

## UNITED STATES PATENT OFFICE

2,314,975

## METHOD OF TREATING THERMOPLASTIC MATERIALS AND RESULTING PRODUCT

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No Drawing. Application December 20, 1940,  
Serial No. 370,969

12 Claims. (Cl. 41—21)

The invention relates in general to a method of treating a body of transparent thermoplastic material such as polymerized acrylic resin, commonly known as "Plexiglas," for the purpose of creating a frost of a white or colored appearing coating on the surface thereof and integral therewith, and the invention also relates to the resulting product.

The primary object of the invention is to provide a simplified and improved technic for producing either a milky white or frost-like white coating, or a frosty coating of any of the usual dye colors on the body of the otherwise transparent thermoplastic material for decorative purposes, for sign producing and for use in other arts where it is designed to create either a solid, continuous surface showing or a design or letter on an otherwise transparent sheet or bar of "Plexiglas" or equivalent thermoplastic material.

Still another object of the invention is to produce a sign character, ornamental sheet or bar composed entirely of "Plexiglas," or equivalent transparent plastic material, the body portion of which has the usual transparent characteristics of such material, but the surface or preformed areas thereof shall visually disclose a frosty appearance of either white or any other desired color and in all cases distinguishing from the balance of the glass-like transparent body.

Various other objects and advantages of the invention will be in part obvious from a consideration of the method features of the disclosure and in part will be more fully set forth in the following particular description of one method of practicing the invention, and the invention also consists in certain new and novel modifications of the preferred method hereinafter set forth and claimed.

One method which has proven highly satisfactory in practice in obtaining the above objectives has been to clean a surface of the polymerized acrylic resin in the form now known as "Plexiglas," so as to free the surface to be treated from grease, oil or dirt of any kind. This preliminary cleaning may be done by washing with soap and water, or dilute alcohol, or, in fact, any of the presently known grease solvents which will leave the cleaned surfaces free of any residue.

A hot bath of a liquid solvent for the particular thermoplastic material to be treated is thus prepared and brought to its boiling point. It is suggested that the bath be a solution of denatured or diluted alcohol, such as isopropyl alcohol. An approximate 70% solution of 180 proof isopropyl alcohol has proven to be most satisfactory.

Other solvents may be used such as ethyl alcohol in a 70% solution but the results on "Plexiglas" when using ethyl alcohol are not as good as when the isopropyl alcohols are used on this plastic. In any case, the temperature of the bath should be kept well below 220°–250° F. in the case of "Plexiglas" being used as this particular material will become soft at this temperature.

The previously cleaned thermoplastic resin while cold, that is, at room temperature, is immersed in the boiling bath and held therein for a period of time until the surface is slightly flexible but not so long as will cause the surface to become soft or to melt. This will occur anywhere from about eight to ten seconds, but fifteen seconds is not too long, especially if the body of the material used is not too thin. There is effected a slight surface penetration of the solvent into the surface of the thermoplastic body, the depth of the penetration being dependent upon the time lapse while the material is in the hot bath.

The resin is then removed from the boiling alcohol bath and immediately subjected, of course, while still hot and while still covered with the bath adhering thereto, to a blast of atmospheric air or equivalent inert gas with the air at room temperature. The air is preferably directed across the surface to be dried. This drying action is continued until the treated surface is dry and has turned to a milky, frost-like white surface color. The material is permitted to cool to room temperature and is then ready for the market.

The frosting so formed is permanent and does not easily rub off. It can be polished with a dry soft cloth and this results in producing an egg-shell, substantially permanent gloss.

While the polymerized acrylic resin, known as "Plexiglas," has been referred to as a preferred material to be used due to the fact that a greater degree of frosting is produced thereon over other forms of transparent thermoplastic materials, other materials have also been used with satisfaction. For instance, an other material suggested for use in practicing the method herein featured is methyl methacrylate, commonly known as Lucite.

It is also suggested that in place of the white frosting on the surface of the thermoplastic material produced as above described, the frosting may be formed of any of the usual dye colors. In order to obtain such an effect, any of the usual powdered vegetable dyes, one form of which is at present marketed under the trade

name of "Tintex" may be added to the alcohol bath in an amount necessary to give the desired depth of tone or color value to the final product. This intensity of surface coloring is most easily controlled by containing the dye in a cotton bag, immersing the bag in the alcohol, preferably while it is being brought to a boil, and removing the bag when the desired depth or density of the color used at the time has been attained. The method of procedure with the dyed bath is the same as above described. The material is dipped in the colored bath of boiling alcohol, is removed after a short time and then quickly dried by means of an air blast. There will result a surface dyeing of the thermoplastic material no deeper than the frosting, thus leaving the interior of the material with its initial transparency and ability to transmit or pipe white light as such through any undyed surfaces of the material. As was the case with the white frosting, this colored frosting cannot be easily rubbed off and thus provides a substantially permanent surfacing of the desired color.

It is also suggested that the material so frosted, either with the white or colored facing produced as above outlined, may be further treated to render the frosted surface both water and sweat proof and capable of resisting the effects of certain mild chemicals, such as salt water. Liquid wax is applied to the frosted surface which will have the immediate effect of causing the frosting to disappear but the frosting will reappear in a few seconds. This reappearance can be hastened by subjecting the waxed surface to an air drying operation as by means of blowing atmospheric air onto the same. The dry waxed surface is then rubbed lightly with a dry, clean, soft cloth free from grit until it becomes somewhat polished and develops an egg-shell finish.

