United States Patent [19]

Plaskett

[11] **3,903,575**

[45] **Sept. 9, 1975**

[5] **METHOD AND APPARATUS FOR MAKING REORIENTED REINFORCING LAYER FOR MULTI-PLY PRODUCTS**

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[22] Filed: **July 5, 1972**

[21] Appl. No.: **269,116**

[52] **U.S. Cl.** **29/2.25**; 29/2.15; 29/2.17; 156/191; 156/193; 156/426; 226/1; 226/172; 226/197; 156/259

[51] **Int. Cl.**[2] **B65H 23/32**; B65H 23/30

[58] **Field of Search** ..... 156/171, 174, 177, 184, 156/191, 193, 195, 271, 426, 427, 428, 254; 242/56 R, 56 A, 67.3 R; 226/1, 172, 197; 29/2.25, 2.15, 2.17

[56] **References Cited**

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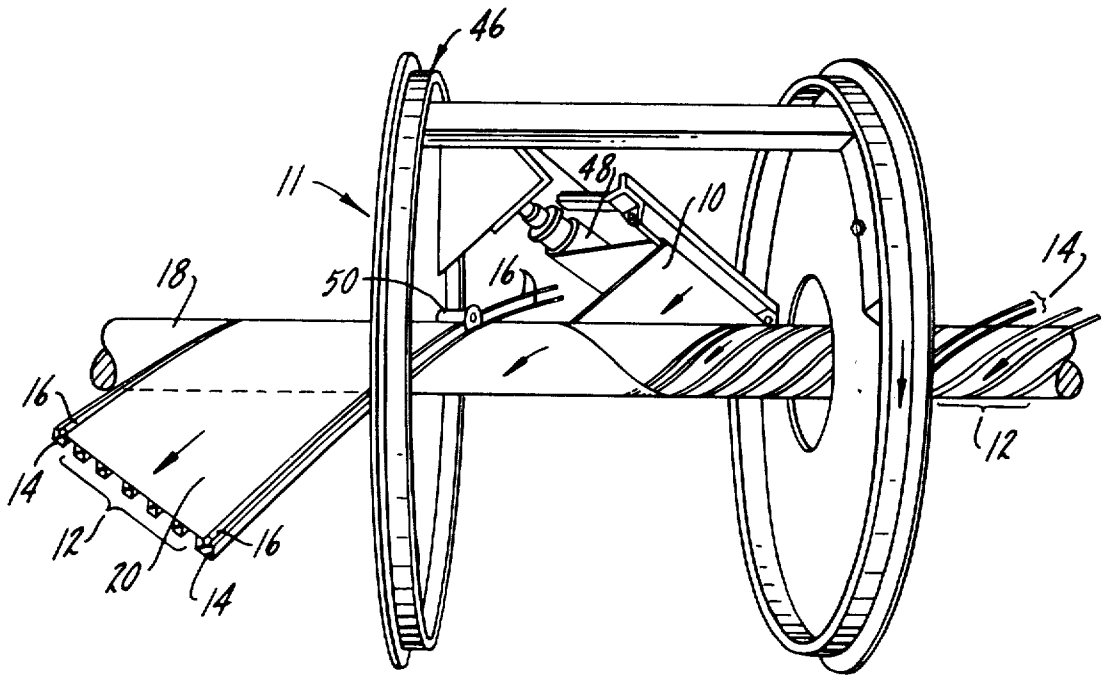
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Attorney, Agent, or Firm—Darbo, Robertson & Vandenburgh

[57] **ABSTRACT**

A method and apparatus for reorienting the material of a layer of plastic, paper, or a multiplicity of natural or synthetic threads, tapes or filaments such that the longitudinal axis of the layer, which initially coincides with its direction of travel, is eventually at right angles to its direction of travel. In accordance with the method and apparatus of the invention, a plurality of belts move over a stationary mandrel in a helical path. The layer is wrapped about the belts and stationary mandrel such that the longitudinal axis of the layer and its direction of movement is at right angles to the longitudinal axis of the belts. Gripper cables cooperate with the belts to grip the layer just prior to its being cut as it leaves the mandrel. The result is a newly formed layer comprising reoriented abutting pieces of the material held together by the belts and gripper cables. These pieces are as long as the width of the newly formed layer, but the longitudinal axis of the pieces is now at right angles to the direction of movement of the new layer.

