United States Patent

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[54] **BANDING APPARATUS**
16 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** ..... **53/3,** 53/198 B, 53/291
[51] **Int. Cl.** **B65b 13/00,** B67b 5/00
[50] **Field of Search** 53/241, 256, 196, 197, 291, 198, 180, 183, 28, 29; 17/42; 226/8; 53/3

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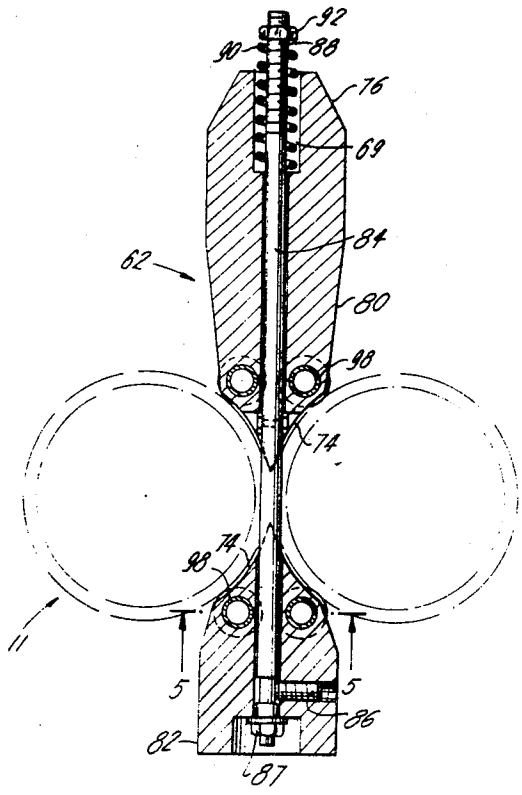
ABSTRACT: A banding apparatus for opening a substantially continuous ribbon of flattened flexible tubular material such as cellulose and severing that opened material to the desired length. Such apparatus includes a roll supported floating material which is actively positioned for internal engagement with the material by a pair of driven feed rollers. An electronic or similar control system synchronizes the feeding, cutting and positioning of an article to be enclosed by the severed sleeve of material.



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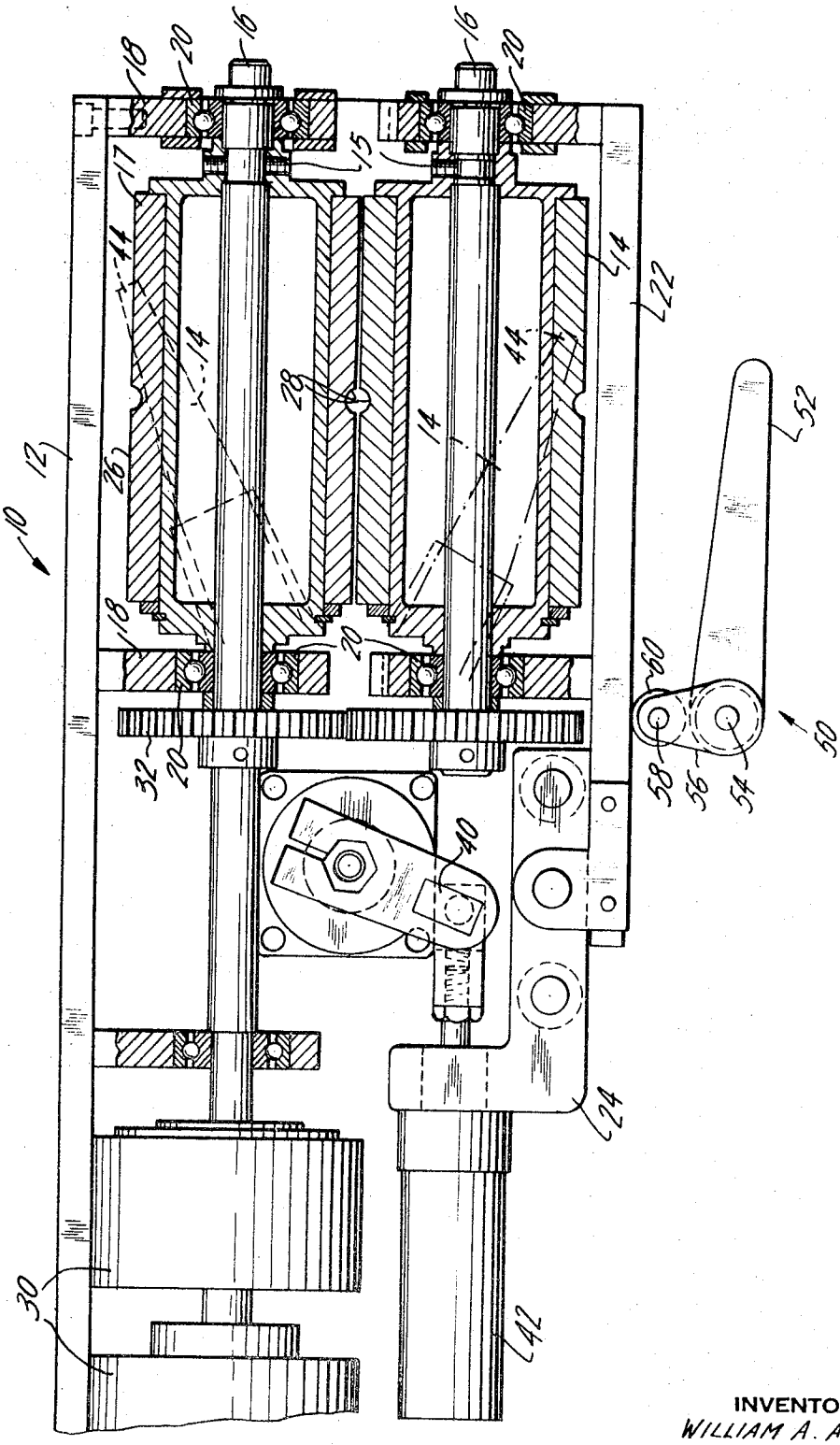

