Machine for Producing Bias Weave Fabric

This invention relates to the art of producing what is known in the trade as bias binding, which is an elongated strip or web, usually of a woven fabric, in which the weft and warp threads of the woven structure do not extend longitudinally and transversely at right angles to the margin, but extend diagonally, and usually at an angle of about 45° to the side margins of the web. The practice at present is to cut these tapes or bindings from a sheet or web of the material on lines extending diagonally, or at an angle to the weaving threads, and therefore the length of any one of these strips or webs is the diagonal distance from side to side, or end to end of the sheet. Consequently to provide a long strip or web of the bias binding it is necessary to fasten together, as by stitching, a series of these comparatively short lengths of the bias binding.

The main object of the present invention is to produce such bias binding or tape in the form of a web of very considerable length, just as webs of fabric are produced in any length desired.

A further object of the invention is to provide means and the method of producing an elongated web from an elongated tube, in which the two side margins of the resulting web will be constituted by the two edges produced by a helical line of severance of the tube, and therefore these margins of the web will extend at an angle to the normal axial elements or lines of the unsevered tube.

In the accompanying drawings showing embodiments of my invention,

Figure 1 is a partial plan view of the apparatus with the feed rolls cut away.

Fig. 2 is a side elevation of the machine.

Fig. 3 is a partial plan view enlarged at the rear end of the machine.

Fig. 4 shows a detail of the winding up rolls.

Fig. 5 is a cross section on the line 5—5 of Fig. 3 showing the cutting means for the web.

Fig. 6 is a similar view showing a modified cutting means.

Fig. 7 is a partial axial section through the tube support enlarged.

Fig. 8 is a cross section on the line 8—8 of Fig. 7.

Fig. 9 is a section on the line 9—9 of Fig. 7.

Fig. 10 is a section on the line 10—10 of Fig. 7.

Fig. 11 is a section on the line 11—11 of Fig. 7.

Fig. 12 shows some of the inner parts of the tube support and its carrying means.

Fig. 13 is an end elevation.

Figs. 14, 15 and 16 show details of the conveyor.

Fig. 17 shows a detail of the cutting means and adjacent parts.

Fig. 18 shows the bracket for the cutter and guide roll.

Fig. 19 shows the cutter and shaft.

The mechanism comprises a substantially cylindrical support over which from one end portion is drawn a seamless tube of fabric, such as a woven tube of fabric in which the wrap threads extend longitudinally or parallel to the axis or middle line of the tube, and the weft threads obviously extend transversely around the tube. In connection with this support and means for advancing the woven tube along the support, I provide cutting means that will sever the tube, but which line of severance does not extend parallel with either the weft or warp threads, but at an angle thereto, and preferably at 45°. In other words, the tube is provided with a helical line of severance, and as will be understood from the following, a web is thus produced in which the threads extend from edge to edge at the angle of 45°, and thus make bias goods. It will be further understood that this tubular weave is an article of trade or commerce, as tubular goods such as bags or pillow shams or cases, and obviously such articles can be produced of indefinite length, just as a flat web can be woven as long as desired. I provide, as stated, a support with means for advancing the fabric web along the support, and a cutter, and a relative movement is effected between the cutter and the support to cause this helical line of severance; and which I accomplish by causing the support to rotate at the same time that the fabric tube is advanced thereon, and the engage-
ment of a fixed cutter, with the fabric tube that rotates will sever on this helical line. Thus a web is produced, that is taken off from the rotating support, preferably at the same angle of 45°, and it is thereupon wound on a roll or form as fast as produced. Means are also preferably provided for supporting this fabric tube of considerable length, that is conveniently folded back and forth into a pile to be fed or drawn onto the said support and advanced along the same. Since the support, as shown, is rotated, the fabric tube would become twisted, and to avoid this the support on which the folded supply tube rests, is caused to rotate at the same speed at which the support is rotated. I further provide means on the support to draw the fabric tube along the same at the same time that the support rotates, and this is preferably done by a series of endless conveyors on the support that operate longitudinally and engage the inner wall of the fabric tube by their outer exposed faces and cause the tube to travel along until severed by the cutter.