3 Claims, 6 Drawing Figures



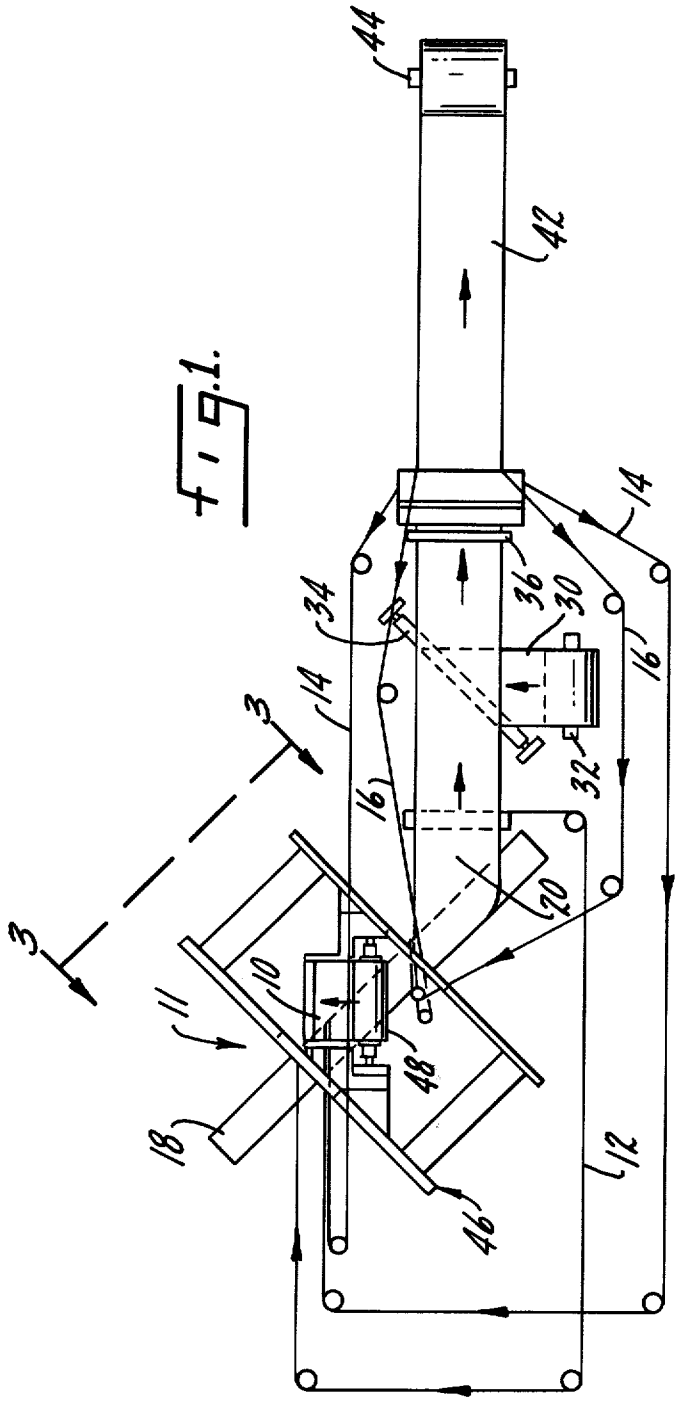


FIG. 1.

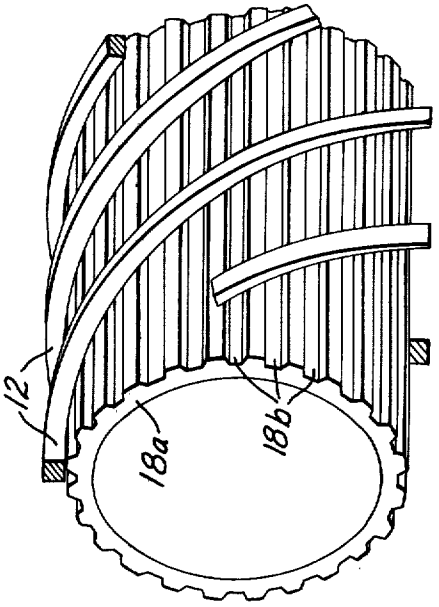


FIG. 6.

