Sept. 12, 1972 Y. MAHE ET AL 3,690,910

COATING PROCESS FOR REGENERATED CELLULOSE FILM

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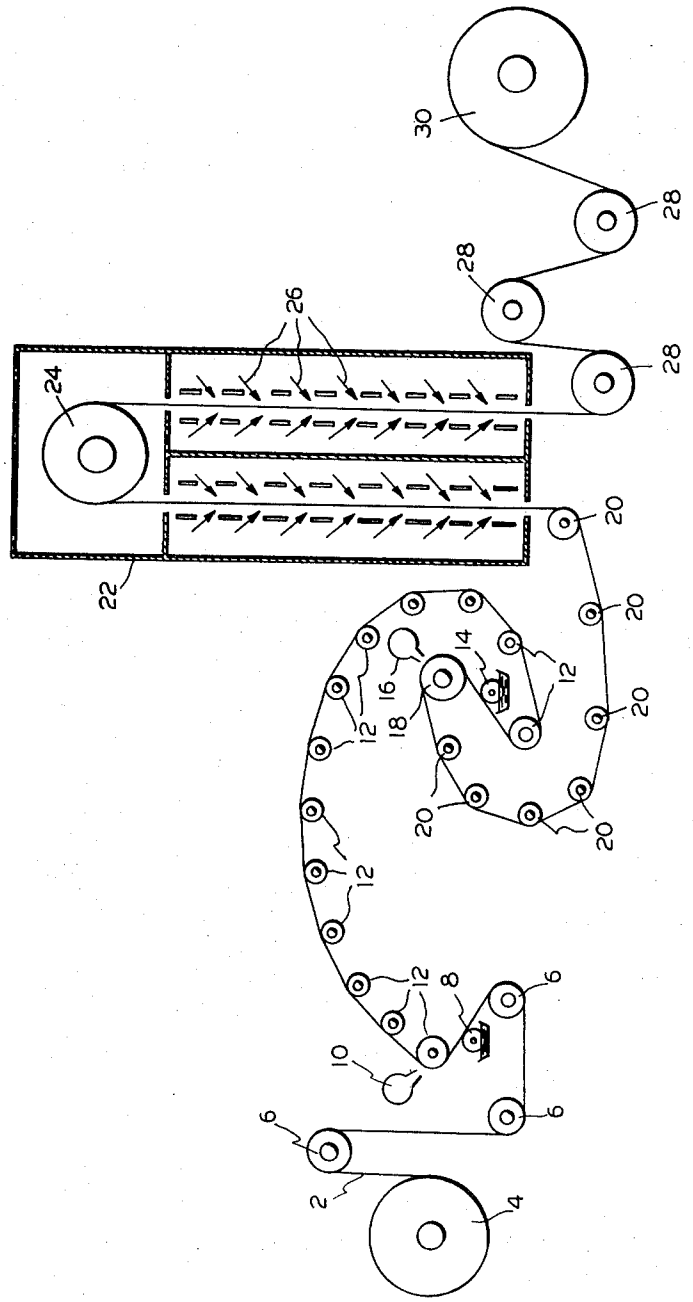


FIG. 1

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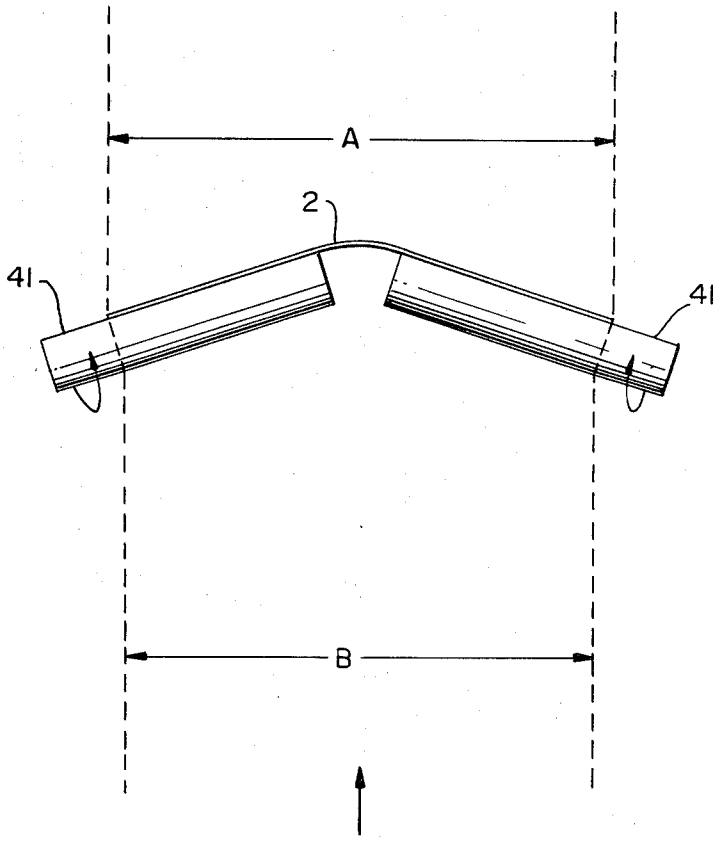
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FIG. 2



