June 18, 1957 G. B. COOKE ET AL 2,796,189

CLOSURES

Filed Dec. 28, 1953

FIG. 1.

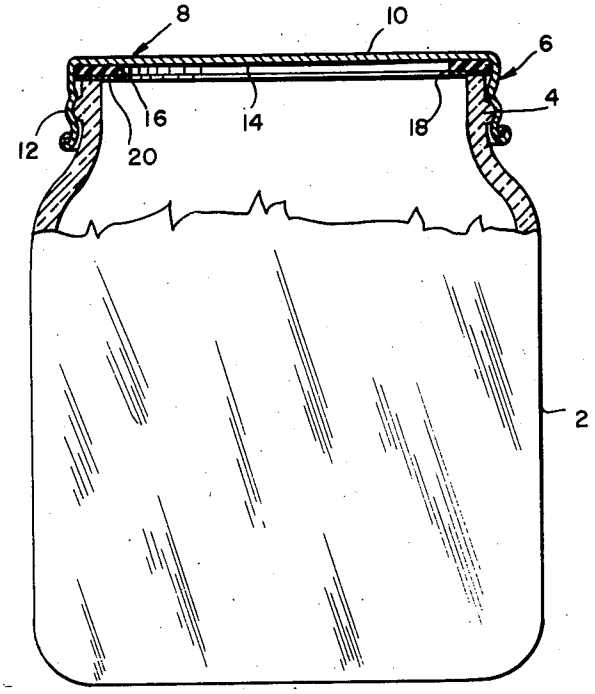


FIG. 2.

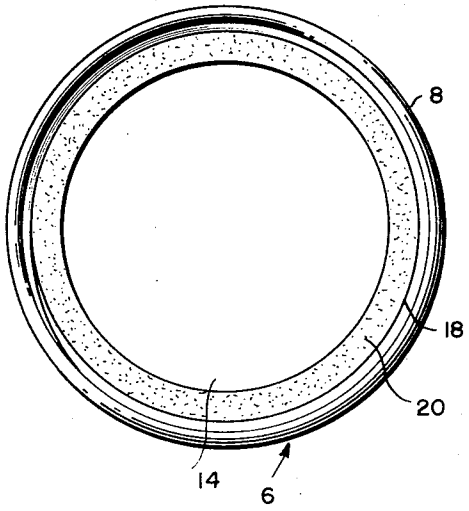
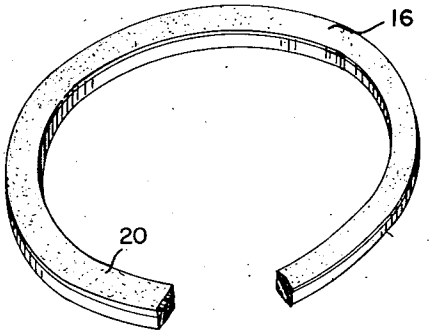


FIG. 3.



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CLOSURES

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3 Claims. (Cl. 215—40)

The present invention relates to closures, and, more particularly, metal closures of the screw, lug, pressed-on and crown types.

An object of the invention is to produce decorated or plain coated closures or metal closures without any coating, which will be resistant to scratching, which will be protected against mosture, which will have a more attractive luster and sheen and which will feed more easily in the hoppers of capping machines.

In addition, the present invention aims to reduce substantially the dusting which develops when caps are fed in a cap machine and occasioned by the abrasion of the caps with each other and further to reduce the dusting which occurs in the cartons in which the caps are shipped where there is frequent abrasion of the caps with each other and in which the sharp edges of the skirts have a tendency to abrade and scratch the decoration on the caps.

Moreover, it is an object of the invention to provide closures which will be free of a characteristic attribute of closures having an oil or wax coating, namely, of picking up dust and foreign matter so that in accordance with the present invention, the caps are maintained clean, which is important, particularly where such closures are utlized in the packaging of foods, beverages and pharmaceuticals.

It is a further object of the invention to preclude the sticking which sometimes develops when closures are stacked in nested relation for feeding in a capping machine. Where this sticking occurs in the stack, the high speed feeding operation must be stopped and the caps individually separated in order that proper feeding may be resumed.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description. It should be understood, however, that the detailed description and specific examples, while indicating the preferred embodiments of the invention, are given by way of illustration only since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

In the manufacture of closures using cork composition liners for some applications, it is important that the liner be provided with a continuous film which will be moisture resistant and the invention seeks to produce such a film on the cork composition liners which will not only be resistant to moisture, but also reduce, in many cases, staining of the cork composition, which is objectionable, particularly in the case of food products and beverages.