Fig. 3.

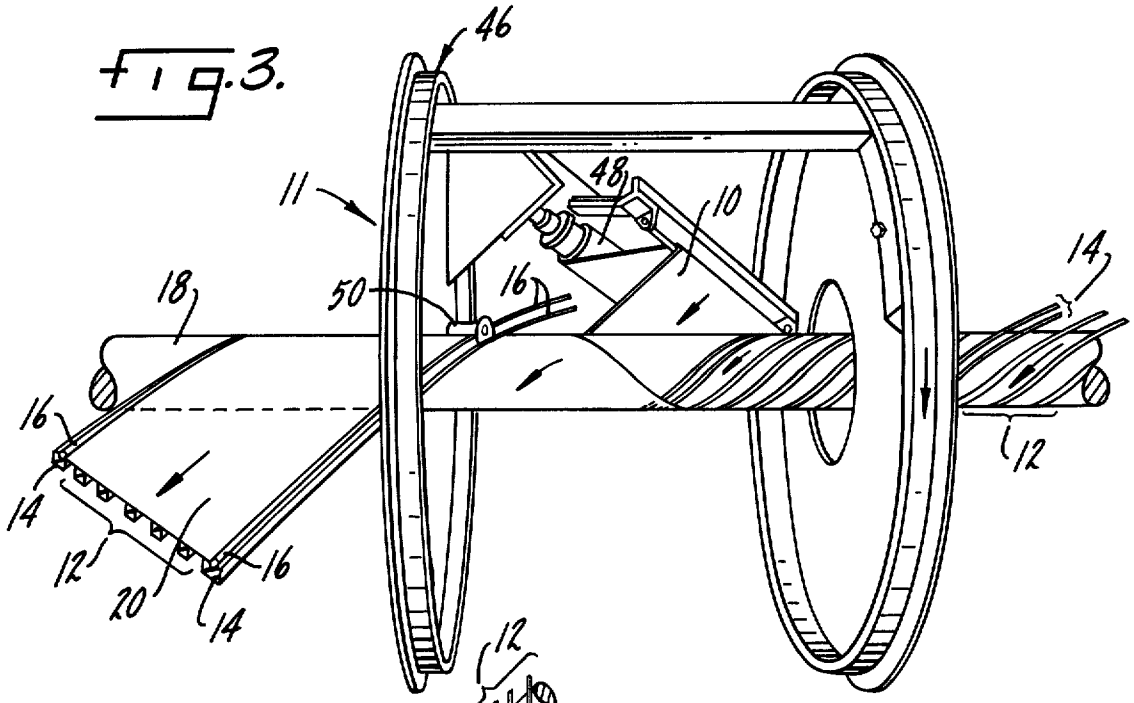


Fig. 4.

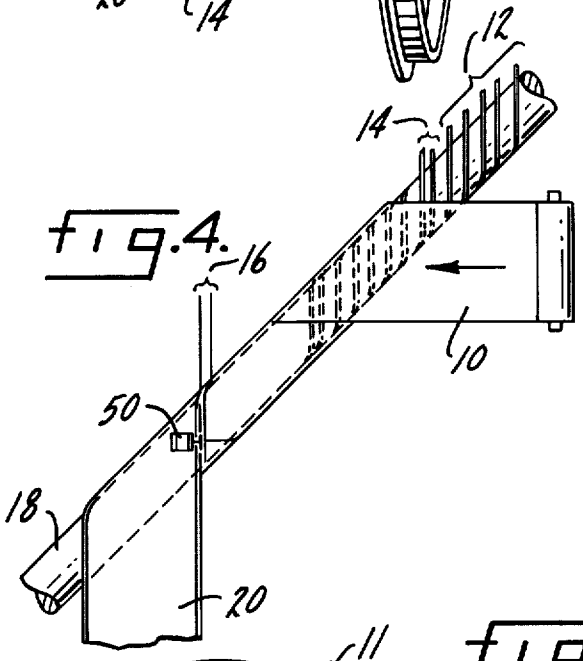


Fig. 5.