Display signs with any desired form of lettering or other sign characters, or treated areas, may be formed on the surfaces so treated, and preferably not waxed, by first applying thereto a stencil with the desired sign characters or other form of lettering or area desired. This stencil may be formed of tough paper, similar to the masks now used in protecting the polished surfaces of "Plexiglas" and Lucite, and applied in place with a pressure sensitive rubber adhesive. The parts of the surface exposed through the openings in the stencil are thus subjected to a polishing operation to remove the frosting. This may be done by sanding with extremely fine sandpaper and buffing with a thin paste of magnesium carbonate and otherwise treating the exposed area following known practices in polishing such thermoplastic materials.

It is also suggested that the stencils be formed of a material not effected by the hot bath applied to the marketed form of the thermoplastic materials and subject the areas exposed through the stencil openings to the frosting action above described. In this way the sign characters are formed directly on the surface of the material in either a white or colored character, depending on whether the alcohol bath is left clear or colored as above suggested.

I claim:

1. In the art of treating a surface of a body of material composed primarily of plastic acrylic resins, the method which consists in immersing a previously grease-cleaned portion of said surface into a hot liquid bath containing a dilute solution of isopropyl alcohol, permitting the sur-

face to be immersed for a period of the order of eight to fifteen seconds, removing the body from the hot alcohol bath, immediately subjecting the surface while still wet with the alcohol bath, to an air blast at room temperature and continuing such air blast treatment until the surface has dried and has turned a milky or frost-like white.

2. In the art of treating a surface of a body of material composed primarily of plastic acrylic resins, the method which consists in immersing a previously grease-cleaned portion of said surface into a hot liquid which is a solvent of the material, permitting the surface to be immersed for a period of the order of eight to fifteen seconds, removing the same from the hot solvent, immediately subjecting the surface to an air blast at room temperature and continuing such air blast treatment until the surface has dried and has turned a milky or frost-like white, applying a coating of liquid wax to the frosted surface and rubbing the surface with a dry cloth until an egg-shell permanent gloss develops.

3. In the art of treating a body of a thermoplastic material at least superficially soluble in isopropyl alcohol, the method which consists in providing a boiling hot bath containing a solution of isopropyl alcohol of approximately 70% strength, immersing in said boiling bath a body of the thermoplastic material while said body is at room temperature, permitting the material to remain in the bath for a period of time of the order of eight to fifteen seconds or until it is slightly flexible but not melting, and then subjecting the surface of the material so treated to the drying action of an air current passing over the surface until it is dry and until the surface has turned a milky white.

4. In the art of treating thermoplastics soluble in isopropyl alcohol of the type of which acrylic resins and methyl methacrylate are examples to change the visual appearance of one of the surfaces, the method which consists in submerging the surface into a solution of isopropyl alcohol, maintaining the surface submerged in the alcohol solution for a period of time of the order of eight to fifteen seconds, removing the surface from its engagement with the alcohol and exposing the surface so treated and while still wet from the alcohol adhering thereto to a blast of air until the surface becomes dry and a white film or frosting appears thereon.

5. In the art of frosting transparent thermoplastic resins soluble in alcohol and of the type of which acrylic resins and methyl methacrylate are examples, the method which consists in applying a solution of hot dilute isopropyl alcohol substantially at its boiling point, to a surface of the material which is at room temperature, and exposing the surface so treated to a blast of atmospheric air until the surface is dry and a milky white frosting appears.

6. In the art of producing a colored frosting on a surface of a transparent thermoplastic alcohol soluble resin of the type of which acrylic resins is an example, the method which consists in introducing into a bath containing an alcoholic solvent of the material and a dye of the desired color, maintaining the bath at a boiling temperature, submerging the body while at room temperature and thus relatively cold into the boiling bath for a short period of time, removing the body from the bath before it has an opportunity to become soft, subjecting the body on removal and while still hot to an air

drying operation until a frosting of the color of the bath appears on the surface of the body.

7. In the art of treating a surface of a body of a transparent thermoplastic material of the type of which acrylic resins and methyl methacrylate are examples to produce a frosting thereon, the method which consists in subjecting the surface to the action of hot solvent of the material for a period of time sufficient to cause a limited degree of surface penetration, subjecting the surface so treated and while still hot to the effect of a rapidly moving current of air to dry the same, and applying a coating of liquid wax to the surface so dried.

8. In the art of treating a surface of a body of a transparent thermoplastic material of the type of which acrylic resins and methyl methacrylate are examples to produce a frosting thereon, the method which consists in subjecting the surface to the action of a hot solvent of the material for a period of time sufficient to cause a limited degree of surface penetration, subjecting the surface so treated to the effect of a rapidly moving current of air to dry the same quickly, applying a coating of wax to the surface so dried and rubbing the waxed surface with a clean dry cloth until there is produced on the surface an egg-shell finish.

9. In the art of forming designs, letters and like sign characters on the surface of a body of thermoplastic material of the type of which acrylic resins and methyl methacrylate are ex-

amples, the method which consists in submerging the material at room temperature in a hot bath of a solvent of the material for a few seconds, drying the surface by means of an air blast and until a surface frosting appears, causing a stencil of the desired sign character to adhere to the frosted surface, subjecting so much of the frosting as is exposed through the openings in the stencil to a polishing operation to remove the exposed frosting and removing the stencil.

10. An article of manufacture comprising a body of thermoplastic material initially all transparent and composed primarily of acrylin resin, a surface of said body provided with a thin white film or frost-like area contrasting with and integral with the remaining transparent portion of the body.

11. An article of manufacture comprising a body one-piece of material composed primarily of plastic crylin resins, one surface of said body composed of a dried solution of the material of which the body is formed and having a frost-like appearance and a layer of wax on said surface.

12. A body of acrylic resin, one surface of which is defined at least in part by a thin dried solution of the acrylic resin of which the body is formed and which dried solution forms a frost-like surface area to the body.

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