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PREVENTION OR INHIBITING OF ICE ACCUMULATIONS

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1 Claim. (Cl. 117—161)

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This invention relates to the treatment of surfaces exposed to moisture under freezing conditions and to the prevention of the accumulation of ice or frost on such surfaces. The surfaces treated may be the windshield of a vehicle such as an automobile, the windows of buildings, vehicles or other structures, the propeller blades of an aircraft or of various other types.

Formation of ice on propeller blades is particularly dangerous, as pieces of ice breaking off are projected at high speed like missiles, and leave the propeller out of balance. Ice formations on windows, windshields, etc., destroy or reduce visibility therethrough.

Many compositions have been proposed for this purpose, but none with which I am familiar are entirely satisfactory. Some are water-soluble so that they have short life and are often washed off before the need for de-icing or preventing of ice formation occurs.

Other compositions are translucent rather than transparent and interfere with free vision through the protected glass. To continuously supply a compound to the surface to be protected is wasteful, and uniform distribution is difficult, if not impossible, on a surface which is moving at high speed with a resulting rapid air flow over the surface. Some compounds that have been proposed to lower or depress the freezing point of water contacting therewith are corrosive to metal or the surface coating of the part to be protected.

I have discovered that a compound composed of a polyhydric alcohol and a polycarboxylic acid may be formed, which serves admirably for anti-icing purposes. It is well known that glycerine, in certain proportions, may be reacted with phthalic anhydride or other polycarboxylic acid to form a hard insoluble resin, but such a resin cannot be readily applied to a surface to be protected, and has little or no anti-icing action. In making my anti-icing compound, the glycerine and phthalic anhydride are reacted under conditions and in such proportions that a somewhat sticky compound is formed in which there are free hydroxyl groups and which has a limited amount of free glycerine.

As a preferred procedure for making the coating composition, phthalic anhydride and glycerine are mixed in substantially equal molecular proportions and are slowly heated up to about 240° C. in about forty-five minutes to one hour with stirring and until limited gelling occurs. Then an additional amount of glycerine, which is preferably substantially equal to the original amount, is added, and the temperature is brought up to

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about 200° C. and the heating continued with stirring until a test shows that the desired end point has been reached. This may be ascertained by placing a drop of the compound on a clean metal surface. The drop should be somewhat cloudy but not opaque, and sufficiently plastic so that it can be smeared out with the finger and without showing long stringy adherence to the finger from the metal plate. It should not be hard or brittle on becoming cold and should remain soft and sticky. When this end point is reached, the heat is shut off but stirring is continued and the compound allowed to cool to about 100° C., at which point ethyl alcohol or other suitable volatile thinner is added and the stirring continued to effect a uniform dispersion. The amount of thinner added is usually about 40 to 45% by weight of the compound, but should be such that the compound may be readily sprayed or brushed on the surface to be protected from icing. If the compound is applied to the surface in a heated condition, very little, if any, thinner is needed.

The temperature of cooking may vary between about 200° C. and 280° C. and the time of cooking may be correspondingly varied. At 200° C. the reaction is slow and requires considerable time, and at 280° C. it is very rapid. A temperature about half way between those extremes is the preferred one. The heating after the additional glycerine is put in, should not be substantially above 200° C. nor for a very long time.

I am not prepared to state the definite chemical composition of the compound but it is believed to be mainly a compound of phthalic anhydride and glycerine in the ratio of about 1 mol of the former to 2 mols of the latter, and thus each glycerine radical contains two free or unesterified hydroxyl groups. There should be a small amount of free glycerine uniformly dispersed throughout the compound, but due to such dispersion, it can be leached out by water only at a very low rate. The proportions of the polyhydric alcohol and the polycarboxylic acid may be varied and the amount of reaction may be controlled by varying the time and temperature of cooking. It is important that the compound be soluble in a readily volatile thinner or liquid and that after the evaporation of the thinner, the coating be somewhat sticky.

The coating acts to depress the freezing point of water which may contact with the treated surface, as for instance, in the form of rain, fog, mist or snow flakes, and the water having its freezing point depressed or lowered, drains off or

is thrown off if the treated surface be that of an airplane propeller, or is blown off if the surface be some other exposed part of an aircraft. The free glycerine is retained in the coating for a considerable length of time under service conditions, but gradually becomes dissipated or leached out, and then a fresh coating may be applied directly upon the original coating or after washing the latter off by the use of a suitable solvent.

Although it is preferred that the coating contain only a relatively small amount of free glycerine, a very much larger amount of glycerine may be added in preparing the compound and thus a larger amount will be present in the coating. The amount should not be so large as will permit draining of the glycerine away from the coating or the formation of a coating with is sufficiently pre-flowing to drain off the surface. Instead of using a single polyhydric alcohol such as glycerine, other polyhydric alcohols may be used together with the glycerine, such for instance as glycols or pentaerythritol.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

The method of preventing ice accumulation on an exposed surface, which includes the step of

coating the surface with a liquid containing a volatile solvent and a reaction product of substantially equal molecular proportions of glycerine and phthalic anhydride partially reacted with an additional molecular proportion of glycerine to leave a small amount of free glycerine, and which coating is somewhat sticky upon evaporation of the solvent.

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