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APPARATUS FOR FORMING TUBULAR ARTICLES

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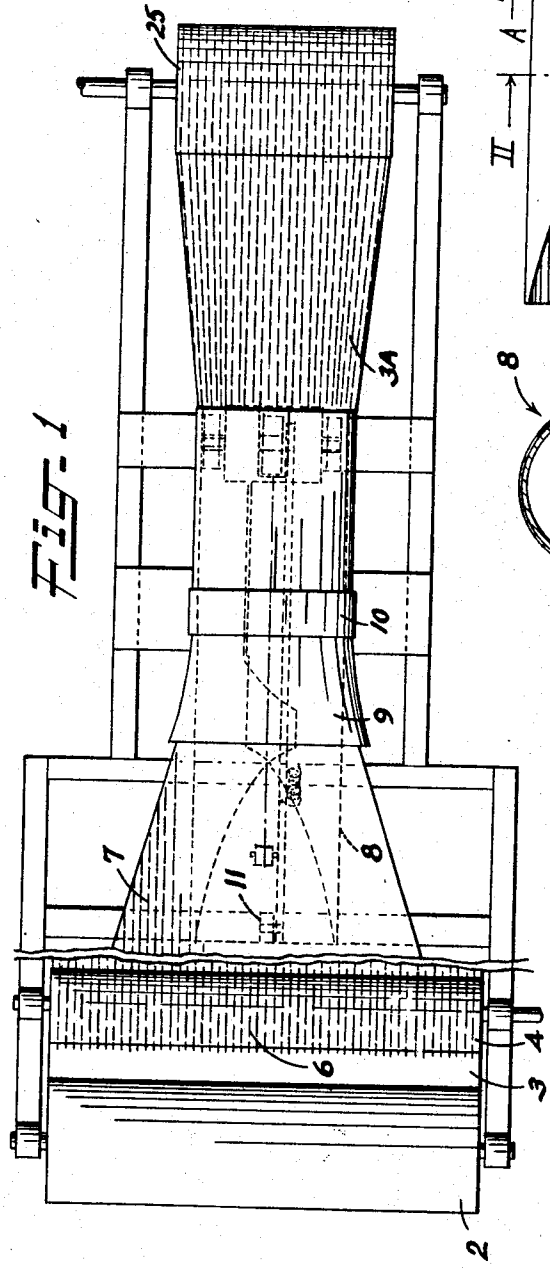


Fig-1

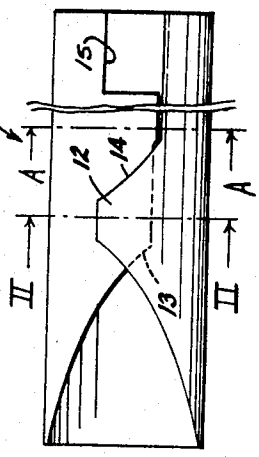


Fig-4

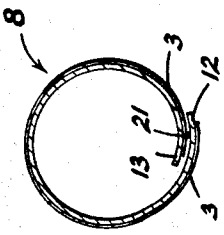


Fig-2

Fig-3

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APPARATUS FOR FORMING TUBULAR ARTICLES

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Original application July 18, 1944, Serial No. 545,504. Divided and this application July 13, 1950, Serial No. 173,565

8 Claims. (Cl. 93—82)

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This invention relates to the production of a continuous tubular article from a flat sheet. It is particularly concerned with the production of tubes of paper for wrapping wound packages of textile materials, such as rayon "cakes," cones, or the like, preparatory to liquid treatment of such wound packages. However, it is applicable as well to the formation of tubes from a sheet or web of paper, textile fabrics, metal foils, or other flexible materials for any use or purpose whatsoever. This application is a division of copending application Serial No. 545,504, filed July 18, 1944, now Patent No. 2,631,509, patented March 17, 1953.

In accordance with the present invention, a sheet of a flexible material is guided so that one of its lateral edges is lapped over the opposite lateral edge to form a hollow tube and a narrow strip or thread of a thermosensitive material is directed between the overlapped portions of the material and these portions are then subjected to heat and pressure to cement the lapped joint. The invention is of special advantage when specifically modified for the continuous production of tubular articles.

