

Aug. 4, 1953

O. A. BATTISTA

2,647,816

METHOD OF MAKING A WOUND PACKAGE AND AFTER-TREATING THE SAME

Filed July 10, 1948

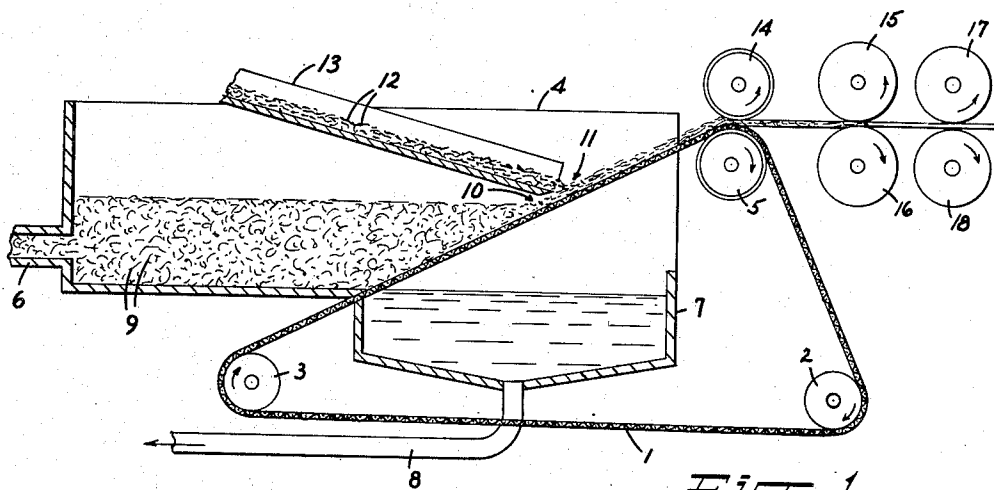


Fig. 1

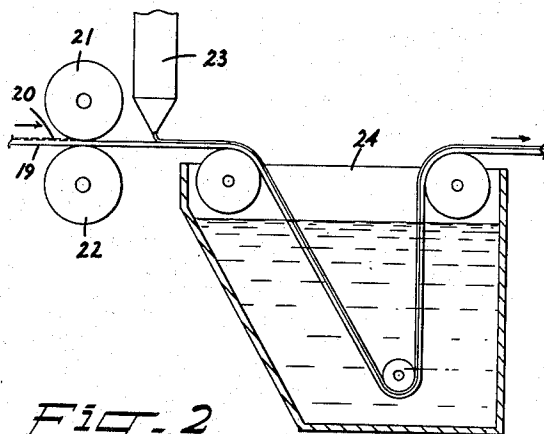


Fig. 2

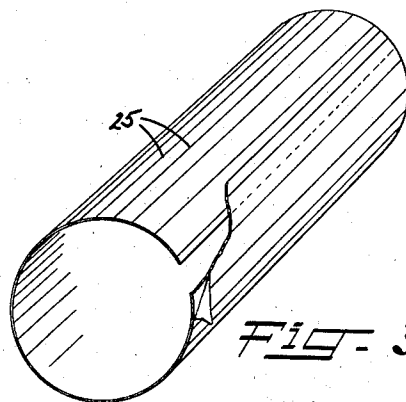


Fig. 3

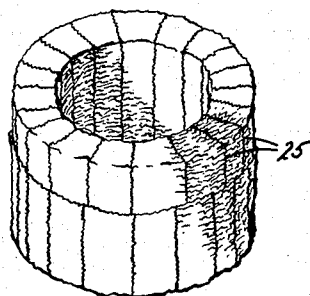


Fig. 4

Fig. 5

INVENTOR.
ORLANDO A. BATTISTA
BY

Thomas R. McElroy
ATTORNEY

UNITED STATES PATENT OFFICE

2,647,816

METHOD OF MAKING A WOUND PACKAGE
AND AFTER-TREATING THE SAMEOrlando A. Battista, Drexel Hill, Pa., assignor to
American Viscose Corporation, Wilmington,
Del., a corporation of Delaware

Application July 10, 1948, Serial No. 38,133

4 Claims. (Cl. 8-155.2)

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This invention relates to a method of handling wound packages or cakes of filamentary material comprising regenerated cellulose from viscose; and to a novel shrinkable wrapper adapted to be applied to the cakes prior to such handling.

