Nov. 2, 1971 C. K. DUNLAP, JR., ET AL 3,616,819

SPIRALLY WOUND PAPER TUBE

Original Filed Jan. 5, 1966

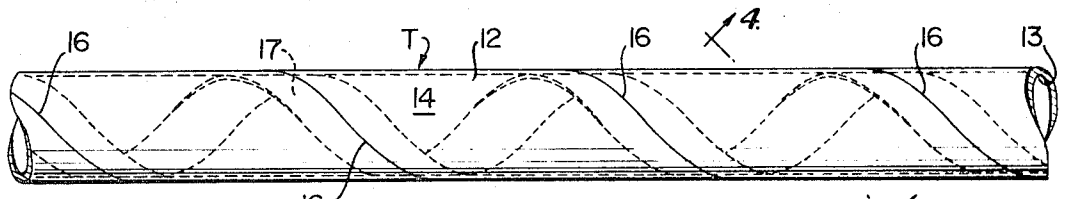


FIG. 1

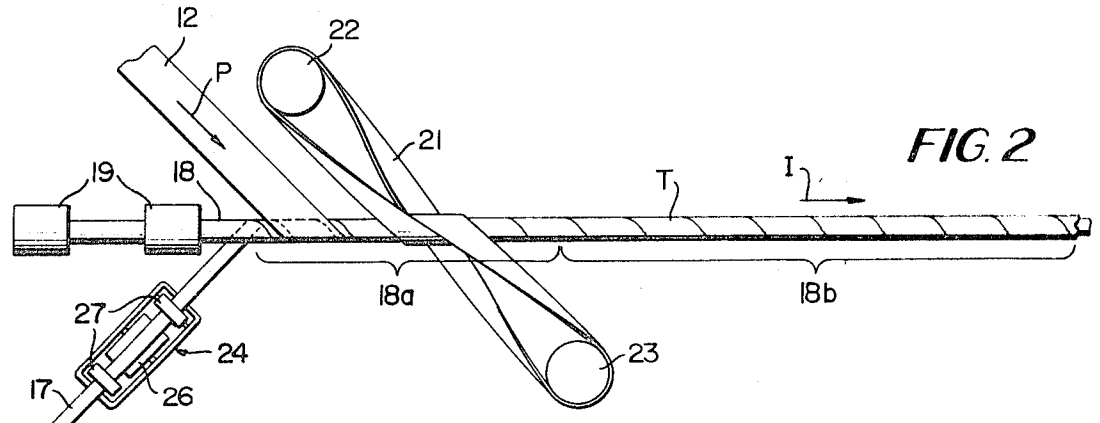


FIG. 2

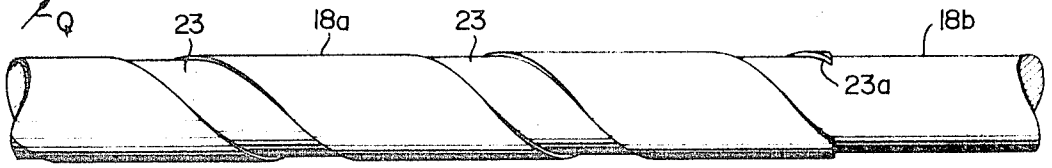


FIG. 3

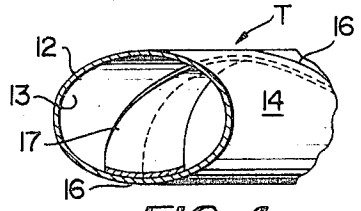


FIG. 4

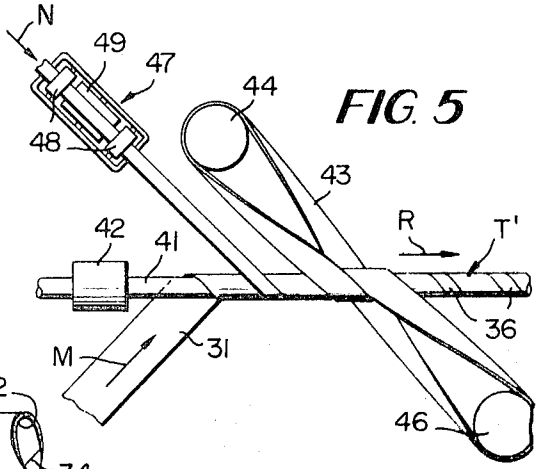


FIG. 5

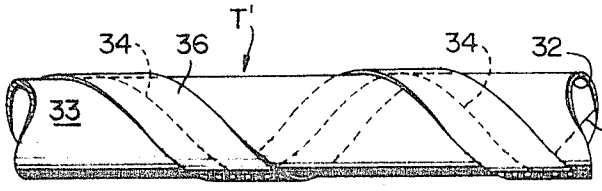


FIG. 6

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SPIRALLY WOUND PAPER TUBE

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Int. Cl. F16l 9/16; B31c 3/04, 9/00

U.S. Cl. 138—144 2 Claims

ABSTRACT OF THE DISCLOSURE

A spirally wound paper tube including a relatively narrow strip of paper spirally wound in underlying relationship with a relatively wide paper strip with adhesive therebetween and with the spiral seam of the relatively wide paper strip positioned approximately intermediate the side edges of the narrow strip.

This application is a division of the pending application entitled Method of Producing a Spirally Wound Tube, Ser. No. 519,819, filed by the applicants herein on Jan. 5, 1966, now U.S. Pat. No. 3,468,733.

Spiral tubes and in particular spirally wound paper tubes are in widespread use today for a multitude of purposes such as the winding of sheet material including paper, plastic film and the like. Such spiral tubes are required to possess certain minimum strength characteristics such as beam and crush strength so as to receive the windings of sheet material without collapsing. In order to provide the desired degree of strength in such spirally wound paper tubes, they are commonly formed from a plurality of plies of spirally wound paper strips arranged in staggered relationship with adhesive therebetween to hold the plies together in the spiral tube form.

As can be understood, such a spiral tube generally requires at least two plies for mutual retaining engagement so as to hold the plies together in the spiral tube form. This required use of at least two plies adds materially to the cost of such a tube from both the standpoint of the paper required for the additional plies as well as the additional adhesive required to secure the overlying plies together. Such additional cost factors represent the difference between commercial success and failure in many instances where it is required that an absolute minimum of cost be represented by the spiral tube or core on which the relatively costly sheet material is wrapped.

