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WATER REPELLENT COATING MATERIAL

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This invention relates to a coating composition which has water repellent properties and which is particularly adapted for use on metal surfaces and the like.

An object of the invention is to provide a water repellent coating composition which will tenaciously adhere to metal surfaces and which is not brittle although sufficiently hard to be tough.

It is a further object to provide a coating for metal and the like which due to its constituency substantially prevents ice from sticking to the metal.

In carrying out the above objects it is a further object to provide a coating composition for ice trays which, due to its toughness, will perform the function of substantially preventing the adherence of the ice through many cycles of ejection from the tray without appreciably wearing away and/or flaking off.

A further object is to provide a hard adhering wax composition to be applied to the surface of various articles, usually metallic articles, to protect the surface from water and to substantially prevent the adherence of ice thereto.

In carrying out the above objects it is a further object to utilize a mixture of waxes with a resin, which resin may be polymerized to harden the same and to reinforce the wax.

Further objects and advantages of the present invention will be apparent from the following description.

This application is a continuation-in-part of application No. 283,463, filed July 8, 1939.

The use of water repellent coatings has been in general use in the manufacture of ice trays and the like for the past few years. These coatings are generally waxes of the paraffin type which are coated onto the surface of aluminum or other metallic ice trays, and which prevent the ice therein from sticking tenaciously to the metal tray. In this manner, the ice may be easily and quickly ejected from the tray without utilizing the expedient of partially melting the ice in warm water as was the practice prior to the use of water repellent coatings. In order to make the wax more adherent to the metal surface, it has been the practice to anodize the surface of the aluminum and thereby create a layer of microscopic thickness of porous aluminum oxide, the wax when melted upon application thereof impregnates the pores of the anodized surface and thereby holds the coating material in place more firmly.

We are not aware of any wax coating prior to our invention which would provide non-adhering

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properties to the surface of the metal grid and tray for any appreciable number of ejection cycles. That is to say, the prior types of wax coatings were generally worn off the surface of the metal either in part or completely after 50 to 75 ejections of ice cubes therefrom. After this period of use it was usually necessary to resort to the conventional partial melting of the ice in order to remove the same from the tray, since the coating when even partially worn off permitted marked adhesion of the ice to the metal surface.

The water repellent coating to be herein described has triple and quadruple the life of the usual type wax coatings, and due to its constituency is tough and remains on the surface of the metal for long periods of time.

Another use to which this composition may be applied is in the finishing of automobile bodies and the like wherein the composition, colored if desired, is coated onto the metal body and will take a high wax polish. The coating aids in repelling water and substantially prevents the adherence of ice, sleet or snow, in this instance the fluidity of the coating should preferably be reduced by using a suitable solvent whereby a more uniform coating may be obtained which also provides a smooth and lustrous wax finish. Cloth may likewise be coated and impregnated.

The formula of coating composition in accordance with our invention comprehends the use of a mixture of urea-formaldehyde resin with alkyd resins of the thermal setting group although the alkyd resins which are of the thermal plastic group may also be utilized. These resins are preferably utilized in proportions of from 2 to 30% urea formaldehyde resin with the remainder of the resin ingredient being an alkyd resin. This resin combination is mixed with carnauba and "stanolind" wax together with suitable solvents and may then be applied to the metal preferably by dipping the article into the coating solution. After the article is coated we next heat the same in an oven to drive off the solvent and to polymerize the resin present. This polymerization step hardens the resin and tends to set the film thereby reinforcing the wax and increasing the life of the coating.

The "stanolind" wax above referred to is a wax obtained from petroleum and is a member of the paraffin series however it does not have the physical characteristics of wax sold under the name of paraffin. Commercial grades of paraffin have a melting point of about 128° F. and an empirical formula of $C_{24}H_{50}$ with a M. W. of about 346.

"Stanolind has a M. W. slightly above 500, an empirical formula of about $C_{35}H_{72}$ and is but slightly soluble in solvents which readily dissolve paraffin, likewise other physical characteristics differ greatly as noted in the following table.