Freshly spun regenerated cellulose from viscose is subjected to a series of after-treating liquids, including bleaching and desulfiding liquids, finally washed with water, and dried. In the conventional practice, the filamentary material proceeding from the spinning bath is collected in a centrifugal spinning bucket to form a so-called rayon cake, and is then after-treated and dried in the cake form.

The after-treated and washed regenerated cellulose is in the form of a highly swollen gel, comprising from 200% to 500% by weight of water. The moisture content of the cake is reduced to at least 7 to 12% during drying, and as the water is removed, the filamentary material shrinks, with shrinkage of the cake as a whole.

Prior to the liquid treatments, each cake is provided with a wrapper which is retained during the liquid treating and drying steps. Both fabric and paper wrappers have been proposed for this purpose.

One of the difficulties in processing the cakes has been the problem of providing them with a wrapper which will accommodate the cake while the filamentary material is in the extended water-swollen condition resulting from the liquid treatment, and then shrink with the cake as the water is removed therefrom during the drying step. When the cake draws away from the wrapper during drying, the wrapper is too loose for the dried cake and slips relatively of the cake, making it difficult to handle and tending to disturb the thread layers at the outer and inner surfaces of the cake. Additionally, the ends of the wrapper are tucked into the hollow center of the cake and when the wrapper does not shrink with the cake, the loose ends of the wrapper occupy the center of the dried cake and make it difficult for the operator to slip the cake without damaging the wrapper on perforated rods or tubes such as are used in supporting the cake during dyeing thereof in a subsequent operation.

It is a primary object of this invention to provide a wrapper for protecting wound packages of regenerated cellulose from viscose during conventional liquid after-processing, which, as a result of such liquid treatment, shrinks with the cake during the drying step and fits closely to all surfaces of the dried cake. A further object is to provide a shrinkable cover or wrapper for

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a rayon cake which is inexpensive and can be thrown away after one use without substantially increasing the cost of producing the thread. A further object is to provide a shrinkable protective wrapper which is strong enough to withstand processing conditions as well as the moderately rough handling to which the processed cake is subjected during shipment to a rewinding, twisting or other textile working device.

The objects of the invention are accomplished by providing the cakes, after collection of the filamentary material and prior to liquid processing, with a liquid-permeable protective paper-like cover or wrapper comprising fibers of a material which is not affected as such by aqueous saponifying media, and fibers of a cellulose ester, the fibers being bonded together, and the fibers in the wrapper occurring initially in a condition of potential unbalance, whereby when the wrapped package is treated with an aqueous saponifying medium to decrease the ester content of the wrapper by removal of ester groups, the cellulose ester fibers are free to shrink and draw the remaining fibers with them, to cause cockling of such remaining fibers, with shrinkage of the wrapper as a whole and acquisition of a crepe effect thereby.

The wrapper is placed on the cake, which is then subjected to the liquid after-treatments, including an aqueous saponifying medium, washed, and dried as by centrifuging or by exposure to warm air currents or the like.

The cellulose ester fibers, from which the ester groups are removed by the saponifying medium, shrink or contract when the cake is dried, and due to the condition of potential unbalance of the fibers, shrinkage of the de-esterified fibers causes the remaining fibers to cockle or buckle. Shrinkage of the wrapper occurs simultaneously with shrinkage of the cake of regenerated cellulose, during drying, and, after completion of the drying operation, the shrunk wrapper fits closely against the inner and outer peripheries of the cake.

By "condition of potential unbalance" of the fibers is meant any relation of the fibers such that the cellulose ester fibers are free to shrink and draw the remaining fibers with them. The potential unbalance may be due to the presence of a preponderance of the cellulose ester fibers; or random distribution of the fibers in the product, or it may be due to the occurrence of those fibers at or on the surface of a thin felt-like, or paper-like, base, either at localized areas of the surface, or at all portions of the surface, or both, provided that when the ester fibers occur at the

surface there is not such intermingling of the fibers that shrinkage of the cellulose ester fibers would be opposed by the tendency of the remaining fibers to resist the shrinkage.