Accordingly, a primary object of this invention is to provide a new and novel spiral tube.

A further object of this invention is to provide a new and novel spiral tube utilizing only a single body ply.

Still another object of this invention is to provide a new and novel spiral tube of one body ply construction which requires only a minimum amount of paper and adhesive so as to be relatively inexpensive to manufacture but at the same time is sufficiently strong and durable so as to be capable of being wound with a wide variety of sheet materials.

Other objects and advantages of the invention will become apparent from the following description taken in connection with the accompanying drawing.

The objects stated above and other related objects in this invention are accomplished by winding a relatively

wide body ply of strip material such as paper into a tubular body having a spiral seam utilizing a spiral tube winding operation. At the same time, a relatively narrow strip of material, preferably also paper, having adhesive applied thereto is spirally wound over the spiral seam on the tubular body. This relatively narrow paper strip is thus adhesively secured to the edge portions of the body ply adjacent the spiral seam and maintains the body ply spirally wound into the tubular body to form a spirally wound paper tube.

The novel features which are believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation may be best understood by reference to the following description taken in conjunction with the accompanying drawing in which:

FIG. 1 is a side view of the spiral tube of the invention;

FIG. 2 is a schematic plan view of winding aparatus for forming the spiral tube of FIG. 1 and for carrying out the method of the invention;

FIG. 3 is an enlarged plan view of a portion of the mandrel of the winding apparatus of FIG. 2;

FIG. 4 is a sectional view taken substantially along line 4—4 of FIG. 1 in the direction of the arrows;

FIG. 5 is a view similar to FIG. 2 showing a modification of the invention; and

FIG. 6 is a side view of a portion of the spiral tube formed with the arrangement of FIG. 5.

Referring now to the drawing and to FIG. 1 in particular, there is shown a spiral tube formed in accordance with the invention and designated generally by the reference character T. Although the spiral tube T may be formed of any suitable material, it is preferably formed of a fibrous material such as paper.