In addition, the coating which we provide upon the cork composition disc will avoid many of the disadvantages of using thermoplastic films, particularly where the sealed container is heat processed.

With the present invention the presence of residues

from the cap liners collecting upon the lip of the container is substantially precluded.

In connection with the use of liners in closures, it is well known that rubber rings are made from a composition having a lubricant which blooms to the surface of the liner, and the purpose of this lubricant is to facilitate the turning of the cap to effect the removal as well as the sealing of the container. Frequently, the lubricating surface does not afford easy turning, and it is an object of the present invention to assure that a closure, for example, a screw closure, provided with a rubber sealing ring or disc, made from natural or synthetic rubber, e. g., butadiene-styrene copolymer, will at all times be easily turned upon the threaded neck of the container which may have a vacuum of from 5 to 20 inches without presenting objectionable friction between the rubber and the sealing surface of the container.

We have also found it highly desirable to provide liners for cosmetic containers and similar articles, for example, liners made of polystyrene, with an abrasion resistant surface in accordance with this invention, and we have found that the same is of particular importance in that it renders the product, such as the cold cream, attractive at all times, whereas an intermediate liner, which is easily scratched, is objectionable in appearance and is to be avoided in such fastidious items as cosmetic containers and containers for similar products.

In producing caps or closures in accordance with this invention, the stamping out of the metal shells is a very important step, and it is an object of the invention to assure that the decorated sheets will be in a condition to allow the cap shells to be stamped therefrom accurately within precision tolerances and without marring or scratch the coating or decorated surface.

In the drawings:

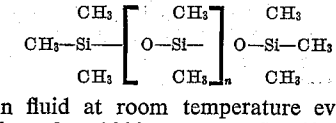
Figure 1 is a vertical section of a glass container and a closure therefor in accordance with the present invention;

Figure 2 is a bottom plan view of a closure; and

Figure 3 is a sectional view of the jar ring showing the silicone coating thereon.

Referring more specifically to the drawings, a glass container **2** having a threaded top **4** is sealed by a closure **6**. This closure comprises a metal shell **8** having a top **10** and an internally threaded skirt **12** depending therefrom. The interior surface **14** of the top of the shell is provided with a relatively flat cushion liner **16** for engaging in sealing relation the sealing lip of the container to seal the same. The exposed surface **18** of the cushion liner which engages the container sealing lip has a coating **20** comprising a thin film of liquid polysiloxane.

In carrying out the invention the customary decorated metal sheet or plain coated metal sheet is first provided with a thin coating or film of one of the silicones, namely, polysiloxanes, for example, General Electric Company's SM61 or Dow Corning's DC200. These products are methyl polysiloxanes having the following formula:



and remain fluid at room temperature even though n may vary from 0 to 2000 or more. Specifically, n can be 0, 15, 50, 200, 500, 1000, or 2000.

While preferably the siloxane used is a methyl polysiloxane, the methyl radical in the formula can be replaced by other organic radicals, such as monovalent hydrocarbon radicals including aryl radicals such as the phenyl radical and alkyl radicals, more specifically lower alkyl radicals, such as ethyl and propyl.

The viscosity of the liquid can vary widely, e. g. from

0.5 to 1000 centipoises, e. g. 340 centipoises. The average length of the molecular chain determines the viscosity of the fluid. The coating comprises a dispersion of the polysiloxane in water or some volatile organic vehicle, for example, isopropyl alcohol. Any organic solvent should be one which will be inert, i. e., will not soften the coating on the metal and should be readily removable by volatilizing. Generally, the water dispersion will comprise from about 1% to about 5% of the silicone, e. g., 2%. For some purposes a 36% silicone dispersion in water may be preferred. This aqueous coating is applied to the surface of the metal sheet by spraying, brushing, wiping or customary coating, e. g., as by a roller. Following the provision of the silicone coating on one or both surfaces of the sheet, the vehicle, e. g., water or the organic vehicle, is volatilized in any suitable manner, e. g., with heat or by means of a current of air. This air may be dry in some cases, and also may be warmed or heated to as high as 240° F., the latter to assure speedy removal of the vehicle. In certain cases it may be desirable to apply a film of silicone from the pure polysiloxane. The siloxane is deposited upon the decorated or plain coated surface of the metal sheet as a thin protective coating, which is substantially continuous and is resistant to moisture. This facilitates the movement of the sheets over each other as they are automatically fed into the stamping press, reducing scratches and maintaining a clean, brilliant, and continuous coating or decoration. At the same time, this coating exerts a lubricating action with respect to the stamping dies for punching out the cap shells, as a result of which the cap shells are accurately formed and the caps are free of abrasion or scratching while the stamping apparatus itself is lubricated and thereby protected from wear so that it operates in a true manner for an augmented period of time.

