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A. G. OSBORNE ET AL

2,373,847

COATED FOIL CLOSURE

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Fig. 1.

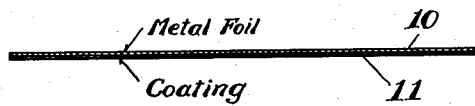


Fig. 2.

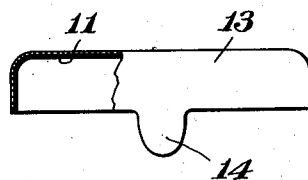
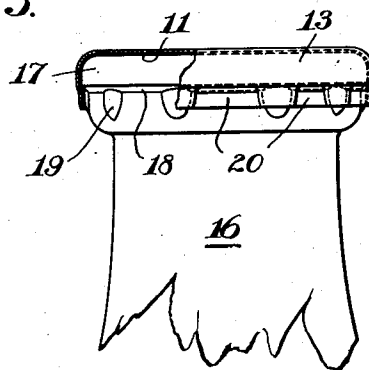


Fig. 3.



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COATED FOIL CLOSURE

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9 Claims. (Cl. 215—38)

This invention relates to closures for containers, particularly cup-like or the hood type closures for containers such as glass bottles.

The invention is particularly concerned with pliable metal foil closures of the hood type which are provided with a coating having both lubricating and sealing properties. Prior to this invention no foil closure of this character has been satisfactorily produced with a coating on the inner surface thereof capable of heat-sealing the closure to a container to form a substantially hermetic seal, or capable of cold-sealing a closure to a container to form a substantially fluid-tight seal, especially without heat softening of the coating. Likewise prior to this invention, many lubricants used for facilitating drawing of a closure and removal thereof from a container have not been fully satisfactory, particularly when used on a closure having a decorative or like lacquer coating on an external surface. Ordinary lubricating materials either harmfully attack the decorative or like coating or fail to sufficiently well lubricate and adhere to the foil, as it is formed into a closure, to permit ready removal of the closure from a container.

Previous foil closure coatings, whether for sealing or for lubrication, have been found upon test or use to be open to many objections. Some of these materials have exhibited good closure sealing properties but have lacked good metal-adherence properties. Many closure coating materials exhibit a marked lack of metal-adherence properties by tending to peel away from metal foil during handling, winding and unwinding thereof, or during drawing of the foil into cup-like closures. On the other hand, many closure coating materials which exhibit good metal-adherence properties are poor sealing materials. Likewise many such materials are not capable of properly lubricating the closure forming dies during drawing of cup-like closures, nor are they capable of facilitating the removal of a closure from a container.

A further objection to many otherwise suitable closure coating materials is that they are found to exhibit a tendency to partially transfer or offset onto metal, glass or the like, into contact with which the coated foil or closure may be brought. The tendency of such materials to transfer or to offset may be a characteristic entirely independent of the metal-adherence properties of the materials, but nevertheless is a characteristic which interferes with the fabrication, particularly drawing, of hood type or cup-like foil closures. Furthermore, such characteristics prevent free re-

moval of a closure from a container and often cause an excessive portion of the coating to remain upon the container, thus contributing to an unsightly appearance thereof when opened.

5 It is of course understood that any coating material which is applied to a metal foil to be fabricated into foil closures should, for convenience, be applied to the foil in a continuous film, and that such film should be not only adherent to
10 the metal foil but flexible and moldable.

As indicated by the foregoing remarks, it is an object of this invention to provide an improved cup-like foil closure with a sealing or lubricating coating on the inner surface thereof. Further
15 objects are to provide on such a closure a coating adapted to both thermoplastic or heat-sealing of the closure to a container at temperatures around 140 to 180° F. and to cold-sealing of the closure to a container at temperatures as low as those
20 ordinarily encountered in packaging refrigerated foodstuffs, such as milk.

Another object is to provide a cup-like foil closure with a lubricating coating which will facilitate drawing of the closure, and removal of
25 such a closure from a container. Another object is to form a drawn, cup-like foil closure from foil provided with a coating material adapted to function as a sealing or lubricating material without destruction of the coating during fabrication of
30 the closure. It is particularly an object to provide a closure coating of the character here mentioned which is adherent to metal foil and which will retain its continuity and not tend to transfer or offset onto surfaces into contact with which
35 it is brought.

Another object is to provide a closure sealing coating which has sufficient flexibility to withstand deformation necessitated by application of the closure to a container. Another object is to
40 provide a cup-like foil closure with a coating capable of effecting a vacuum tight seal between the closure and a container. Another object is to provide a cup-like foil closure with a sealing coating which is protective to the foil and non-toxic, one suitable for use in the closing of containers filled with foodstuffs such as milk and
45 fruit juices.