	"Stanolind"	Paraffin
Specific gravity.....	0.920-0.940.....	0.902.....
Tack (room temp.).....	Very slight.....	Little.....
Structure.....	Semi-crystalline.....	Crystalline.....
Solubility in organic solvents at room temperature.....	Very slight.....	Quite soluble.....
Penetration 100 grams at 75° F.....	10.5.....	24.8.....
Melting point (F.).....	178°-181°.....	128°.....
Empirical formula.....	$C_{35}H_{72}$	$C_{25}H_{50}$
Molecular weight.....	500+.....	346.....

"Stanolind" is a trade name and wax can be purchased on the market under said name. While we prefer to use "Stanolind" with a carbon-hydrogen ratio of 35-72 we have determined that waxes with a carbon-hydrogen ratio of 30-62 and above are within a useable range.

In compounding our improved coating material it is preferable to utilize a mixture of urea-formaldehyde resin and alkyd or modified alkyd resin as the resin ingredient, although either resin alone will improve the physical characteristics of the wax coating. In the preferred formula, however, the resin is utilized in quantities from 50 to 90 percent by weight of the coating and wherein the remainder of the coating constitutes a wax. We prefer to utilize alkyd resins of the thermal setting group which are solid at room temperature. However, it is to be understood that alkyd resins of the thermal plastic group may also be used and will improve the characteristics of the final coating compound. The alkyd resins may be of the modified type whereupon a partial oxidation also occurs during the polymerization step.

The mixture of resins to waxes may vary without destroying the beneficial effects of the composition for example the ratio of resins to waxes may be 1 to 1 or may be 9 to 1 or any ratio therebetween. In practice for use on ice trays and other related metal parts, we prefer to utilize a mixture of resin to waxes in the ratio of 4.5 to 1. As an example, 90 grams of urea-formaldehyde-alkyd resin wherein the proportions of urea formaldehyde may vary from 2-30% with the remainder being alkyd resin, or modified alkyd resin mixture are combined with approximately 410 grams of a suitable solvent such as coal-tar solvent. These ingredients are stirred and result in solution A. Second, we take 15 grams of "stanolind" wax and 5 grams of carnauba wax and mix with 300 grams of coal-tar solvent at a temperature of approximately 300° F. to form a solution B. Solution B, after the wax is dissolved therein, is cooled to say 150° F. and then solution A is added slowly with stirring. A suitable quantity of this mixture is then placed in a container preferably maintained at a temperature of from 120° to 140° F. to aid in keeping the wax in solution, also the solution may be agitated. The ice trays and grids or other metal parts are preferably dipped into the solution, removed and allowed to drain. The coated trays and grids are next placed in an oven and are heated for a period of approximately 30 minutes at a temperature of 300° F. whereupon the resin component is polymerized to harden the coating.

We have found that when using urea-formaldehyde resin alone that the coating is hard but tends to be somewhat brittle, whereas the use of

alkyd resin alone while toughening the coating is soft, thus by choice of the proper mixture, coatings of any degree of hardness may be obtained by the use of the combination of the urea-formaldehyde resin in the alkyd resin.

Other examples of useable compositions include:

1. Urea-formaldehyde resin in percentages of from 50 to 90% together with a wax of the paraffin series making up the remainder of the coating, said wax being of the high molecular weight variety having 30 carbon atoms or more therein. This coating when polymerized, is very hard but somewhat brittle.

2. An alkyd resin in percentages of from 50 to 90% of the coating composition together with a wax of the paraffin series having 30 carbon atoms or more therein. This wax tends to be somewhat soft after polymerization.

3. Combinations of urea-formaldehyde resin and alkyd resin wherein the urea-formaldehyde portion varies from 2 to 30% and the alkyd resin makes up the remainder of the resin ingredient which in itself is present in percentages of from 50 to 90% of the total weight of the coating, the remainder of the coating being made up of a high melting point wax of the paraffin series having 30 carbon atoms or more therein. This wax, when polymerized, is not too brittle nor too soft for usual purposes and the exact toughness or hardness may be controlled by varying the percentages of the two resins. Increase of the urea-formaldehyde portion hardens the coating whereas use of more alkyd resin softens the coating.