The cap shells having a plain coating or a decorated coating thus produced are provided with an outer exposed coating of the polysiloxane which has a number of advantages, as above related. For instance, the shells do not stick to one another as, for example, in the case of caps which are stacked in nested relation. Furthermore, the surface of the caps are abrasion resistant, so that the decoration or finish is not marred and the caps will also present an attractive appearance. Again, the caps, by reason of their siloxane coating, feed readily in the capping machines which, in high speed capping apparatus, is of great significance. In this connection, the siloxane coating is of extreme thinness, while giving maximum protection, and by reason of its thinness, the full effect of the decoration is preserved and presented which would not be true where customary protective lubricants are utilized which have to be employed in substantial thickness to afford the desired protective results, as well as the lubricating action. In connection with the decorated metal plates, as well as the caps stamped therefrom, the surfaces are of such a character that they do not pick up dust or dirt or foreign matter. The advantage of this can be readily appreciated, particularly when the caps are to be employed in connection with food products, beverages or pharmaceuticals. Of considerable importance is the fact that dusting, occasioned by abrasion, is substantially reduced in the hoppers of the capping machines, as well as in the shipping cartons. It is also interesting to note that the presence of the siloxane coating protects the metal plate from which the caps are stamped as well as the caps themselves as, for instance, where there are any spots of metal which are exposed or which have become exposed by reason of the fabrication of the caps from the metal plate. That is to say, if the die should scrape off spots of the decorated or plain coating the siloxane coating creeps and seals up spots and, in addition, the die itself wipes the siloxane coating over said spots to form a protective coating on the same.

It will thus be seen that the presence of the siloxane coating has tremendous advantages in enabling the stamping of the caps from the decorated metal sheets and also the presence of the siloxane is highly advantageous in the finished caps which have been stamped from such sheets.

We have also found that rubber, e. g. natural rubber, sealing rings which are customarily employed in closures are greatly improved by providing the surface which contacts with the lip of the containers or glass jars with a coating of the polysiloxane as above described. As is well understood, the rubber sealing liner will frictionally engage the sealing surface of the jar and container which would make it difficult to tighten up the closure, and particularly difficult to remove the same due to the friction between the rubber and the glass. Many efforts have been made to overcome this, the most common expedient being the introduction of a lubricant into the rubber composition which lubricant will bloom on the surface of the rubber liner. We find, however, that the presence of a coating of the siloxane, and this coating need not be continuous, constitutes a material improvement in permitting ready removal of a closure having a rubber sealing liner from a container, such as a glass jar. While we have mentioned the provision of rubber sealing rings with a coating of the polysiloxane, it is to be understood that the coating may be applied to rubber discs which are frequently employed as sealing liners in the smaller types of closures, such as screw closures. The siloxane coating may be applied to the rubber rings or discs in the manner above set forth so as to provide a coating on one or both surfaces of such rubber liner.

Further, in the manufacture of closures, particularly closures of the crown type, discs of cork composition or natural cork are employed as sealing liners. Such discs are usually provided with a protective film to render the closures more water resistant and free-moving in the automatic assembly machinery in which the discs are automatically inserted in the crown shells. We find that such discs or liners are greatly improved by providing the same with a coating of the polysiloxane in the manner above described which will be highly resistant to moisture, will enable the discs to freely feed in the assembly machine, and, moreover, will resist staining when in contact with foods, beverages and pharmaceuticals. Moreover, the siloxane coating has the advantage that it will resist heat processing which is not true of any of the conventional coatings, which are of a thermoplastic nature.