FIG. 1

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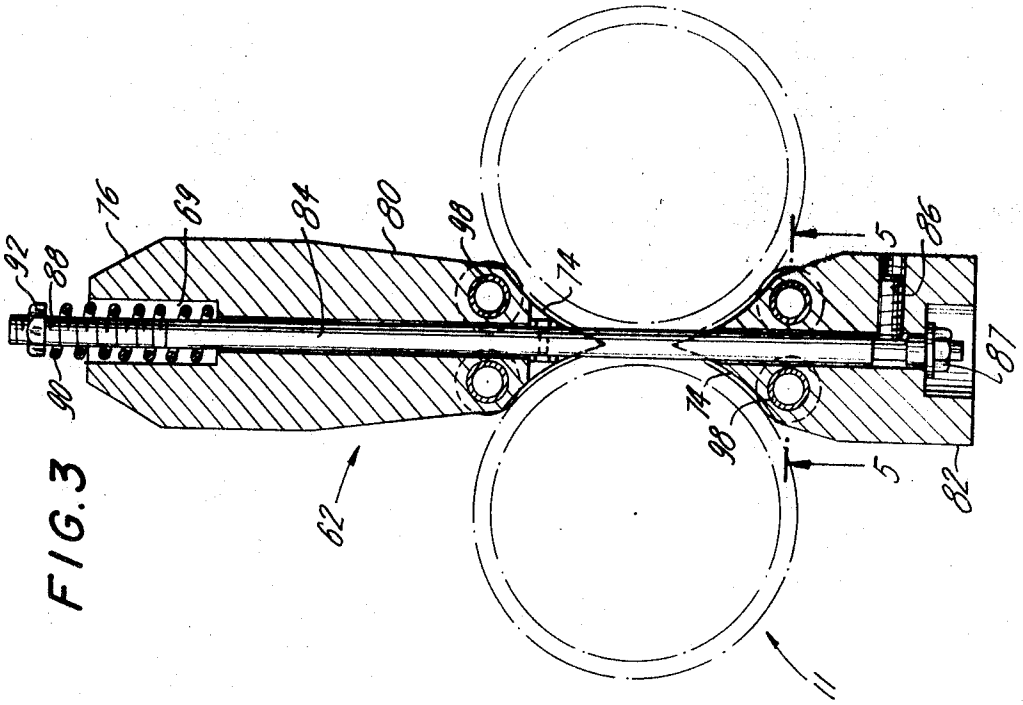

