

1

2,705,682

METHOD OF COLORING CELLULOSIC MATERIALS BY HOT EMBOSsing

Karl Wille, Somerville, N. J., assignor to American Cyanamid Company, New York, N. Y., a corporation of Maine

No Drawing. Application May 11, 1951,
Serial No. 225,907

11 Claims. (Cl. 117-11)

This invention relates to the treatment of coating stock or other cellulosic materials to obtain tone-on-tone effects, such as brown on orange, blue on purple, green on yellow, etc., by a hot embossing process, as well as to compositions suitable for coating such cellulosic materials and the product obtained thereby.

By the practice of the present invention one may for the first time obtain two distinct colors by the hot embossing process, which has not been possible heretofore. Hot embossing has been used to develop a darker or duller effect on dark-colored paper stock that had been previously coated with a mixture containing a white and/or colored pigment in combination with a binder such as casein, and a wax emulsion. Such a process, however, is limited to slight differences in shade of the same color, whereas by the present process one may obtain two distinctly different colors.

It is an advantage of my process that no change in equipment is required, as the desired effect may be obtained by the conventional hot embossing rolls generally employed in the industry. The composition with which I coat paper or other cellulosic material to obtain these results may be readily prepared from low-cost available materials and the method of application of my composition is simple, as it may be applied by a continuous operation.

The present invention is used in the paper field for stationery, shelf paper and decorative paper in general. The composition and process of my invention are also well adapted to the improvement of other products such as cellulosic materials.

The manner in which my invention operates is readily understood and it will be seen that there are a minimum of critical factors involved, which makes the present process a very practical one. In brief, I coat paper or cellulosic stock with a mixture containing a white or colored pigment, a binder such as casein, a wax emulsion and an oil-soluble color or color base. The white or color pigment is insoluble in both water and oil. The oil-soluble color or color base present in the coating mix does not normally affect the overall color of the coated stock, until both heat and pressure are applied.

The pigment and color are generally applied in a wax-in-water emulsion, said water also containing a small amount of binder such as casein. Other water-soluble binders may be substituted for the casein, as its only function is to cement the pigment, oil-soluble color, and the finely divided wax particles to the paper surface. The wax may be any product which has a melting point above about 140° F. and below 270° F. Economic considerations and availability will generally determine the particular wax to be employed, and I have found mixtures of two or more different waxes to be satisfactory. One may also add small amounts of stearic acid to the wax emulsion, which acid seems to have the property of preventing coalescence of the individual wax particles.

When the above composition is applied to one side of a sheet of paper and dried at a temperature below the melting point of the wax, for example, 110° F., the water is evaporated and the coating mixture including pigment, binder, wax-emulsion and oil-soluble color or color base are bound to the paper by the casein. If this coated paper is then passed under an embossing roll that has been heated to a temperature above the melting point of the wax, the wax will fuse at the point of contact and dissolve the oil-soluble pigment. This brings the

2

oil-soluble pigment to the surface as a strong contrasting color.

It will be recognized that numerous variations may be made without departing from the scope of this invention, for example, the mixture of pigment, color and wax may be applied first, followed by a second coat of the wax emulsion, or the pigment and color mixture may be applied separately. If it is desirable to improve the water resistance of the coated paper, a top water-resistant coating may be applied.

The following examples are for the purpose of illustrating the invention only, and should not be interpreted as a limitation of this disclosure.

Example 1

A casein solution is prepared by slurring 500 parts of casein in 2,300 parts of cold water. This mix is then entered into a double boiler, stirred and heated gradually to 110° F. Fifty parts of borax are then dissolved in 200 parts of water, added to the casein-water slurry and stirred for 20 minutes at 110° F. Fifty parts of 28° Bé. ammonium hydroxide are then added, and stirred for one hour. The heat is then removed, 400 parts of water added and stirring is continued until the casein solution has cooled, approximately two hours being required. This gives a 17% casein solution.

