Patented Sept. 1, 1942

2,294,717

UNITED STATES PATENT OFFICE

2,294,717

METHOD OF TREATING ANODIZED ALUMINUM SURFACES

Clifford R. Carney, Detroit, Mich.

No Drawing. Application January 24, 1940, Serial No. 315,331

5 Claims. (Cl. 117—135)

The present invention relates to a novel method of treating anodized aluminum surfaces and particularly to a novel method of sealing, coloring and waxing such surfaces.

As is known in this art, a hard substantially non-corrosive surface may be formed on aluminum articles by treating such articles in a suitable electrolytic bath and producing thereon a hard porous surface composed chiefly of aluminum silicon oxide. As is known, the exact composition of the surface varies with the particular alloy of aluminum used in the fabrication of the article which is subjected to the electrolytic treatment. Physically, however, such coatings are much harder than the aluminum but are porous to the extent that unless the pores are sealed in some suitable manner, various types of corrosive substances will penetrate the pores and attack the untreated aluminum or aluminum alloy lying immediately adjacent the lower face of such surface. These surfaces may be formed on the aluminum in various ways and according to various processes known in the art, and such treated surfaces are commonly referred to in the art as "anodized aluminum surfaces."

The phrase "anodized aluminum surfaces" used herein is intended to cover surfaces consisting chiefly of aluminum silicon oxide formed on articles composed chiefly of aluminum or aluminum alloys, or articles which have been provided with a skin or covering of aluminum or an alloy thereof. Such surfaces are relatively thin and very porous. As is known, the porosity of such surfaces causes a capillary attraction to be exerted on certain types of fluids. The present invention proceeds in part upon my observation and discovery that a wax-containing coating can be secured to an anodized aluminum surface provided the coating material is compounded and the processing is regulated as herein disclosed to provide a substance which, through the capillary attraction exerted by the pores of the anodized surface, is drawn into the pores while in a fluid state and is thereafter solidified in situ.

Prior to the present invention the inherent defects in porous anodized aluminum surfaces have been recognized and various attempts have been made to seal the pores with various types of substances, such for example as molten wax, copper sulfate, oils, and the like. All of these processes and materials are subject to the inherent defect that the sealing of the pores is accomplished only by the immersion of the article in a surplus of the sealing material, and excess amounts thereof which remain on the surface must be removed, usually by a hand buffing, rubbing or polishing operation. It is known that this method is costly and at the same time prevents a uniform sealing of the anodized surface and provision of a coating of uniform thickness thereon. Due to the viscosity of such materials when applied to such surfaces, there is little if any capillary action exerted thereon and consequently there is very little if any penetration of the anodized surface thereby.

The use of wax for the purpose of sealing the pores of an anodized aluminum surface is particularly valuable in the field of anodized aluminum refrigerator pans and ice tray grids in that a properly applied coating of a properly selected wax not only seals the pores but assists in a ready mechanical removal of the frozen ice tubes from the pan and the grid. However, the advantages of the use of wax in this field have been largely nullified by the cost of providing a commercially satisfactory coating thereon. Also, excess amounts of wax which frequently are deposited on the grids and pans by conventional waxing methods are readily rubbed off the pan and frequently contaminate substances which may be frozen therein.

It is, therefore, a principal object of the present invention to provide a novel method of sealing and waxing an anodized aluminum surface by a method which assures the formation of a uniform relatively thin wax coating thereon and in which the fluid wax coating is firmly secured in the pores of the anodized coating as well as extending over the surface.

Another object of the invention is to provide a novel method of sealing and waxing anodized aluminum surfaces which is particularly adapted for the treatment of such surfaces on a commercial scale and which results in marked economies in the operation, in addition to providing a superior sealed and waxed surface thereon.

A further object of the invention is to provide a novel method of sealing, waxing and coloring anodized aluminum surfaces in a single operation to provide an ornamental and protective coating on the anodized aluminum surface.

Other objects and advantages of this invention will appear in the following description and appended claims. Before explaining in detail the present invention it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation, and it is not intended to limit the invention claimed herein beyond the requirements of the prior art.