FIG. 3

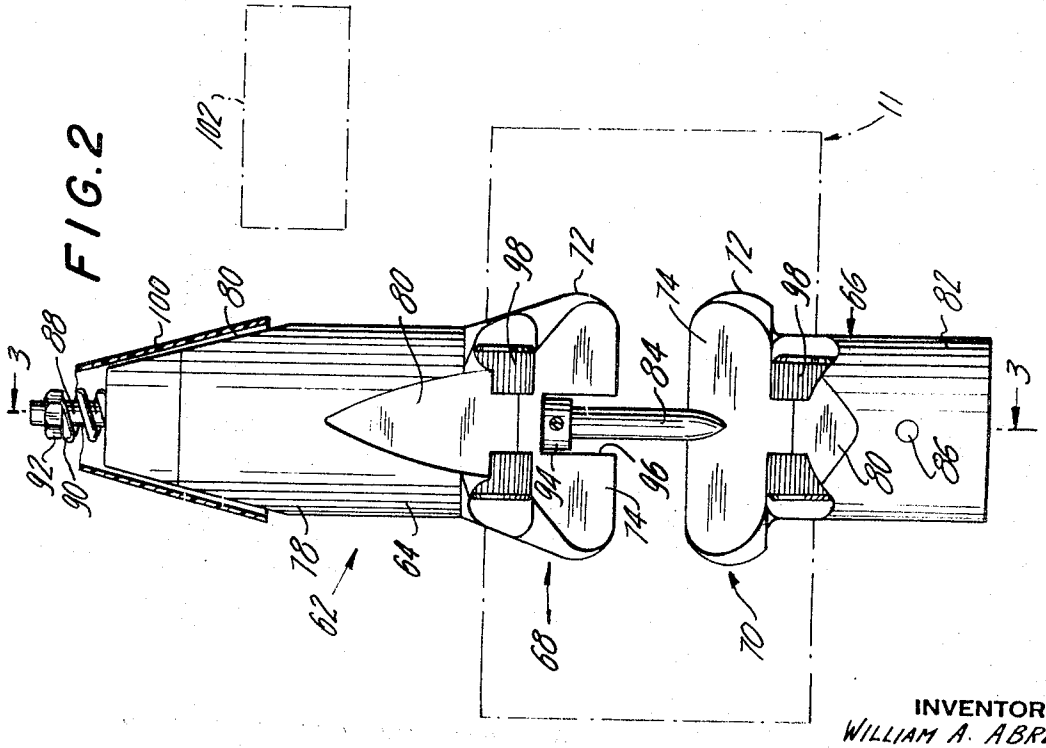

FIG. 2

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FIG. 5

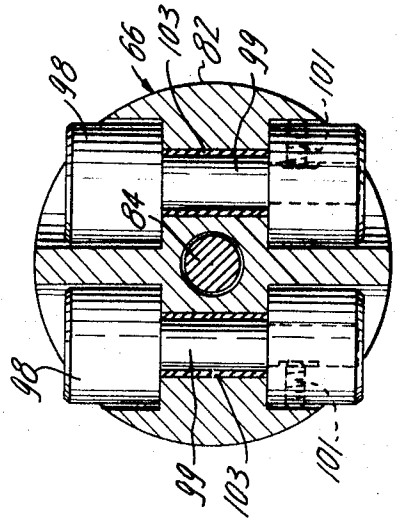
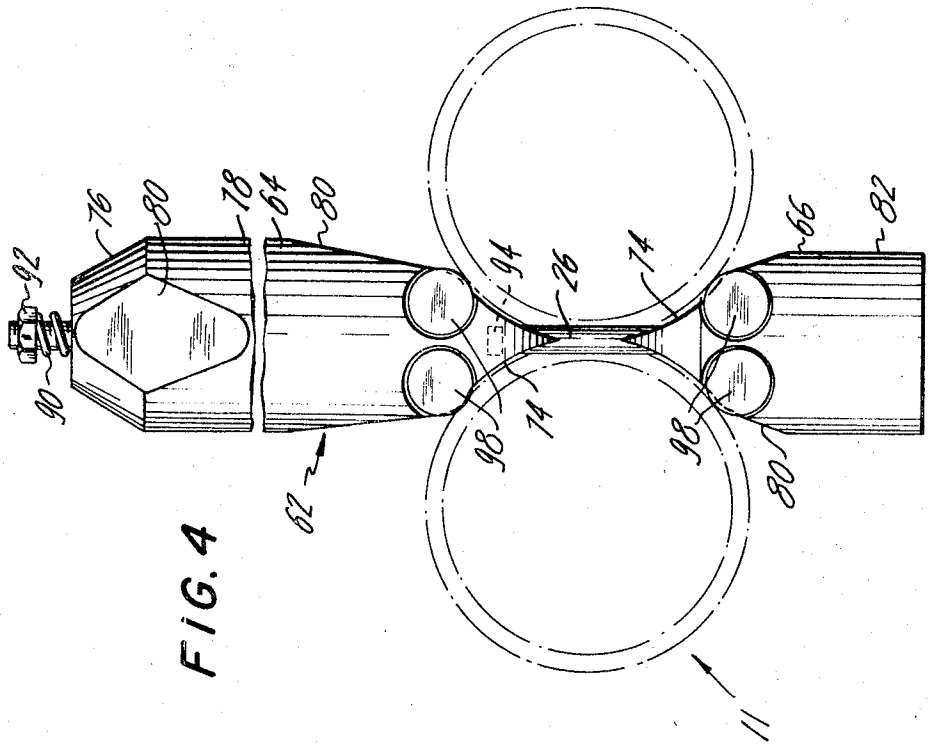


FIG. 4



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BANDING APPARATUS

This invention relates to a device for applying tubular bands or sleeves to a variety of products or product packages. More particularly, the invention relates to an applicator construction for feeding an elongated continuous ribbon of flattened flexible material over a product package and thereafter severing the material to the desired length.

In specific areas of the bottling industry and in other packaging, it has become conventional to apply a sleevelike seal interconnecting the package cover or closure and the container itself. Such seals in overlapping both the cover and container create a tamper and pilferproof package, assure a hermetical seal therebetween, and present a more attractive package. Additional utility for these devices may encompass the application of protective sleeves to glassware, thus eliminating the need for individual paper or cardboard wrapping, and to packaging per se where the sleeve only will encase the product.

Various sleeve materials may be employed with this apparatus, several of which are cellulosics, shrinkable thermoplastics, and polyethylene or similar nettings. As indicated, these may function as sealing, protecting and/or encasing media but for the purpose of this disclosure, emphasis will hereinafter be placed upon sealing a container and its closure. Further, the included discussions will relate principally to the use of a flexible flattened ribbon of cellulose which, to be properly maintained without premature shrinking, must be stored in formaldehyde, alcohol, glycerine or some other suitable liquid.

For convenience in manufacturing, shipment and use, this tubular cellulose material is flattened and spooled. It therefore must be opened to its original tubular form and severed into the desired lengths as it is applied in use. It is to this end that this invention is directed.

Prior art devices for the application of these tubular sleeves have in many respects been unsatisfactory. Principally, these deficiencies relate to difficulties in material feeding which in turn are brought about by the inherent adherence of such plastics, as are mentioned, to themselves. Thus, a flattened ribbon of cellulose tends to stick together and resists efforts directed to its opening. Further, because it is necessary to maintain cellulose in a fluid bath, nonuniform coefficients of friction throughout the feed train may cause variations in cut lengths of material. This in turn may result in defective sealing, improper registry of printed matter on the material and apparatus jamming or plugging.

Several of these devices also necessitate abutment between the ribbon opening mandrel and the top of the bottle or container. This, of course, presents the possibility of damage to the bottle and mandrel, as well as requiring that either the bottle or the device be moved toward the other, an amount substantially equal to the seal length desired. Such relative movement further complicates the apparatus construction, increasing its initial cost and making operation and maintenance more difficult.

In addition, presently commercial apparatus includes a cutoff arrangement that actively severs against the lower extremity of the opening mandrel. This also creates maintenance and operational problems.

