METHOD OF COATING ARTICLES WITH A FILM-FORMING MATERIAL

James L. Dunn, Jr., Lake Jackson, Tex., assignor to The Dow Chemical Company, Midland, Mich.
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1 Claim

ABSTRACT OF THE DISCLOSURE

The present invention concerns a process for coating a surface with a film-forming material dissolved or dispersed in a chlorinated solvent, which comprises (1) raising the temperature of the surface while the surface passes through a first zone containing the saturated vapors of said solvent, applying said film forming-material in a second zone and removing the solvent from said film by maintaining said surface having said film in said second zone in immediate contact with air or other inert gas having a solvent relative humidity preferably less than 50%, and during which period the surface temperature is raised above the boiling point of the solvent and reducing the surface into a third zone containing saturated vapors of said solvent and finally withdrawing the surface coated with the film to the ambient atmosphere, withdrawing the solvent laden air from said second zone, removing the solvent therefrom and returning said air to said second zone.

DESCRIPTION OF INVENTION

In accordance with the present invention a surface, such as metal, plastic, wood or fabric, upon which it is desired to deposit a coating is introduced into a first zone wherein the surface is heated to the boiling point of the solvent to be employed in the coating composition. This first zone is filled with saturated vapors of the solvent in which the film-forming material is dissolved or dispersed. During passage through said zone the surface absorbs sensible heat sufficient to raise its temperature to about the temperature of the vapor atmosphere. The surface then is introduced into a second zone wherein two operations are carried out. Firstly, the film-forming or coating composition is applied to the surface. This operation can be conducted by spraying the surface or dipping the surface into a bath of said film forming composition or coating or applying the film-forming composition by the technique of electrostatic coating. The surface is then subjected to intimate contact with an inert gas, such as air or nitrogen, argon, helium or the like, which has a solvent relative humidity of less than saturated with the vapors and preferably less than 50%. This gas may be cooler than the surface, the same temperature as the surface or hotter than the surface. The gas, introduced into the second zone in a state of low solvent relative humidity, contacts the surface, takes up solvent vapors and is removed from the zone. The solvent vapors then are condensed, at least in part, and the gas returned to the zone in a state of low solvent relative humidity. It is to be understood that the gas is heated prior to re-introduction into the zone. The surface is heated to a temperature above the boiling point of the solvent either by absorption of heat from the gas or by inductive, infrared, or resistance heating. After the surface is dry, the solvent removed, the surface is introduced into a third zone before exiting to the ambient atmosphere. This third zone is filled with the saturated vapors of the solvent. The surface is then removed to the ambient atmosphere, dry.

One embodiment of an apparatus as illustrated in the drawing, suitable for carrying out the present invention, comprises a box-like structure having an opening at each end. These openings provide an entrance and an exit to and from the interior 10A of the box-like structure 10. Surrounding each of the interior walls 13 and 14 of the entrance 11 and the interior of walls 15 and 16 of the exit 13 are a series of coils 17 and 18 and 19 and 20, respectively. Directly beneath each coil 17, 18, 19, and 20 are troughs 21, 22, 23 and 24 respectively. Wall 14 and wall 16 each form a barrier extending below the opening 11 and 12 respectively, thus providing a tortuous path of ingress and egress from the opening 11 into the interior 10A of the structure 10 and from the interior 10A of the structure 10 to the exit 11. Situated within the interior 10A at each end 11 and 12 respectively, of the box 10 and spaced apart from the walls 14 and 16 are a pair of walls 27 and 28. These walls 27 and 28 extend from the bottom 10B of the interior 10A of structure 10 above the opening 25 and 26 to a point near the top 10C and at least as high as the coils 17 and 18. Also located interior of each wall 27 and 28 are downwardly extending walls 29 and 30. These walls 29 and 30 extend into interior 10A to a point below the upper extent of walls 27 and 28. Positioned near the top 10C of box 10 in interior 10A in a distribution duct 31 which is connected to an exterior condenser 32, which may be in the nature of a tube and shell exchanger. The exchanger or condenser 32 is provided with solvent vapors by means of blower 33 whose intake 34 is located within the zone 10A or in this case through top 10C thus connecting the blower 33 and exchanger 32 in fluid communication with the interior 10A of box 10. A heater 32A between the exchanger 32 and distributor 34 provides the heat necessary to bring the gas to the desired temperature to establish the desired solvent relative humidity. A work carrier, not shown, but whose path 35 is illustrated in dashed lines courses the interior of box 10 in a serpentine manner, conducting a part along a path from entrance 11 through passages 35 and 36 into interior 10A and out through passages 37 and 26 and exit 12. A spray zone 38 is shown along the path 35 with attendant spray nozzles 39 connected by piping, not shown, to a source of film-forming or coating material dissolved or dispersed in a volatile organic solvent. Boiling vapors 40 and 41 are located in the bottom of the entrance 11 and exit 12, respectively, are filled with liquid to cover heating coils 42 and 43. These sumps provide the source of saturated vapors to fill the entrance and exit zones to the vapor level control coils 17, 18, 19 and 20. A drain 46 is provided to remove any condensate or dripping from the spray nozzles and which collect in the bottom of the intermediate zone.

