METHOD FOR REMOVING VOLATILE MATTER FROM ROLLS OF SHEET MATERIAL IN PREPARATION FOR COATING UNDER VACUUM

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This invention relates to a method of preparing rolls of sheet material for coating under vacuum.

It is an object of this invention to provide a method for preparing rolls of sheet material for the application of thin layers of metal or other substances in a vacuum coating apparatus. A further object is to provide a method of preparing the surface of rolls of sheet material for the application of an adherent film by means of a vacuum coating apparatus. A further object is to provide a method for the preparation of long strips of material for the application of an adherent coating by means of a vacuum coating apparatus. Another object is to improve the state of the art. Other objects will appear hereinafter.

These and other objects are accomplished by this invention which provides a method of preparing the surface of rolls of sheet material, sometimes referred to as "strip stock," by repeatedly running said material from one spool to another in an atmosphere in which the pressure is about 10 microns Hg, and at a rate in excess of 25 linear feet per minute.

I have discovered that the gases at the surface of sheet material are almost instantaneously removed by a vacuum of 10 microns; and further that, when the surface gases are thus removed, the dissolved gases from the interior of the sheet slowly diffuse to the surface of the sheet at a diffusion rate which is not appreciably affected by the presence or absence of vacuum at the surface during such diffusion. Thus, the degassing can be carried out at high linear rates of exposure, for example at 50 to 100 ft. per minute rather than a few inches per minute, since the direct application of vacuum to the surface of the sheet throughout the degassing period is unnecessary. Degassing, in accordance with this invention, is readily effected at a pressure of 10 microns Hg even though the subsequent coating operation is to be carried out at a pressure of 1 micron.

In the accompanying drawings wherein like numerals refer to like parts, Fig. 1 represents a degassing apparatus of the type in which the strip material is exposed to an atmosphere of very low pressure.

Fig. 2 is another view of the apparatus of Fig. 1.
The number of times the material must be exposed varies with the thickness of the material, the composition of the material and the rate of exposure. At an exposure rate of 25 feet per minute most of the volatile matter present in thin cellulose acetate sheeting is removed in about six exposures and the material will be suitable for the application of a coating after about 12 exposures. At a rate of 100 feet per minute most of the volatile matter will be removed after about 15 exposures and the material will be suitable for the application of a coating after about 35 exposures. Rates in excess of 100 feet per minute are feasible and cut down the total time necessary in order to place the material in proper condition for the application of a coating; however, the number of exposures necessary increases as the rate increases.

After the volatile material has been removed from the sheeting the rolls are taken from the vacuum apparatus in tightly rolled form. If the sheeting material is an air-tight plastic, only the outer surface will be exposed to the atmosphere where it can absorb volatile matter. The interior remains free of volatile matter and after storage for a number of hours at atmospheric pressure it may be exposed to a coating unit without any further treatment in the vacuum degassing chamber.

While the invention has been described in considerable detail with reference to a preferred embodiment thereof, it will be understood that many modifications and variations therein may be made without departing from the spirit and scope of the invention as it is defined by the appended claims.

What I claim is:

1. The method of bringing sheet material into condition suitable for subsequent application of coating material thereon under vacuum, which method comprises degassing said sheet material to effectively remove dissolved gases therefrom by repeatedly and alternately exposing unrolled portions of said sheet material for short periods of time to vacuum effective to remove occluded gases adjacent the surfaces of the sheet and maintaining said portions in a rolled condition for substantially longer periods of time sufficient to allow diffusion of gases from the interior of the sheet to the surfaces thereof, said degassing being effected by repeatedly unrolling and rewinding said sheet material in an atmosphere of about 10 microns Hg pressure at a linear rate of at least 25 feet per minute.

2. The method of conditioning sheet material to effect substantial removal of dissolved gases therefrom which comprises degassing said sheet material by repeatedly and alternately subjecting unrolled portions of said material for short periods of time to vacuum effective to remove occluded gases adjacent the surfaces of the sheet and maintaining said portions in a rolled condition for substantially longer periods of time effective to allow diffusion of gases from the interior of the sheet to the surfaces thereof, said degassing being effected by subjecting a roll of said sheet material to a reduced pressure of about 10 microns Hg, exposing said sheet material to said reduced pressure while winding said material from one spool to another, and repeating said winding and unwinding at a linear rate of at least 25 feet per minute until occluded gases cease to diffuse to said surfaces in substantial quantity.

3. The method of conditioning strip stock which comprises removing dissolved gases from said stock by repeatedly and alternately subjecting unrolled portions of said stock for short periods of time to vacuum effective to remove occluded gases adjacent the surfaces of said stock and maintaining said portions in a rolled condition for substantially longer periods of time sufficient to allow diffusion of gases from the interior of the sheet to the surfaces thereof, said removal of gases being effected by subjecting said strip stock in roll form to a pressure of about 10 microns Hg, unwinding said roll and rewinding it at a linear rate in excess of 25 feet per minute, and repeating the operation of unwinding and rewinding said roll at a linear rate in excess of 25 feet per minute until gases is substantially removed from said strip stock.

4. The method of conditioning sheet material such as cellulose acetate sheeting and the like to remove from said sheet material gases which would otherwise be evolved during a subsequent application of coating material to said sheet material under vacuum of the order of 1 micron of mercury, which method comprises progressively unrolling and simultaneously rolling sheet material in an atmosphere of about 10 microns Hg pressure, said unrolling and rolling being repeated a plurality of times, the total time in which any given portion of said sheet material is unrolled being substantially less than the total time necessary for degassing a given portion of said sheet material in a single sustained exposure, the linear rate of said unrolling and rolling being at least 25 feet per minute.

5. The method of conditioning sheet material such as cellulose acetate sheeting and the like to remove from said sheet material gases which would be evolved during a subsequent application of coating material to said sheet material under vacuum of the order of 1 micron of mercury, which method comprises progressively unrolling said sheet material at a linear rate of at least about 25 feet per minute while subjecting the sheet material to vacuum of about 10 microns of mercury and thereby subjecting at least 25 feet of unrolled sheet material per minute to said vacuum of about 10 microns of mercury to remove gases from the surface of said unrolled sheet material, and simultaneously rolling said sheet material at said linear rate at least 25 feet per minute, and repeating said simultaneous unrolling and rolling a plurality of times, whereby any given portion of said sheet material is in the rolled condition substantially longer than said sheet is in the unrolled condition.

6. In the application of thin coatings of metal to plastic sheet material by high vacuum evaporation processes, which plastic sheet material normally contains an undesirable amount of dissolved gases which tend to interfere with proper application of metal coatings to such sheet material by high vacuum evaporation coating processes, the method of preparing such sheet material for subsequent coating by evaporation of coating material under vacuum which comprises removing substantially all of the amount of dissolved gases from said sheet material by rapidly unrolling and simultaneously rolling said sheet material in an atmosphere maintained at a pressure of about 10 microns of mercury and thereby exposing progressive portions of said sheet material to a vacuum atmosphere, said exposing of each said progressive portion being insufficient to effect substantially complete degassing of said portion, and repeating said unrolling and rolling a plurality of times whereby