Another problem is caused by the shrinkage of the cellulose material prior to its arrival at the opening mandrel and container top. As noted, this material is maintained in a fluid bath and, upon its removal therefrom, drying and consequently shrinkage begins. Thus, upon its arrival at the opening mandrel, the material may already be undersize. This then further complicates opening because it must be stretched back to size as it is pushed over the forming section of the mandrel and onto the container. This creates an additional resistance to the forward feeding of the material and therefore contributes to the problems noted above.

It therefore is the primary objectives of this invention to produce a seal applicator apparatus which more simply, effectively and efficiently will position a tubular sleeve on a container or similar product or package. In accomplishing these objectives and overcoming the problems of the prior art, this device provides a plural positive feeding action exterior and interior of the flexible flattened tubular material. Contact between the container and apparatus and relative movement of these towards each other to effect that contact is eliminated. A portion on the upper part of the floating mandrel is constructed to "oversize" (i.e., stretch) the tubular material prior to its being finally opened and inserted over the container.

Additionally, the mandrel, in its operational position between the feed roller system, is stabilized by the placement idler rolls on the mandrel. These rolls also assist in the positive feeding mentioned, which feeding is further improved due to a pressure loading that may be adjustably applied between the idler rolls and feed rollers. The added stability and accurate feed also now make it feasible to employ electronic sensing means to activate and synchronize the related feeding and cutting functions responsive to the perception of indicia on the material.

These and additional objectives, uses and advantages of the invention will become more apparent upon reference to the following description, claims and appended drawings wherein:

FIG. 1 is a top plan view in partial cross section showing the feed roller and cutter arrangement of the invention;

FIG. 2 is a front elevation of the floating mandrel with the feed rollers and a ribbon-sensing device shown in phantom;

FIG. 3 is a vertical cross section of the floating mandrel taken along line 3–3 in FIG. 2;

FIG. 4 is a side view of the application device partially broken away; and

FIG. 5 is a horizontal cross section of the floating mandrel showing the idler roller arrangement and taken along line 5–5 of FIG. 3.

With continuing reference to the accompanying drawings wherein like reference numerals designate similar parts throughout the various views, and with initial attention directed to FIG. 1, reference numeral **10** is used to specify the feed roller assembly of the invention. This assembly includes a pair of opposed feed rollers **14** which when operational are pressed together in side-by-side relationship forming roller nip **26**. The feed roller frame **12** supports the rollers **14** in bearings **20** and bearing mounts **18** both of which are interconnected to the frame.

Each roller, of course, is securely positioned on a suitable shaft **16** which is, in turn, supported by the bearing **20** in frame **12**. Any satisfactory fastening means, such as set screws **15** may be employed to secure the rollers to their respective shafts.

The feed rollers **14** are resiliently covered as for example by rubber **17** which material is centrally grooved as at **28**. These grooves are intended to mate as is seen in FIG. 1 forming a cylindrical opening between the rollers at nip **26**. This opening is adapted to accommodate a support rod **84** more fully described below.

In a preferred arrangement, the frame **12** includes a pivoted frame member **22**. This member, as its name implies, is pivotally attached by means of yoke **24** to the stationary portion of frame **12** and is adapted to be held in its operational position by a locking mechanism **50**. This mechanism may also be attached to the stationary portion of the frame through an axle mounting **54**. To this axle is mounted a handle **52** and integral yoke **56** the latter of which carries a bearing roller **60** on axle **58**. As should be apparent when the handle is pivoted counterclockwise, as viewed in FIG. **1**, the bearing roller **60** will be moved out of contact with the frame member **22**. Such movement to an out of the way position enables member **22** to be swung or pivoted away from the stationary frame portion so that a floating mandrel **62**, more fully described hereinafter, can be easily positioned within the feed roller assembly **10**.

The assembly **10** also includes a motor, brake and clutch unit **30** which acts through spur gears **32** to drive each of the rollers **14**. This then provides a positively driven roll pair which in their operational position are biased into contact at nip **26** by the locking mechanism **50**.

Also attached to the frame **12** is a cutting device or knife **44**. A fluid cylinder **42** activates the knife through a reciprocatory to oscillatory translation mechanism **40**, thus sweeping the knife across the path of feed of the rollers **14**. In a preferred construction, it is anticipated that the knife **44** be single acting so as to cut in one direction of movement only, however, a dual-acting knife may be suitably employed as desired. It should also be apparent that the intermittent operation of the motor combination **30** and fluid cylinder **42** must be synchronized to satisfactorily accomplish repetitive cutting of predetermined accurate lengths of any material that is fed between the rollers **14**.

