

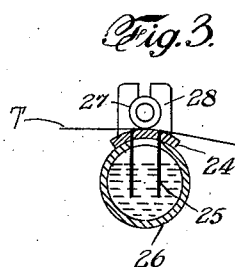
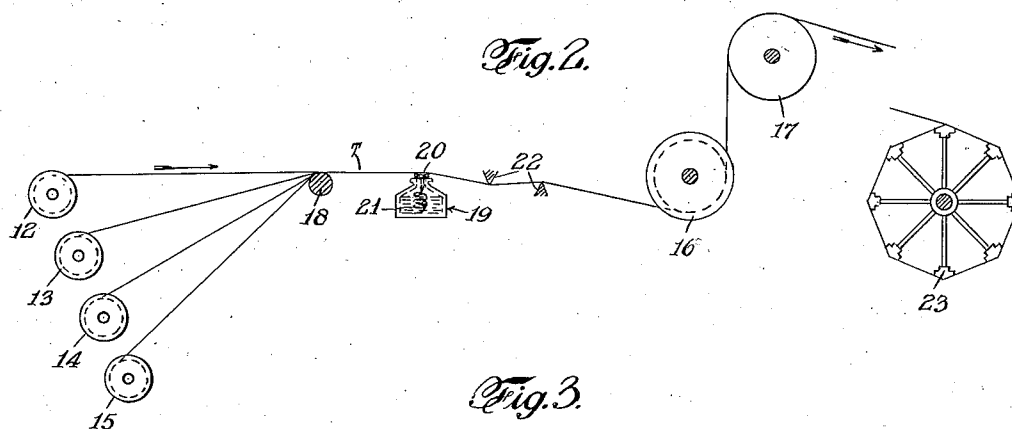
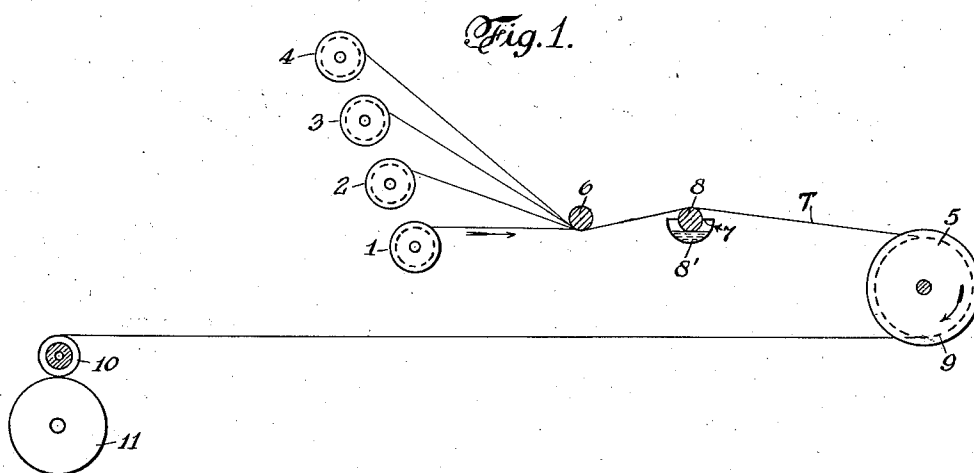
Sept. 22, 1936.

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2,054,786

METHOD AND APPARATUS FOR PREPARING ARTIFICIAL MATERIALS

Filed May 3, 1933



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UNITED STATES PATENT OFFICE

2,054,786

METHOD AND APPARATUS FOR PREPARING
ARTIFICIAL MATERIALS

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Application May 3, 1933, Serial No. 669,103
In France June 3, 1932

7 Claims. (Cl. 18—8)

This invention relates to the manufacture of artificial straws, tapes, bands, ribbons, horsehair and the like, at a rapid rate and without the usual degradation of the material. More particularly, this invention relates to a method and apparatus for producing materials of the type mentioned under such conditions that no undue stretch will be imparted thereto.

Prior to the instant invention various processes had been devised and used for the manufacture of artificial straws, tapes, bands, ribbons, horsehair and the like from filaments or threads formed of a cellulose derivative, such as, for example, cellulose acetate. According to these processes, a plurality of filaments or threads was rendered plastic or swollen by means of a solvent or swelling agent of the material constituting the thread, and the filaments or threads united into the shape of the desired final product by being glued together, either completely or partially. Usually pressure was applied directly to the component elements after they had been glued to each other.