According to the method of the present invention a completed article formed of aluminum or an aluminum alloy and which has previously been processed to form an anodized surface thereon, is immersed in hot water to wash out any remaining electrolyte which may be held in the pores of the coating or which may remain on the surface thereof. The article is then dried and is subsequently immersed in a sealing and waxing liquid which is composed of a wax and a solvent therefor. The article, after immersion in the liquid, is then permitted to air dry and when dried is then heated to a sufficient temperature to drive out any remaining solvent and to fuse the deposited wax particles to form an unbroken wax film or coating.

The wax may be any desired type of wax and will be selected in accordance with the particular field in which the article is intended to be used. Among waxes which I have found suitable for this purpose are paraffin wax, montan wax, carnauba wax, as well as the modified waxes known as "Ekko" waxes. It is to be understood that these waxes are mentioned merely by way of example rather than by way of limitation since the method may be applied to any desired type of wax by the proper selection of the wax and the particular solvent which is used therewith.

The solvents which may be used will be selected in accordance with the particular wax used and the particular use to which the waxed article is to be put. Among solvents which I have found satisfactory for this purpose, the following are mentioned by way of example but not of limitation: Commercial xylol, benzol, toluol, tetrahydronaphthalene (tetranap), cymene, cymol-methyl-isopropylbenzene, dipentene, ethylene, glycol, and various alcohols and acetates which act as a solvent for waxes.

In applying the method of the present invention to the sealing and waxing of refrigerator pans and grids, I have used a relatively high melting, bland, non-toxic wax such, for example, as carnauba wax, and have admixed this wax with commercial xylol. In a preferred embodiment approximately one pound of No. 3 commercial grade powdered carnauba wax was admixed with approximately twelve gallons of commercial xylol to form a liquid in which the anodized aluminum pans and grids were immersed. While the proportion of wax to solvent may be varied, I have found the proportion above specified very desirable from the standpoint that it is sufficiently low in viscosity that the capillary action of the pores of the anodic coating draws the resultant liquid into the coating so that upon the final heating operation the deposited wax is found throughout the pores of the coating and also extends over the surfaces thereof. Attempts to duplicate the results by the use of a molten body of carnauba wax have shown that the wax, due to the higher viscosity of such a liquid, does not permit the capillary action of the pores to draw the wax into the surface, but that instead the coating which results is a congealed wax coating which is chiefly on the surface of the anodized aluminum article. Such a coating can be readily removed by rubbing, scraping, or the like, while the coating which is formed by carrying out the method of the present invention cannot be so removed since it has permeated the porous anodized surface and is secured thereto.

Using the solution above given consisting of approximately one pound of No. 3 powdered carnauba wax in approximately twelve gallons of commercial xylol, I have found that an apparently homogeneous liquid is formed at a temperature of approximately 80° F. This liquid possesses many of the properties of a true solution but it is my belief that it is substantially a colloidal dispersion of the wax particles in the xylol as the fluid medium. I do not desired, however, to be limited to either theory, since it is not essential to the operation of the present process.

The article having the anodized aluminum surface thereon, after being washed to remove the electrolyte therefrom, is immersed in the waxing liquid for a period of approximately five minutes and the liquid is maintained at a temperature within the range of approximately 150° to 170° F. The article is then removed from the liquid and is allowed to air dry until a film forms thereon and excess solvent is evaporated therefrom. In a typical instance this takes approximately ten to fifteen minutes at room temperature. After the film has set, the article is then subjected to treatment at elevated temperatures within the range of approximately 260° to 280° F. until the excess solvent is driven off and the wax coating is fused thereon.

In certain instances it is desirable to impart a color to the anodized aluminum surface. Where the surface is not likely to come in contact with a foodstuff or the like, I incorporate in the waxing liquid a suitable quantity of any soluble dyestuff to give the desired color to the surface. In those instances where the article is likely to come in contact with foodstuff I incorporate in the waxing liquid a soluble non-toxic dyestuff. In either instance the dyestuff enters into solution with the solvent employed and is carried into the anodized surface along with the wax. When the solvent is driven off during the air drying of the article or by the subsequent heat treatment thereof, the color is separated therefrom and remains in the wax on the surface. This imparts pastel colors to the article due to the action of the wax coating in refracting the light and due also to the etched nature of the surface which holds the color.