Another object is to provide a cup-like foil closure with an improved coating comprised of
50 a wax-miscible vehicle and a suitable wax. A particular object of the invention is to provide a cup-like aluminum foil closure drawn from a foil blank having a continuous coating comprised of a metal-adherent, substantially unoxidized condensation derivative of rubber, and a wax which

will not soften at ordinary handling and operating temperatures.

Other objects and advantages of the invention will appear as the description thereof proceeds.

The property of sealing a foil closure to a container, usually when moderate heat and pressure are applied, is a characteristic of certain wax coatings. However, such coatings can only be applied, as a practical matter, to the foil before formation of the closure. Since wax coatings do not adhere well to metal foil, the operation of drawing a cup-like foil closure from a blank of metal coated with wax usually removes substantially all of the wax coating from the foil forming the closure. When it is attempted to insure the presence of wax on the foil by using large quantities of wax to form the coating, difficulty in keeping the closure forming dies free of the wax is encountered. It will be recognized, then, that closures which are drawn from ordinary wax coated foil cannot be expected to have sufficient wax retained on the sealing surfaces thereof to serve either as a sealing material or as a lubricating material.

On the other hand, closures formed of foil coated with ordinary adhesive and thermoplastic materials are incapable of satisfactory use for one or another of several reasons. For instance, it has been found that many adhesive or thermoplastic materials do not have good metal-adherence characteristics; or in cases where such materials adhere well to metal, they do not have sufficient flexibility or moldability to permit sealing the closure to the container; or in many cases they are incapable of facilitating ready removal of a closure from the container.

A coating material for a cup-like foil closure has been discovered, however, which may be applied to foil from which cup-like or hood type closures are to be drawn, and which will adhere to the metal, will not transfer or offset, and will facilitate removal of the closure from a container. This material and modifications thereof are suitable for heat-sealing or cold-sealing a closure to a container. When the coating is applied to foil even in small quantities, it is useful as a closure lubricating material.

It has been found that a coating material having the desired characteristics set forth above may be produced by dissolving a wax in a suitable vehicle. It has been found that a lacquer-like vehicle, which is readily miscible with wax and which is adherent to metal foil, may be employed to support and carry large quantities of wax in solution therewith and to, in effect, bind the wax to metal foil from which a cup-like closure may be drawn. It is a further discovery that variations in type and proportion of wax and wax-miscible vehicle, and in the thickness of the coating formed therefrom and applied to the foil, can be made to adapt the coating to heat-sealing or cold-sealing of closures to containers and to adapt the coating to lubrication of closures during fabrication and removal thereof. A coating material made in accordance with the invention retains the desirable metal adherence and non-tackiness properties of the vehicle which is employed, and further retains the desirable sealing and lubricating characteristics of the wax which is employed, without producing any undesirable characteristics in the coating or destroying any of the desirable characteristics of its constituents.

A drawing forming part of this specification illustrates various phases of the invention. In the drawing:

Fig. 1 is a side view of a metal foil blank provided with a coating conforming to the invention;

Fig. 2 is a side view, partly in section, of a cup-like or hood type foil closure formed from a coated blank such as is shown in Fig. 1; and

Fig. 3 is a side view, partly in section, of a cup-like or hood type closure as it appears when it is applied on a typical container.

The drawing illustrates various stages in the formation of a cup-like coated metal foil closure and the application thereof to a container. A metal foil blank 10 is shown in Fig. 1 having a coating material 11, to be more fully described, on one surface thereof.

A cup-like foil closure 13, shown in Fig. 2, may be fabricated from the metal foil blank 10 by the usual drawing operation, retaining the coating material 11 on the inner surface thereof. The closure 13, shown in Fig. 2, is provided with a pull tab 14 which may be employed to tear off and remove the closure 13 from a container. The pull tab 14 forms no part of the present invention, and it may or may not be provided on the closure 13 as is desired.

The closure 13 is particularly well adapted to the sealing of milk or fruit juice bottles, and such a container 16 is shown in Fig. 3 with a closure 13 applied thereto. The container 16 is provided with a bead 17 at its orifice. The bead has a downwardly directed shoulder or flange 18 for retaining the closure 13 when it is pressed into conformity therewith. Suitable lugs or projections 19 are provided below bead 17 and merging therewith for obliterating the detents 20 formed in the lower portion of the skirt of closure 13 when it is applied to container 16. Numerous types of container and mechanical closure retaining means thereon are, of course, suitable to the practice of this invention, the container 16 shown in Fig. 3 being illustrative only.