A wax solution is prepared by heating 20 parts of borax with 700 parts of water until the borax has been dissolved. Forty-four parts of stearic acid, 44 parts of paraffin wax and 44 parts of beeswax are then added to the borax solution and stirring and heating continued until the solid materials have been emulsified. The mixture is then made up to 800 parts by volume with water. This is the solution of wax which is used in the following examples.

The pigment mix was obtained by grinding 100 parts of finely divided titanium dioxide, 50 parts of clay and 15 parts of the color having Color Index 1078, in a pebble mill for 3 hours. This mixture will be referred to in the following examples as "Mix A."

Twenty-five parts of coating clay, 25 parts of finely divided titanium dioxide, and 11 parts of Mix A are slurried in 55 parts of water. Fifty-five parts of the 17% casein solution described above are then added and thoroughly mixed, after which 20 parts of the wax solution are stirred into the mix. This coating is then passed through a 100-mesh screen two times, after which it is ready to be applied to white coating stock (paper stock) or other cellulosic material. The coating is carried out by the customary procedure after which the coated material is air dried at a temperature of 140° F. This coating is then subjected to hot embossing at about 270° F. Contact with the hot embossing roll causes the wax to melt and dissolve the oil-soluble color which is present in the coating. This brings the color out, that is, colors the paper at the spot where the hot embossing roll has come in contact with the coated paper, and the resultant design is colored blue.

Example 2

The previous example is repeated except a second coating is applied for waterproofing purposes. This coat is prepared by using 50 parts of the 17% casein solution described above, 30 parts of water and 1 part of formaldehyde. It is applied after the first coat described in Example 1 has been dried, and the second coat is likewise air dried at 140° F.

When treated with a hot embossing roll as in Example 1, the color in this example is also a blue and the coating is substantially waterproofed.

Example 3

The procedure of Example 1 is repeated except two coats of the material described in Example 1 are applied, the treated paper being dried at 140° F. between coats and after the treatment. When contacted with a hot embossing roll, the blue color is pronounced in those portions where the contact is made.

Example 4

The procedure of Example 1 is repeated except that

3
two coats of the material described therein are applied. This is followed by a top coat of the casein-formaldehyde solution described in Example 2. The shade of the color is slightly greener than when no top coat is applied.

Example 5

The procedure of Example 1 is repeated and this first coat is followed by a second application of a wax emulsion which contained no color. The result after embossing is similar to that obtained in Example 3, but the ground color is whiter than that of Example 3.

Example 6

A top coat of the waterproofing casein-formaldehyde solution described in Example 2 was applied to a sample of the paper coated according to Example 5. This treatment resulted in a good greenish blue shade.

Example 7

Twenty-five parts of coating clay, 25 parts of finely divided titanium dioxide and 11 parts of Mix A are slurried in 50 parts of water. Fifty-five parts of the casein solution described in Example 1 are then added and thoroughly mixed. This coating is then passed through 100-mesh screen two times and applied to white paper stock. After air drying at a temperature of 140° F. a second coat of the wax emulsion described in Example 1 was applied and dried at 140° F. When the hot embossing roll contacted the treated material a good blue shade on a white background was developed.

Example 8

The waterproofing casein-formaldehyde mixture described in Example 2 was applied to a sample of the product of Example 7. A good color on an excellent white background was obtained.

Example 9

The procedure of Example 1 is repeated except that 5 parts of the pigment prepared from dichlorobenzidine tetrazotized and coupled with aceto acetorthotoluidide was added to the coating composition before application. This was followed by the application of a casein-formaldehyde waterproofing composition described in Example 2. When this paper is hot embossed it gives a green design on a yellow background.

Example 10

Twenty-five parts of coating clay, 25 parts of finely divided titanium dioxide, 3 parts of Mix A and 5 parts of the pigment prepared from dichlorobenzidine tetrazotized and coupled with aceto acetorthotoluidide are slurried in 55 parts of water. Fifty-five parts of the 17% casein solution described in Example 1 are then added and thoroughly mixed, after which 20 parts of the wax emulsion are stirred into the mix. This composition is applied to paper stock and dried at 140° F. The shade developed upon hot embossing is yellower than that of Example 9.