In the drawing which is illustrative of the invention—

Figure 1 is a plan view of a preferred embodiment of the invention;

Figure 2 is a cross-section on line II—II of Figure 4;

Figure 3 is a side elevation; and

Figure 4 is a bottom view of one of the guiding elements of Figure 1.

As shown in Figures 1 and 2, the apparatus comprises a supply roll 2 for a continuous sheet of the flexible material to be formed into a tube, which, in the specific instance herein described, happens to be paper. From the supply roll, the paper 3 may pass between slitting mechanism which may comprise two rolls 4 and 5, one or both of which is provided with suitably arranged knives 6 to slit the paper longitudinally with parallel rows of slits 7, so that those in any one row are offset from those in the next adjacent row. The rolls 4 and 5 may be driven by means (not shown) suitably synchronized with the take-up.

After the paper sheet has been slitted as described above, it is fed continuously over a guide or inner circular sleeve 8 and simultaneously through a forming guide or outer circular sleeve 9 into which the sleeve 8 preferably extends. The outer periphery of inner sleeve 8 is radially spaced from the internal surface of the guide or outer sleeve 9 to form an annular path for

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the flexed sheet. Sleeve 9 is mounted on bracket 10 and is substantially circular in shape throughout its length except that it is desirably flared at its forward end to enhance forming and guiding of the sheet. Inner sleeve 8 is entirely mounted on a bracket 11 which is located preferably in advance of the forward edge of sleeve 9 and in a cut away or truncated area 8a of the sleeve. In order to facilitate proper overlapping of the edges of the sheet an area or tongue 12 of inner sleeve 8 extends around a part of the corresponding area 13 of the sleeve and is held in radial spaced relation thereto to form a spaced overlapping guide for the sheet. The area 12 is cut back at 14 so that it does not thereafter overlap the opposite edge of the sleeve and in the preferred form the trailing edge of the sleeve is cut away at 15 to provide an opening or aperture for a purpose to be described hereinafter.

The outer sleeve 9 is cut away at 16 in alignment with the cut away portion 15 of sleeve 8 to permit a heated drum or roll 17 mounted outside the sleeves to cooperate with a pressure roll 18 mounted inside the inner sleeve 8 in alignment with notches 15 and 16. Pressure roll 18 is supported on an arm 19 which extends through the bore of sleeve 8 and may be mounted in advance of the sleeve in any suitable manner such as on member 11. Suitable sealing pressure between the roll 17 and the pressure roll 18 is supplied by means of an extension spring 20 likewise positioned in advance of sleeve 9.

A thread or narrow strip 21 of thermosensitive material passes through a tension device 22 and a guiding pulley 23 and between the overlapped edge portions of the flexible sheet as shown in Figure 3, until it finally passes between the rolls 17 and 18 where the heat and pressure render it adhesive to bond the overlapped edges of the sheet 3, thereby forming the tube 3A which proceeds under a bail or rod 24 and to the take-up 25 which may be rotated by any suitable means (not shown).

While the apparatus as shown includes the slitting devices 4, 5, this may be omitted entirely, or it may be arranged between the discharge side of the guides 8 and 9 and the take-up 25. For certain purposes it may be desired to replace such means with a perforating means.

The thread or strip 21 may be composed of any material thermoplastic or even thermosetting which is rendered adhesive by heating. Examples of such materials include the vinyl resins, particularly those of polyvinyl chloride, copolymers of vinyl chloride with vinyl acetate or acrylonitrile, after-chlorinated vinyl polymers or

copolymers, polyvinylidene chloride; also acrylic and methacrylic acid ester resins, such as polymerized methyl methacrylate; nylons; cellulose derivatives, such as ethyl cellulose and so on.