As shown in the drawings, I provide a support that broadly consists of a frame that carries a series of four endless belts extending longitudinally and that obviously partake of the rotation of the support, and at the same time the belts travel all in the same direction and draw the fabric onto one end of the support and carry it to the cutter; beyond it the severed web is drawn off from the support. This support is carried by a fixed inner shaft 2, supported at the rear end only by standards 3 and 4, see Fig. 12. On the shaft 2, rotates a sleeve 5, that may have a special journal 6 at the rear end, carried by a standard 7, similar to the standards 3 and 4. This sleeve carries a gear 8 that engages a gear 9 on a shaft 10, and the latter carries a gear 11 engaged by a worm 12 on the shaft of a motor 13, by which means the sleeve 5 is rotated and which constitutes the rotating means for the support as a whole. The sleeve 5 carries a frame 14 fast thereon, see Fig. 7, which frame has four hubs 15 a quadrants distance apart, that each carry a short shaft 16 provided at one end with a small gear 17. The latter gears engage a fixed large gear 18, see Fig. 7, that is stationary and is fixed to the journal 6, see Fig. 12. Since the frame 14 is carried around with the sleeve 5, these four gears will have a planetary action and rotate their shafts from engagement with the fixed gear. Each of these shafts 16 carries a bevel pinion 19 that meshes with a bevel pinion 20 carried by a cross shaft 21. These four shafts 21 are carried by a star frame 22, see Fig. 10, provided with a bearing for each end of this cross shaft and by this means the small gear 17 will drive the four cross shafts 21 in unison.

At the other end of the sleeve 5 is mounted a star frame 23, see Fig. 9, fixed to the sleeve 5, and similar frames 24 and 25 are arranged, along the support, which three frames are connected by longitudinal members, such as four long bolts 26 passing through holes in these frames, and also through the other two star frames 14 and 22, with sleeves on the bolts between opposite frame members.

It will be understood that all of these star frames will thus be connected and rotated by the sleeves around the fixed shaft 2. This shaft is provided with an extension shaft 27 at the forward end, that is secured thereto, and which has the frame 25 rotatable thereon. Another star frame 28 identical with the frame 22 of Fig. 10 is mounted on this extension shaft 27 and carries four shafts 29 identical with the shafts 21.

Each of the cross shafts 21 and 29 carry a roll 30, see Fig. 15. These rolls being oppositely located in respective pairs serve to carry endless belts 32 of suitable material such as rubber or leather. Inside of each belt may be an endless chain 33, and each of the shafts 21 and 29 carries a sprocket 34 at its middle portion to engage the chain 33. This chain may have projections 35 extending into the belt, see Fig. 14.

It will thus be seen that when the sleeve 5 is rotated from the motor by the gears as set forth, the four endless belts will be carried around with the sleeve, and the bevel gear connections of each belt with the fixed gear 18 will cause the belts to advance in the same axial direction on their outer faces. Between the four belts I arrange guide plates 36 at four places carried by the frames 28, 24, 27, see Fig. 9, to preserve the continuity of the cylindrical carrier. At the front end of the machine the extension shaft 27 carries a conical guide 37 that will serve to lead the tubular fabric 75 onto the cylindrical support, formed by the endless belts 32 and the intervening guide plates 36. Intermediate of the ends of the belts are guide rolls 38 carried by the frames, that correspond with the frame 25 shown in Fig. 10, to prevent sagging of the belts.

As shown in Figs. 1 and 2, the tubular fabric 75 of elongated form has its open end first passed over the conical guide 37 that will distend it and cause it to be engaged by the four endless bands, that on their outer faces travel away from this guide, and upon rotation of the carrier by the motor and actuation of these bands, this fabric tube will be advanced along the carrier, and will be opened out or distended by this guide. Since the fabric tube is rotated as soon as it is engaged by the carrier, it would tend to twist or wind up unless the tube also is rotated. As shown, I provide a table 39 on a vertical shaft 40 supported on a standard 41, and this table that carries the tube in folded arrangement, as shown, is caused to rotate in unison.
with the rotation of the support for the distended tube. A shaft 45 is driven from the driving shaft 10 by a chain 43 and miter gears 44 and 45 causing rotation of the table 39 at the proper speed for this purpose.

