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WEFTLESS RIBBON

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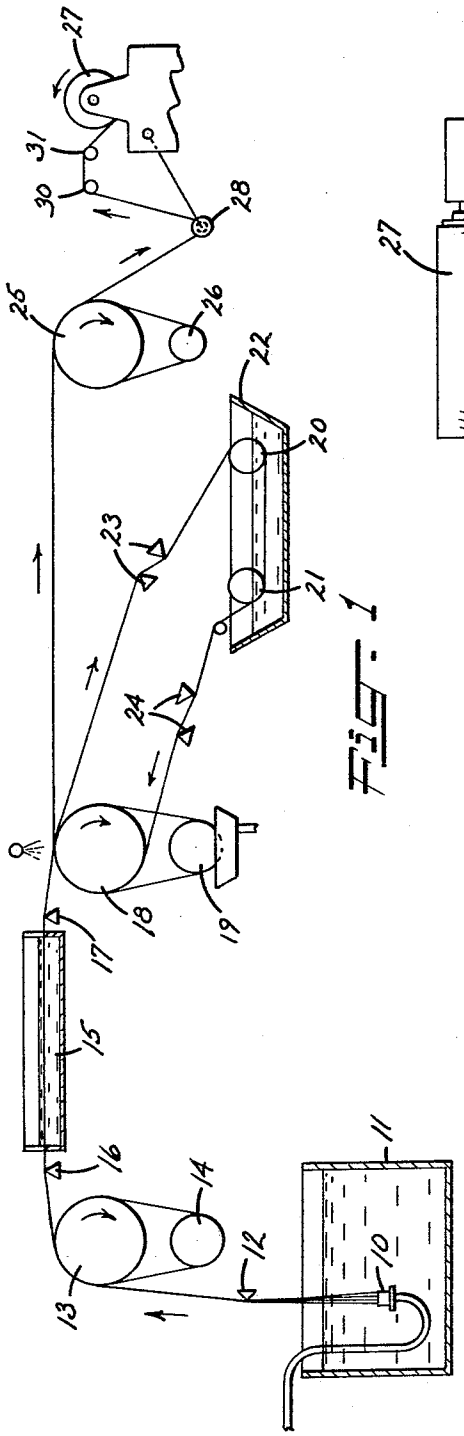



FIG. 1

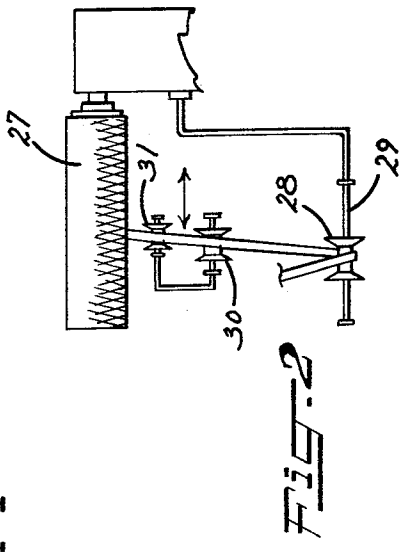



FIG. 2

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3,052,584

# WEFTLESS RIBBON

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This invention relates to weftless ribbons or tapes and more particularly to an improved method of making such a ribbon.

Weftless tapes or ribbons have been used extensively for many years by florists, candy makers and others for tying dainty packages and more recently have found use as a tear tape for corrugated and other heavy paper cartons and have also been employed for reinforcement in corrugated boxes and the like. Generally speaking, ribbons or tapes of this type have been made by arranging a plurality of cotton or other spun threads in side-by-side relationship and securing the same together by means of a suitable adhesive. Weftless ribbons have also been made of continuous synthetic or artificial filaments by flattening a small tow or bundle of filaments and securing the filaments together by means of an adhesive composition.