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COATING PROCESS FOR REGENERATED CELLULOSE FILM

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Continuation-in-part of abandoned application Ser. No. 544,219, Apr. 21, 1966. This application Jan. 19, 1971, Ser. No. 107,775
Claims priority, application France, May 4, 1965, 15,623
Int. Cl. B44d 1/16
U.S. Cl. 117—7 6 Claims

ABSTRACT OF THE DISCLOSURE

A process for coating a water-absorbent support, e.g., regenerated cellulose films, with an aqueous solution or dispersion whereby the support poses little or no tendency to roll up upon itself, which comprises coating the support with such aqueous solution or dispersion along its entire width on both faces successively and without intermediate drying, the support, after being coated on one face traveling over a supported path which is of sufficient length to permit the deposited coating to reach a degree of coalescence so that the coating will not be altered by passage of a detour roll; coating the second face while allowing coalescence thereof in substantially the same manner, and drying the coated support.

This application is a continuation-in-part of application Ser. No. 544,219 filed Apr. 21, 1966, now abandoned.

The present invention is directed to a process for coating of water-absorbent supports and more particularly to a process for coating such supports, e.g., regenerated cellulose films, from an aqueous solution or dispersion.

In general, it is known to coat water-absorbent supports such as regenerated cellulose films, with suitable products in aqueous solutions or dispersions. Such a process ordinarily comprises coating one face of the support, drying it, then coating the other face with a composition that may be the same or different than that employed for coating the first face of the support material. In such a procedure, after the coating of the second face of the support material, a second drying step is employed. The amount of products deposited on the faces of the support can be regulated in an extremely accurate manner with a conventional air jet doctor and thus deposits can be attained with a rigorously constant thickness and as slight as desired.

Such a procedure, however, suffers from various serious drawbacks. With the individual coating of the faces of the support material with intermediate drying, there is a great tendency for the support to roll up upon itself lengthwise immediately after each coating operation and inside the driers.

In order to employ this process on a commercial scale, therefore, it has been necessary to leave an uncoated zone of about 25 mm. in width on each edge of both faces of the support material. In this way, the support keeps a sufficient degree of flatness to be treated, but after it has been dried twice, the uncoated edges become fragile and brittle. This frequently results in the starting of tears which hinder winding and make it necessary to take precautions which limit the feed rate. In any event, losses from cutting the uncoated edges are considerable and costly. For these reasons it has long been the desire of the coating industry to provide a process for the coating of

such water-absorbent supports by a process which will substantially eliminate this costly loss of materials and accompanying reduction in quality of the product which is prepared.

It has now been found that it is possible to eliminate the various drawbacks of such previously employed processes by employment of the process of the present invention wherein a water-absorbent support is coated all along its width with an aqueous composition on its two faces successively and without intermediate drying.

Additionally, it has not been possible until this development of the present invention, for the reasons indicated above, to proceed from spinning to coating of regenerated cellulose films, i.e., coating directly on freshly made film coming from the dryer. The present invention makes it possible to apply such a process thereby bringing about considerable saving.

It is therefore a principal object of the present invention to provide a process for coating water-absorbent supports which are free from the drawbacks and deficiencies present in previously employed processes.

