ABSTRACT: A convolute tube winding machine is described with which tubes having portions of reduced diameter can be continuously produced, timed cutters being utilized for this purpose to sever and remove edge portions of the strip so that, upon winding, the reduced diameter portions occur at the locations of the severing and removal.
CONVOLUTE TUBE WINDING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention
This invention relates to convolute tube winding machines and more particularly to such a machine for making a tube having one or more portions of reduced diameter.

2. Description of the Prior Art
It has heretofore been proposed to provide convolute tube winding machines. One suitable machine of this type is shown in the U.S. Pat. No. 3,190,195 to Joseph Snyderman and Martin Schmalzl.

The convolute tube machines now and heretofore available include provisions for feeding from a roll, and glue coating, an elongated strip of paper, advancing the paper strip along a mandrel onto which it is to be wound, cutting the strip to the desired length in accordance with the length of the paper tube to be made, further advancing the strip along the mandrel to a location for winding, winding the strip onto the mandrel to form a convolute paper tube, stripping the wound paper tube from the mandrel after completion of the winding by moving a tube stripper along the mandrel returning the tube stripper to its initial position, all in timed sequence, and repeating the foregoing operations for the continuous production of paper tubes of predetermined length.

The machines heretofore available whether for large or small, long or short, convolute tubes produced tubes of substantially uniform outside diameter.

SUMMARY OF THE INVENTION

In accordance with the invention a convolute tube winding machine is provided with which a convolute tube can be produced having one or more portions of reduced diameter, and at any desired location. To accomplish this one or more edge cutters are provided for removing portions of the strip in timed relation during its advance from the roll to the winding mandrel.

It is the principal object of the present invention to provide a convolute tube winding machine with which tubes having portions of different external diameter can be quickly and easily produced.

It is a further object of the present invention to provide apparatus which can be utilized on existing machines for severing edge portions of the strip which is to be wound and thereby reduce the diameter at spaced locations of tubes being wound.

Other objects and advantageous features of the invention will be apparent from the description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The nature and characteristic features of the invention will be more readily understood from the following description taken in connection with the accompanying drawings forming part thereof, in which:

FIG. 1 is a fragmentary top plan view of a convolute tube winding machine equipped with the apparatus of the invention;

FIG. 2 is a vertical sectional view taken approximately on the line 2--2 of FIG. 1;

FIG. 3 is a vertical sectional view taken approximately on the line 3--3 of FIG. 1;

FIG. 4 is a vertical sectional view taken approximately on the line 4--4 of FIG. 3;

FIG. 5 is a vertical sectional view, enlarged, taken approximately on the line 5--5 of FIG. 2;

FIG. 6 is a vertical sectional view taken approximately on the line 6--6 of FIG. 5;

FIG. 7 is a vertical sectional view taken approximately on the line 7--7 of FIG. 2;

FIG. 8 is an enlarged fragmentary view in perspective showing the transverse cutter and the edge cutter;

FIG. 9 is a sectional view taken on the line 9--9 of FIG. 8;

FIG. 10 is a view in perspective showing the transverse cutting and edge cutting of the strip; and

FIG. 11 is a view in perspective of the end of a convolute tube with an end of reduced cross section and made with the machine of the present invention.

It should, of course, be understood that the description and drawings herein are illustrative merely, and that various modifications and changes can be made in the structure disclosed without departing from the spirit of the invention.

Like numerals refer to like parts throughout the several views.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Refer now more particularly to the drawings, a portion of a convolute tube winding machine is shown which includes a frame F, L-shaped as seen from above with a transverse frame portion 15 and a longitudinal frame portion 16 (see FIGS. 1A and 1). The frame portion 15 has a top horizontal transverse frame plate 17. The frame portion 16 has a top horizontal longitudinal frame plate 18, at the same level as the frame plate 17.

The frame portion 15 has a glue pan 23 with provisions for glue application to the paper strip S including glue transfer rollers 24, and glue applying and transfer rolls 25, 25' as has heretofore been common practice. The rollers 24 and rolls 25, 25' are intermittently driven as the paper strip S is advanced by chain drives 26 and 27. The rollers 24 and rolls 25, 25' can be mounted in frame portions 19.

The upper roll 25 has annular ribs 25a, and the cover roll 25' has grooves 25b, in which the ribs 25a are received.

A shaft 28 is provided, driven from a motor 29 through a driving connection 30 which includes a chain drive 31. A supporting bracket 32 provides a support for the driving connection 30 and a bracket 53 has the shaft 28 journaled therein.