4. A resin ingredient with urea-formaldehyde resin, alkyd resin or combinations thereof making up from 50 to 90% by weight of the coating together with a wax of the paraffin series having a molecular weight in the neighborhood of 500, said wax making up the remainder of the coating.

5. A resin ingredient as described in Example 4 together with a mixture of waxes including a substantial portion of a wax of the paraffin series having a high melting point, preferably a wax containing 35 carbon atoms therein together with a minor portion of carnauba wax, ceresin wax or a wax of the paraffin series which has a melting point in excess of 140° F.

Any of the above varieties produce coatings of a satisfactory nature although the preferred formula as described, produces a coating which is most desirable for use in connection with metal ingredients and ice trays. This preferred formula is highly satisfactory due to its wax percentages but it is to be understood that these physical properties may be varied within the limitations quoted when the composition is used for various purposes and in fact the composition may be varied when used in connection with ice trays and the like to produce desired results.

The use of these resins in any type of wax provides an improved waxed coating on metal parts. We prefer, however, to use a high molecular weight wax of the paraffin series and carnauba wax since these waxes have definite properties which make them highly successful in metallic coating compositions. It is to be understood, however, that in place of the carnauba wax that a petroleum derived wax having a melting point above 140° F., ceresin wax of high melting point, or any of the synthetic waxes of suitable melting points may be used. The composition as described will adhere well to metal parts that have not been anodized which is in direct contrast to the conventional waxing compositions used here-

tofore. Also when used on ice trays and the like, our improved wax does not have a tendency to flake off as do waxes of the usual paraffin type.

We attribute the success of the coating composition, made in accordance with our formula, to a large extent to the polymerization of the resin compound which hardens the wax and forms a reinforcing compound in the wax thus increasing its life against wear.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A freezing device comprising in combination a container member for holding a liquid to be frozen, and a partitioning member for dividing a frozen content into blocks, at least one of said members being coated with a water repellent coating composition polymerized after application to said member for hardening the coating and making it an adherent to the member, said coating consisting of a urea formaldehyde resin and alkyd resin in quantities of from 50% to 90% by weight of the composition together with a high melting point wax which includes a wax that has a melting point in the neighborhood of 180° F., together with a wax which has a melting point above 140° F., said waxes making up the remainder of the coating composition.

2. A freezing device comprising in combination a container member for holding a liquid to be frozen, and a partitioning member for dividing the frozen contents into blocks, at least one of said members having a minutely porous surface thereon, said pores being so minute as to be invisible to the eye, said porous surface being impregnated by and coated thereover with a water repellent composition which is normally hard at room temperature, said composition consisting of a mixture of urea formaldehyde resin and alkyd resin in quantities of from 50 to 90% by weight of the composition together with a combination of waxes having a melting point in excess of 140° F., and including "Stanolind" wax, said waxes making up the remainder of the composition.

3. A freezing device comprising in combination a container member for holding a liquid to be frozen, and a partitioning member for dividing the frozen contents into blocks, at least one of said members having a minutely porous surface thereon, said pores being so minute as to be invisible to the eye, said porous surface being impregnated by and coated thereover with a water repellent composition which is normally hard at room temperature, said composition consisting of a mixture of resins and waxes, said resins including urea formaldehyde resin and an alkyd resin and said waxes including "Stanolind" wax and carnauba wax, the ratio of said resins to said waxes being in the order of 4.5 to 1 by weight of the coating composition.

4. A freezing device comprising in combination a container member for holding a liquid to be frozen, and a partitioning member for dividing the frozen contents into blocks, at least one of said members having a minutely porous surface thereon, said pores being so minute as to be invisible to the eye, said porous surface being impregnated by and coated thereover with a water repellent composition which is normally hard at room temperature, said composition consisting of a mixture of urea formaldehyde resin and alkyd resin in quantities of from 50 to 90% by weight

of the composition together with a wax of the paraffin series having 30 to 35 carbon atoms per molecule, said wax comprising the remainder of the composition.