If the wrapper comprises a thin liquid-permeable paper-like product such as a thin felt-like product formed from a mixture of the two types of fibers, such as may be obtained by commingling the fibers by any of the known methods, for example, carding, deposition from an inert fluid conveying medium, etc., in order to insure the condition of potential unbalance the cellulose ester fibers must be present in an amount of at least 25%, and in the range of 55 to 70%, if the fibers are parallelized, 25 to 70% if the fibers occur in random disposition.

If the wrapper comprises a paper or paper-like product formed from the fibers of a material which is not affected as such by the aqueous saponifying media, and the cellulose ester fibers occur at the surface only, the cellulose ester fibers must be present in an amount not less than 7% by weight, and may be present in an amount of from 7% to 50% by weight, or more.

The de-esterification of the cellulose ester fibers may be partial or complete, with partial or complete reconstitution of the cellulose.

I have found that the aqueous alkaline solutions commonly used at the desulfiding stage in the after-treatment of regenerated cellulose threads effect a sufficient decrease in the ester content of the wrapper to result in the desired shrinking and creping thereof during the drying step. The removal of the ester groups to render the wrapper shrinkable upon drying while it is in place on the cake can be effected, therefore, without modification of the conventional after-treating procedures.

The invention is illustrated in the accompanying drawing in which

Fig. 1 illustrates diagrammatically means for practicing one embodiment of the invention;

Fig. 2 illustrates means for practicing another embodiment;

Fig. 3 shows a tubular cake wrapper in accordance with one embodiment of the invention;

Fig. 4 shows an annular cake of thread having a wrapper in accordance with the invention, the cake being shown in the extended condition resulting from the liquid after-treatments, including treatment with an aqueous saponifying agent and washing, but prior to drying; and

Fig. 5 shows the cake after the drying operation, the wrapper being, as shown, creped and shrunken with the cake due to shrinkage of the de-esterified cellulose ester components.

The cellulose ester fibers may be in the form of discontinuous fibers, bundles of such fibers obtained by cutting or chopping a continuous filament yarn to the desired lengths, or a continuous filament or filament yarn may be distributed on the surface of the paper in a pattern such that the cellulose ester fibers occur locally on the paper. The term "cellulose ester fibers" as used herein is intended to include such fiber bundles as well as the fibers or filaments per se. The cellulose ester fibers may be bonded to the surface of a finished paper in any appropriate manner. If the cellulose ester is in plasticized condition, the paper on which they are distributed is heated, preferably under pressure, for example by passing it between heated calendar rolls, to convert the cellulose ester to adhesive condition and bind fibers in the product together. In another embodiment, the cellulose ester fibers are bonded to the surface of the paper by means

of a solvent for the ester, for instance, acetone, when the ester is cellulose acetate. When the cellulose ester fibers are deposited on the surface of a web of the other fibers, for example cellulose fibers, as a step in the manufacture of paper, they may be anchored to the surface by autogenous bonding of the fibers, or they may be bonded to the surface of the paper by means of a thin, continuous film of a film-forming material such as regenerated cellulose which is not itself affected by the saponifying agent used subsequently to remove ester groups.

A web of cellulose ester fibers may be deposited on the paper, either continuously or discontinuously, during the course of its manufacture, as shown in Fig. 1, which illustrates more or less diagrammatically that portion of a paper making machine located in general proximity to the head box. Referring to Fig. 1, the paper making wire screen 1 travels continuously and in the direction of the arrows under idling roll 2, around roll 3, through head box 4 and between the rollers 5 and 14. A water suspension of paper-making fibers of a material which is not affected as such by aqueous saponifying media for cellulose esters flows into the head box 4 through inlet 6, toward the continuously travelling inclined wire screen and, as the fibers reach the screen they are deposited on it, the water passing through the screen to a collector 7, and being returned to the system through the pipe 8. The fibers thus deposited on the screen are represented by fine lines 9. The sheet of paper is not completely formed until it reaches the point 10 which is the point of contact of the level of the fiber suspension with the moving screen. From point 10 the paper passes on to be finished in the usual manner.

At point 11, above the level of the fiber suspension in the head box, a suspension of cellulose ester fibers 12 in water is fed into the box, through an inclined trough 13, which may be provided with baffles if necessary. The outlet of trough 13 extends completely across the screen so that the suspension of cellulose ester fibers (indicated by the heavy lines 12) is deposited on the web across the width of the screen. The outlet end of the trough may be provided with an automatically operated trap door or the like, (not shown) to permit deposition of the suspension of plasticized cellulose ester fibers on the web of other fibers carried on the screen at spaced intervals along the web. The cellulose ester fibers are laid down on the surface of the already formed web, and occur on the surface with little penetration of the cellulose ester fibers into the web, and minimum intermingling of the two types of fibers.