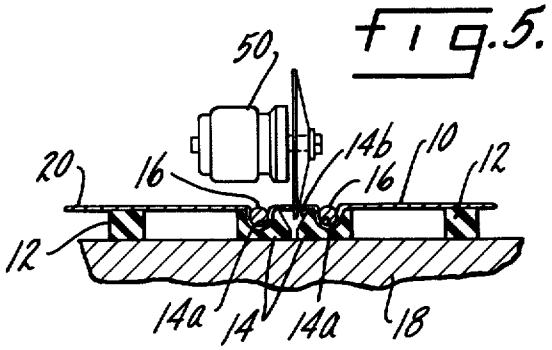
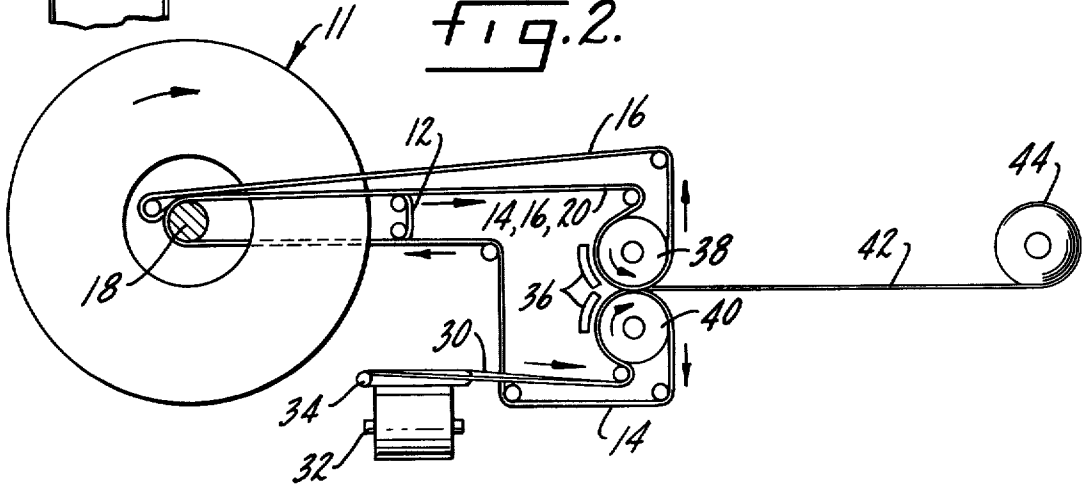


Fig. 2.



METHOD AND APPARATUS FOR MAKING REORIENTED REINFORCING LAYER FOR MULTI-PLY PRODUCTS

This invention relates generally to a method and apparatus for making multi-ply products of plastic, paper, or a multiplicity of natural or synthetic threads, tapes or filaments. More specifically, the invention relates to a method and apparatus for reorienting the material of one layer such that its orientation in the laminated product at right will be angles to the layer to which it is attached.

In the manufacture of multi-ply layers of plastic, paper, or natural or a multiplicity of synthetic threads or filaments, it is often desirable to have the layers oriented in directions to take advantage of the additional strength and/or the additional tear and burst resistance the material may have in one direction. For example, a web of plastic film generally has greater strength in its longitudinal direction than in its transverse direction. Therefore, it is advantageous when a two-ply product is made from such a web for the longitudinal axis of the material of one layer to be transverse to the longitudinal axis of the other layer. In this manner, the two-ply product would have strength in both its longitudinal and transverse directions. To achieve this end, one layer must, of course, be cut into pieces and oriented such that when the pieces are attached to the other layer, the longitudinal axes of the pieces are at right angles to the longitudinal axis of the second layer. It is, of course, desirable that this cutting and reorienting be effected in a continuous manner.

