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METHOD OF APPLYING A WAX COMPOSITION
TO THE CONVEX COUNTERSINK PORTION
OF A CAN END
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Fig. 1

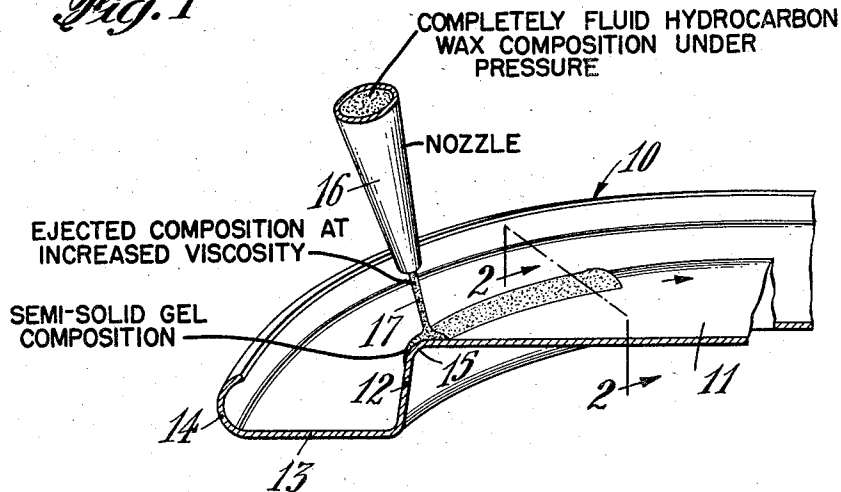
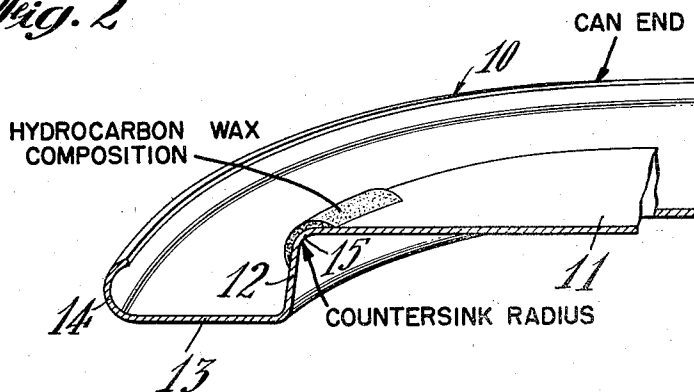


Fig. 2



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METHOD OF APPLYING A WAX COMPOSITION TO THE CONVEX COUNTERSINK PORTION OF A CAN END

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The present invention pertains to a method of applying a coating composition to an article and more specifically it pertains to a method of applying a wax composition to a particular portion of a metal can end.

In the canning of certain products, e.g. carbonated soft drinks, it was observed that corrosion of the countersink radius of the metal can end occurred. It is this part of the end which is subjected to the greatest strain in the drawing and stamping of the end from flat metal sheets. This corrosion was sometimes sufficiently severe to cause actual perforations in the end of the can. It was determined that this corrosive deterioration of the can end could be prevented by applying to the susceptible countersink radius a wax-rubber composition.

In order to be commercially and economically feasible, it is necessary that the can end and other portions of the container be completely fabricated and finished with a minimum of operations and at a high rate of speed. Although the means for preventing corrosion to the countersink radius of the can end was known, there was presented the problem of applying the wax-rubber composition to this restricted portion of the can end efficiently and at a high rate of speed.

Numerous attempts to spray, roll or "iron" on, the coating material as a hot melt, i.e. solvent-free and molten, composition met with failure. In all of these experiments, the coating composition would either solidify too rapidly upon contacting the can whereby a lumpy, discontinuous and insufficient coating would result; or the coating would be too fluid upon contacting the can end whereby it would be displaced from the end upon rapid movement or revolution thereof, or flow to undesired portions of the can end.