It is a further object of the present invention to provide a process for coating a water-absorbent support, such as a regenerated cellulose film, in which there is no tendency for loss of materials or for the rolling up of the film length upon itself.

It is yet a further object of the present invention to provide a process for the coating of water-absorbent supports in which the support is coated all along its width on its two faces successively and without intermediate drying.

Still further objects and advantages will become more apparent from the following more detailed description of the present invention and accompanying drawings.

By the proecss of the present invention, a suitable water-absorbent film, e.g., a regenerated cellulose film, is coated all along its width with a suitable aqueous solution or dispersion on its two faces successively and without intermediate drying. The support after being coated on one of its faces, travels between the first and second coating stand, or station along a rather long supported path to permit the deposited varnish to reach a sufficient degree of coalescence so that it will not be altered by passage on a detour roll.

Under the effect of the first coating, the water-absorbent support reacts by presenting a tendency to roll up on itself lengthwise. It is essential to oppose this tendency for the entire period of time that is necessary for the water contained in the coating composition to penetrate the interior of the water-absorbent support. The tensions balance each other during this time, and the tendency of the support to roll up on itself decreases considerably. At the same time as the penetration of the water into the support, the particles in dispersion accumulate on the surface of the support and dry. A time comes when the coated surface presents a sufficient coalescence so that it can come into contact with the detour roll without being altered. It is then possible to proceed to the coating of the reverse side without prior drying. This coating causes a tendency of the support to roll up on itself lengthwise in the opposite direction, a tendency opposed in part by the wetting caused by the first coating, but which also has to be opposed by supporting the other face during the time necessary for the tensions to balance each other. The coating support can then go into a drier without difficulty where a drying is carried out, preferably balanced on both faces. The support may then be removed.

This process, therefore, consists in replacing the first drying by a coalescence operation carried out on a supported path and in also employing a second traveling on a supported path after the second coating. By the process of this invention, it is possible to attain a sufficient degree

of flatness during the operation without loss of edges which are also coated, and to obtain thereby a better output. Another advantage of the process lies in the simplification and savings involved in the elimination of the first drying. Finally, it makes it possible, due to the fact that there is only one drying, to obtain a better balanced film.

The depositing of the coating in accordance with the present invention can be carried out according to conventional coating processes and the amount of coating deposited can be regulated by known means in the art, for example, by an air jet doctor, etc.

The tendency to roll which is possessed by regenerated cellulose films results from the unsymmetrical taking up of water undergone by the absorbing material when only one of its faces is wetted, the other remaining dry. The rolling occurs in such a way that the wet face envelops the dry face.

The tendency to roll is accentuated by the fact that the regenerated cellulose film is a molecularly oriented material. Its crosswise expansion capacity when it is wetted with water reaches 10% between the edges, while, the crosswise expansion capacity of ordinary paper is only 1% under the same conditions.

The purpose of the intermediate rollers according to the present invention is therefore to support the freshly coated film and to prevent it from rolling up on itself.

Since the film totally lacks rigidity by itself to a greater extent than paper, for example, the support rollers also have to produce an uncreasing effect. For this reason, spreading rollers, preferably, positively driven, are utilized in accordance with the present invention to produce a spreading effect.

The gap between the spreading rollers used in the present invention should be smaller for slower machines than for fast machines. These rollers should be closer together when the film has just been wetted, i.e. immediately after the coating station rather than farther from it, because the tendency of the film to roll up on itself decreases as it absorbs water. Finally, the gap between these rollers can be greater when the back of the film has already been coated, i.e., after the second coating station.

It is noted that the coat cellulose films with aqueous compositions, with a vinylidene chloride base, for example, the minimal time to obtain coalescence of the coating is 3 to 4 seconds. Accordingly the time for passage of the coated film over the suggested path is at least 3 seconds, there being no disadvantage to continuing passage after coalescence of the coating.

Coating of cellulose films is performed at speeds which can be between 30 meters and 300 meters per minute (.5 to 5 meters per second). The minimal distance that the cellulose film has to travel to reach its coalescene is therefore 2 m. for the slowest machines and can reach 20 m. for the fastest machines.