Particularly when making ribbons from tows of continuous filaments, there has been difficulty in adhering the individual filaments together sufficiently that the integrity of the ribbon is maintained during use. Such ribbons contain several thousand individual filaments and so far as applicant is aware, have always been made from a completely processed and dried tow. That is to say, the adhesive has been applied to the tow after the tow was completely manufactured. Not only has this entailed a separate adhesive applying operation but because of the slippery nature of the filaments and the closely compacted arrangement thereof there has generally been insufficient bonding between individual filaments.

The present invention is directed to the manufacture of weftless ribbon or tape formed of continuous synthetic or artificial filaments and aims to provide a more economical method of manufacture and a method which results in a superior product. Broadly, the method is applicable for use with any of those types of filaments which may be or are customarily wet spun, such as viscose rayon, cuprammonium rayon, acrylics, cellulose ethers and esters, and the like. Generally, the method comprises extruding a spinning solution into a spin bath to form a large multiplicity of filaments, gathering the filaments into a tow, flattening the tow by drawing it over flat guides, applying an adhesive composition to the flattened tow while the filaments are still in a so-called wet gel state and, finally, drying the thus formed ribbon and winding the same into a suitable package.

Accordingly, it is an object of the present invention to provide a new and more economical method of making weftless tapes or ribbons.

Another object of the invention is to provide a method of making weftless ribbons which results in a product having superior qualities.

A more specific object is to provide a method of making weftless ribbons of artificial filaments, which method is continuous from initial spinning of the filaments to wind-up of the completed ribbon.

Other and further objects, features and advantages of the invention will become apparent as a detailed description thereof proceeds.

Referring now to the drawing:

FIGURE 1 is a diagrammatic representation of one form of apparatus which may be employed for practicing the invention; and



FIGURE 2 is a schematic showing of a mechanism for winding the finished ribbon into a package.

A spinning solution, which may be a conventional viscose solution used in the manufacture of viscose rayon, is extruded through a spinneret **10** into a conventional acid spin bath **11**. Preferably, the spinneret contains a relatively large number of orifices, say between three and four thousand, so as to form a corresponding number of low denier filaments which are gathered together into a tow either within the bath **11** or shortly after they emerge therefrom. A flat guide **12** bears against the side of the tow so as to flatten the same as it passes between the surface of the bath and a pair of godets **13** and **14**. From the godet **13** the tow is pulled or drawn through one or more after-treatment baths **15**. In the case of viscose rayon filaments, the after-treatment baths include the conventional acid regenerating bath and may also include additional baths such as the usual bleaching and desulfurizing baths. Flat guides **16** and **17** are located at either end of the bath **15** so as to maintain the tow in a flat condition as it passes through the bath. From the guide **17** the tow passes in a helical path about a pair of wash drums **18** and **19** and during its passage around the wash drums it is treated with plain water to wash out the excess acid, as is conventional in the manufacture of viscose rayon. Preferably the tow is stretched between the godets **13**, **14** and the wash drums **18**, **19**.

From wash drum **18** the tow is led beneath a pair of rollers **20** and **21** located beneath the surface of an adhesive composition contained in a trough **22**. Before entering the trough the tow passes over and under a pair of flat stripper guides **23** which remove excess water. From roller **21** the tow passes between a pair of flat stripper guides **24** which remove excess adhesive and from these latter stripper guides the tow is redirected for one turn about wash drum **18**, this one turn of course being beyond that portion of the drum to which the wash water is applied.

After its final single turn about wash drum **18** the tow, the filaments of which are now adhered together to form a flat tape, passes about a pair of dryer drums **25** and **26**. The tape or ribbon moves in a helical path about and along dryer drums **25** and **26** for a sufficient period of time to not only remove most of the water but to cure or set the adhesive. After a sufficient residence time on the dryer drums the tape is led to a winding mechanism **27** where it is wound into a package, care being exercised to wind the ribbon in such manner that it retains its flat form and does not become twisted upon itself.