It is therefore an object of the present invention to provide a method whereby the protective coating of a wax-rubber composition may be applied efficiently and at high speed to a restricted portion of the can end.

A further object of the invention is to provide a method of the character described wherein the coating composition can be made to flow out over a predetermined, restricted area of a metal can end moving or revolving at a high rate of speed.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

I have discovered that the aforementioned and other objects can be accomplished by providing a wax-rubber composition dissolved and dispersed in a volatile hydrocarbon solvent, maintaining the resultant suspension at an elevated temperature and pressure, forcibly ejecting the suspension from a suitable orifice in a fine stream and causing it to impinge upon the countersink radius of the from the orifice and its point of impingement on the can end and simultaneously evaporating some of the solvent from said suspension whereby, due to the combined effects of the cooling and solvent evaporation, the suspension

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increases in viscosity to a paste or grease-like gel between the time it is ejected from the orifice and the time it flows out on the can end, causing said increased viscosity suspension to flow out or spread radially from the point of impingement of the fine stream due to the force of the impingement on the can end to form a continuous film over the predetermined portion of the can end, and thereafter leveling the film and evaporating the residual solvent from the suspension to cause said wax-rubber composition to set to a substantially rigid solid.

Referring to the drawings:

Fig. 1 is a schematic sectional view in perspective with parts broken away showing the application of a wax-rubber composition to the countersink radius of a can end in inverted position; and

Fig. 2 is a perspective sectional view of a can end in inverted position with parts broken away showing the disposition of the wax-rubber composition after completion of the steps of the present invention.

The success of the method of the instant invention depends upon the ability of the coating material to go through a phase of semi- or pseudo-solidity or gel phase between its completely fluid and its solid phases. In other words, the completely fluid coating composition, by the cooling thereof and by the partial evaporation of solvent therefrom, changes first into a grease-like or paste-like gel, and thereafter becomes a substantially rigid solid after complete solvent removal and cooling to room temperature. By careful control of the conditions of temperature, pressure and the composition of the coating material, I have been able to bring about the change in the composition from complete fluidity to semi-solidity or a grease-like consistency in a very brief period of time. After assuming this grease-like consistency, the composition is sufficiently deformable to flow out and cover the desired portion of the can end under the influence of certain forces, and yet has reached a point of sufficient rigidity whereby it will not splash appreciably, flow indiscriminately over undesired portions of the object to be coated or be dislodged from the article moving at high speed.

As a preferred or exemplary embodiment of the instant invention the drawings illustrate in Figure 1 the can end 10 in inverted position consisting of a central or countersunk panel 11 which merges into a substantially vertical surrounding wall section 12, which in turn merges into an annular substantially horizontal flange 13, which flange terminates in an inwardly curved or curled edge 14. The countersink radius 15 is the curved portion of the can end extending between the countersunk panel 11 and the vertical wall section 12. By means of any suitable mechanism (not shown), can end 10 is being rotated at a relatively high angular velocity in a direction indicated by the arrow.

From a suitably aligned device such as the nozzle 16 illustrated in Figure 1, which nozzle is shown spaced a distance above can end 10, a coating composition comprising, by weight, 95 parts of microcrystalline wax, 5 parts paraffin wax, 5 parts Butyl rubber, all dissolved and dispersed in hexane to give a composition having about 44% by weight total solids, is ejected under pressure in a fine stream 17 toward and onto the countersink radius 15. By any suitable apparatus (not shown) the nozzle 16 or other applicator means is maintained at a constant temperature so that the coating composition as it leaves the nozzle is at a temperature of about 150° F. Also, from a suitable source (not shown), 3 to 5 pounds per square inch (p.s.i.) gage pressure, in the form of compressed air, is applied to the material to eject it forcibly from nozzle 16.