Now referring to FIGS. **2**, **3** and **5**, one may gain a better appreciation for the feeding mechanism **11** of this invention and which, in its most rudimentary form, includes the combined opposed driven feed rollers **14** and a floating mandrel **62**. As is explained hereinabove, the mandrel is adapted to be inserted into a substantially continuous ribbon of flattened flexible tubular material **100** and is intended to open the material so that it may be cut to length and placed over a container or similar article that is to be sealed.

The floating mandrel **62** includes a generally cylindrical upper mandrel member **64** and a lower mandrel member **66** which are held in a spaced and predetermined relationship to one another by a support rod **84**. As can best be seen in FIG. **3**, this rod passes through each of the mandrel members **64**, **66** and is securely yet removably fixed to the lower member by a set screw **86** and nut and washer assembly **87**.

A rectangularly shaped stop collar **94** is also attached to the rod **84** at a position above the upper end **70** of the lower mandrel member **66**. This collar is adjustable along the rod and is adapted to mate with a similarly shaped rectangular slot **96** in the lower end **68** of the upper mandrel member. It should be also apparent from FIGS. **2**, **3** and **5** that the upper mandrel member **64** is maintained on the support rod **84** by an adjustment nut **92** which acts to force a coil spring or other suitable resilient means **90** against and into a counterbored area **69** of the member **64**.

The adjustment nut **92** is movable along the extended threaded portion **88** of the support rod **84**. Further, its placement therealong determines the degree of pressure that is transferred from the coil spring **90** to the upper mandrel member **64**. Regardless, however, of the position of nut **92**, the longitudinal movement of member **64** is confined between the spring and collar **94**. In addition, due to the respective rectangular shapes of the collar **94** and slot **96**, the upper mandrel member **64** is also restrained from any substantial rotational movement about the rod. Thus, simply by locking the collar **94**, as with a set screw or the like, the upper mandrel member may be retained in any one of a number of desired orientations with respect to the lower mandrel member (i.e., both in terms of longitudinal separation and in angular attitude).

The relationship of feed rollers **14** to the floating mandrel **62** is also readily apparent from FIGS. **2**, **3** an **5** wherein these rollers are shown in phantom outline. As was indicated above, these rollers are, in their operational position, urged by locking mechanism **50** into a mating side-by-side association producing the roller nip **26**. At the same time, the floating mandrel **62** is positioned between and on each side of the rollers due to the accommodation of rod **84** in the roller grooves **28**. Similarly, the lower end **68** of upper mandrel member **64** and the upper end **70** of lower mandrel member **66** are arcuately recessed at areas **74** so as to be spaced from but yet in close communication with the adjacent peripheral surfaces of rollers **14**. This particular mandrel, roller construction means that the feed rollers **14** may extend laterally across the entire width of the feed ribbon and thus actively feed across the entire width thereof.

Additionally, each mandrel member has four idler rolls **98** (as are best seen in FIG. **4**) mounted for rotation in roll recesses (unnumbered). Such adjacent mounting enables each roll to be exteriorly exposed in their respective arcuate recesses **74** and to protrude slightly therefrom. These exposed roller elements then are in a position to abut feed rollers **14** and to act in concert therewith. Therefore, a minimum drag or frictional effect is experienced between the mandrel **62** and rollers, and a positive driving effect is obtained inside of the tubular sleeve of material **100**.

The particular means for securing rolls **98** to the mandrel members is optional, however, one preferred construction is shown in FIG. **4**. There, one of each roll pair includes an integral shaftlike extension **99** that is adapted to accept a similar roll on its extreme end. This attached roll, of course, may be securely attached thereto in any suitable fashion, for example, with a set screw **101**. Further, to assist in the rotary movement of these rolls **98**, a sleeve of suitable bearing material **103** may be inserted in the mandrel member bore which is to accommodate the shaft **99**.

