a side seal between vertically extending surfaces of the type previously described. The coating of sealing material may be applied to the cap before or after fabrication thereof.

While specific examples of preferred sealing compositions have been set forth it should be understood that any suitable sealing composition capable of providing a hermetic seal while being used in the form of a coating having a thickness on the order designated may be used. Such sealing compositions may be made sufficiently adhesive to allow the cap to be used in sealing containers under internal pressure.

This is a continuation-in-part of my copending application Serial No. 579,096, filed April 18, 1956, and now abandoned.

Obviously, many modifications and variations of the invention as hereinbefore set forth may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. In combination, a cylindrical cap received about a cylindrical surface of a container in hermetically sealed relation therewith, said cap comprising a one-piece shell of thin inherently stretchable sheet metal provided with a top panel and a substantially vertically depending cylindrical skirt portion of initial smaller inside diameter than the cylindrical surface of said container prior to application thereof to said surface for expansion thereof beyond its elastic limit when forced down over said cylindrical surface, said cylindrical skirt portion of the shell being coated interiorly with a thin adherent film of sealing material, which in thickness ranges from about 0.001 to 0.017 of an inch, said coated cylindrical skirt portion of the shell being expanded beyond its elastic limit with attendant stretching occurring in the film coating the same and molded to the shape and size of said cylindrical surface in hermetically sealed relation thereto to still retain in some measure its molded condition when removed from the cylindrical surface.

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2. The combination of claim 1 wherein the shell of said cap is formed from aluminum with the cylindrical skirt portion being of a thickness of from about 0.007 to 0.014 of an inch.

3. The combination of claim 1 wherein the shell of said cap is formed from steel with the cylindrical skirt portion being of a thickness of from about 0.004 to 0.011 of an inch.

4. In combination, a cylindrical cap received about a cylindrical surface of a container in hermetically sealed relation therewith, said cap comprising a one-piece shell of thin inherently stretchable sheet metal provided with a top panel and a substantially vertically depending cylindrical skirt portion of initial smaller inside diameter than the cylindrical surface of said container prior to application thereof to said surface for expansion thereof beyond its elastic limit when forced down over said cylindrical surface, said cylindrical skirt portion of the shell being of a thickness of from about 0.004 to 0.014 of an inch and being coated interiorly with a thin adherent film of sealing material, which in thickness ranges from about 0.001 to 0.017 of an inch, said coated cylindrical skirt portion of the shell being expanded beyond its elastic limit with attendant stretching occurring in the film coating the same and molded to the shape and size of said cylindrical surface in hermetically sealed relation thereto to still retain in some measure its molded condition when removed from the cylindrical surface.

5. In combination, a cylindrical cap received about a cylindrical surface of a container in hermetically sealed relation therewith, said cap comprising a one-piece shell of thin inherently stretchable sheet metal provided with a top panel and a substantially vertically depending cylindrical skirt portion of initial smaller inside diameter than the cylindrical surface of said container prior to application thereof to said surface for expansion thereof beyond its elastic limit when forced down over said cylindrical surface, said cylindrical skirt portion of the shell being of a thickness of about 0.0085 of an inch and being coated interiorly with a thin adherent film of sealing material, which in thickness is of about 1/4 the thickness of the sheet metal of the cylindrical skirt portion, said coated cylindrical skirt portion of the shell being expanded beyond its elastic limit and molded to the shape and size of said cylindrical surface in hermetically sealed relation thereto to still retain in some measure its molded condition when removed from the cylindrical surface.

6. In combination, a cylindrical cap received about a cylindrical surface of a container in hermetically sealed relation therewith, said cap comprising a one-piece shell of thin inherently stretchable sheet metal provided with a top panel and a substantially vertically depending cylindrical skirt portion of initial smaller inside diameter than the cylindrical surface of said container prior to application thereof to said surface for expansion thereof beyond its elastic limit when forced down over said cylindrical surface, said cylindrical skirt portion of the shell being of a thickness of from about 0.004 to 0.014 of an inch and being coated interiorly with a thin adherent film of sealing material, which in thickness is of about 1/4 the thickness of the sheet metal of the cylindrical skirt portion, said coated cylindrical skirt portion of the shell being expanded beyond its elastic limit and molded to the shape and size of said cylindrical surface in hermetically sealed relation thereto to still retain in some measure its molded condition when removed from the cylindrical surface.

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