As the fabric tube rotates and is advanced by the endless belts, it is engaged by a suitable cutter and this will necessarily cause a severance of the tube in a helical line or path, similar to the cutting of a screw thread on a lathe, except in the latter the cutter advances and the work rotates without advancing. As shown, I arrange a circular cutter 46 carried by cutter shaft 80 rotatable in journals 77 on a bracket 76 that is mounted on table 48.

At the forward end of the machine I provide a kind of table 48 supported on the standards 3, 4 and 7 on its inner edge, and on posts 49 and 50 on its outer margins. This cutter wheel may be rotated by a flexible shaft 51 driven from the motor 13, and it projects into a kind of slot 52 in a guide plate 47. It will be observed that this guide plate projects beneath the web portion of the fabric tube that has just been severed by the knife, and also projects slightly beneath the portion of the tube adjacent the severed edges. The web portion now produced by this cutting, denoted by 53, is carried away from the rotating support as indicated in the Figs. 1 and 3, and may pass beneath a guide roll 54 on the table 48.

Another form of cutting arrangement is shown in Fig. 6 in which two blades on opposite sides of the fabric are relatively reciprocated. Here a blade 55 is carried by a slide 56 in a suitable frame 57 and moves in engagement with a fixed blade 58. A rock arm 59 reciprocates the slide 56 and is rocked by a crank pin 60 fast on a shaft 61 that may be driven by a flexible connecting shaft 51 extending to the motor 13.

The web as produced by the cutter and rotating support is advanced along the table 48 and preferably wound up. In Fig. 4 and elsewhere, the web 53 is caused to engage a winding roll 62, after passing around a roll 63, the winding roll 62 being initially supported on the said roll 63 and on a similar roll 64, spaced apart a short distance, so that the roll 62 can frictionally engage these two rolls and cause the web to wind up on the roll 62 at a uniform surface speed. These two rolls 63 and 64 carry gears 65 and 66 that mesh with a gear 67. The latter is connected with an angle gear 68 that meshes with an angle gear 69 fast on the driving shaft 10. The roll 62 carrying the web 53 wound thereon, is mounted on arms 71 and 72 that are carried by upstanding bars 73 and 74. It will thus be seen that the web roll itself engages these driven rolls 63 and 64 and will be turned at a constant surface speed, that is so designed to wind up the roll as fast as the web is produced by the cutter.

In the use of the apparatus the tube 75, in folded form, is placed on the rotatable table 39, and the end of the tube is placed over the conical guide 37 that will expand the tube to a conical form and it is then drawn over the four endless belts 32. Thereupon the motor is started that will cause these belts to advance with their outer faces moving away from the guide, that will advance the fabric tube. As soon as it reaches the cutter, such as the rotating disc 46, the tube will be cut at an angle of 45° to the longitudinal axis of the tube, and which margin will be at this angle to the weft and warp threads of the tube. The severed portion is passed beneath the guide roll 54 and moved across the table 48. The end, that, if cut perpendicular to the axis of the tube, will extend at 45° to the side margins of the web, may be cut off square with the sides and is then attached to the wind-up roll 62, and the latter, by engagement with its engaging rolls 63 and 64, will wind up this web on the roll 62 at a constant surface speed, that is so designed by the relative rotation of the pair of rolls with the rotation of the tube support, that the web 53 will be drawn across the table 48 as fast as this operation takes place. The web produced from the woven tube if cut at an angle of 45° will have a width a little more than twice the diameter of the distended tube. It will thus be seen that the two margins of the web are produced by the helical line of severance and that the warp and weft threads extend each at the 45° angle to this margin.

It is obvious that very simple slitting machines can take this web and divide it into any number of narrow webs, and of different widths, each of which band or ribbon will be on the bias form, as desired.