5. A freezing device comprising in combination a container member for holding a liquid to be frozen, and a partitioning member for dividing the frozen contents into blocks, at least one of said members having a minutely porous surface thereon, said pores being so minute as to be invisible to the eye, said porous surface being impregnated by and coated thereover with a water repellent composition which is normally hard at room temperature, said composition consisting of a mixture of urea formaldehyde resin and alkyd resin in quantities of from 50 to 90% by weight of the composition together with a wax including a member of the paraffin series having a carbon hydrogen ratio in the neighborhood of 35 to 72 said wax making up the remainder of the coating.

6. A water repellent coating composition comprising; a resin mixture, including a resin ingredient consisting of urea-formaldehyde from 2 to 30 percent, and an alkyd resin from 98 to 70 percent; together with "Stanolind" wax, and carnauba wax the quantity of said waxes being in a ratio of from 1:1 to 1:9 of said resins.

7. A water repellent coating composition comprising, a urea formaldehyde-alkyd resin which is adapted to be polymerized after the coating has been applied in quantities of 50% to 90% by weight of the coating, in combination with "Stanolind" wax and carnauba wax said waxes making up the remainder of the coating composition.

8. A water repellent coating composition comprising, a urea formaldehyde-alkyd resin which is adapted to be polymerized after the coating is applied, in combination with "Stanolind" wax and a wax having a melting point above 140° F. said resin consisting of at least 50% and not more than 90% by weight of the composition.

9. A coating composition for preventing adherence of ice to metal parts comprising, a urea-formaldehyde-alkyd resin, "Stanolind" wax, and carnauba wax, said waxes being in the ratio of approximately 1 to 4.5 to said resins.

10. A water repellent coating composition for preventing the adherence of ice to metal parts comprising, a urea-formaldehyde resin, an alkyd resin and "Stanolind wax," said resin being adapted to be polymerized after application of the composition to the metal parts for reenforcing the composition, said resins being in quantities of from 50% to 90% by weight of the total weight of the coating composition, the remainder of the coating composition consisting of wax.

11. A water repellent coating composition for preventing adherence of ice to metal parts comprising, a resin ingredient consisting of a mixture of urea-formaldehyde resin and an alkyd resin in quantities of from 50 to 90% by weight of the coating composition and a wax of the paraffin series having between 30 and 35 carbon atoms per molecule making up the remainder of the composition, said resin ingredient being adapted to be polymerized after application of the composition to the metal parts for reenforcing the wax and thereby toughening the coating.

12. A water repellent coating composition for preventing adherence of ice to metal parts comprising, a resin ingredient consisting of a mixture of urea formaldehyde resin and an alkyd resin in quantities of from 50 to 90% by weight of the coating composition and a wax of the

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paraffin series having a carbon hydrogen ratio of 35 to 72.

13. A water repellent coating composition for preventing adherence of ice to metal parts comprising, a mixture of urea-formaldehyde resin and alkyd resin to form a resin ingredient which is present in quantities of from 50 to 90% of the total weight of the composition and a wax ingredient making up the remainder of the coating composition, said wax ingredient including at least a portion of a wax of the paraffin series having 30 to 35 carbon atoms per molecule, said resin ingredient being adapted to be polymerized after application of the composition to the metal parts for reenforcing and toughening the wax, thereby making the wax more adherent and longer wearing.

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14. A water repellent coating composition for preventing adherence of ice to metal parts comprising, a mixture of urea-formaldehyde resin and alkyd resin to form a resin ingredient which is present in quantities of from 50 to 90% of the total weight of the composition and a wax ingredient making up the remainder of the coating composition, said wax ingredient including at least a portion of a wax of the paraffin series having a formula of $C_{35}H_{72}$, said resin ingredient being adapted to be polymerized after application of the composition to the metal parts for reenforcing and toughening the wax, thereby making the wax more adherent and longer wearing.

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