The structure comprising the cellulose ester fibers is dried by passing it between heated rollers 15 and 16, and is then passed between the rollers 17 and 18 heated to the temperature at which the plasticized cellulose ester fibers are converted to a tacky adhesive condition, whereby the cellulose ester fibers are autogenously bonded to the paper fibers. The structure is then cooled, for example by subjecting it to cold air currents, to set the fibers in the bonded relation. The paper is then formed into a tube or sleeve-like member to provide the cake wrapper. The tube may be formed by overlapping the edges of the paper sheet, and subjecting the overloaded edges to heat and pressure whereby the cellulose ester fibers which occur at the edge are again activated to tacky condition, and bonded together to seal the edges. The tubular wrapper is then slipped over

the rayon cake to be after-treated, the ends of the wrapper being tucked into the hollow center of the cake, and the wrapped cake is treated with the after-treating liquids, including an aqueous saponifying medium, which may also be a desulfiding medium for the thread, such as an aqueous solution of about 6.0% sodium sulfide and 0.5% sodium carbonate, finally washed, and dried, as by centrifuging followed by exposure to circulating warm air currents.

As an example, when the wrapped filamentary material is desulfided using the solution of sodium sulfide and sodium carbonate mentioned above, at a temperature of 40–45° C. for one-half hour, and the paper cake wrapper comprises 20% of cellulose acetate fibers, the percent combined acetic acid in the cellulose acetate component of the wrapper drops from 54 to 30%, and the wrapper shrinks correspondingly during the drying step, with the development of crepe effects.

If unplasticized cellulose ester fibers are laid down on the web carried by the travelling wire screen of the paper-making machine, they may be bonded to the surface by spraying or otherwise treating the paper with a solvent, or the paper may be provided with a thin film of a film-forming material, preferably regenerated cellulose, which will anchor the cellulose ester fibers to the paper. Means for practicing this embodiment of the invention is illustrated diagrammatically in Fig. 2, only a portion of the apparatus being illustrated, and the web 19 carrying the cellulose ester fibers 20 being shown as it passes from the travelling wire screen of Fig. 1. As an illustrative example, the structure carried by the screen may comprise 80% by weight of cellulose fibers and 20% by weight of cellulose acetate fibers, the ester fibers being in the form of bundles obtained by cutting or chopping 300 denier/80 filament cellulose acetate yarns having a twist of 2½ turns per inch. The structure is dried by passing it between the heated calender rolls 21 and 22 which also serve to press the cellulose ester fibers against the web consisting of the other fibers. An aqueous solution of viscose of from 2 to 5% concentration is extruded onto the surface of the web carrying the ester fibers through the extrusion device 23, after which the product is passed through the vessel 24 containing an aqueous sulfuric acid coagulating and regenerating bath which regenerates the cellulose. After drying the paper carrying the cellulose ester fibers and regenerated cellulose film in any suitable manner, a suitable length of the paper is formed into a tube and sealed along its edges. For example, one edge may be brushed with a solution of cellulose acetate in acetone, and lapped over the other edge, the acetone evaporated, and the overlapped edges subjected to heat and pressure to seal them together.

A tubular cake wrapper in accordance with the invention is shown in Fig. 3, the cellulose ester fibers being in the form of bundles or yarn lengths distributed on the surface of the wrapper in a series of parallel strips or ribs 25. It will be understood that the cellulose ester fibers may occur at all portions of the surface of the paper base, the proportion of cellulose ester fibers being not less than 7% by weight. The upper limit for the cellulose ester fibers is not critical, but generally those fibers are used in an amount in the range of 7% up to 50%.

As shown in Fig. 4, the tubular paper wrapper is placed over the cake. When the cake is after-treated by liquids including an aqueous saponifying medium for the cellulose ester, the

ester groups are removed, and the wrapper shrinks with the cake during the drying step. As shown in Fig. 5, the wrapper which fitted closely to the water-expanded liquid treated cake of Fig. 4, also fits closely against the surfaces of the dried and shrunken cake.