Generally, in such procedures, the filaments, either individually or a plurality thereof, were passed over or into a suitable moistening or impregnating device, whereby the swelling agent or solvent was applied. Subsequently, the moistened materials were passed over a wringing device and, when a lamé was desired, between the surfaces of a device which applied pressure on the band of threads, whereby they were made to adhere. Finally, the threads, after drying, were wound on a suitable collecting device.

The means for conveying the filaments through the apparatus was disposed at such a position that it drew the threads, while in a softened or swollen state, for a considerable distance throughout the apparatus. This arrangement imposed a considerable tension on the filaments or threads, the tension depending to a great extent upon the resistances offered by the coating, flattening and/or wiping devices. Since the thread was under tension at a time when it was softened and acquired the maximum state of plasticity, the filaments would be broken if the tension were excessive. On the other hand, if the tension did not exceed the breaking point of the material, then the filaments were stretched.

Also, in a number of prior art procedures, the filaments were deliberately stretched prior to the collection on the receiving device. This was secured by regulating the speed of the conveying of the thread and the speed of the receiving device

on which the thread was collected or of the device conveying the finished material.

Recently, there has been devised a process of manufacturing materials of the type hereinbefore mentioned, whereby only the filaments on the exterior of the material were united or glued together. This was secured by passing a band or bundle of filaments or threads at a relatively high speed in contact with a solvent or swelling agent in such a manner that the latter could not penetrate and cause the filaments on the interior to adhere together. Such a process was advantageous because due to the high speed of operation, economical production of the desired material could be secured. When, however, this process was carried out in an apparatus, such as that briefly hereinbefore described, the disadvantages of such apparatus were present.

A thorough study of the phenomenon involved in processes of the type previously desired has shown that the filaments, after treatment with the swelling agent or solvent, are moistened and the swelling or plastification of the material does not take place until after a certain interval of time. In other words, the solvent or swelling agent does not immediately swell or render the cellulose ester constituting the threads or filaments plastic, but that this occurs after a certain period of time.

I have found that, contrary to the usual arrangement of the apparatus employed in the manufacture of materials to which this invention relates, by positioning the conveying or drawing mechanism in a zone relative to the solvent-applying mechanism where the threads are wetted or moistened with the solvent or swelling agent but have not yet been swollen or rendered plastic thereby, and, after the threads or filaments have been swollen or rendered plastic, conveying them under conditions which impose no undue tension and therefore impart no substantial stretch thereto, I can provide a method and apparatus which eliminates the above-mentioned disadvantages of the prior art and produce a material without the usual degradation.

It is therefore an object of this invention to provide a method of producing artificial straws, tapes, ribbons, horsehair or the like, which comprises conveying or drawing a plurality of artificial filaments or threads formed of a cellulose derivative through a system before they have been swollen or rendered plastic and, after they have been swollen or rendered plastic, conveying the assembled component elements under conditions wherein no undue tension is applied, where-

by the product has no undue stretch imparted thereto.

Another object of this invention is to provide a method of making materials of the class mentioned which comprises applying a solvent or swelling agent to a plurality of artificial threads or filaments and conveying said threads or filaments from said applying means for a distance or interval of time insufficient for the solvent or swelling agent to render the material plastic, uniting the materials, removing the solvent or swelling agent, and winding the material on a suitable collection device, the last three operations being carried out under substantially no undue tension on the material, whereby substantially no stretch is imparted thereto.

An additional object of this invention is to provide an apparatus for carrying out the above-mentioned method which comprises means to apply a solvent or swelling agent to a plurality of artificial threads or filaments formed of a cellulose derivative, means to draw said filaments or threads from the source of supply through the applying means and away therefrom for a distance or time insufficient to permit the solvent or swelling agent to act on said threads or filaments, and means to convey the assembled filaments or threads after they have been swollen or rendered plastic under no undue tension, whereby no substantial stretch is imparted thereto.

A further object of this invention is to provide an apparatus as set forth in the preceding paragraph wherein the drawing mechanism constitutes a channeled roller which, in addition to effecting the functions already mentioned, also serves to assemble the plurality of threads or filaments into the shape desired.

Other objects will become apparent from the following description, appended claims and accompanying drawing wherein:

Figures 1 and 2 designate diagrammatically several different forms of apparatus which may be employed in accordance with the principles of this invention; and

Figure 3 illustrates in section a modified form of an applying means.

In accordance with the principles of the instant invention, a plurality of artificial threads or filaments is drawn from a suitable source of supply and treated with a modifying agent, such as a solvent or swelling agent of the material constituting the threads or filaments. The drawing means is disposed in a zone relative to said applying mechanism and conveys the filaments or threads moistened with the modifying agent for a distance or period of time which is insufficient for the modifying agent to render the filaments or threads swollen or plastic. After the filaments or threads have become swollen, plastic or adherent, they are conveyed under such conditions as do not impose any undue tension thereon, whereby the stretch is reduced to a minimum. While the filaments and threads are thus conveyed, they are caused to unite and, after the solvent has been substantially eliminated, the material is wound on to a suitable collection device.

The drawing or conveying mechanism may be composed of one or two rollers, one or both of which may be provided in the peripheral surface thereof with a channel or groove having the form and shape of the desired material. For example, the rollers may be provided with a narrow V- or U-shaped channel or opening or a groove of substantially rectangular shape corre-

sponding to the width and/or thickness of the product to be obtained.

It is apparent that, since these rollers constitute the means for conveying the materials from the source of supply and through the applying mechanism, they are positively driven.

These rollers, as indicated above, are disposed intermediate the applying mechanism and winding roller. They are positioned at such a distance from the applying mechanism that, in the course of operation, the threads or filaments conveyed from the applying mechanism are merely moistened with the solvent or swelling agent and which has not yet rendered the materials plastic. The optimum position of the conveying or drawing elements in any system must be chosen in accordance with the nature of the filaments, solvents or swelling agents used, and the speed of operation in such a way that the softening or gluing takes place substantially after the moistened materials leave this element. In such an arrangement the moistened material does not adhere to the drawing roller.

The modifying agent, i. e. solvent or softener, may be applied by spraying or immersing the filaments or threads in any suitable immersion apparatus or by passing them over rollers, rods, wicks or other devices moistened with the desired substance.

As the modifying agent, i. e. solvent or swelling agent, any suitable material may be used which does not immediately, upon application thereof to the threads or filaments, swell or soften the same. A composition comprising 90% of acetone and 10% of ethyl alcohol has given satisfactory results with, for example, cellulose acetate materials.

Referring now to the drawing and particularly Figure 1, the reference numerals 1, 2, 3 and 4 designate a plurality of flanged bobbins or spools containing the filaments or threads T to be united into the desired product. If desired, a suitable braking mechanism (not shown) may be used in conjunction with these bobbins in order to govern the tension of the thread withdrawn therefrom. The artificial threads or filaments T are withdrawn from the bobbins 1-4 by means of the roller 5 which is positively driven in any suitable manner. After withdrawing the filaments or threads T from the spools and bobbins 1-4, they are passed to a suitable guide 6 and thence to the solvent-applying mechanism 7. The guide 6 may serve to bundle the threads or filaments T together and, together with the roller 5, are so positioned relative to the applying mechanism 7 that the threads or filaments are caused to contact with the applying element.

In this embodiment, the applying mechanism 7 constitutes a roller 8, with or without a suitable cover, rotating in a receptacle 8' containing the desired material. The applying element 8 may be positively driven, the direction of rotation being the same or opposite to the direction of movement of the materials, or it may be loosely mounted and rotated by movement of the thread T thereover.

The roller 5 is disposed at such a distance from the applying mechanism 7 that in the course of operation the threads T contacting therewith are merely moistened with the material and have not yet been softened, plasticized or swollen. In this embodiment, the roller 5 is provided with an annular groove 9 of the shape and size desired in the final product, and thus it serves to bring the moistened threads into the desired

shape. After leaving the roller 5, the assembled materials become swollen and plastic and they are united in the form given them by the groove 9. The solvents are then eliminated in any suitable manner as, for example, by a suitable passage in air or through a heated tube (not shown). Finally, the material is wound on to the bobbin 10 which in the form shown is frictionally driven by the element 11.

The peripheral speed of the bobbin 10 and the drawing device 5 are so regulated that the thread passing therebetween is subjected to no undue tension, with the result that the material wound on the bobbin is not stretched to any undue degree. It is also apparent that, while the filaments are in the swollen or plastic state, substantially no stretching thereof is effected.

Instead of using a single drawing roller, a plurality of such rollers may be used. When a plurality of such rollers is used, either one or both of them may be channeled to impart the desired shape to the materials under treatment. It is, of course, understood that in accordance with the principles of this invention, both of these rollers are so disposed relative to the applying mechanism that the materials contacting therewith are merely moistened with the solvent or swelling agent and have not yet become swollen, plasticized or softened.

Referring now to Figure 2, wherein a modification utilizing two rollers is disclosed, the reference numerals 12, 13, 14 and 15 designate spools of the material T and constitute a source of supply for this apparatus. From the source of supply, the threads T are withdrawn by the positively driven rollers 16 and 17 and caused to pass over a guide 18 and thence across the solvent-applying mechanism 19.

In this form the solvent-applying mechanism comprises a wick 20 suspended in a receptacle 21 containing the desired solvent or swelling agent. As the materials are drawn from the wick, they may be passed between one or more wipers 22, designed to eliminate the excess solvent or swelling agent, and thence to rollers 16 and 17. The constituent materials, after leaving the roller 17, are caused to unite and the solvent removed as described in the preceding modification. The material is then wound on a reel 23, the peripheral speed of which is adjusted relative to the peripheral speed of the roller 17 so that no undue tension is imparted to the thread.

The rollers 16 and 17 are positively driven at the same peripheral speed or at speeds slightly different from one another.

It is to be noted that these rollers in Figure 2 are shown as one above the other. This is not necessary or essential for the successful practice of this invention. The rollers may be disposed and positioned in the same horizontal plane or otherwise as desired.

Referring now to Figure 3, there is illustrated another form of solvent-applying mechanism. It comprises a pervious and preferably absorbent material 24 supplied with the solvent by means of capillary action through a wick 25 suspended in a vessel 26 in which the liquid is maintained at a constant level by mechanism well known in the art. A freely mounted roller 27 in a bearing 28 serves to maintain the threads or filaments in contact with the applying mechanism.

It is apparent that the apparatus above described may be used with any number of threads, depending on the product desired. Likewise, the apparatus may be employed to produce materials

wherein the threads on the exterior surface are only united or wherein all the threads are united.

In order to more clearly define the nature of the invention, the following specific procedures are set forth. It is to be understood that the process described in these examples may be carried out in any of the apparatus previously described, and that the invention is not restricted to the precise details set forth therein.

Example I.—A 300 denier, 48 filaments, 150 twist acetate thread wound on a bobbin is unwound therefrom at a linear speed of 250 m. per minute. It is moistened by means of any coating or wetting apparatus with a mixture composed of 90% acetone and 10% ethyl alcohol.

A conveying device composed of a roller with a narrow and not very deep groove is placed at a distance of from 10 cm. to 1 m. from the coating apparatus. In this region the filaments are not as yet glued together and are, by virtue of the groove, made to assume the shape which they are subsequently to have in the horsehair.

On leaving the roller, the horsehair traverses a certain distance, either in the free air or in a pipe, whereby solvent recovery is facilitated, and then wound on a receiving device (bobbin or reel) which revolves at such a speed that there is no appreciable tension between the receiving apparatus and the conveying apparatus.

Example II.—Eight 300 denier, 24 filaments, cellulose acetate threads, without tension, wound on flanged bobbins are unwound together at a speed of 150 m. per minute and, after being combined into a band of any width, are passed over an apparatus whereby they are given an acetone coating.

The conveying apparatus, which may be placed at a distance of 20 to 50 cm. from the coating device, is composed of two parallel cylinders over which the band is wound successively, each of these cylinders or only the second having the groove of a practically rectangular cross-section, of 5.5 mm. width and $\frac{1}{2}$ mm. depth. After these two rollers, the lamé thus formed passes through the free air until it is practically dry and is then wound on a reel revolving at such a speed that there is the least possible tension between this drum and the conveying rollers. This gives a very regular lamé of 4 mm. thickness which has not been stretched.

Since it is obvious that various modifications may be made in the above details without departing from the nature or spirit thereof, this invention is not restricted thereto except as set forth in the appended claims.

I claim:

1. A method of making artificial horsehair, straws, tapes, bands, ribbons and the like which comprises applying a modifying agent to a plurality of artificial filaments formed of a cellulose derivative, conveying the filaments moistened with the modifying agent for a time insufficient to permit the modifying agent to soften or swell said filaments, uniting said filaments, and conveying the filaments, after the modifying agent acted thereon and while said filaments are in the swollen and plastic state, under such conditions that substantially no stretch is imparted thereto.

2. In a method of making artificial horsehair, straws, tapes, bands, ribbons and the like, the steps which comprise treating a plurality of artificial filaments with a modifying agent, uniting said filaments after they have been swollen or rendered plastic, conveying said filaments after they have been swollen or rendered plastic and

while said filaments are in the swollen and plastic state under conditions imposing substantially no tension thereon whereby substantially no stretch is imparted thereto, and winding the united filaments under conditions whereby substantially no stretch is imparted thereto.

3. A method of making artificial horsehair, straws, tapes, bands, ribbons and the like which comprises applying a modifying agent to a plurality of artificial filaments formed of a cellulose derivative, conveying the filaments moistened with the modifying agent for a time insufficient to permit the modifying agent to soften or swell said filaments, arranging said filaments in the desired shape prior to the softening or swelling thereof, uniting said filaments after they have been swollen or rendered plastic, conveying the filaments, after the modifying agent acted thereon and while said filaments are in the swollen and plastic state, under such conditions that substantially no stretch is imparted thereto, and winding the united filaments under conditions whereby substantially no stretch is imparted thereto.

4. An apparatus for making artificial horsehair, straws, tapes, bands, ribbons and the like comprising means to apply a solvent or swelling agent to a plurality of artificial filaments or threads formed of a cellulose derivative, a positively driven roller having a channel in its peripheral surface through which the treated filaments or threads pass, said roller being disposed at such a distance from the applying means that it will convey the treated filaments or threads before they have become plastic or swollen, and means cooperating with said roller to convey the threads or filaments, after they have become plastic or swollen and while said filaments are in the swollen and plastic state, under conditions imposing no undue tension on said threads or filaments.

5. An apparatus for making artificial horsehair, straws, tapes, bands, ribbons and the like comprising means to apply a solvent or swelling agent to a plurality of artificial filaments or threads formed of a cellulose derivative, a positively driven roller having a channel in its peripheral surface through which the treated filaments or threads pass, said roller being disposed at such a distance from the applying means that it will

convey the treated filaments or threads before they have become plastic or swollen, said roller also serving to convey said filaments or threads from a source of supply and through the applying means, and means cooperating with said roller to convey the threads or filaments, after they have become plastic or swollen and while said filaments are in the swollen and plastic state, under conditions imposing no undue tension on said threads or filaments.

6. An apparatus for making artificial horsehair, straws, tapes, bands, ribbons and the like comprising means to apply a solvent or swelling agent to a plurality of artificial filaments or threads formed of a cellulose derivative, a positively driven roller having a channel in its peripheral surface through which the treated filaments or threads pass, said roller being disposed at such a distance from the applying means that it will convey the treated filaments or threads before they have become plastic or swollen, means cooperating with said roller to convey the threads or filaments, after they have become plastic or swollen and while said filaments are in the swollen and plastic state, under conditions imposing no undue tension on said threads or filaments, and means to wind the united filaments without stretching the same.

7. An apparatus for making artificial horsehair, straws, tapes, bands, ribbons and the like comprising means to apply a solvent or swelling agent to a plurality of artificial filaments or threads formed of a cellulose derivative, a positively driven roller having a channel in its peripheral surface through which the treated filaments or threads pass, said roller being disposed at such a distance from the applying means that it will convey the treated filaments or threads before they have become plastic or swollen, said roller also serving to convey said filaments or threads from a source of supply and through the applying means, means cooperating with said roller to convey the threads or filaments, after they have become plastic or swollen and while said filaments are in the swollen and plastic state, under conditions imposing no undue tension on said threads or filaments, and means to wind the united filaments without stretching the same.

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