The spiral tube T includes a relatively wide body ply **12** which is spirally wound as shown in FIG. 1 into a tubular body having an inner surface **13** and an outer surface **14**. The single body ply **12** is spirally wound with the edges of adjacent convolutions in abutting relationship to form a spiral seam **16**.

A relatively narrow strip **17** of material such as paper is also spirally wound over the spiral seam **16** of the tubular body formed by the body ply **12**. By means of an adhesive which is preferably applied to one surface of the relatively narrow strip **17**, the strip **17** is secured to edge portions of the body ply **12** adjacent the spiral tube seams **16** with the steam **16** preferably substantially intermediate the side edges of the strip **17** as shown.

In the embodiment of FIG. 1, the strip **17** is secured to the inner surface **13** of the spirally wound ply **12** and maintains the body ply **12** spirally wound into the tubular body to form the spiral tube T of the invention. Thus, the spiral tube T employs only a single body ply **12** together with a relatively narrow strip **17** which prevents the single body ply **12** from unwinding from the spirally wound tubular body forming the spiral tube T.

The spiral tube T of FIG. 1 is formed utilizing a novel method as illustrated schematically by the spiral tube winding apparatus of FIG. 2. The spiral tube winding apparatus of FIG. 2 includes a mandrel **18** supported at one end in a suitable frame **19** and a flexible endless belt **21** extending around a pair of pulleys **22, 23** at least one of which is driven for rotating and advancing the tube T in the direction of the arrow I as it is formed in the well-known manner.

The mandrel **18** includes a guide portion **18***a* adjacent the fixed end of the mandrel and a smooth cylindrical portion **18***b* forwardly of the section **18***a* having an outer diameter corresponding generally to the inner diameter of the spiral tube T defined by the strip **17**. The mandrel guide portion **18***a* is formed with a spiral groove **23** extending substantially throughout its length which accommodates the relatively narrow paper strip **17** during the winding operation. Thus in one embodiment of the invention, the spiral mandrel groove **23** is approximately 1 inch in width to accommodate a strip **17** having a width of 1 inch and is approximately 0.009 inch in depth to accommodate a strip **17** of approximately 0.015 inch in thickness. The groove **13** is preferably of such a depth so as to permit the strip **17** seated therein to project above the outer surface of the mandrel portion **18***a* thus insuring contact with the overlying body ply **12**.

In the winding of the spiral tube T by the novel method of the invention, the paper strip forming the relatively wide body ply **12** is unwound in the direction of the arrow P from a supply roll (not shown) and wound onto the mandrel **18** with the edges of adjacent convolutions in abutting relationship to form the spiral seam **16**. At the same time, the relatively narrow strip **17** is similarly unwound in the direction of the arrow Q from a supply roll (not shown). The strip **17** is conducted through a glue applicator designated generally by the numeral **24** and spirally wound onto the mandrel **18** between the mandrel and the strip **12** within the mandrel groove **23**.

In order to adhere the strip **17** to the body ply **12**, the strip **17**, advancing through the glue applicator **24** is maintained in contact with an applicator roll **26** suitably supported for rotation in the glue applicator **24**. Contact between the applicator roll **26** and the strip **17** is maintained by suitable guide rolls **27** supported for rotation on the glue applicator as shown in FIG. 2 so that the applicator roll **26** applies adhesive to the surface of the strip **17** which subsequently contacts the ply **12** when the strips **12, 17** are wound onto the mandrel **18**.

During the winding operation of FIG. 2, the strip **12** is positioned so as to locate the spiral seam **16** approximately intermediate the side edges of the relatively narrow strip **17** so that the strip is adhesively secured to the edge portions of the body ply **12** adjacent the spiral seam **16** as shown best in FIG. 1 to maintain the body ply **12** spirally wound into the tubular body to form the spirally wound tube T.

As the tube T formed by the strips **12, 17** wound together moves in the direction of the arrow I by means of the belt **21**, the strip **17** moves along the groove **23** throughout the mandrel portion **18***a* until it emerges at the groove opening **23***a* securely and permanently glued to the overlying body ply **12**. Subsequently, further movement of the formed spiral tube T takes place along the smooth mandrel portion **18***b* with the continuously formed spiral tube T cut into appropriate lengths in the well-known manner by suitable cutoff means (not shown).