The present invention has numerous advantages in that the messiness that accompanies the application of liquid adhesives is entirely avoided. The strip **21** is readily controlled reliably, so that it cannot escape from its relationship between the overlapped edge of the sheet to be bonded before its activation to an adhesive condition. In addition, the use of a narrow continuous thread or strip provides a simple way of controlling the amount of adhesive and the width of bonding layer in the product, which makes it possible to limit the change in liquid permeability of the bonded areas of the sheet to a minimum, or to control it to provide any predetermined change in permeability, depending upon the ultimate use to which the product is intended to be put.

The invention is of special advantage when applied to the production of liquid-permeable paper wrappers for wound cakes of rayon resulting from the collection of freshly spun filaments in centrifugal buckets. Such wrappers and their use is disclosed and claimed in the copending application for United States Letters Patent of Decker and Spangler, Serial No. 506,526, filed October 16, 1943 now Patent 2,382,400. After the tubular wrapper is collected on the take-up **25**, it needs merely to be cut to the desired length to provide the final wrapper of sleeve-like form.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined by the appended claims. In the claims, the term "strip" is intended in a generic sense to comprehend monofilament or multifilament threads as well as ribbons or bands of slight or considerable width. Similarly, "tubular" and "tube" is not to be restricted to a hollow cylindrical article, but may include a hollow article of any cross-section.

I claim:

1. Apparatus for producing a tubular element from a flexible sheet comprising means for drawing the sheet continuously through a path, means along the path for slitting the sheet, guide means along the path for forming the sheet into tubular shape and arranged to lap one edge of the sheet over the opposite edge thereof, means in advance of the guide means for directing a strip of thermosensitive material between the overlapped edges, means for tensioning the strip, means adjacent the discharge side of the guide means and in substantial alignment with the strip-directing means for subjecting the overlapped edges with the strip therebetween to heat and pressure, and means for winding the tubular article in flattened form.

2. Apparatus for producing a tubular element from a flexible sheet comprising means for drawing the sheet continuously through a path, guide means along the path for forming the sheet into tubular shape and arranged to lap one edge of the sheet over the opposite edge thereof, said guide means comprising two generally concentric members having an approximately annular passage therebetween, said inside member having a substantially circular hollow trailing edge and having a split truncated hollow leading edge, a tongue forming one terminus of said leading edge and overlapping in radially spaced relation the opposite terminus of the leading edge, means in advance of the guide means for directing a strip of thermosensitive material between the overlapped edges, means for tensioning the strip, and roll means adjacent the discharge side of the guide means and in substantial alignment with the strip-directing means for subjecting the overlapped edges with the strip therebetween to heat and pressure, said roll means comprising a pair of adjacent rolls between which the overlapped edges pass and means for heating one of the rolls.

3. A forming guide assembly for producing a tubular element from a sheet travelling continuously through a path comprising a first outer circular sleeve through which the sheet passes, a member for rigidly supporting said first sleeve in said path, a second inner circular sleeve over which the sheet passes said second sleeve extending into the bore of the first sleeve, means for rigidly supporting the second sleeve in said path in advance of said first sleeve to form a fixed annular passage for the sheet between the first and second sleeves, and means along said path in advance of said sleeves for slitting the sheet.

4. A forming guide assembly in accordance with claim 3 having a sealing member extending through the second inner sleeve to a point adjacent the rear terminus thereof.

5. A forming guide assembly in accordance with claim 3 in which the inner sleeve extends in advance of the outer sleeve to form a truncated forward shell to guide the sheet over the inner sleeve support.

6. A forming guide assembly in accordance with claim 5 having a sealing member extending through the second inner sleeve to a point adjacent the rear terminus thereof, a sealing head on said member and a support for said member in front of the outer sleeve and below the truncated portion of the inner sleeve.

7. A forming guide assembly in accordance with claim 3 having a pressure sealing member extending through the inner sleeve to a point adjacent the rear terminus of the inner sleeve, a sealing head carried by said member adjacent the terminus of said outer sleeve, a second sealing head cooperating with said first sealing head positioned outside the tubular element, and means associated with said sealing member for applying sealing pressure to the tubular element between the sealing heads.

8. A forming guide assembly in accordance with claim 3 in which the slitting means comprises a roller having a plurality of axially spaced staggered knives around its periphery.

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