From the foregoing it will be observed that the novel method of sealing and waxing an anodized aluminum surface herein disclosed contains numerous advantages over methods previously known, among which are the following:

1. The provision of a smooth uniformly thin coating of wax on the anodized aluminum surfaces without requiring the wiping of excess wax from the surface.

2. The simultaneous sealing of the pores of the coating, waxing of the surface, and if desired, coloring of the surface, eliminating the need for separate sealing, coloring and waxing operations.

3. The wax is not discolored by any heating or melting operation and is kept free from foreign materials which are unavoidable where the articles carrying the anodized surfaces are dipped in a bath or vat of molten wax.

4. There is a more efficient utilization of the wax and a given quantity of wax will cover a greater area of anodized surface than is possible by conventional dipping of such surfaces in a bath or vat of molten wax.

While I have set forth certain preferred constituents, proportions, times and temperatures of treatment, it is to be understood that all of

such matters may be varied within the knowledge of those skilled in the art for the purpose of using any particular type of wax desired and for the purpose of providing any desired type of sealed and waxed surface thereon. Accordingly, I do not desire to be specifically limited by anything contained in the foregoing disclosures except as such limitations are expressly carried into the claims.

I claim:

1. The method of sealing and waxing aluminum refrigerator trays and grids having surfaces bearing a coating consisting chiefly of aluminum oxide deposited by an anodizing operation and having a multiplicity of small pores, which comprises compounding a liquid comprising approximately 1 part by weight of carnauba wax and approximately 12 parts by volume of a solvent therefor, substantially completely filling said pores with said liquid by immersing said surfaces in the liquid while maintaining the temperature of the latter within the range of approximately 150° F. to approximately 170° F. whereby said liquid penetrates into said pores by capillary attraction, air-drying the surfaces thus treated, and thereafter heating said surfaces to elevated temperatures for driving off any remaining solvent and for fusing the carnauba wax into a continuous coating disposed over said surfaces and anchored within said pores.

2. The method of sealing and waxing aluminum refrigerator trays and grids provided with anodized surfaces having capillary pores, which comprises compounding a liquid comprising 1 part by weight of carnauba wax and 12 parts by volume of commercial xylol, substantially completely filling said pores with said liquid by immersing said surfaces in the liquid while maintaining the temperature of the latter within the range of approximately 150° F. to approximately 170° F. whereby said liquid penetrates into said pores by capillary attraction, air-drying the surfaces thus treated, thereafter heating said surfaces to elevated temperatures within the range of 260° F. to 280° F. for driving off any remaining solvent and for fusing the carnauba wax into a continuous coating disposed over said surfaces and anchored within said pores.

3. The method of sealing and waxing porous anodized aluminum surfaces which includes the steps of immersing said surfaces in a liquid comprising carnauba wax dissolved in a solvent therefor, maintaining the temperature of said liquid during said immersion within a range of approximately 150° F. to approximately 170° F. to insure penetration of said liquid into the pores of said surfaces by capillary attraction, air-drying the surfaces thus treated, and thereafter heating said surfaces to elevated temperatures for driving off any remaining solvents and for fusing the carnauba wax into a continuous coating disposed over said surfaces and anchored within said pores.

4. In a method of sealing and waxing aluminum refrigerator trays and grids having anodized surfaces, said surfaces therefor having a multiplicity of capillary pores, the steps of immersing said surfaces in a liquid consisting of approximately 1 part by weight of carnauba wax and approximately 12 parts by volume of a solvent therefor while maintaining the temperature of the liquid within the range of approximately 150° F. to approximately 170° F., and thereafter removing said solvent, thereby filling said pores with carnauba wax.

5. In a method of sealing and waxing aluminum refrigerator trays and grids having anodized surfaces, said surfaces therefor having a multiplicity of capillary pores, the steps of immersing said surfaces in a liquid consisting of 1 part by weight of carnauba wax to approximately 12 parts by volume of xylol while maintaining the temperature of the liquid within the range of 150° F. to 170° F., and thereafter removing said xylol, thereby filling said pores with carnauba wax.

CLIFFORD R. CARNEY.