Due to the sudden release of pressure as the material emerges from the nozzle 16 and also due to the elevated

temperature at which the coating is maintained, the hexane solvent begins to evaporate at a rapid rate, causing an increase in total solids and thereby an increase in viscosity of stream 17 as it travels toward the countersink radius 15. The viscosity of stream 17 is further increased by the cooling thereof due to the heat taken up by the evaporation of the solvent (latent heat of vaporization) and the air at room temperature surrounding the stream 17. Upon contact with the countersink radius 15, the viscosity of stream 17, has increased to a point where, instead of being completely fluid, i.e. having a Brookfield viscosity of less than 25 centipoises, as it was upon emergence from nozzle 16, it now gelled or assumed a paste- or grease-like consistency having a Brookfield viscosity in excess of 1,000 centipoises. Also by the combined cooling effects mentioned above and by contact with the can end which is preferably maintained at room temperature, the composition composing stream 17 has cooled to a temperature of about 120° F. As the composition contacts the end, its percent total solids value has increased to about 54% due to the loss of solvent therefrom.

The force of impingement of the fine stream 17 onto the counter sink radius 15 under the influence of the pressure by which the stream is ejected from nozzle 16 causes the coating composition to flow or spread out radially from the point of impingement. As stated previously, by regulating the proportions of ingredients of the composition, the pressure and temperature conditions and thereby its viscosity as it strikes can end 10, the amount of radial flow-out of the composition on the can end can be regulated. In the preferred or exemplary embodiment illustrated, the centrifugal force exerted on the coating composition due to the rapid spinning of the end causes the composition to flow a greater extent radially outwardly from the center of the can end 10 than towards the center of the can end. This greater radial outward flow is desired in order to have the coating cover that portion of wall section 12 which will be exposed to the product in the finished, packed can. It is believed that portions of the can end, such as wall section 12 and countersink radius 15, which have been subjected to bending and shaping operations during fabrication of the end, are more susceptible to corrosion due to disturbance of the base metal and/or its protective coating, e.g. tin, organic enamel, etc., during these operations. However, the amount of flow-out and the direction thereof can be varied to cover any desired area of any type of article by varying the controlling conditions enumerated above, i.e. temperature, pressure, and composition of the coating material, by varying the angle of impingement of stream 17, and/or movement of the article to be coated, e.g. slower or faster angular velocity to vary the centrifugal force exerted on the coating, straight line motion instead of rotational motion to obviate any centrifugal force.

After complete deposition of an annular ring of coating composition to the countersink radius 15, any residual solvent left in the coating is then removed as for example by passing the coated end into an oven and maintaining it at an elevated temperature for a sufficient time. During this time, the heat causes the surface of the coating to level and become smooth. When the drying, i.e. solvent removal and leveling operation are complete, the countersink radius 15 has a thin, continuous, smooth coating of 100% solids composition thereon extending laterally from countersink radius 15 a short distance onto the countersink panel 11 and down the vertical wall 12, as best seen in Fig. 2.

The proportions and types of ingredients specified in the preferred embodiment above may be varied within certain limits and still obtain satisfactory results. Microcrystalline waxes having a melting point between 150° F. and 205° F. and preferably about 170° F. may be used in an amount of from 90 to 97 parts by weight. High melting point waxes having similar properties may also be used, e.g. I.G. waxes, montan waxes and ceresins. The

paraffin wax specified above is a hydrocarbon wax having a melting point of about 155° F. Other wax like materials having a melting point in the range of 130° F. to 170° F. and which are compatible with the other components of the composition, such as beeswax, vegetable wax, and certain resins, e.g. polyethylene, may also be used. The lower melting wax component of the composition is present in proportions of 0 to 5 parts by weight. Other rubbers, natural or synthetic, may be used in place of the Butyl rubber specified above, providing they are compatible with the wax used in the composition and they are soluble in the solvent used. Examples of such other rubbers are: natural rubbers such as pale crepe, balata and gutta-percha; and synthetic rubbers such as polybutadiene, polyisobutylene, styrenebutadiene elastomers, Pliolite (Goodyear product made by refluxing a benzene solution of the high-grade, low protein rubber with an amphoteric metal halide, such stannic chloride) and halogenated rubber. These rubber materials are present in proportions ranging from 3 to 10 parts by weight.