It will also be obvious that the same device can be used for producing a web from any tubular structure that can be severed by the cutter.

What I claim is:

1. A substantially cylindrical support for a woven seamless tube of fabric, means for rotating said support, a cutter arranged to engage the fabric tube on the support while being rotated, a series of conveyors carried by the rotatable support, and means for actuating the conveyors while the support is being rotated to cause the fabric tube to advance on the rotating support while the fabric tube parakes of the tube rotation, whereby the fabric tube will receive a continuous helical severance in its periphery to produce a fabric web or band with the two side web margins constituted by the helical line of severance of the cutter and which margins will extend at an angle to the normal thread elements of the_unsevered woven fabric tube.

2. A substantially cylindrical support for a woven seamless tube of fabric, means for rotating said support, a cutter arranged to
engage the fabric tube on the support while being rotated, a circular series of endless band conveyors extending longitudinally on the rotatable support, and means for actuating the conveyors while the support is being rotated to cause the fabric tube to advance on the rotating support while the fabric tube partakes of the tube rotation, whereby the fabric tube will receive a continuous helical severance in its periphery to produce a fabric web or band with the two side web margins constituted by the helical line of severance of the cutter and which margins will extend at an angle to the normal thread elements of the unsevered woven fabric tube.

3. A substantially cylindrical support for a woven seamless tube of fabric mounted for rotation, means carried by the support arranged to advance the fabric tube along the support and a cutter arranged adjacent the support to engage the fabric tube whereby the fabric tube will receive a continuous helical severance in its periphery to produce a fabric web or band with the two side web margins constituted by the helical line of severance of the cutter and which margins will extend at an angle to the normal thread elements of the unsevered woven fabric tube.

4. A substantially cylindrical support for a woven seamless tube of fabric mounted for rotation, and means actuated by the rotation of the support to cause the fabric tube to advance on the rotating support while the fabric tube partakes of the tube rotation, and a cutter arranged to engage the fabric tube on the support while being rotated, whereby the fabric tube will receive a continuous helical severance in its periphery to produce a fabric web or band with the two side web margins constituted by the helical line of severance of the cutter and which margins will extend at an angle to the normal threaded elements of the unsevered woven fabric tube.

5. A substantially cylindrical support for a woven seamless tube of fabric, means for rotating said support, means actuated by the rotation of the support arranged to cause with the support to cause the fabric tube to advance on the rotating support while the fabric tube partakes of the tube rotation, and a cutter arranged to engage the fabric tube on the support while being rotated, whereby the fabric tube will receive a continuous helical severance in its periphery to produce a fabric web or band with the two side web margins constituted by the helical line of severance of the cutter and which margins will extend at an angle to the normal thread elements of the unsevered woven fabric tube.

6. A substantially cylindrical support for a woven seamless tube of fabric, means for rotating said support, a cutter arranged to engage the fabric tube on the support while being rotated, a series of conveyors carried by the rotatable support, and means actuated by the rotation of the support for actuating the conveyors while the support is being rotated to cause the fabric tube to advance on the rotating support while the fabric tube partakes of the tube rotation, whereby the fabric tube will receive a continuous helical severance in its periphery to produce a fabric web or band with the two side web margins constituted by the helical line of severance of the cutter and which margins will extend at an angle to the normal thread elements of the unsevered woven fabric tube.

7. A substantially cylindrical support for a woven seamless tube of fabric, means for rotating said support, a cutter arranged to engage the fabric tube on the support while being rotated, a circular series of endless band conveyors extending longitudinally on the rotatable support, and means actuated by the rotation of the support for actuating the conveyors while the support is being rotated to cause the fabric tube to advance on the rotating support while the fabric tube partakes of the tube rotation, whereby the fabric tube will receive a continuous helical severance in its periphery to produce a fabric web or band with the two side web margins constituted by the helical line of severance of the cutter and which margins will extend at an angle to the normal thread elements of the unsevered woven fabric tube.

Signed at White Plains, N. Y., on April 27, 1931.

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