Transverse frame bars (not shown) have wires 34 extending therebetweent in a well-known manner for supporting the paper strip advanced from the paper supply roll (not shown) and from the rollers 24 and roll 25 in preparation for winding into convolute tubular form.

The drive shaft 28 is also connected through gearing 35 to a drive shaft 42 for operating other parts of the machine.

The frame F supports spaced parallel drive guide rails 43 and 44 on which slide guides 45 and 46 are secured to a cutter frame plate 47 are mounted for transverse movement of the plate 47. The position of the frame plate 47 is determined by a screw 48 journaled in a bearing 49 carried by the frame portion 16. The screw 48 has an externally accessible handle 50 for rotating it and is engaged in a nut 51 on a bracket 52 secured to and extending downwardly from the frame plate 47. A bracket 53 is provided secured to and extending downwardly from the frame plate 47, spaced from the bracket 52, and with a brace bar 54 therebetween. The brackets 52 and 53 have journaled therein, in bearings 55, a shaft 58. The shaft 58 has an elongated splined portion 59. A gear 60, in engagement with a gear 61 fixed to the shaft 42, has an internal complementary splined portion engaged with the splined portion 59 to drive the shaft 58. The gear 60 is journaled in a bearing 62 carried on a bracket 63 on the frame F.

The shaft 58 has secured thereto a cam 65 (see FIG. 7) for transverse knife blade actuation as hereinafter explained.

The cutter frame plate 47 has spaced brackets 67 and 68 secured thereto within which a transverse cutter blade shaft 70 is journaled in bearings 71. The shaft 70 has a blade holder 73 secured thereto for movement therewith to which a transverse cutter blade 74 is detachably secured as by screws 75. The cutter blade 74 is rotatably and oscillately movable in paper shearing relation to a detachably fixedly mounted blade 76 carried on an upright supporting bar 77 secured to the cutter frame plate 47.

The shaft 70 has an actuating arm 77 adjustably secured thereto and held in adjusted position by a stud 78. The arm 77 is connected by a pivot pin 79 to an actuating link 80 which is
connected by a pivot pin 81 to an actuating bar 82. The bar 82 carries a cam follower 83 which engages in a cam groove 84 in the cam 65. An opening 85 is provided in cutting frame plate 47 for the bar 82.

The camming groove has an accurate portion 84a which holds the transverse knife blade 74 in an out-of-action position and a fall and rise portion 84b to move the knife blade 74 to a cutting position and return it to its out-of-action position in a predetermined timed relation to the advance of the paper strip S.

The cutter frame plate 47 also has upright edge cutter blade brackets 88 with a pivot pin 89 carried thereby for mounting of a movable edge cutter blade 90.

The blade 90 has an end terminal edge portion 90a, diverging edge portions 90b and spaced parallel edge portions 90c. Fixed blades 91 are provided, removably mounted in supporting bars 92 by screws 93. The blades 91 have complemental edge portions 91a, 91b and 91c for shearing action with respect to the respective edge portions of the blade 90.

The shape of the blades 90 and 91 can be varied as desired, the specific shape shown providing a cutout 94 on the strip S which is symmetrical with respect to the cut 95 made by the knife blade 74, and which provides a short longitudinal portion 94a, diverging edge portions 94b and spaced parallel portions 94c. This blade configurations will provide on the finished tube T (see FIG. 11) a small shoulder 96a, a frustoconical shoulder 96b and a portion 96c of reduced diameter.

In order to control the positioning of the blade 90 for cutting, the blade 90 is connected by a pivot pin 98 to a link 99 of adjustable length, which is connected by a pivot pin 100 to a lever 101 carried on a pivot pin 102 on the bracket 66. The lever 101 has a pivot pin 103 connected to a link 104 which is connected by a pivot pin 105 to an actuating arm 106 adjustable mounted on the shaft 70 and held in adjusted position by a stud 107.

The positioning of the arm 106 and the length of the link 99 are preferably such that the blade 90 is lowered to its cutting position before the blade 74 has descended to a location where there would be any interference and is not retracted until the blade 74 is clear.

In order to facilitate the cutting operation it is desirable to temporarily interrupt the advance of the paper while the cutting is being effected.

