March 21, 1961 R. B. KENYON 2,975,486

DECORATIVE SHEETING AND METHOD FOR ITS MANUFACTURE

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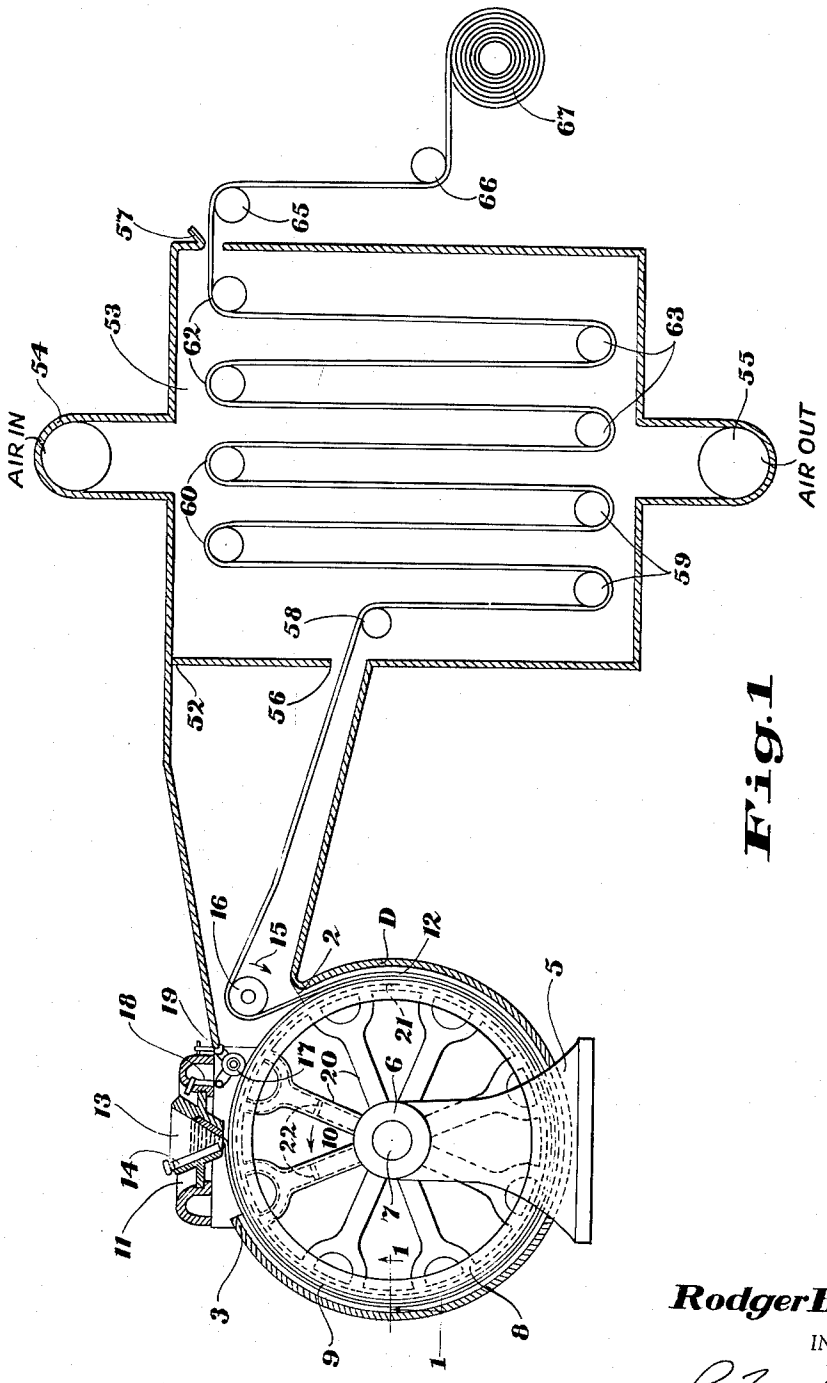


Fig. 1

Rodger B. Kenyon
INVENTOR.

BY R. Frank Smith
Walter O. Hodsdon
ATTORNEYS

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Fig. 2

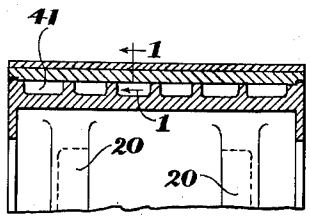


Fig. 3

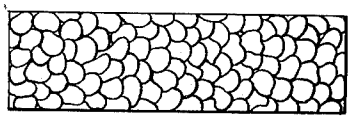


Fig. 4



Rodger B. Kenyon
INVENTOR.
R. Frank Smith
By Walter O. Hodsdon
ATTORNEYS

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DECORATIVE SHEETING AND METHOD FOR ITS MANUFACTURE

Roger B. Kenyon, Rochester, N.Y., assignor to Eastman Kodak Company, Rochester, N.Y., a corporation of New Jersey

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3 Claims. (Cl. 18—57)

This invention relates to a novel sheet of cellulose organic acid ester material and more particularly to such a cellulose ester sheet having a decorative appearance as well as to the process for producing such a decorative sheet.