In the past, such transverse orientation has been effected by two different techniques. In the first technique, one layer is wrapped about a stationary mandrel. An adhesive is applied to the upper or exposed surface of this layer. A second layer is wrapped about the first layer and the stationary mandrel such that the longitudinal axis of the second layer is transverse to the longitudinal axis of the lower layer. The two-ply product is slit as it comes off the mandrel such that the lower layer is not affected, and the upper layer is cut into lengths corresponding to the width of the lower layer. Such a system is exemplified by U.S. Pat. No. **2,696,244,** issued on Dec. **7, 1954,** to Patrick P. Jackson, Jr. In the Jackson system, the bottom layer preferably has a low porosity so that friction between this layer and the mandrel may be reduced by blowing air therebetween. In a modification of this technique, the bottom layer may be carried by a moving belt such as described and illustrated in U.S. Pat. No. **2,841,202,** issued on July **1, 1958,** to Harlan W. Hirschy. This technique has the disadvantage that the two layers must be bonded together on the mandrel and thus, as a practical matter, bonding must be effected with an adhesive. This limits the type of product that can be made by this technique. Moreover, this technique cannot handle the layer which has been reoriented to a transverse position alone.

U.S. Pat. No. **2,954,816,** issued on Oct. **4, 1960,** to Robert A. Havemann, illustrates the second technique. In this approach, individual strands of material are placed transversely on a second layer. This technique is limited to use of individual threads or filaments and does not afford a system which could use a continuous or slit film, for example, as the transverse layer.

As used hereinafter, layer embraces any kind of layer made of plastic, paper, or natural or synthetic fibers, including webs, tapes, films, sheets, carted webs, cut

films, strands, yarns, filaments and the like made of plastic, paper, or natural or synthetic threads or filaments. The subject tapes, strands, yarns, threads, filaments, etc., need not abut each other but may be cross-laid with any degree of spacing between the individual members.

It is an object of the present invention to provide a method and apparatus for reorienting a layer of material such that the longitudinal axis of the material, which initially coincided with its direction of travel, is at right angles to its direction of travel in the finished product.

It is a further object to provide a method and apparatus to achieve such transverse orientation on a stationary mandrel.

These and other objects and advantages are achieved in accordance with the present invention by utilizing in conjunction with the stationary mandrel a plurality of belts which move over a stationary mandrel in a helical path. A layer is wrapped around the belts and stationary mandrel such that the longitudinal axis of the layer and its direction of movement is at right angles to the longitudinal axis of the belts. Gripper cables cooperate with certain of the belts to grip the layer just prior to its being slit or cut as it leaves the mandrel. The result is a reoriented layer comprising a succession of abutting pieces held together by the belts and gripper cables. These pieces are as long as the width of the newly formed layer, but the longitudinal axis of the pieces is not transverse to the direction of movement of the new layer. A second layer may be joined to the reoriented layer by numerous conventional techniques as the two layers move in parallel directions. In this manner, a multi-ply product is obtained with the longitudinal axes of the plies transverse to one another.

The invention both as to its organization and method of operation, together with further objects and advantages thereof, will be understood by reference to the following description taken in conjunction with the accompanying drawings in which:

FIG. **1** is a schematic plan view of a system for making a two-layer product utilizing the method and apparatus of the present invention;

FIG. **2** is a schematic side view of the system shown in FIG. **1**;

FIG. **3** is a perspective view along the line **3-3** of the turret and mandrel station of the system illustrated in FIG. **1**;

FIG. **4** is a top view of the stationary mandrel shown in FIG. **3**; and

FIG. **5** is an enlarged view of the cutter utilized with the turret and mandrel station.

FIG. **6** is a detail view, in perspective, showing a modified form of mandrel.

Referring now to FIGS. **1** and **2**, there is illustrated a system for making a two-layer product in accordance with the method and apparatus of the present invention. In this instance each layer is made from the same plastic film which has greater strength in the direction of its longitudinal axis than in a direction transverse to its longitudinal axis. In accordance with the method and apparatus of the present invention, rolls of this plastic film may be made into a two-layer product that has the longitudinal axis of the material of one layer at right angles to the longitudinal axis of the second layer.