The apparatus described above and illustrated in the drawing is insulated about its exterior walls to reduce heat losses and condensation of vapors within the chamber on the walls of the chamber. Further it is conventional to employ a cold wall on the exterior of walls 13 and 16 as shown at 44 and 45.

Although a spray zone has been illustrated as the means for applying the coating or film-forming material to the parts passing through the apparatus, it is to be understood that other means can be employed with equal success. For example, the parts may be dipped into a tank or tray located along the path 35 which contains the coating or film-forming material. While the technique known as electrostatic spraying may be employed to coat the parts.

It is to be further understood that various means can be employed to generate the vapors both in the entrance and exit as well as in the intermediate zone. For example,
in place of the boiling sumps 40 and 41 an external boiler may be employed to generate the vapors and the vapors directed through appropriate tubing or piping to each zone. Also liquid solvent may be heated to its boiling point or higher under pressure and delivered hot to each zone whereas upon release of pressure the solvent will vaporize.

Modifications can be made in the apparatus at entrance and exit such as placing doors within the wells 44 and 45 which reduces solvent vaporization during operation.

A preferred method for coating a surface with a film-forming material applied from a solution or dispersion in a solvent, such as a halogenated solvent, comprises introducing said surface into a first zone of vapors of the halogenated solvent, then into a second zone wherein the film-forming material is applied to said surface, maintaining said surface after application of the film-forming material in said zone while subjecting said surface to air having a solvent relative humidity less than about 50%, removing the surface when dry into a third zone containing solvent vapors, and continuously circulating the solvent laden air of said second zone through a condenser for said solvent and returning said air to said second zone, and withdrawing said surface from said third zone.

Solvents which can be employed in preparing the coating compositions and which can be removed in accordance with this invention are the hydrocarbon solvents such as toluene and naphtha, the halogenated hydrocarbon solvents, such as methylene chloride, dichloroethane, 1,1,1-trichloroethane, perchloroethylene, trichloroethylene, fluorinated hydrocarbons and the like.

I claim:

1. A method for coating a metal, plastic, wood or fabric with a film-forming material dissolved or dispersed in a volatilizable organic solvent which comprises; raising the temperature of the surface while the surface passes through a first zone containing the saturated vapors of said solvent, applying said film-forming material in a second zone and removing the solvent from said film by maintaining said surface having said film in said second zone in immediate contact with air or other inert gas having a solvent relative humidity preferably less than 50%, and during which period the surface temperature is raised above the boiling point of the solvent, introducing the surface into a third zone containing saturated vapors of said solvent and finally withdrawing the surface coated with the film to the ambient atmosphere, withdrawing the solvent laden air from said air in said second zone, condensing at least a part of the solvent therein heating said air to a temperature to provide the desired solvent relative humidity, and returning said air to said second zone.

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WILLIAM D. MARTIN, Primary Examiner
W. R. TRENOR, Assistant Examiner
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