The pliable metal foil or light metal closure 13, having a desired continuous coating 11 on the inner surface thereof, may be produced and applied to a container 16 for sealing foodstuffs such as milk or fruit juices by the procedure set forth hereinafter.

The preferred coating material, before application, is made up of a lacquer-like vehicle, a wax and a suitable solvent. The preferred lacquer-like vehicle has as its base a substantially unoxidized condensation derivative of rubber marketed under the trade name "Pliolite" by the Goodyear Tire and Rubber Company, Inc., and described in the United States patent to Endres, No. 2,052,391. A lacquer-like vehicle having such a base is a metal-adherent material, miscible with large quantities of wax. It may be purchased in various grades distinguishable by softening point tests of the base material during its manufacture. It is preferred that a grade of the condensation derivative of rubber be employed which has a minimum of tackiness, i. e. which is not highly sensitive to ordinary temperatures, and which has the property of strong adherence to metal, particularly to aluminum foil, if such is the material to which a coating is to be applied. The grade of vehicle having the condensation derivative of rubber found best suited to the practice of this invention as its base is the "Plicote" lacquer sold by the Watson Standard Company of Pittsburgh, Pennsylvania, under the numerical trade designation "V-1107-M." This lacquer is one which has a base material manufactured by the Goodyear Tire and Rubber Company, Inc. and identified by its numerical trade designations,

"P843" or "P1233." It has a selected softening point which characterizes the base material after its manufacture of about 71° F.

Lacquers are formulated from the above condensation derivative of rubber by dissolving the same in a suitable solvent. The preferred lacquer or lacquer-like vehicle consists of about 30 per cent by weight of the condensation derivative of rubber as a base and about 70 per cent by weight of a solvent such as toluol. Other suitable solvents are xylol, petroleum naphtha, butyl acetate, or mixtures of such materials. The above proportions may, of course, be varied somewhat to conform to various operating conditions. The base material is dissolved or "cut" in the solvent in the usual manner, preferably with some agitation.

A lacquer or lacquer-like vehicle formed in substantially the above proportions is capable of dissolving and carrying large quantities of waxes such as paraffin and petroleum waxes which remain mixed with the base material even after volatilization of the solvent, as when a coating film is formed and dried. The dissolving of wax in the lacquer does not noticeably diminish the film-forming and metal-adherence properties characterizing the lacquer. Therefore, this lacquer may be employed as a vehicle for carrying and supporting a wax to form a coating material.

Any paraffin or petroleum type wax having a melting point from about 132 to 180° F. is suitable for the preparation of a coating material by mixture with the above described vehicle. It is preferred that a paraffin or petroleum type wax having a melting point of about 141 to 143° F. be employed, particularly one having a sharply defined melting point in the named range. Sharpness of melting point is most desirable for heat-sealing purposes. Waxes having melting points below about 141° F. exhibit sensitivity to heat, and can be satisfactorily used in coatings only when the coated foil or closures fabricated therefrom are not subjected to unusual handling or storage temperatures. Waxes having melting points above about 143° F. may require, when used in a coating material, higher sealing temperatures, when closures are to be heat-sealed to containers.

The wax chosen for use in the coating material may be mixed with the lacquer-like vehicle in proportions of about 4 to 16 ounces of wax to each gallon of the above described 30 per cent base vehicle. The coating on the completed closure consists of a vehicle base containing about 10 to 30 per cent wax. The preferred proportion is about 8 to 12 ounces of wax to each gallon, which provides a coating on the closure of a vehicle base containing about 20 to 25 per cent wax. Higher proportions of wax may in some cases undesirably load the vehicle, creating a tendency for excessive quantities of the wax to exude or appear at the surface of a film formed by the coating material and to transfer or offset from the coating. Smaller proportions of wax decrease the sealing ability of films formed of the coated material, but for a wide range do not interfere with the lubricating characteristics of the coating.

Another example of a coating material conforming to the invention may be mentioned. It has been found that a lacquer-like vehicle of the nitro-cellulose type is also adapted to serve as a coating material vehicle in the practice of this invention. A useful nitro-cellulose type of lacquer is the clear lacquer marketed by E. I. du Pont de Nemours and Company under the numerical trade designation

"1385." This nitro-cellulose lacquer is usually prepared with solvents in the proportion of about 40 per cent base and 60 per cent solvents. A 40 per cent base nitro-cellulose type vehicle is miscible with wax of the character above described in proportions up to about 8 ounces of wax to each gallon of vehicle. Higher amounts of wax are not readily miscible in this nitro-cellulose type of vehicle. The properties of the nitro-cellulose type vehicle make a coating prepared therefrom suitable for heat-sealing or cold-sealing and for lubrication of closures. Somewhat higher temperatures may be necessary to the efficient use of this second type of coating material when it is desired to effect a heat-seal between a closure and a container, but otherwise comparable results are obtainable with both types of coating material.

