PROCESS OF FORMING A RIBBED SHEET

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Fig. 1

Fig. 2

Fig. 3

Fig. 4

JULIAN W. SHIRLEY, DECEASED
BY NANCY A. SHIRLEY, ADMINISTRATRIX
& GRAVES T. GORE
INVENTORS

BY

Parrott & Rankin
ATTORNEYS
This application is a continuation-in-part of copending application Ser. No. 691,988, filed Oct. 23, 1957, now U.S. Patent No. 3,052,211.

The present invention relates generally to the production of a ribbed sheet and particularly to the production of a raised rib on a base sheet using thixotropic material which can be made to flow in a stream onto the base sheet and adhere thereto while maintaining a raised configuration and maintaining a widthwise dimension with substantial lateral spreading.

Briefly described, the invention involves the application of pressure to a thixotropic composition to lower the viscosity of the composition and render it readily flowable. The composition in flowable form is directed in a stream onto a base sheet in the form of a raised rib with the stream being initially flowable onto the surface of the base sheet to adhere strongly thereto. The sheet carrying the stream is caused to travel away from the pressure application with the viscosity of the stream rising as it leaves the pressure with the result that the raised configuration of the rib is retained and the widthwise dimension of the rib is maintained without substantial lateral spreading.

In the preferred embodiment of the present invention a thixotropic thermoplastic composition is rendered flowable by pressure and is directed onto a sheet of textile fabric in the form of spaced raised ribs with the initially flowable ribs partially flowing into the surface of the fabric sheet to adhere strongly thereto, but with the spacing and raised configuration being maintained without substantial lateral spreading by reason of the increase in viscosity of the thixotropic thermoplastic composition as it travels away from the pressure application.

The apparatus of the present invention comprises a closed supply reservoir having an inlet opening and a plurality of spaced discharge nozzles. Viscous material is fed into the reservoir by a pair of closely spaced parallel feeding and pumping rolls mounted across the inlet opening. The rolls are rotated in opposite directions to feed the viscous material into the reservoir and to apply a pumping action to the viscous material confined within the closed reservoir to cause the viscous material to flow through the nozzles onto the base sheet.

By the use of the present invention it is possible to produce sheets having raised spaced ribs of long wearing material strongly adhering to the base to provide a strong protective surface that protects the base sheet with the maintained spacing of the ribs providing a decorative effect and also retain substantially in the product the flexibility, breathability, appearance and other characteristics of the base sheet.

Ribbed sheets made according to the present invention have many applications, such as in clothing, upholstery draperies, etc., wherever the wearing advantage or decorative effect of the product of the present invention would be desirable.

Therefore it has not been considered possible to apply a single material in a rib on a base sheet at a viscosity low enough to provide proper adherence of the material to the base and yet at a viscosity sufficiently high to maintain a substantially raised configuration without spreading. This has been accomplished for the first time by the method of the present invention.

Examples of thixotropic thermoplastic compositions suitable for use in the present invention are disclosed in copending application Ser. No. 698,056, now abandoned, filed Nov. 22, 1957.

The advantages and features of the present invention will be apparent from the following description and accompanying drawings in which:

FIG. 1 is a more or less diagrammatic sectional detail of a preferred means for applying a pressure to a thixotropic material and applying streams of the material according to the present invention;

FIG. 2 is a perspective illustration of the manner in which a fabric web or the like is handled in relation to the means shown in FIG. 1 for application of thixotropic ribs thereto;

FIG. 3 is a plan view of a fragmentary portion of the ribbed web illustrated in FIG. 2; and

FIG. 4 is an exaggerated sectional detail taken substantially on the line 4-4 in FIG. 3.

Referring now in detail to the drawing, the means shown in FIG. 1 for applying raised ribs S to a web W, as seen in FIG. 2, comprises a supply reservoir 10 arranged for disposition transversely over a traverse base web such as W. The top of this supply reservoir 10 is formed by a pair of closely spaced parallel feeding rolls 12 that are rotated in opposite directions to travel downwardly with respect to the supply reservoir 10 at their adjacent surfaces, and by a pair of doctor blades 14 acting on the respective feeding rolls 12 and otherwise closing the top of the supply reservoir 10, which in turn has a plurality of discharge nozzles 16 arranged at the bottom thereof for discharge in spaced alignment with the traveling direction of the base web W.

The construction for forming the raised ribs is delivered by any suitable means such as a perforated supply line (not shown) above the pair of feeding rolls 12, the rotating motion of which results in carrying the delivered composition downwardly therebetween for removal by the doctor blades 14 and accumulation within the supply reservoir 10. The action of the feeding rolls 12 as arranged in this manner is in the nature of a pumping action, and not only serves to transfer the delivered composition to the supply reservoir 10 but also to build up a pressure therein. The amount of pressure resulting from the roll action depends on the spacing of the rolls 12 and this spacing is preferably made adjustable so as to regulate the pressure as desired, the pressure being increased by decreasing the roll spacing and a relatively close roll spacing, under some circumstances as close as a few thousandths inches, being employed.