This travel should be supported, according to the present invention, by a number of rollers arranged closer together as the speed is slower, i.e., the distance between rollers being proportional to the speed of advancement of the film, these rollers being, as indicated above, closer together near the coating station.

The number of necessary spreading rollers between the first coating station and the second is between 10 rollers, spaced an average of 25 to 30 centimeters apart for coalescence travel of 2 to 3 m. which corresponds to slow speeds, and 30 rollers, spaced an average of 50 to 70 centimeters apart for a travel f 30 meters corresponding to the fast speeds.

After coating of the back side, the coalescence of the coating deposited on the second face should be obtained before the film goes into the vertical dryer. As in the case of coating the front side and in the same way, the travel should be supported by spreading rollers over an equivalent length, the spacing of the rollers being slightly less if desired, the number of rollers being reduced about 10% for the same length.

Referring now to the accompanying drawing:

FIG. 1 schematically illustrates a coating device embodying the present invention.

FIG. 2 schematically illustrates spreading or enlarging rollers useful in accordance with the present invention.

A water-absorbent film **2** is unwound from a reel **4** and after passing around a plurality of guide rolls **6**, is coated at the time of its passage in coating stand **8** with an aqueous dispersion the thickness of which is regulated by a pneumatic doctor **10**. The film then passes over a number of guide rolls **12** over a sufficiently long path to permit the water contained in the coating composition to penetrate inside the film while the surface coat reaches the desired degree of coalescence.

The reverse side of the film is then coated, on a coating stand **14** with an identical or somewhat different composition, the thickness of which is regulated by pneumatic doctor **16**, while the face of the film which underwent the first coating passes over detour roll **18**. The film then passes over a number of guide rolls **20** which make it follow a sufficiently long path to permit the water of the second emulsion to penetrate the inside of the support. The coated film then goes into the drier **22** where it follows a vertical upward path. Then, after passing around guide drum **24** the film follows a downward path. During these travels, hot air, shown by arrows **26**, is blown on each of its faces.

Following its course through the drier, the coated film passes over cold rolls **28** before being wound around reel **30** for ultimate storage or use. Although the film can be dried in any suitable drier, it is preferable to employ a pulsed air drier, the draft of which acts symmetrically on both faces of the film. A balanced drying and an excellent degree of flatness are thereby obtained.

FIG. 2 schematically illustrates the type of spreading rollers preferably utilized in accordance with the present invention. In FIG. 2, spreading or enlarging rollers **41** are positively driven in the directions indicated by suitable driving means (not shown). The regenerated cellulose film **2** passes over the spreading or enlarging rollers **41** with the width of the film to be increased upon passage of the film over the spreading or enlarging rollers **41**. The width B designates the width of the film **2** before passing over spreading or enlarging rollers **41** while width A designates the width thereafter. By utilizing such spreading or enlarging rollers **41** as support or guide rollers **12** and **20**, the rigidity of the film is maintained and an uncreasing effect is achieved through passage of the film over the support rollers.

While the process of the present invention has been described particularly with respect to the regenerated cellulose film, it is to be understood that the invention is not limited thereto but in actuality any water-absorbent support capable of absorbing water sufficiently rapidly, can be advantageously employed. Thus, for example, suitable supports can include hydroxyethyl cellulose films, films of carboxymethyl cellulose, cellulose ether films, paper of various varieties and many other various materials, it again only being necessary that such material have a fairly substantial degree of water-absorbency.

Similarly, it is possible to deposit on such water-absorbent supports all products that can be dispersed or dissolved in water. Especially suitable are film-forming resins and particularly, waterproofing resin with a copolymer base having a large proportion of vinylidene chloride to which may be added other monomers, for example, lower alkyl acrylates, lower alkyl methacrylates, unsaturated acids, vinyl esters e.g., vinylchloride, vinyl acetate or acrylonitrile, etc.

The process of the present invention is particularly suitable for the waterproofing of water-absorbent films,

e.g., regenerated cellulose films, and for making them thermosealable. In particular, in the preferred embodiment of the present invention, such a support is coated with an aqueous solution or dispersion of polyvinylidene chloride or a copolymer of vinylidene chloride and one of the various other monomers set forth above.

The following examples illustrate the process of the present invention. It is to be understood that the examples are for purposes of illustration only, and the invention is in no way deemed to be limited thereto.