Example 11

When the composition described in Example 4 is applied to brown wrapping paper, dried and embossed, a green color is obtained on a brown background.

Example 12

The procedure of Example 10 is repeated except the yellow pigment of that example is replaced with the pigment prepared from dinitraniline diazotized and coupled to beta naphthol. A two-tone effect is obtained.

Example 13

The procedure of Example 10 is repeated except the inorganic pigment red iron oxide is used instead of the yellow pigment of that example. When the paper is dried and embossed, a gray design on a reddish background is obtained.

Example 14

The procedure of Example 10 is repeated except that the phospho molybdo tungstic lake of the dye having Color Index 680 is used instead of the yellow pigment of

Example 10. When this paper is hot embossed it gives a blue design on a violet background.

Although casein has been employed as the water-soluble binder in all the preceding examples, it will be recognized that other binders such as gum arabic, starch, methylcellulose, etc., may be substituted for casein with similar results.

I claim:

1. A composition suitable for coating paper and other cellulosic materials which comprises an emulsion, the internal phase of said emulsion being a water-insoluble wax having a melting point above 140° F. and below 270° F., the external phase of said emulsion being an aqueous dispersion of a finely divided water insoluble pigment and a finely divided oil-soluble color in an aqueous solution of a water-soluble binder.

2. A composition according to claim 1 in which said waxes are a mixture of beeswax and paraffin wax.

3. A composition according to claim 2 in which said water-soluble binder is casein.

4. A composition according to claim 3 in which said insoluble pigment is titanium dioxide.

5. A sheet of cellulosic material, one side of which is coated with a binder having dispersed therein a finely divided water insoluble pigment, finely divided oil-soluble color and discreet particles of water-insoluble wax, said wax particles having a melting point above 140° F. and below 270° F.

6. A product according to claim 5 in which said wax is a mixture of beeswax and paraffin wax.

7. A product according to claim 6 in which said insoluble pigment is titanium dioxide.

8. A product according to claim 5 which has improved water-resistance due to the presence of a second coating of a casein-formaldehyde condensate.

9. A product according to claim 5 in which said oil-soluble color is adjacent to the cellulosic surface and between said cellulosic surface and said wax particles.

10. A method of obtaining dual color effects on cellulosic materials by hot embossing which comprises applying to one surface of said cellulosic material an emulsion, the internal phase of said emulsion being a water-insoluble wax having a melting point above 140° F. and below 270° F., the external phase of said emulsion being an aqueous dispersion of a finely divided water insoluble pigment and a finely divided oil-soluble color in an aqueous solution of a water-soluble binder; drying said coating at a temperature substantially below the melting point of said wax; and passing said coated cellulosic material under an embossing roll heated to a temperature above the melting point of said wax, the resulting melting of the wax acting to develop at point of contact with the embossing roll the contrasting color of the said finely divided oil-soluble color by dissolving it in the said molten wax.

11. A sheet of cellulosic material one side of which is decorated with a two-color design; the area of the said two-color design having one color shade being coated with a binder having dispersed therein a finely divided water-insoluble pigment, said coating being further coated with a water-insoluble wax having a melting point above 140° F. and below 270° F., said wax coating having dissolved therein an oil-soluble color; the remaining portion of said surface being coated with a binder having dispersed therein a finely divided water insoluble pigment, a finely divided oil-soluble color and water-insoluble wax particles having a melting point above 140° F. and below 270° F.

References Cited in the file of this patent

UNITED STATES PATENTS

1,535,999	Harrington	Apr. 28, 1925
1,582,416	Mason	Apr. 27, 1926
1,930,853	Kollek et al.	Oct. 17, 1933
1,956,197	Lines	Apr. 24, 1934
2,099,880	Ellis	Nov. 23, 1937
2,248,233	Heritage	July 8, 1941
2,288,527	Lumphner	June 30, 1942
2,306,525	Cummings	Dec. 29, 1942
2,374,862	Green	May 1, 1945