One of the great advantages of the present invention in connection with the use of liners, particularly cork composition liners, as well as the other liners referred to, is the fact that when the closure is removed, no residue of the coating is found on the sealing lip of the container, such as a glass container. Not only that, but in the case of the cork composition liners, no cork particles are pulled away from the liner and adhered to the surface of the sealing lip so that a clean, uninterrupted sealing lip is available for the pouring or other removal of the contents of the glass jar or other container.

In the manufacture of cosmetic containers where a free liner is frequently provided and arranged to rest upon the lip of the container when the cap, such as a screw cap, is removed, we have found that when such liners are made, for example, of polystyrene, that a coating of the polysiloxane thereon has a very desirable effect, namely, prevents the sticking of the loosely assembled inner protective liner to the cap, on the one hand, and resists abrasion and scratching, on the other. This is important in preserving the attractiveness of the container which, as appreciated, is quite important with fastidious items such as cosmetics and toiletries, and the containers in which they are customarily sold. In this connection, also, the thinness of the coating affords the desired protective effects without, however, interfering

with the transparency of the free liner which is desirable since, when the cap is removed, it is important that the contents be readily observable without removing the liner, as when a cosmetic, such as cold cream, is being displayed at a sales counter.

The silicone lubricant may be used in a number of concentrations, 1%, 5%, 20%, and 36% water dispersions have proven satisfactory and effective for various applications. We have found, for example, the 5% aqueous dispersion applied against the cutting knife in the manufacture of rubber jar rings lubricates the operation and leaves a permanent, non-slip film on the freshly cut surface of the rubber rings. An aqueous dispersion of 2% silicone has proven satisfactory for lubricating decorated sheet metal which is stamped into screw and lug caps.

For some purposes, it is desirable to disperse the silicone in an organic solvent. As an example, isopropyl alcohol may be used. The concentrations are the same as in the use of water dispersions. It is important, however, that the organic solvents selected have no deteriorating effect on the decoration or coating. In all cases, for caps and closures which are used in the food and beverage industry sanitary grades of silicone DC–200 or SM–61 are employed. The coatings are applied at room temperature in a manner similar to the conventional waxes and lubricants.

Where residual water is objectionable because of a deteriorating effect on the machine dies, the coated sheets may be dried in warm air or by any other suitable means. Likewise, in some cases, it may be desirable to air dry sheets which have been lubricated with silicone in an organic vehicle. This drying would remove all traces of the organic solvent so as to prevent any softening or deterioration of the coating or decoration.

In some instances, it is found desirable to use 100% silicone. When this is done, it is important for reasons of appearance, as well as economy, that the coating equipment be precision controlled so that only a very minute film of the silicone is applied to the surface of the metal.

In some cases, it is also desirable to have the silicone lubricant applied to the stamping dies. When the dies are coated with a film of silicone, abrasion to the coating or decoration during the stamping is even further reduced or eliminated. In normal operations, some silicone lubricant will build up on the dies and only in special cases would it be necessary to apply the silicone directly to the parts of the dies.

We claim:

1. In combination, a glass container and a closure thereof, said closure comprising a metal shell having a top and a skirt depending therefrom, the interior surface of the top of said shell being provided with a relatively flat cushion liner for engaging in sealing relation the sealing lip of the container to seal the same, the exposed surface of said liner which engages the container sealing lip having a coating comprising a thin film of liquid polysiloxane.

2. A combination of a glass container and a closure thereof as recited in claim 1 wherein said liner is a rubber ring.

3. A closure comprising a metal shell having a top and a skirt depending therefrom the interior surface of the top of said shell being provided with a relatively flat cushion liner for engaging in sealing relation the sealing lip of a container to seal the same, the exposed surface of said liner which is adapted to engage the container sealing lip having a coating comprising a thin film of liquid polysiloxane.

References Cited in the file of this patent

UNITED STATES PATENTS

1,299,974	Lorenz et al.	Apr. 8, 1919
1,861,589	Warth	June 7, 1932
1,872,046	Teague	Aug. 16, 1932
1,989,428	Scofield	Jan. 29, 1935
2,553,742	Bloch	May 22, 1951
2,573,637	Bender	Oct. 30, 1951
2,649,090	Parsons et al.	Aug. 18, 1953
2,652,182	Umbdenstock	Sept. 15, 1953