Either of the coating materials above described may be applied to metal foil from which may be fabricated metal closures by the usual methods. Any suitable pliable metal foil or light gauge sheet metal may be employed for forming coated closures of the hood type in the practice of this invention. Foil is usually defined as metal of about 0.0005 to about 0.005 inch gauge, but the invention should not be confined to metal of such thicknesses only. A preferred closure material is aluminum foil of about 99.35 per cent to about 99.5 per cent purity in gauges of about 0.003 to 0.004 inch. In this specification and in the claims the metal material of the closure is referred to as foil or pliable metal, which terms are used with reference to the above explanatory remarks.

The thickness of the film of coating material upon the foil may be expressed in terms of weight of coating per unit area. A light sealing coating is one in which there are about 300 milligrams of coating film per square foot of foil surface. A heavy sealing coating is one in which there are about 1300 milligrams of coating film per square foot. Coated foil for the formation of cup-like closures preferably has a sealing coating present in the proportions of about 600 to 800 milligrams per square foot. Foil coated with a film of such weight is suitable both for heat-sealing and cold-sealing closures to containers. Coatings lighter than the preferred coating do not seal closures to containers as well as the preferred coating; and coatings heavier than the preferred coating tend to more easily be stripped from the foil. However, a range of coating thicknesses from 300 to 1300 milligrams per square foot have been found in general to be useful. While it is difficult to determine the thickness of a coating in linear measure, it is estimated that a coating weighing about 700 milligrams per square foot of area has a thickness on the order of about 0.0003 inch.

It has been a further discovery, however, that the coating material herein described is eminently suited for use as a foil or closure lubricating coating. For this purpose a coating material may be applied to the foil in film thickness ranging from about 5 milligrams per square foot to and including thicknesses in the above described sealing ranges. When lubrication is the sole purpose to be served by the coating material, the wax content can be conveniently reduced to about 4 ounces of wax to each gallon of about 30 per cent base vehicle, applied in film thicknesses from about 5 to 100 milligrams per square foot.

A lubricating coating of the material described herein has been found to be an excellent drawing lubricant. Furthermore, because of its quality of strong adherence to the foil and its quality

of strength, flexibility and abrasion resistance, it has been found that such a lubricating film persists upon the surface of a closure after it has been drawn so that it may serve as a lubricant during manual removal of a closure from a container. Thus it is noted that the coating material of the present invention is not only adapted to serve as a sealing material, but also independently as a lubricating material.

Foil which has been coated and prepared as set forth above may be drawn to form closures in the usual manner. If it is desired, the top panels of the coated closures may be embossed with the usual decorative or trade designs. It is desirable, however, for good heat-sealing purposes that any embossing in the top panels of the coated closures be confined to areas inside the sealing surfaces of the closures. In other words, embossing appearing on the peripheral edges of the closure will interfere with the successful use of the closure for making a vacuum tight seal.

A closure 13 prepared in the manner of the invention may be applied to a container 16 by molding the same into conformity with the container orifice. Compressible rubber sealing heads are preferably employed, and closure applying apparatus such as is disclosed in United States patent to Hogg, No. 2,112,842 is eminently suited to the applying of closures prepared in accordance with this invention to containers.

Closures prepared in the manner of the invention are adapted to be heat-sealed to containers in the following manner. Fruit juices are ordinarily packaged in glass containers at temperatures of around 140 to 180° F. Containers are filled with fruit juices at such elevated temperatures, thus heating the container to approximately those temperatures. A coated foil closure applied to a container at such temperatures will be thermoplastically sealed when it is pressed into conformity with the container orifice. Cooling of the packaged foodstuffs, such as fruit juices, will produce a vacuum within the sealed container and the coated closure of the invention will be adapted to hold the vacuum thus produced. To set up a vacuum quickly, spray or water cooling of closure and container may be resorted to.

Likewise closures prepared in the manner of the invention may be employed for closing containers packaged at ordinary or low temperatures. In such cases, moderate amounts of sealing pressure will mold the closure and coating material into conformity with the orifice of the container, and irregularities therein, to a sufficient degree to produce a fluid-tight seal even though there be no heat softening of the coating material on the closure. Of course, in cases of either heat-sealing or cold-sealing, the closure should preferably be mechanically secured to the container in some suitable manner such as that shown in Fig. 3 of the drawing.