It should be understood that the paper strip **12** may be of any suitable width within a wide range for forming the spiral tube T such as is commonly found in spiral tubes manufactured today. The width of the strip **17** need only be such as to provide for positive adhesion between the strip **17** and the edge portions of the ply **12** adjacent the seam **16** for maintaining the tube T in the wound condition. In one embodiment of the invention, the width of the strip **17** is ⅓ the width of the strip **12** so that a 1 inch strip **17** is used together with a 3 inch width strip **12** to form the tube T.

FIGS. 5, 6 show a modification of the invention in which a modified method of winding is employed to produce a modified spiral tube T'. The spiral tube T' of the modification utilizes a relatively wide body ply **31** having an inner surface **32** and an outer surface **33**. The body ply **31** is wound similarly to the body ply **12** of the embodiment of FIG. 1 with the edges of adjacent convolutions in abutting relationship to provide a spiral seam **34**. However, the relatively narrow strip of the embodiment of FIGS. 5, 6 identified by the numeral **36** is spirally wound onto the outer surface **33** of the body ply **21** and is adhesively secured to edge portions of the body ply outer surface **33** adjacent the spiral seam **34**. The strip **36** functions similarly to the strip **17** of the embodiment of FIG. 1 in that only a single body ply **31** is employed which is held spirally wound in the form of a tubular body by the strip **36** to form the spiral tube T'.

In carrying out the modified method of the invention with the apparatus of FIG. 5 by means of which the tube T' is produced, a smooth surfaced mandrel **41** is provided supported at one end in a frame **42** and has associated therewith a winding belt **43** extending around belt pulleys **44, 46**. The strip **31** forming the relatively wide body ply of the tube T' is advanced in the direction of the arrow M and spirally wound onto the mandrel **41** as shown. The strip **36** to which adhesive is applied in the glue applicator **47** is advanced in the direction of the arrow N and spirally wound on the outer surface of the wound strip **31** as shown over the spiral seam **34**. The glue applicator **47** includes guide rolls **48** and an applicator roll **49** which applies glue to that surface of the strip **36** which contacts the underlying wound strip **31** and the strip **36** is positioned so that it is adhesively secured to the edge portions of the wound strip **31** adjacent the spiral seam **34** intermediate the side edges of the strip **36**. As in the embodiment of FIGS. 1–4, the wound tube T' is moved in the direction of the arrow R by means of the belt **43**.

It can be seen that there has been provided with the novel construction of this invention a spirally wound tube which may be formed from relatively soft weak material such as paper and utilizing only a single body ply while achieving strength characteristics adequate to support windings of sheet material without collapsing. An outstanding feature of the invention is the elimination of a second body ply presently required to maintain spirally wound paper tubes in the wound condition utilizing present day spiral tube winding practices. Not only does the elimination of the second ply simplify the manufacture of the spiral tube of the invention but in addition a substantial saving in paper and adhesive costs result permititng the production of a far cheaper tube than presently manufactured for the same purposes. By the novel method for forming the spiral tube of the invention, the tube may be inexpensively and easily wound at a high production rate with an elimination of such problems as unstuck plies, and a reduction of start-up time for tube manufacture. In addition, the spiral tube of the invention may be formed selectively with the relatively narrow holding strip on the inside or outside of the single body ply without any sacrifice in utility or increase in cost thereby producing a remarkably simple commercially attractive throw-away paper tube of the type long required by purchasers.

While there has been described what at present is considered to be the preferred embodiment of the invention, it will be understood by those skilled in the art that various changes and modifications may be made therein without departing from the invention.

Having thus described the invention, what is claimed is:

1. A spirally wound paper tube consisting of a relatively wide body ply of fibrous material spirally wound with the side adges of adjacent convolutions in abutting engagement to form a tubular body having a spiral seam; a relatively narrow, spirally wound strip of fibrous material extending over said spiral seam and adhesively secured on the outer surface of the edge portions of said relatively wide body ply adjacent said spiral seam to maintain said body ply spirally wound into said tubular body and thereby form a strong and durable spiral tube with

a minimal amount of materials to permit winding a wide variety of sheet materials thereon.

2. A spiral tube in accordance with claim 1 wherein said relatively narrow strip has a width of about ⅓ the width of said relatively wide body ply.

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U.S. Cl. X.R.

138—129, 137, 154; 156—188, 190, 195, 304; 161—47, 145