The solvent useful in the present invention is a hydrocarbon solvent, and preferably a 5 to 8 carbon atom alkane, having at atmospheric pressure a boiling range of about from 80° F. to 250° F. Solvents with a boiling point above 250° F. are unsuitable in that they will not be sufficiently volatile at application temperatures to flash-off from the composition as it emerges from the nozzle or other applicator orifice; while solvents having a boiling point below the minimum tend to generate too high a vapor pressure at the working temperatures.

The various viscosities obtaining in the present invention are a function of the operating temperatures and the percent total solids of the composition. For the temperatures of operable semi-solidity given hereinafter, i.e. 90° F. to 190° F. and preferably 120° F. to 160° F., the composition as it contacts the article to be coated contains about from 10% to 60% and preferably 35% to 55% by weight total solids. The percent total solids of the composition prior to its ejection from the orifice will be somewhat lower than those given immediately above due to a greater proportion of solvent in the composition.

The action of the hydrocarbon solvent on the solids of the composition is more in the nature of a solvent-dispersing medium than a true solvent. It does have a solvating effect on the rubber component; but the wax component, in the amounts used in the present invention, is dispersed therein in a molten state. The principal function of the hydrocarbon solvent is to enable the composition to go from a completely fluid phase to a gel or grease-like phase upon cooling and partial solvent removal in a controllable, brief period of time, whereby the coating composition may be handled as a low viscosity liquid in the coating apparatus but functions on the article to be coated as a high viscosity gel.

As stated previously, viscosity of the coating composition will depend upon the make-up of the composition and its temperature. For compositions of the type useful in the present invention, the operable viscosity of the composition when it is completely fluid, i.e. before and up to its ejection from the orifice, is less than 50 and preferably less than 25 centipoises. After the composition assumes its grease-like consistency, i.e. after striking and flowing out on the article to be coated, it has a viscosity of at least 1,000 centipoises. A viscosity substantially higher than 1,000 centipoises is operable in the present invention providing the composition is still sufficiently grease-like and deformable to flow out over the area to be coated under the conditions of application.

In preparing the coating composition, the solids and solvent are combined and heated, preferably in a closed vessel to prevent excessive volatilization and consequent loss of solvent.

The composition must be heated at least to a temperature at which it is completely fluid, i.e. has a Brookfield viscosity of less than 50 centipoises. This fluidization

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temperature will vary directly with the percent solids in the composition and the melting point of these solids, principally the high melting point wax. For a composition of the type described above, the fluidization temperature range is about from 100° F. to 200° F. and preferably 130° F. to 170° F. In order to avoid developing too high a vapor pressure of the solvent and consequent sputtering as the composition leaves the applicator orifice, and to obviate the necessity of a great amount of cooling of the composition after it leaves the orifice, the composition should not be heated above the boiling point of the solvent at atmospheric pressure.

Conversely, in the instant method, the composition must be cooled to a temperature below its fluidization temperature as it flows out on the article to be coated so that it has its desired high viscosity, i.e. 1,000 centipoises or more, and a gel or grease-like consistency. Since the change from complete fluidity to operable semi-solidity is relatively gradual, i.e. there is no sharp division between the two phases, the temperature at which the composition assumes its operable grease-like consistency will be at least about 10° F. below the fluidization temperature. For the composition described hereinbefore, this temperature of operable semi-solidity is in the range of about from 90° F. to 190° F. and preferably 120° F. to 160° F. As long as the composition retains an appreciable amount of solvent, it will maintain its operable, semi-solid, grease-like consistency at temperatures well below the freezing or solidification temperature of the composition containing little or no solvent, and even down to room temperature, i.e. 70° F.