EXAMPLE I

A regenerated cellulose film ½ meter in width is coated at a first coating stand with an aqueous dispersion of polyvinylidene chloride, the coating material comprising about 30% solids. Using such a dispersion, it is possible to deposit without any difficulty, from 20–25 gr. of the coating composition per square meter, corresponding to approximately 7–8 gr. of the solid material per square meter per face of support. With subsequent experimentation, it is found that although these amounts could possibly be reduced to about 4.5–5 gr. of composition per square meter, i.e., about 1.5 gr. of solid material per square meter per face, it is not advantageous to reduce these amounts too much because it becomes necessary to bring the coating roll extremely close to the doctor and to increase greatly the air pressure of the latter.

Similarly it is found that it is advisable not to reduce too much, i.e., below about 15–20%, the proportion of the solid materials in the coating composition. When too great a proportion of water is employed, there is a possibility of slight shrinkage of the support in the drier and an accompanying increase of the weight per square meter for the same amount of coating.

After the excess coating from the first stand is removed by the doctor, the coated film is passed over a number of guide rolls, the passage being sufficient to allow penetration into the film and coalescence of the coating material. At a rate of approximately 40 meters per minute, some 10 guide rolls, spaced approximately 0.30 meter apart, are utilized in such operation.

The cellulose film support is then coated on the reverse face with a composition and amount that is the same as employed in the first coating operation. Here again, excess is removed by a doctor and the film is passed over guide rolls of a similar arrangement as used previously. The coated film is then passed into a pulsed air drier where it moved first upwardly and then downwardly, pulsed air being symmetrically applied to both faces of the support. The dried film is then wound upon a reel for storage or further use.

This procedure is accompanied by no noticeable loss of materials since coating is performed along the entire width of the support, and no rolling up of the support lengthwise or cracking or tearing of the support along the edges, is observed. The material, also, is found to possess excellent waterproof properties and possesses an excellent degree of lasting flatness.

EXAMPLE II

The procedure of Example I is repeated except that the coating composition consists of an aqueous dispersion of a copolymer of 92% vinylidene chloride and 8% methyl methacrylate and the coating is applied at a rate of approximately 90 meters per minute, with 15 rollers spaced a distance of 0.40 m. apart being utilized. Here again there is no tendency for the film to roll up upon itself lengthwise, nor is any cracking or tearing of the support observed.

What is claimed is:

1. A process for coating a regenerated cellulose film with an aqueous composition which consists essentially of:
   (1) coating said regenerated cellulose film across the entire width of a first face with a first film-forming aqueous composition;
   (2) passing said regenerated cellulose film coated in step (1) over a supported path at a speed of from about 30 to 300 meters per minute for a period of at least three seconds, whereby the coating on said first face reaches a degree of coalescence, without drying, so that said coating will not be altered by passage of a detour roll, said supported path comprising a plurality of rollers which stretch said regenerated cellulose film in the width direction, said rollers being spaced from each other by a distance of from 30 to 70 centimeters;
   (3) passing said film from step (2) over a detour roll and thereafter coating said regenerated cellulose film across the entire width of the second face with a second film-forming aqueous composition;
   (4) passing said film from step (3) over a supported path at a speed of from about 30 to 300 meters per minute for a period of at least three seconds, whereby the coating on said second face coalesces, said supported path comprising a plurality of rollers which stretch said regenerated cellulose film in the width direction, said rollers being spaced from each other by a distance of from 30 to 70 centimeters; and
   (5) thereafter drying said regenerated cellulose film.

2. The process of claim 1 wherein said first and second film-forming aqueous compositions are the same.

3. The process of claim 2 wherein said first and second film-forming aqueous compositions comprise an aqueous solution or dispersion of a homopolymer or coplymer of vinylidene chloride.

4. The process of claim 1 wherein said first and second film-forming aqueous compositions are different.

5. The process of claim 4 wherein one of said first and second film-forming aqueous compositions comprises an aqueous solution or dispersion of a homopolymer or copolymer of vinylidene chloride.

6. The process of claim 1 wherein the distance between said rollers in steps (2) and (4) is directed proportionally to the speed of passage of said film over said supported path.

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