For this purpose a cam 110 is secured to the shaft 42. The cam 110 has its rim 111 for engagement by a cam follower 112. A projection 111a is provided on the rim 111 for moving the follower 112 at a predetermined time. The cam follower 112 is carried by an arm 114 which is adjustable secured to a shaft 115 mounted in the frame portions 19 by studs 116. The shaft 115 has a plurality of presser fingers 117 carried thereon to urge the paper against the upper rolls 25, 25' and thereby temporarily arrest the advancing movement of the paper.

The mode of operation will now be pointed out.

Paper, from the supply roll (not shown), has glue applied to one face thereof at the glue pan 23, and is advanced by the rolls 25, 25' between and beyond the knife blades 74 and 76, the length of the strip being determined by the length of the convolute tube to be wound. The timed operation of the machine is such that, at the appropriate location for cutting, the cam rim portion 111a causes the follower 112 to be raised, and this is effective, through the arm 114, shaft 115 and presser fingers 117 to press the paper strip against the upper roll 25 and temporarily arrest its advance. During this short stoppage, the cam 65 is effective for diverging cutting edge portions 94c.

The cam groove portion 84b causes the follower 83 to change its position so that the actuating bar 82 is drawn down. This downward movement is effective through the link 80, and actuating arm 77 to rotate the shaft 70.

As the shaft 70 is turned the actuating arm 106 acts through the link 104, lever 101, and adjustable length link 99 to swing the blade 90 downwardly to sever a cut out 94 on the edge of the strip S.

Turning of the shaft 70 is also effective for moving the blade 74 downwardly in transverse severing relation to the strip S. It is preferred to sever the cut out 94 before the transverse cut at 94 is made for better control of the paper strip and the downward movement of the blade 90 ahead of the downward movement of the blade 74 is effective for this purpose.

Upon completion of the transverse severing at 95 the knife blade 74 is first retracted, followed by the knife blade 90. The blades 74 and 90 remain in their out-of-action positions until the next cutting operations are effected in timed relation to the advance of the strip S.

The strips S, with edge cutouts of the desired shape is then wound onto a convolute tube T in a well-known manner. Upon the completion of the winding of the tube T it will have portions of reduced diameter and as determined by the portions removed.

As illustrated the tube T has shoulders 96a and 96b and a portion 96c of reduced diameter. The tube T can be severed intermediate the ends of the portion 96c so that smaller tubes each having ends of reduced diameter are available. The reduced diameter ends can serve as bearings, or for the reception of connectors or for other purposes.

The cutter frame plate 47 can be positioned on the guide rails 43 and 44 to accommodate different widths of strips S so that the edge cutting and transverse severing can be effected for finished convolute tubes T of different thickness.

It will thus be seen that apparatus has been provided for attaining the objects of the invention.

I claim:

1. In a convolute tube winding machine for winding a strip into a tube having portions of reduced diameter comprising a frame, members mounted on said frame for advancing a paper strip from a supply, glue applying means carried by said frame adjacent to said members for applying glue to one side of said strip as said strip is advanced from said supply, means carried by said frame having members engaging said paper strip and interrupting the advance of said paper strip for cutting of said paper strip, a cutter frame mounted on guides in said frame and having members for adjustably positioning said cutter frame at a selected position transversely of said strip, first cutter means mounted on said cutter frame for severing a portion of the edge of the strip, second cutter means mounted on said cutter frame for transversely severing said strip, and means for successively actuating both said cutter means in timed relationship to the movement of the members interrupting the advance of said paper strip.

2. Convolute tube winding apparatus as defined in claim 1 in which said first cutter means comprises a pivotallly mounted knife blade.

3. Convolute tube winding apparatus as defined in claim 1 in which said first cutter means comprises a knife blade having parallel cutting edge portions.

4. Convolute tube winding apparatus as defined in claim 1 in which said first cutter means comprises a knife blade having diverging cutting edge portions.

5. Convolute tube winding apparatus as defined in claim 1 in which said first cutter means comprises a knife blade having a cutting edge portion disposed longitudinally of the strip to be cut.

6. Convolute tube winding apparatus as defined in claim 1 in which said actuating means has members for advancing said first cutter means to a severing position prior to advance of said second cutter means to a severing position.

7. Convolute tube winding apparatus as defined in claim 1 in which:
said first cutter means comprises a movable blade, a shaft, a cam mounted on said shaft, and actuating connections between said cam and said blade.
8. Convolute tube winding apparatus as defined in claim 7 in which said actuating connections have adjustable portions thereon for setting the position of said blade.

9. Convolute tube winding apparatus as defined in claim 1 in which said second cutter means comprises a pivotally mounted knife blade.