The total pressure, in excess of atmospheric pressure, exerted on the completely fluid composition prior to its ejection from the nozzle or other applicator means is the sum of the vapor pressure produced by the heated solvent and pressure supplied from an external source, such as compressed air. This total pressure is above atmospheric pressure so that the composition is forcibly ejected from the applicator means to cause it to flow outwardly from the point of contact with the article to be coated and also so that solvent will flash-off from the composition upon emergence thereof into an atmosphere of reduced pressure. However, the total pressure must not be so high as to cause the composition to sputter or, in effect, be unrestrictedly sprayed or atomized as it emerges from the applicator orifice.

The total pressure may be varied by varying the type of solvent and the temperature thereof within the limits set forth above; and/or by varying the pressure supplied from the external source. The preferred method of total pressure control is by varying the pressure supplied from the external source. The magnitude of the externally supplied pressure will depend upon a number of independent factors, e.g. the make-up of the coating composition, including the boiling point of the solvent, the temperature to which the composition is heated and the type of equipment used. Guided by the limitations and restrictions on the total pressure set forth above, the magnitude of the externally supplied pressure will be readily apparent to one skilled in the art. Preferably this pressure will be in the range of 1 to 10 p.s.i. gage.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes

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may be made in the steps of the method described and their order of accomplishment without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the method hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. A method of applying a wax composition to the convex countersink portion of an can end comprising, heating a mixture containing a hydrocarbon wax and a 6 to 8 carbon atom alkane to a temperature of about 130° F. to 170° F. and not above the boiling point of the alkane to form a homogeneous liquid composition having a Brookfield viscosity of less than 50 centipoises, ejecting a non-atomized stream of said liquid composition toward said can end by means of superatmospheric pressure of 1 to 10 p.s.i.g. whereby a portion of said alkane evaporates from said stream, impinging said stream onto said countersink portion, simultaneously with said evaporation cooling said stream to a temperature at least 10° F. below the aforesaid heating temperature to solidify said hydrocarbon wax and enclose the unevaporated alkane remaining in said stream within said solidified wax whereby said stream upon contacting said article has a paste like consistency with a viscosity of at least 1,000 centipoises, and spreading and leveling said impinged stream over said area by at least the force of said impingement.

2. A method of applying wax composition to the convex countersink portion of an can end comprising, heating a mixture containing by weight about 90 to 97 parts of a microcrystalline wax having a melting point between 150° F. and 205° F., about 0 to 5 parts of a paraffin wax having a melting point between 130° F. and 170° F., about 3 to 10 parts of an organic solvent soluble rubber, and a 6 to 8 carbon atom alkane to a temperature of about 130° F. to 170° F. and not above the boiling point of said alkane to form a homogeneous liquid composition having a Brookfield viscosity of less than 50 centipoises, ejecting a non-atomized stream of said liquid composition toward said can end by means of superatmospheric pressure of 1 to 10 p.s.i.g. whereby a portion of said alkane evaporates from said stream, impinging said stream onto said countersink portion, simultaneously with said evaporation cooling said stream to a temperature at least 10° F. below the aforesaid heating temperature to solidify said hydrocarbon wax and enclose the unevaporated alkane remaining in said stream within said solidified wax whereby said stream upon contacting said article has a paste like consistency with a viscosity of at least 1,000 centipoises, and spreading and leveling said impinged stream over said area by at least the force of said impingement.

References Cited in the file of this patent

UNITED STATES PATENTS

2,150,096	Bogin	Mar. 7, 1939
2,342,643	Cessna	Feb. 29, 1944
2,376,777	Kallander	May 22, 1945
2,732,315	Birkland	Jan. 24, 1956
2,754,228	Bede	July 10, 1956
2,790,736	McLaughlin	Apr. 30, 1957

FOREIGN PATENTS

525,373	Great Britain	Aug. 27, 1940
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