Again referring to FIGS. **2**, **3** and **5**, it will be apparent that the bearing pressure between the feed rollers **14** and idler rolls **98** may be varied by adjusting the nut **92**. Such adjustment, of course, compresses the spring **90** biasing the mandrel members more forcefully towards one another, which in turn varies the pressing contact between the rollers **14** and rolls **98**. With particular reference to FIGS. **3** and **4**, note that this arrangement therefore provides three areas of positive feeding: (1) at the nip **26** between the feed rollers **14**; (2) at the lines of contact between the rolls **98** and the upper mandrel member **64**; and (3) at the lines of contact between the rolls **98** and the lower mandrel member **66**.

In addition to the feeding aspect, the idler rolls, support rod and spring-loaded mandrel members when positioned on the feed rollers **14** function together to actively stabilize the mandrel rather than relying on gravity alone for such stabilization. So stable is the feeding mechanism **11** that it may be used as a part of a photoelectric sensing and control system more fully described hereinafter.

As should be obvious from the foregoing explanation, the ribbon of flattened flexible tubular material **100** initially contacts the upper mandrel member at a conical tongue area **76**. In addition to this area there are several other areas or flats **80** at various locations on both members **64**, **66** which are intended to assist in the passage of the material over the mandrel.

There is also a central portion **78** of the upper mandrel member **64** which has a peripheral measurement greater than that at any other point along either mandrel member. This portion is also intended to be oversize with respect to the particular fed ribbon and thus acts as a sizing die to stretch the ribbon as it passes thereover. It should be noted that this sizing is accomplished under tension because of the downstream pull of the rollers **14**, **98**, instead of under compression as would be the case if sizing were to be undertaken downstream of the rollers and rolls. Thus, as the ribbon passes over the lower mandrel member **66** and off the cylindrical terminus **82** thereof friction therebetween is reduced to a minimum.

Referring now in particular to FIG. **2** one will see that the lower end **68** of upper mandrel member **64** and the upper end **70** of lower mandrel member **66** include flared lips **72**. These lips protrude outwardly from their respective members to accommodate and guide the ribbon of flexible tubular material as it is substantially reflattened and fed between the nip of the feed rollers **14**. Such prevents a folding of the material upon itself and instead retains the original material integrity. Thus, the flattened ribbon is first opened and sized on the upper mandrel member **64** (i.e., upstream of the feed rollers). Thereafter, the material is substantially reflattened as it is fed between the feed roller nip **26**, however, as it exits the nip over the inside acting idler rolls, it is reopened and exits the cylindrical terminus **82** in the shape thereof. Note, in particular, that the cylindrical terminus **82** of the lower mandrel member **66** is also as short as possible, thus negating frictional drag.

This is in essence accomplished due to the elimination of longitudinal mandrel movement in the feeding action.

A package or container to be sealed is preferably conveyed to a position below or adjacent the cylindrical terminus. The feed rollers **14** are then activated in response to an electrical or other suitable signal, thus inserting the desired sleeve length over the package. The feed is thereafter discontinued in response to a similar signal and the cutter is activated to sever the material at a point between the terminus and the package top. Conveyance of the package is then continued to its next station. It should be pointed out that although this particular disclosure relate to the direct placement of the tubular sleeve on a container, it may be equally advantageous to insert the opened and severed sleeve into a transfer mechanism which will at some remote point in time deposit the sleeve on an appropriate package.

In a preferred embodiment of the apparatus control system, a photoelectric cell **102** is positioned adjacent the upper mandrel member **64** in an attitude suitable for sensing the presence of printed or similar indicia on the tubular material. This linked with a similar signal indicating the presence of a properly positioned container will function to initiate and terminate feeding and activate the cutter **44** in synchronization. Although cell **102** is shown to be scanning upstream from feed rollers **14**, other locations may be equally satisfactory.

Although the invention has been described in detail with particular reference to preferred embodiments thereof, it is to be understood that various modifications may be effected within the spirit and scope of the invention.

I claim:

1. A mandrel adapted for feeding and opening a flattened flexible tubular material and comprising: upper and lower mandrel members, support means adapted to separate said members such that each is maintained in a predetermined orientation with respect to the other and to resiliently mount one of said members for movement longitudinally along said means, and rotatable elements secured to said mandrel members which are adapted to assist in feeding said tubular material.

2. A mandrel according to claim **1** herein at least a portion of said upper mandrel member has a peripheral extent greater than the maximum peripheral extent of said lower mandrel member.

3. A mandrel according to claim **1** wherein the lower and upper ends respectively of said upper and lower mandrel members include opposed arcuately recessed areas adjacent which are positioned said rotatable elements.

4. A mandrel according to claim **3** wherein said lower and upper mandrel member ends protrude outwardly from said mandrel members so as to accommodate and guide said tubular material as it passes over said arcuately recessed areas.

5. A mandrel according to claim **3** wherein two each of said rotatable elements are secured adjacent and extending into each arcuately recessed area of both the upper and lower mandrel members.

6. A mandrel according to claim **5** wherein said support means includes a support rod fixedly yet removably fastened to and extending from said lower mandrel member at the upper end thereof, an adjustable stop collar secured to said rod at a point spaced from said upper end, and a resilient means connected to the extended portion of said rod and acting against said upper mandrel member biasing same along said rod and into contact with said collar.

7. A mandrel according to claim **6** wherein the lower end of said upper mandrel is slotted so as to accommodate aid collar which positions said mandrel in a predetermined orientation with respect thereto.

8. A banding machine adapted for feeding, opening and severing a ribbon of flattened flexible tubular material and comprising: a feeding mechanism including a pair of opposed and driven feed rollers which are adapted to grip and feed said flattened material between the nip thereof, a knife positioned downstream from said feeding mechanism which is operable in synchronization therewith, and a mandrel adapted to receive said tubular material thereover and positioned both up and downstream of said feed rollers and including upper and lower mandrel members, support means adapted to separate said members such that each is maintained in a predetermined orientation with respect to the other and to resiliently mount one of said members such that each is maintained in a predetermined orientation with respect to the other and to resiliently mount one of said members for movement longitudinally along said means, and a plurality of idler rollers secured to each of said members and positioned so as to actively engage said feed rollers and stabilize said mandrel thereagainst with said tubular material pressed therebetween.

9. A banding machine according to claim **8** wherein said feed rollers are substantially centrally grooved so as to accommodate a portion of said support means therebetween and in which the ends of said upper and lower mandrel members adjacent said feed rollers include arcuate recessed areas that are so shaped to closely receive the feed rollers in such manner that said members extend partially around said rollers.

10. A banding machine according to claim **9** wherein said support means includes a support rod removably secured to said lower mandrel member and extending therefrom between said feed rollers, and a resilient means acting against said upper mandrel member biasing same along said rod and into contact with said feed rollers.

11. A banding machine according to claim **10** wherein said resilient means is adjustably positionable such that the pressure between said idler rolls and feed rollers is adjustable.

12. A banding machine according to claim **8** wherein one of said feed rollers is pivotally mounted with respect to the other and a locking mechanism is positioned adjacent thereto so that in operation said rollers may be securely retained in juxtaposition.

13. In a banding machine, a feeding mechanism for feeding a ribbon of flattened flexible tubular material comprising: a pair of driven feed rollers in side-by-side relationship and respectively adapted to frictionally engage the opposite outer sides of said flattened ribbon during the feeding thereof between said rollers, said rollers having similar ribbon engaging surfaces extending more than the width of said ribbon, a floating mandrel adapted to be received within said ribbon and provided with plurality of idler rolls for stably supporting said mandrel between said rollers with the sides of said ribbon being interposed therebetween, and an adjustable resilient means positioned on said mandrel such that said idler rolls and the feed rollers are biased against one another.

14. A banding machine according to claim **7** wherein a sensing means positioned adjacent said mandrel and material activates said feed rollers and knife in a timed relationship responsive to an indicia on said material.

15. A method of opening a ribbon of flattened flexible tubular material comprising:

conducting said tubular material onto and over a mandrel member supported by a feed roller arrangement;

initially opening said material to a shape conforming to that of the mandrel;

stretching the material in conformance with its original maximum manufactured tolerance peripheral size;

substantially reflattening said ribbon as it passes between the feed roller arrangement; and,

finally reopening said material as it exists said arrangement and passes onto and over another mandrel member.

16. A method according to claim **15** wherein the reopened tubular material is fed from said another member onto an article and is thereafter severed to a desired length.