To these ends a roll of film **10** is placed, for example, in the turret and mandrel station indicated generally by

reference numeral **11**. A plurality of continuous carrier belts **12**, two continuous edge belts **14**, and two continuous gripping cables **16** are fed into the station **11**. The carrier and edge belts **12** and **14** move in a helical path about a stationary mandrel **18** while the film **10** is wrapped on top of the assemblage of belts about the stationary mandrel **18** in a helical pattern at right angles to the longitudinal axis of these belts. Thus, as the film **10** is laid on the carrier and edge belts **12** and **14**, its longitudinal axis is transverse to the direction of travel of these belts. The gripping cables **16** in cooperation with the edge belts **14** hold the film **10** as it is being cut. The carrier belts **12** and the edge and gripping cables **14, 16** carry away from the mandrel **18** a new reoriented layer **20** comprising abutting pieces of the film **10** wherein the longitudinal axis of these pieces is now transverse to the direction of travel of the layer **20**. Shortly, after leaving the mandrel **18**, the carrier belts **12** are returned by appropriate rollers to the mandrel **18** and the reoriented layer **20** is carried by the edge belts **14** and gripper cables **16**, only, to the next station where a second layer is attached thereto.

A second film **30**, which is identical to the film **10**, passes from its roll **32** over a direction changing roller **34** so that it is traveling below, but in the same direction as the layer **20**. The layers of film **20** and **30** are in this instance joined together by heat from heaters **36** and pressure from rollers **38** and **40** to form a twoply product **42** which is wrapped about roll **44**.

Referring now to FIGS. **3** through **5**, the method and apparatus of the present invention will be discussed in greater detail. The turret and mandrel station **11** includes the stationary mandrel **18** and a turret indicated generally by reference numeral **46**. The mandrel **18** is mounted against rotation on a frame (not shown). The plurality of carrier belts **12** and the two edge belts **14** move about the stationary mandrel **18** with a longitudinal sliding motion in a helical pattern. The belts **12, 14** hold their position lengthwise of the mandrel **18**, which they would not do if the mandrel were rotated. The speed and advance of the belts **12** and **14** may be varied by, for example, suitable variation in the speed of the rolls which drive these belts as will be understood by one with ordinary skill in the art. The means for driving the belts **12, 14** and cables **16** do not per se constitute a part of the present invention and the selection of suitable means is a matter of choice within the ordinary skill of one in the art.

The turret **46** is of conventional construction and does not per se constitute a part of the present invention. A typical turret is described and illustrated in previously mentioned U.S. Pat. No. **2,841,202**. The turret **46** is a cylindrical drum-type member mounted coaxially with and for rotation about the stationary mandrel **18**. The turret **46** is suitably supported by means not shown, and suitable gearing is used to control the rotation of the turret **46** about the mandrel **18**.

The turret **46** carries a roll **48** of film **10**. As the turret **46** is driven in rotation about the stationary mandrel **18**, the film **10** is wrapped about the carrier and edge belts **12, 14** such that the longitudinal axis of the film **10** is transverse to the direction of the travel of these belts. In the illustrated embodiment (see FIGS. **3** and **4**), the film **10** is laid on the belts **12, 14** such that its longitudinal axis (along its length) is perpendicular to the direction of travel of these belts. The film **10** is wrapped about the stationary mandrel **18** and these belts in such a manner that the edge of one turn of the film **10** abuts the edge of the previous turn of the film **10** so that there is, in effect, an abutting relationship between the successive turns of film **10** as it is being wrapped about the stationary mandrel **18**.

The gripping cables **16** are fed into the turret and mandrel station **11** and cooperate with the edge belts **14** to hold the film **10** at what will become the edges of the reoriented film layer **20** being formed. As shown in FIGS. **3** and **4**, the gripping cables **16** grip the film **10** just in front of a cutter **50** which severs the film **10** into a continuous succession of abutting pieces, each of which has its longitudinal axis perpendicular to the direction of travel of the belts **12, 14** and gripping cables **16** to form a reoriented film layer **20** which is carried to a second station where another film is added thereto as previously described.