In order to insure that the tape does not become twisted during winding, the usual dancer roll **28** (which regulates the winding tension) is freely slidable axially along its mounting shaft **29**, as indicated in FIGURE 2, and the tape, after passing around roll **28** passes over another axially slidable guide pulley **30** located near the usual traversing guide roller **31**. Rollers **28**, **30** and **31** all have cylindrical guiding portions of substantially the same width as the tape and flanges which slope outwardly from the cylindrical surfaces, as indicated in FIGURE 2. The axial sliding movement of rollers **28** and **30** permits the path of the tape to move gently from side to side as the traversing guide moves across the core on which the tape is being wound to thus prevent the tape from twisting on itself. However, this particular guiding arrangement is not essential for practicing the invention and it is to be understood that any suitable guiding system may be used which will result in a package wherein the tape is flat and not twisted upon itself.

While the composition of the adhesive should, of course, be selected in accordance with the types of filaments used for making the ribbon, a suitable adhesive for use with

viscose rayon filaments has been found to be an aqueous composition containing as the active ingredients:

Polyvinyl alcohol, 8–9%
Butyl stearate, 1.5%
Ethylene oxide modified glycerol monostearate, 1.5%
Acetyl tributyl citrate, 10% (based on the weight of the polyvinyl alcohol)

In practicing the present invention, the time of applying the adhesive composition is more important than the formulation of the composition. Thus it is essential that the adhesive be applied while the filaments are still in the so-called wet state, that is, before initial drying. When the filaments are in the wet gel state they are very considerably swollen and are capable of accepting and even being impregnated to a certain extent by the adhesive composition. After drying it is not possible to return the filaments to the wet gel state. They can of course be caused to swell to a certain extent by soaking in water but they can never be returned to the soft, swollen, infantile state which exists prior to initial drying.

Preferably, the spinneret has a circular pattern of holes and preferably also the pattern is rather compact, for example, a 5500 denier tow may be spun with a spinneret having 3000 orifices arranged within a ¾" diameter circle. It is also possible to spin a suitable tow using two closely adjacent spinnerets each having approximately 2000 orifices arranged in a compact circular pattern. It is desirable for all filaments to emanate from closely spaced positions in order that each filament will be under substantially the same tension during the entire process and will otherwise be subjected to equal treatment. This assures a ribbon or tape wherein the elements are uniform.

While the tow is stretched between the godet pair **13**, **14** and the wash drums to increase the tenacity of the filaments and decrease the elongation of the finished product, the ribbon is permitted to relax to a controlled extent between stripper guides **24** and the dryer drum **25**. The amount of relaxation or the tension on the ribbon as it



passes between the aqueous adhesive bath and the dryer drums determines to a certain extent the degree of compactness of the filaments and thus by controlling the tension at this point in the operation the width and thickness of the ribbon may be regulated. Thus the dimensions of the final product are dependent not only on the total number of filaments and denier of the filament but also upon the degree of compactness of the filaments. Optimum condition of tension, number of filaments and denier for different size ribbons may best be determined empirically and the present invention is applicable to ribbons of various sizes and of various kinds of wet spun filaments.

Having thus described the invention, what is claimed is:

I claim:

1. The method of making a rayon weftless ribbon comprising extruding a viscose spinning solution through a multiplicity of orifices into a coagulating bath to form a multiplicity of continuous filaments, gathering said filaments into a bundle and drawing the same over a flat guide to form a flat tow, drawing the flat tow through an acid regenerating bath, washing the tow while flat and under tension, drawing the tow over flat guides and through an adhesive composition while the filaments are still in a wet gel state whereby the filaments are adhered together to form a ribbon, stripping excess adhesive from the ribbon, drawing the flat ribbon over a flat guide and drying the same, and winding the thus formed ribbon into a package in such a way that it does not become twisted upon itself.

2. The method set forth in claim 1 including the step of stretching the tow while it is being pulled through the regenerating bath.

3. The method set forth in claim 2 wherein the ribbon is allowed to relax to a controlled extent between the application of the adhesive and the drying thereof.

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