Examples of the cellulose ester fibers which may be used, in plasticized or unplasticized condition, are fibers of cellulose acetate, cellulose propionate, cellulose butyrate, and mixed cellulose esters such as cellulose acetate-butyrate.

Fibers of a material which is not affected as such by the saponifying medium, and suitable for making the paper are natural fibers such as wood, cotton, hemp, linen, abaca, or synthetic fibers such as regenerated cellulose fibers obtainable from viscose or cuprammonium. Such fibers may be of regular paper-making length or they may be longer than normal paper-making length.

Generally, the alkaline desulfiding liquid which is also a saponifying agent for the cellulose ester comprises an aqueous solution of sodium sulfide which may or may not contain a small amount of other alkaline agents such as, for instance, sodium carbonate. However, other saponifying agents may be used, if desired, and it is within the scope of the invention to treat the wrapped cake with a saponifying medium, at a stage separate from the desulfiding treatment, and prior to the final washing step.

If desired or necessary, the paper wrapper may be provided with a multiplicity of minute holes for increasing the porosity of the wrapper, prior to placing it over the thread cake.

The cellulose ester fibers may be activated by heat or the solvent to the point where they flow to form a film which is adhered to the surface of the paper, but preferably the fibers remain in essentially fibrous form in the wrapper. However, after the drying step, neither type of fiber occurs in its original condition, the de-esterified cellulose ester fibers being shrunken, with cockling of the remaining fibers to produce the creped effect.

The bonds between the fibers obtained by converting the cellulose ester fibers to adhesive condition by heating and then cooling the product to set the fibers in the bonded relation are not disturbed by the after-treating liquids. The fibers remain fixed in the bonded condition throughout the after-treatments and the drying step. The dried wrapper in which the fibers are unified by coalescence, i. e. by cellulose bonds, exhibits good tenacity and the dry wrapped cake can be handled without tearing of the wrapper. Since the wrapper shrinks with the cake, it can not slip relatively of the cake after the drying, and this facilitates handling of the cake and prevents damage to the exposed layers of the cake due to brushing of the wrapper thereagainst. Since the wrapper fits closely against both the inner and outer peripheries of the cake, the center of the cakes is left free to receive the rods or the like on which the wrapped cakes are supported for subsequent processing such as dyeing.

By a "liquid permeable" paper-like cover or wrapper as used herein, is meant any permeable sheet material such as paper or thin felt-like products having good wet strength and of sufficient thinness and flexibility to be readily conformed generally to both the inside and outside peripheral surfaces of an annular thread or yarn package.

The above description and examples are intended to be illustrative only, and not to limit the scope of the invention. Any departure there-

from which conforms to the spirit of the invention is intended to be included within the scope of the appended claims.

I claim:

1. The method comprising distributing from 5
about 20 to 50% by weight of cellulose ester fibers
on a surface of an unperforated and unslitted
sheet of liquid-permeable paper formed from
cellulose fibers, said ester fibers being distributed
only at spaced portions of the sheet, rendering 10
the cellulose ester fibers adhesive and subjecting
the sheet to pressure to obtain a sheet in which
the ester fibers are autogenously bonded to the
cellulose fibers, wrapping the unperforated sheet
about all surfaces of an annular package of re- 15
generated cellulose filamentary material freshly
prepared from viscose, treating the wrapped
package with aqueous after-treating liquids in-
cluding an aqueous alkaline solution which is a
desulfiding agent for the filamentary material 20
and a saponifying agent for the cellulose ester
to simultaneously desulfide the filamentary ma-
terial and at least partially de-esterify the ester,
finally washing the wrapped package, and there-
after heating all portions of the wrapped package 25
to thereby (1) dry the filamentary material with
shrinkage of the filamentary package and (2)
shrink the sheet of bonded cellulose fibers and
de-esterified cellulose ester fibers with the pack-
age.

2. The method of claim 1 in which the fibers

distributed on the sheet of cellulose fibers are
cellulose acetate fibers and they are distributed
in spaced parallel strips.

3. The method of claim 1 in which the desul-
fiding agent is an aqueous solution of sodium
sulfide.

4. The method of claim 1 in which the desul-
fiding agent is an aqueous solution of sodium
sulfide and sodium carbonate.

ORLANDO A. BATTISTA.

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