As illustrated in FIGS. 1 and 2, the pair of feeding rolls 12 reach entirely across the top of the supply reservoir 10 and the resulting feeding action is accordingly applied in a uniform manner along the entire length of the supply reservoir 10 so that the previously mentioned discharge nozzles 16 arranged at the bottom thereof are made to deliver uniform streams of the rib forming material onto the web W to form the raised ribs S as the web W is made to travel linearly thereby. In this way, streams of substantially cross-sectional dimensions can be deposited readily on the web W, and by depositing a thixotropic thermoplastic composition of the type noted below, a substantially raised rib is obtained on the base web W as indicated in FIGS. 3 and 4 in which the spaced parallel arrangement of the ribs S on the web W are represented in FIG. 3, and the substantially raised configuration of the ribs S in FIG. 4, the result being a decorated fabric or other sheet material having a unique appearance and hand without modifying the base material otherwise in any way, such as with a continuous back coating or the like.

In carrying out the process of the present invention using the above described apparatus of FIGS. 1 and 2, a
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thixotropic thermoplastic material of the type described below is supplied to the feeding rolls 12, which feed the material into the reservoir 10 and continuously rotate to fill the reservoir and build up pressure in the reservoir after it is filled. This pressure is regulated by the spacing between the rolls and the rate of rotation, which factors may be adjusted to provide sufficient pressure to the material in the reservoir to maintain the viscosity of the material at a desired flowable level. Also the pressure developed by the feeding rolls 12 serves to pump the material in the reservoir through the nozzles 16 in the form of flowable streams, which readily flow onto the web W of fabric or other material, as it travels past the nozzles 16. As the streams are initially flowable to some extent they flow onto the surface of the web W, and in the case of a textile fabric web and similar webs the streams flow partially into the surface thereof to strongly adhere the ribs to the web. As the ribs S are carried by the web W away from the reservoir 10 the pressure on the ribs S is relieved with a corresponding rise in viscosity of the ribbed material. Thus the ribs are no longer flowable and thereby retain substantially the cross-sectional shape of the nozzles 16 without substantial lateral spreading. In this way the widthwise dimensions of the ribs are maintained as is the spacing between ribs on the web W.

Satisfactory results are obtained by the process of the present invention utilizing thixotropic materials such as the thixotropic thermoplastic compositions described and disclosed in the above mentioned copending application Ser. No. 698,056, which sets out several examples of typical compositions, two of which are set out herein by way of example as follows:

Example 1

| Parts |  
|-------|---|
| Vinyl chloride polymer—Geon No. 121 | 50 |
| Vinyl chloride polymer—Geon No. 126 | 50 |
| Flexol plasticizer A—26—di(2-ethylhexyl) adipate | 50 |
| Stabilizer A—5—diglycidyl ether of diphenyl propane | 20 |
| Motor oil lubricant | 1 |
| Color dispersion to shade. | |

Example 2

| Parts |  
|-------|---|
| Vinyl chloride polymer—Geon No. 126 | 100 |
| Flexol Plasticizer A—26—di(2-ethylhexyl) adipate | 80 |
| Stabilizer A—5—diglycidyl ether of diphenyl propane | 20 |
| Motor oil lubricant | 1 |
| Color dispersion to shade. | |

Geon No. 121 and Geon No. 126 are vinyl chloride polymers manufactured and sold by B. F. Goodrich Chemical Company. Geon No. 121 has a particle size range of 0.2 to 2.0 microns, a predominate particle size range (95% of the particles being in this range) of 0.25 to 1.2 microns and a predominate particle size of 0.45 micron. Geon No. 126 has a particle size range of 0.05 to 1.0, a predominate particle size range of 0.2 to 0.8 micron, a predominate particle size of 0.25. The combination of particle sizes and ranges of these vinyl chloride polymers provides thixotropic characteristics that produce the desired results in the process and product of the present invention.

It may be that other types of thixotropic materials may also produce satisfactory results in the process and product of the present invention and it is to be understood that the above two examples are not intended to limit the scope of the present invention.

Also it is to be understood that the base sheet W may be formed of materials other than textile fabrics, such as plastic sheets, paper and other material.

The apparatus as disclosed herein and further disclosed in the above application Ser. No. 691,998, filed Oct. 23, 1957, is claimed in the latter application and not in this application. The process disclosed in these two applications is claimed in the present application and is not claimed in the above application Ser. No. 691,998.

The present invention has been described in detail above for purposes of illustration only and is not intended to be limited by this description or otherwise except as defined in the appended claim.

We claim:

A process of forming a ribbed sheet comprising the steps of:

(a) providing a base sheet;
(b) providing a supply of thixotropic composition characterized by having a sufficiently high viscosity to be nonflowable in the absence of pressure, but which will become less viscous upon the application of pressure to become flowable yet retain sufficient viscosity to maintain a predetermined shape, and which will return to substantially the original high viscosity upon the removal of pressure to become nonflowable;
(c) applying pressure to said thixotropic composition to cause said composition to become sufficiently less viscous to flow, but retain sufficient viscosity to maintain a predetermined shape;
(d) directing the flowing composition in a plurality of spaced apart streams onto said base sheet in the form of raised ribs to adhere strongly to said sheet; and
(e) moving said base sheet with the spaced apart ribs thereon away from the pressure application allowing the viscosity of the composition to rise causing the composition to become nonflowable as it leaves the pressure application to retain the streams in the form of the spaced apart raised ribs of maintained widthwise dimensions without lateral spreading between the ribs.

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RICHARD D. NEVIUS, Examiner.

H. W. MYLIUS, R. HUSACK, Assistant Examiners.