Cellulose organic acid ester sheets having a matte, translucent or "ground glass" type of surface have been made heretofore by continuous methods. One prior art method involves subjecting the previously formed transparent or the like glossy sheeting to some type of action that softens the surface of the sheet, after which the softened surface is contacted with a roll exemplified by a sand blasted or the like embossing roll for securing an embossed or a matte effect upon the sheet. The softening of the surface of the sheet is accomplished by the use of solvents or warming. However, such methods have the disadvantage that any scratches or other imperfections on the sand blasted roll produces repeating defects on the processed sheeting. This is obviously apparent in that a roll contact against the sheet, of course, repeats itself as the embossing roll rotates through a distance equivalent to the circumference of the roll.

It also has been proposed to secure a matte effect on sheeting by subjecting the sheeting to certain surface oxidation treatments, by flame contact or the like. Such flame treatments, in addition to presenting possible hazards in the event the sheeting material is combustible, or happens to have residual combustible solvent, may also cause a degradation of the sheeting. It has also been proposed to secure the translucent matte effect on the surface of the sheeting by depositing on the sheeting various materials exemplified by powdered glass or silica oxide. Such procedure, while producing translucency, creates somewhat higher internal reflection than an embossed surface with accompanying reduction of transmission and is, therefore, disadvantageous in this respect. In addition, the introduction of powdered materials, as aforementioned, on to the surface of the sheeting presents problems of dulling the cutting tools in the event the resulting sheeting is to be subdivided or otherwise processed using cutting knives.

Numerous processes have been described wherein the surface of sheeting and even the entire sheets are subjected to chemical treatment with strong solvents or hydrolyzing agents which attack the sheeting material and thereby affect its appearance. Such hydrolysis methods, which in attacking the sheeting may cause the sheeting to lose strength or perhaps cause degradation, are therefore distinguished from the method of the present invention.

This invention has for one object to provide a method for imparting a translucency to sheeting. Another object is to provide an improved process for casting sheeting whereby controlled translucent effects may be secured in and on the surface of such sheets simultaneously with the casting of the sheeting. A still further object is to provide a new translucent type of sheeting which has a

relatively uniform vesicular surface. Other objects will appear hereinafter.

In accordance with the present invention, these and other objects are attained by providing a cellulose organic acid ester casting solution containing a volatile solvent and containing therein a substantial quantity of small hollow resinous particles. When this casting solution is exposed to an elevated temperature during casting of the solution into sheeting as on a smooth surface such as a rotating roll or endless band, the solvent vaporizes and the small spheres pick up bubbles of the solvent vapor which as the sheeting begins to form produces voids both in the surface and interior of the sheet. The sheeting is conducted from the casting surface and further dried and changed into a flexible, solid form. Both sides of the sheeting will have a vesicular surface but in the surface, which was in contact with the casting surface, this condition will be particularly pronounced. Under optimum conditions, the vesicular surfaces can be produced in a substantially uniform and repetitive pattern.

This novel appearing sheeting may be employed for various purposes where translucent decorative sheeting is required. One such use is in the manufacture of lamp shades. Because of the vesicular surfaces on the sheeting, there is exhibited unusual lighting characteristics in that the entire external surface of the lamp shade gives off a more even distribution of light than other lamp shade materials, such as parchment, paper, textile, various plastic sheetings of conventional type, and so forth. A certain lens effect is provided by the various lens-like voids which results in better lighting efficiency than is possessed by other materials which are commonly employed in lamp shade manufacture.

For a more complete understanding of my invention, reference is made to the attached drawings forming a part of this application.

Figure 1 is a semi-diagrammatic side elevation view of an apparatus arrangement such as can be used to carry out the steps of my invention which will be described in detail hereinafter.

Figure 2 is a section taken on the line 2—2 of Figure 1 showing, in particular, suitable means for heating the underside casting surface.

Figure 3 is a plan view of the surface of the decorative sheet produced by this invention.

Figure 4 is a sectional view on a large scale illustrating the appearance of the sheeting having a translucent vesicular surface in accordance with the present invention.

Referring to Figure 1, there is shown conventional sheet casting apparatus which is adaptable for producing the decorative sheeting of the present invention. A thin coating of the casting solution flows from the V-shaped hopper onto the heated surface of the rotating cylindrical wheel. The upper surface of the sheeting being formed is also exposed to a heated atmosphere, such as air, which is circulated through a chamber substantially surrounding the casting wheel, and due to heat thus applied in these two ways, the solvents are caused to evaporate from the continuously formed sheeting more or less progressively as the wheel turns until, in less than one complete revolution, sufficient solvent has been expelled to admit of the sheeting being removed from the surface of the casting wheel and conveyed into a drying chamber for further drying. From the drying chamber it is conducted to a wind-up.

As shown in Figure 1, a base 5 supports a bearing 6 for the shaft 7 of a casting wheel generally indicated at 8. The wheel body, preferably comprising a single casting of cast iron, includes spokes 20 extending outwardly from a central bearing, not shown, surrounding shaft 7 to support the rim 21. The cylindrical periph-

eral casting surface 9 of the wheel moves during rotation in the direction of the arrow 10 from a solution-applying station 11 to a sheeting stripping or removing station 12 and then through a casting surface cleaning station and back to solution applying station 11. The cleaning pad or roll 17 is carried in a swinging support 18 that is pressed toward the casting surface 9 by a spring pressed plunger 19.

At the solution-applying station 11 is a V-shaped solution holding trough 13 having the usual adjustable gate 14 for regulating the thickness of the layer of solution being deposited on the wheel surface 9. Heat is applied to the casting surface allowing it to be transferred therethrough to the underside of the layer of solution being formed into a continuous sheet. Additional heat is applied to the upper side of the continuously forming sheet by passing heated air through duct D surrounding the casting surface 9. The heated air is forced into end 2 of duct D near the point on the wheel where the sheeting is stripped therefrom, and moves in a direction opposite to the direction of rotation of the wheel to be exhausted at point 3. The sheeting being drawn under tension from the casting surface 9, as indicated by arrow 15, passes over roller 16 and thence into a drying chamber having the overall designation 52.

Referring to Figure 2, it will be apparent that ducts 41 are provided around the periphery of the wheel through which hot water, steam or any other heating element may be admitted to heat the casting solution on the wheel by transmitting heat through the casting surface.

The drying or heating chamber 52 comprises an enclosed chamber 53 provided with an inlet 54 for heated air and an outlet 55 for exhausting the air or other heating medium and solvent vapors from chamber 53. The chamber is provided with suitable slot-like openings at 56 and 57 for the entrance and withdrawal of the decorative sheet. The interior of chamber 53 is provided with a plurality of idler rollers 59 and 63 over which the sheet is looped within the chamber 53 to expose both sides of the sheet to the air drying operation. Rollers 65 and 66 direct the sheet to the windup on shaft 67 which is rotated by conventional means, not shown.

The heated air employed in this sheet forming operation may be supplied from a conventional source at a desired temperature. It may also serve as a source of heat for the casting wheel when wheel heat is not supplied.

The present invention is further described in the following examples.

Example I

A casting solution consisting of 22% cellulose acetate in a solvent mixture of 90% methylene chloride and 10% methyl alcohol. 47% by weight of triphenyl phosphate based on the weight of the cellulose ester and 0.10% by weight of gas-filled hollow resinous spheres of urea-formaldehyde plastic based on the total weight of the solutions was continuously supplied to the hopper of the sheet-forming apparatus shown in Figure 1. The wheel 8 is rotated in a counterclockwise direction and the gate 14 is adjusted to permit a thin layer of the solution to flow onto the wheel surface 9 and be carried around to the stripping roll 16. The surface 9 of the wheel and hence the solution and resulting sheet on the wheel side is heated as above described to a temperature of 105° F. This heating air in duct D, which contacts the opposite side of the sheet is maintained at a temperature of 160° F. as it enters the area around the casting wheel.

At these temperatures, the solvent in a casting solution will volatilize and the formation of a continuous acetate sheet on the wheel surface 9 will commence. During this operation, the heat thus applied to the solution on the wheel surface will cause formation of bubbles around the hollow gas-filled spheres in the sheet. This action produces a pronounced vesicular decoration on the surface of the sheeting which contacts wheel surface 9 as the bubbles near the surface collapse, and as less pronounced effect on the opposite surface of the sheeting.

This decorative sheet is continuously stripped from the casting wheel surface 9 and conducted to a further drying in the drying chamber 52 at a temperature of 225° F., from which it is wound on shaft 67 into a roll of decorative sheeting.

Example II

A casting solution consisting of 28% cellulose triacetate in a solvent mixture of 90% methylene chloride and 10% methyl alcohol, 52% by weight of diethyl phthalate based on the weight of the cellulose triacetate and .10% by weight of gas-filled hollow resinous spheres of urea-formaldehyde plastic based on the weight of the total solution was continuously supplied to the sheet-forming apparatus shown in Figure 1. The casting surface of the wheel 9 was maintained at a temperature of 108° F. The air in duct D was maintained at a temperature of 250° F. The operation was otherwise similar to that of Example I and a decorative sheet characterized by a vesicular surface was continuously produced.

Decorative sheets have been made in accordance with Examples I and II with a thickness of 0.010 to .025" by suitable adjustment of gate 14.

Colored decorative sheeting may be produced in accordance with Examples I and II by adding from .10% to 1.0% by weight of the total solution of suitable pigments such as titanium dioxide, Phthalo Cyanine Blue—C.I. Pig. Blue #15, C.I. Pigment yellow #34 Chrome Oxide, C.I. Pigment (brown) #6, brown oxide pigment, C.I. Pigment Green #7 Phthalo Cyanine, or suitable dyes such as:

Luxal Fast Green B—C.I. Solvent Green #10.
Eastman Fast Yellow 4–R.L.F. (dispersed).
Eastman Fast Blue G.L.F. (dispersed), Unidentified.
Azosol Fast Blue H.L.R. Solvent, C.I. Solvent Blue #38.

The casting solution may contain cellulose organic acid ester in a range of 18% to 30% by weight of the solution composition.

Pigments, dyes, plasticizer and resin spheres may be added by the method described in Adler & Bartlett Serial No. 644,822, filed March 8, 1957.

Various other solvents may be employed in the casting solution other than those mentioned above such as acetone, ethylene dichloride, propylene dichloride mixed with 10% butyl or isopropyl alcohol.

The size of the vesicules in the surface of the sheet can be controlled by adjustment of the concentration of the hollow gas-filled spheres and the temperature at which the solution is coated. The coating temperature for a given solution is critical. If the temperature is too high, the solvents evaporate too rapidly and produce large blisters instead of craters in the product. When the temperature is too low, the desired craters do not form because of lowered vapor forming pressure of the solvent. A general temperature range for suitable operation is from 100° F. to 110° F. for the methylene chloride, methyl alcohol formula when higher boiling solvent formulations are used. Temperatures above the boiling point of the solvents in the mixture are needed. For example, when acetone is used, temperatures of about 140° F. are required.

The hollow gas-filled resinous particles preferably employed in producing my novel decorative sheet consist of a hollow unicellular spherical body of urea-formaldehyde plastic, which is substantially gas tight, containing air. The production of such particles is described in U.S. Patent 2,797,201 of June 25, 1957. The preferred particle size is within the range of 2 to 60 microns in diameter, the compression strength 30 to 50 p.s.i., a bulk density of 3.7 lbs./cu. ft., a white color and a decomposition temperature of 350° F.

However, hollow particles made from the other syn-

thetic plastic mentioned in U.S. Patent 2,797,201 can be effectively employed in my novel process of continuously making cellulose organic acid ester sheeting having the above-described decorative appearance.

I claim:

1. The method of continuously forming decorative sheeting of a cellulose organic acid ester composition having a substantially uniform vesicular surface which comprises spreading a casting solution containing a cellulose organic acid ester in a volatile solvent therefor and a plurality of hollow, gas filled, resinous spheres onto a casting surface, heating the casting surface at a temperature to promote volatilization of the solvent and the formation of vapor bubbles around said gas filled spheres whereby continuous sheeting having a pitted surface is formed.

2. The method of continuously forming decorative sheeting of a cellulose acetate composition having a substantially uniform pitted surface thereon which comprises spreading a casting solution containing cellulose acetate in a volatile solvent therefor and a plurality of non-dissolved gas-filled plastic spheres onto a moving casting surface, heating the casting surface at a temperature to promote volatilization of the solvent and the formation of vapor bubbles around said gas-filled spheres whereby continuous sheeting having a substantially uniform vesicular surface is formed.

3. The method of continuously forming decorative sheeting of a cellulose organic acid ester composition having a vesicular surface which comprises spreading a casting solution containing cellulose acetate in a volatile solvent therefor and a plurality of non-dissolved gas-filled plastic spheres onto a moving casting surface, heating the casting temperature at a temperature to promote volatilization of the solvent and the formation of vapor bubbles around said gas-filled spheres whereby continuous sheeting is formed having a pronounced vesicular surface on the side of the sheeting which contacts the casting surface and a less pronounced vesicular surface on the opposite side of said sheeting, the respective surfaces being substantially uniform in appearance.

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