Coated closures of the invention have been found eminently suited to the vacuum sealing of hot packed foodstuffs, including fruit juices. They have likewise been found eminently suited to the cold-sealing of bottles containing milk. It has been found that bottles containing milk which have been sealed with the closure coated in the manner of the invention are particularly well protected against contamination. Furthermore, it has been found that closures coated in the manner of the invention are particularly well adapted to prevent capillary seepage of fluids into milk containers and to prevent leakage of milk out of milk containers. These improvements have

been noted particularly when the container is filled with foodstuffs difficult to retain by ordinary closures.

A further usefulness of the coated closure of the invention has been in connection with the application and removal of closures to and from containers, especially those having complex closure retaining devices at the orifice thereof. It has been found that closures coated in the above described manner, whether with a sealing coating or with a lubricating coating, are much more easily removed from containers having complex closure retaining means than are any ordinary closures.

Although certain specific embodiments of the invention have been described hereinabove by way of illustration, it is to be understood that the invention is not limited thereto but may be otherwise practiced and applied within the scope of the appended claims.

What is claimed is:

1. A cup-like metal foil closure including a flexible coating adhering to the inner surface of the metal foil, said coating being comprised of a wax-miscible, lacquer-like vehicle base and a wax miscible therein, said base being characterized by continuity and adherence to the metal foil of the closure, said wax having a melting point above about 132° F.

2. A drawn cup-like metal foil closure having a continuous and flexible sealing coating adhering to the inner surface thereof, said coating consisting of a wax-miscible, lacquer-like vehicle base containing between about 10 and 30 per cent wax miscible therein, said base being characterized by adherence to the metal foil of the closure and continuity after die drawing thereof, said wax having a melting point above about 141° F.

3. A drawn cup-like metal foil closure having a continuous and flexible coating adhering to the inner surface thereof, said coating being comprised of a wax-miscible, lacquer-like vehicle base and a wax miscible therein, said base being characterized by adherence to the metal foil of the closure and continuity after drawing thereof, said wax having a melting point above about 132° F., said coating being adapted to heat-seal the closure to a container upon application of moderate pressure at temperatures between about 140 to 180° F.

4. A hood-type pliable metal closure for sealing containers such as glass bottles and including a flexible sealing coating adhering to the inner surface of the pliable metal, said coating being comprised of a wax-miscible, nitro-cellulose base lacquer characterized by strong adherence to the metal of the closure and continuity after forming thereof, and a wax having a melting point above about 141° F. miscible therein and present in an amount proportional to about 4 to 8 ounces to each gallon of a lacquer containing about 40 per cent of said nitro-cellulose base as measured before application of said coating.

5. A drawn hood-type pliable metal closure for sealing containers such as glass bottles provided with a flexible sealing coating adhering to the inner surface thereof, said coating being comprised of a wax-miscible, nitro-cellulose base lacquer characterized by strong adherence to the metal of the closure, continuity, and resistance to abrasion during drawing of the closure, and a petroleum-type wax having a melting point of about 141 to 143° F., said wax being miscible therein and present in an amount proportional

to about 1 part to every 3 to 7 parts by weight of said nitro-cellulose base.

6. In combination, a container and a closure heat-sealed to said container, said closure comprising a metal foil cup-shaped blank reformed onto the exterior mouth surface of said container and a sealing film on the inner surface of said blank securing said blank to said container in a fluid impervious relationship by adhering to the exterior mouth surface thereof, said film being tacky only above about 120° F.

7. In combination, a container and a closure heat-sealed to said container, said closure comprising a metal foil cup-shaped blank reformed onto the exterior mouth surface of said container and a sealing film on the inner surface of said blank securing said blank to said container in a fluid impervious relationship by adhering to the exterior mouth surface thereof, said film adhering more strongly to said blank than to said container surface and being tacky only above about 120° F.

8. In combination, a container and a closure

heat-sealed to said container, said closure comprising a metal foil cup-shaped blank reformed onto the exterior mouth surface of said container and a sealing film having adhesive and plastic characteristics above 132° F. on the inner surface of said blank securing said blank to said container in a fluid impervious relationship by adhering to the exterior mouth surface thereof, said film adhering more strongly to said blank than to said container surface and being non-tacky below about 120° F.

9. A hood-type pliable metal closure for sealing containers such as glass bottles and including a flexible sealing coating adhering to the inner surface of the pliable metal, said coating being comprised of a wax-miscible, substantially unoxidized condensation derivative of rubber characterized by strong adherence to the metal of the closure and continuity after forming thereof, and about 20 to 25 per cent wax having a melting point above about 141° F.

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