In the embodiment illustrated, the edge belts **14** are generally rectangular shaped and have longitudinally extending grooves **14***a* (FIG. **5**) on the tops thereof which receive the generally circular cables **16**. Preferably on adjacent sides of the belts **14**, the corners have been cut away at **14***b* so that the cutter **50** will not damage the belts or be damaged thereby. The belts **12, 14** and cables **16** may be made of rubber, plastic, metal, or any other suitable material, the selection of which would be within the ordinary skill of one in the art. These belts are narrow and will generally not exceed a few inches in width. Insofar as the edge belts **14** and gripping cables **16** are concerned, it is only essential that they cooperate with one another in such a manner to firmly grip the film **10** prior to and after cutting. Thus the gripping cable may have a groove therein rather than the edge belt.

The cutter **50** is of conventional construction and does not per se constitute a part of the present invention. Any type of cutter may be used, the selection of which would be within the ordinary skill of one in the art.

There are many modifications that can be made in the method and apparatus of the present invention without departing from the spirit thereof. For example, the edge belts and/or the carrier belts may run in helical grooves in the surface of the stationary mandrel **18**. Alternatively, stationary rods may be affixed to the stationary mandrel such that their longitudinal axes are parallel to the longitudinal axis of the stationary mandrel **18**. Furthermore, a plurality of longitudinally extending grooves can be cut in the mandrel **18**. This is shown in FIG. **6**, the belts **12** riding on the surfaces of mandrel **18**a between grooves **18**b. These, in conjunction with lubricants and/or rotating bearings, are ways to reduce the friction between the mandrel and the belts **12, 14**.

Although the film **10** has been illustrated and described as having its longitudinal axis placed at right angles to the direction of travel of the belts, it will be understood that this angle may be varied as desired by one with ordinary skill in the art. In addition, two or more layers may be wrapped about the mandrel and belts **12, 14** prior to cutting, if so desired, by the use of equipment well known in the art.

While the preferred embodiment of the present invention has been shown and described herein, it is obvious that many modifications may be made therein without departing from the spirit and scope of the present

invention and it is intended to cover such modification in the appended claims.

I claim:

1. A method for changing the orientation of a layer of material having its longitudinal axis parallel to its direction of travel comprising driving a plurality of spaced narrow endless carrier belts longitudinally in a helical path about a stationary mandrel, wrapping said layer about and upon said mandrel and belts so that the longitudinal axis of said layer is at right angles to the longitudinal axis of said belts, gripping said layer with a pair of endless gripping cables cooperating with a pair of said belts at what will become the edges of a reoriented layer and continuously cutting said layer between said pair of belts at approximately the location of initial gripping to form a reoriented layer consisting of a succession of pieces of said layer each having its longitudinal axis at right angles to the movement of said reoriented layer from said mandrel.

2. An apparatus for changing the orientation of the material of a layer of material having its longitudinal axis parallel to its direction of travel comprising a stationary mandrel, a plurality of spaced narrow endless carrier belts, means to drive said belts in a helical path about and directly upon and in contact with said mandrel, means to wrap said layer about said mandrel and belts such that the longitudinal axis of said layer is at right angles to the longitudinal axis of said belts, a pair of endless gripping cables arranged to cooperate with a pair of adjacent belts to grip said layer, and means to continuously cut said layer at a location between said pair of gripping cables so as to form a reoriented layer consisting of a succession of pieces of material of said first mentioned layer each of which has its longitudinal axis at right angles to the movement of said reoriented layer from said mandrel

3. The apparatus of claim 1 wherein said mandrel has a plurality of longitudinally extending grooves over which said belts ride.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,903,575

DATED : Sept. 9, 1975

INVENTOR(S) : Clyde A. Plaskett

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, l. 10	"product at right will be angles" should read --product will be at right angles--
Col. 1, l. 66	"layer" should read --"layer"--
Col. 2, ls. 28-29	"newly formed" should read --reoriented--
Col. 2, l. 30	before "transverse", "not" should read --now--
Col. 3, l. 28	"twoply" should be --two-ply--
Col. 6, l. 17, (line 1 of claim 3),	claim "1" should read --claim 2--.

Signed and Sealed this

sixteenth Day of *December 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks