United States Patent [19]

Pepmeier

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[45] **Dec. 11, 1973**

[54] **SLEEVE MAKING APPARATUS AND METHOD**

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[52] **U.S. Cl.** ..... **93/94,** 93/1 TS, 93/82, 156/203, 156/250, 156/466

[51] **Int. Cl.** **B31c 13/00,** R31b 1/38

[58] **Field of Search** ..... 93/1 TS, 94, 82, 93/77 R, 77 CL, 1 F; 156/203, 250, 466, 467, 554, 510

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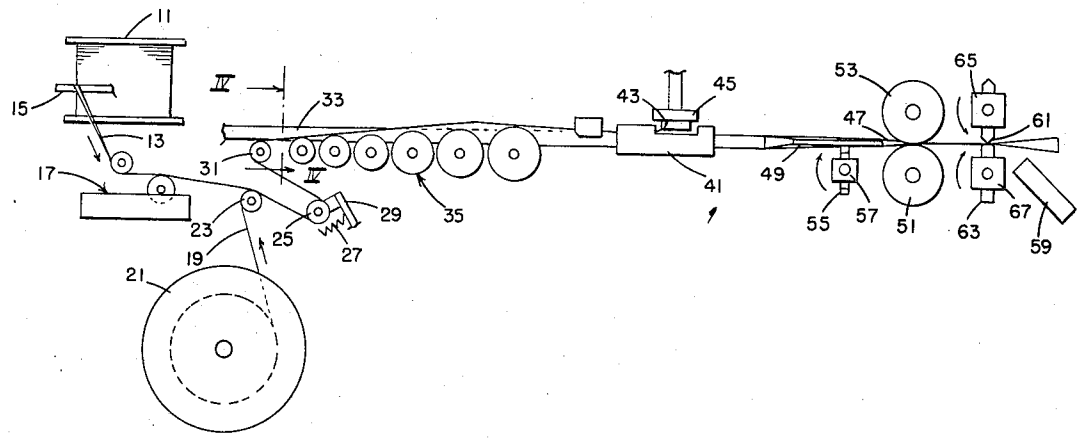
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Assistant Examiner—James F. Coan
Attorney—Thomas R. O'Malley et al.

[57] **ABSTRACT**

Apparatus and method in which a continuous web, having a continuous tear strip extending longitudinally thereof, is formed into a continuous tube, slit simultaneously along opposite sides of the tear strip at intervals spaced longitudinally of the continuous tube, and then severed transversely at locations extending across and inbetween the ends of the slits therein to provide individual sleeves each having a longitudinally extending tear strip for use in effecting sleeve rupture.

12 Claims, 5 Drawing Figures



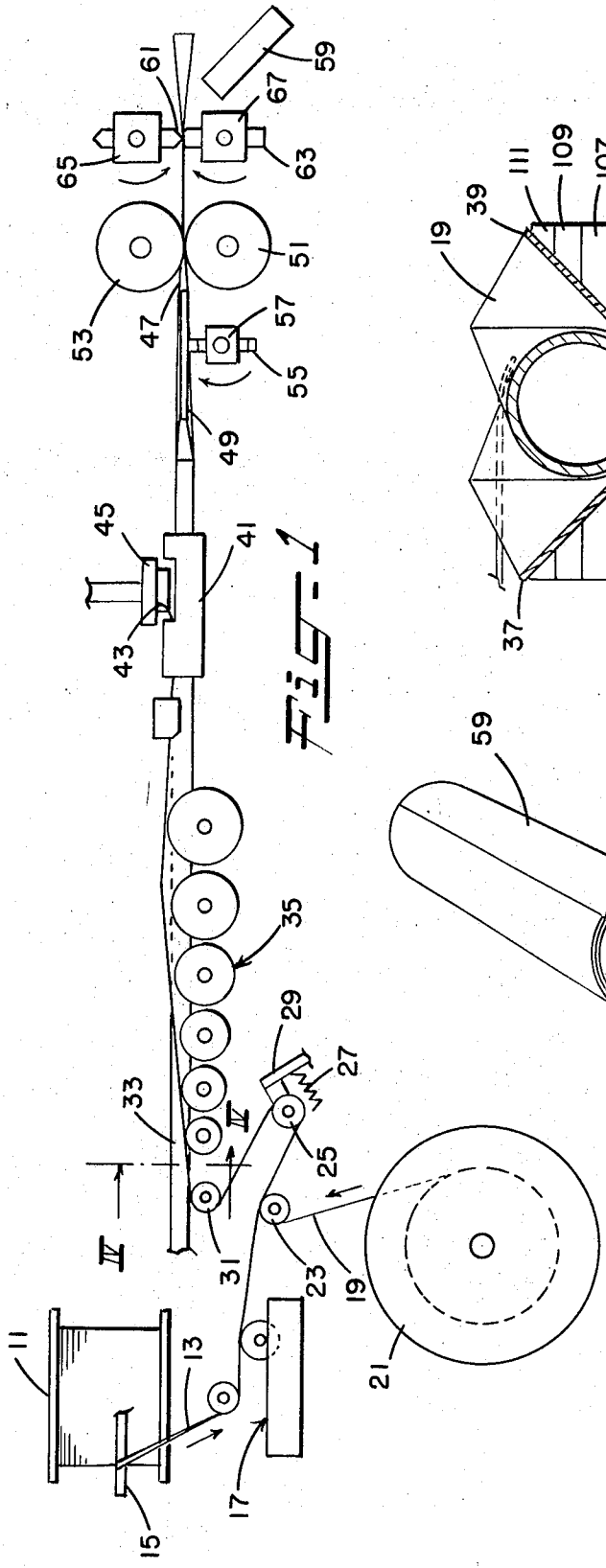


Fig. 1

Fig. 4

Fig. 5

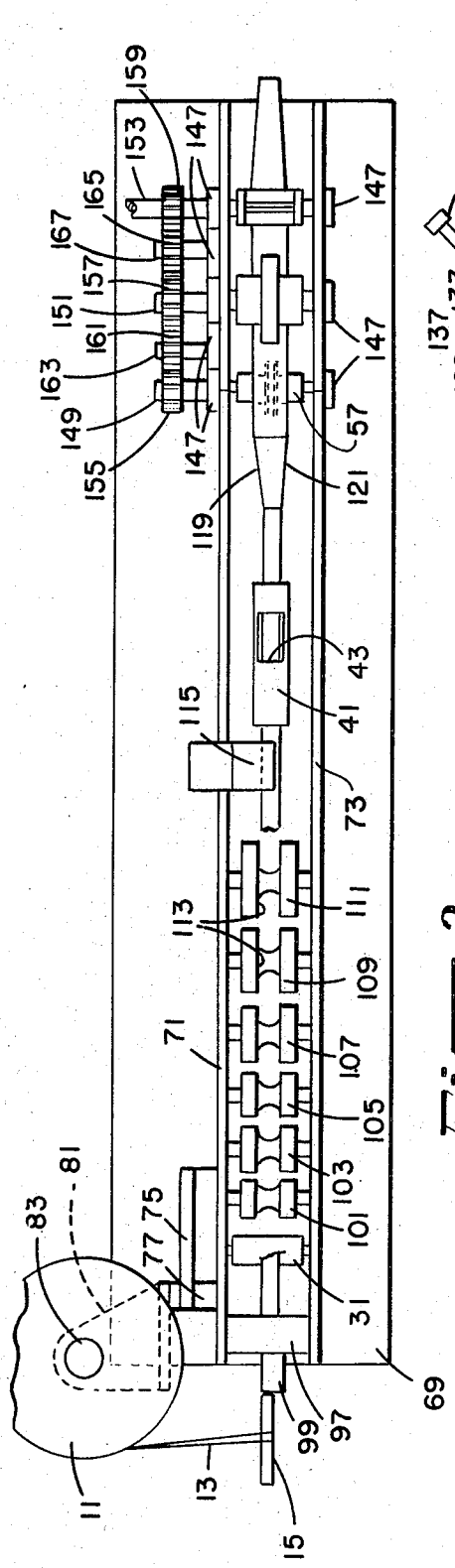

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Fig. 2

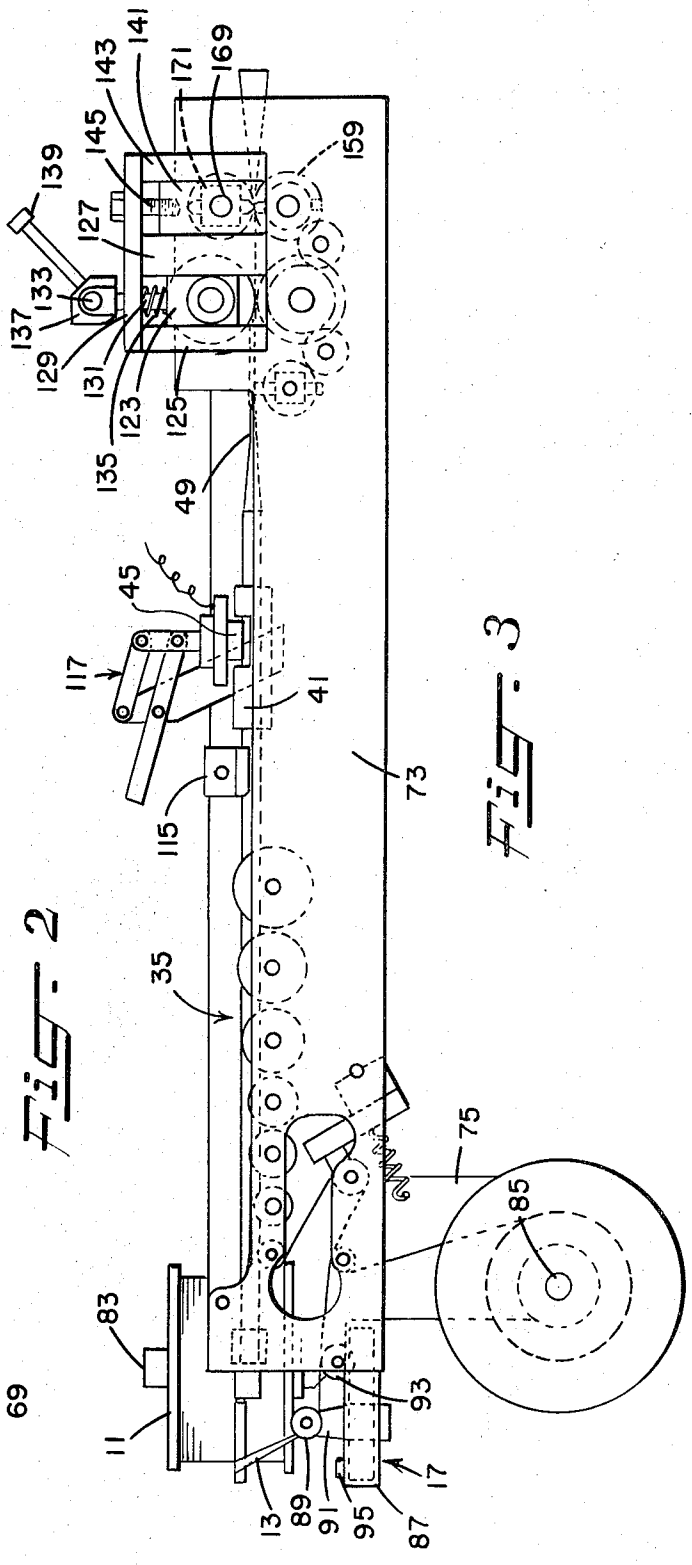

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Fig. 3

SLEEVE MAKING APPARATUS AND METHOD

The present invention is directed to a sleeve making apparatus and method.

The packaging or containing of articles within sleeves is, of course, well known in the art. Shoe strings, ribbons, and yarns are typical of the many products which are packaged within comparatively loose fitting sleeves which can be easily removed by merely sliding the same relative to the packaged product. Other articles as for example tampons, are often contained within snug fitting sleeves which generally must be ruptured to secure access to the contained article.

Packaging of an article within a sleeve may be effected, for example, by merely encircling a flat sheet about the article and sealing its ends in place. Alternatively, the article, while at least partially compressed, may be inserted axially into a preformed sleeve.

In the use of preformed sleeves, at the packaging stage it is essential or desired that the individual sleeves be open at both ends thereof, that they be of generally uniform size throughout the lengths thereof, and that they be capable of snugly containing the article yet be adapted to be easily removed by the article user for access to the packaged article. In view of these and other similar characteristics required or desired in preformed packaging sleeves, a primary object of this invention is the provision of a new or improved and more satisfactory apparatus and method for making individual sleeves from flexible sheet materials.

Another object of this invention is to provide an improved apparatus and method for making individual sleeves from continuous, flexible sheet materials.

Still another object is to provide an improved apparatus and method for making individual sleeves which are particularly suited for use in article packaging with each such sleeve having a longitudinally extending tear strip for use in effecting sleeve rupture.

A further object is the provision of an improved apparatus and method for making individual sleeves with longitudinally extending tear strips each of which is adapted to be pulled from either end of the respective sleeves to effect sleeve rupture.

A still further object is the provision of a new or improved apparatus for making individual sleeves from continuous webs, which apparatus is simple in construction and use, economical, and which may be operated continuously or intermittently with equally satisfactory results.

These and other objects are accomplished in accordance with the present invention by an apparatus and method in which successive portions of a continuous, longitudinally advancing web are progressively deflected, first into a U-shaped configuration, and then into a tubular form in which the longitudinal edges are in overlapped relationship. These overlapping edges are then sealed concomitantly with the continuous advancement thereof to provide a continuous tube.

The web employed in the method and with the apparatus of the present invention has a continuous tear strip attached to one side thereof which is spaced from and substantially parallel to the longitudinal edges thereof. Thus, in the continuous tube which is formed this continuous tear strip will be disposed at a location spaced from the sealed web edges.

Once formed, the successive portions of the continuous tube are gradually urged into a flattened condition and are slit simultaneously along opposite sides of the tear strip but only at intervals spaced longitudinally of such tube. With continued advancement, the tube is then severed transversely at locations extending across and between the ends of the web slits to provide individual sleeves. While severing of the sleeves is effected while the tube is in a flattened condition, the sleeves are permitted to relax immediately after their formation and rapidly assume their intended tubular configuration.

Shaping of the web into a continuous tube is achieved by enveloping the same about a mandrel, which is supported at only one end thereof, concomitantly with the longitudinal advancement of such web relative to the mandrel and toward its free end. This is accomplished by the use of a series of idler rolls, each of which has a peripheral groove within which the mandrel is positioned and each of which is of greater diameter than the adjacent preceding roll, with the roll nearest to the mandrel support means being smallest in diameter. The axes of such rolls and the innermost portions of the roll peripheral grooves lie in planes which are substantially parallel to each other and to the axis of the mandrel. Thus, as the web is advanced inbetween and relative to the mandrel and this series of idler rolls, it is gradually and progressively urged into a U-shaped configuration about the mandrel.

The longitudinal edges of the web may be disposed into overlapping relationship by the means employed in sealing such edges to each other. Desirably, a conventional stationary folding finger assists the sealing means at this stage by urging one longitudinal edge of the partially shaped web onto the mandrel as such web is advanced toward the sealing means.

Sealing of the overlapped web edges is effected before the web is advanced beyond the mandrel and may be accomplished by the use of heat and/or adhesives, depending upon the particular web material employed.

The sleeves provided by the apparatus of the present invention are preferably of cylindrical configuration and thus the mandrel is substantially round in cross-section. Fixed to the free end of such mandrel, however, is a tube spreader, which consists of a flat blade-like member, the opposite longitudinal edges of which are arranged in diverging relationship so as to urge the continuous tube into a flattened or collapsed condition as it is advanced toward and beyond a tube slitting means.

Periodic slitting of the continuous tube simultaneously along opposite sides of the attached tear strip is achieved while such tube is advanced along the spreader. Employed for this purpose is a positively driven rotor having at least one pair of like, laterally spaced, parallel blades projecting from the periphery thereof, with such blades being spaced longitudinally of the rotor a distance at least equal to the width of the tear strip. Obviously, as the number of such pairs of blades on the rotor and/or the rate of rotor rotation is increased, the longitudinal intervals at which the continuous tube is slit become shorter.

A pair of nip rollers are positioned beyond the free end of the tube spreader and serve to advance the continuous web, and the tube formed therefrom, through the apparatus thus far described. One of such nip rollers is positively driven while the other is an idler roller which is mounted for selective movement toward such driven roller. Preferably, the periphery of at least the driven roller is covered with rubber or like material to

insure good frictional contact with the surface of the flattened tube.

Located beyond this advancing means are a pair of synchronized, positively driven rotors, one of which has a longitudinally extending blade projecting from its outermost surface and the other having a longitudinally extending anvil. As mentioned, the movement of these rotors is synchronized so that the projecting blade and anvil together nip and sever the continuous tube in a transverse direction. The movement of these rotors is also synchronized with that of the slitting means to insure that the continuous tube is severed transversely between, and preferably midway between, the ends of each pair of slits provided in such continuous tube. Thus, at the opposite ends of each of the resulting individual sleeves, slits are present along opposite sides of the tear strip, providing ready access to and easy removal of the tear strip by the ultimate user.

The webs employed in making packaging sleeves with the apparatus of the present invention may be of any suitable materials, as for example regenerated cellulose films, paper, longitudinally oriented thermoplastic polymeric materials, such as, polypropylene, polyethylene or polyester films having their molecules oriented in a longitudinal direction, etc. The tear strips can be formed of materials which are like or similar to those of the webs or may be in the form of textile threads, yarns, ribbons, etc. Preferably, the web is formed of heat-sealable material or is provided with a coating of heat-sealable material on at least one side thereof to facilitate bonding of the overlapping longitudinal edges thereof during the manufacture of the continuous tube. In lieu of such heat-sealable coating, bonding of the web edges may be achieved by means of a liquid adhesive. Desirably, the tear strip is colored for easy identification.

Preferably, the continuous web and continuous tear strip are supplied to the apparatus of the present invention from separate sources with the latter being sealed, as by heat or adhesives, to the web immediately prior to shaping of such web into a continuous tube. In this operation, the tear strip is applied to that side of the web which is to form the inside surfaces of the resulting sleeves to thereby protect the same from displacement during sleeve manufacture and handling prior to the time it is intentionally removed.

In the drawing,

FIG. 1 is a diagrammatic side view of the apparatus of the present invention;

FIG. 2 is a plan view of the apparatus shown in FIG. 1 illustrating elements thereof in greater detail;

FIG. 3 is a side view of the apparatus shown in FIG. 2;

FIG. 4 is a transverse vertical section of the apparatus shown in FIG. 1 as viewed along the direction indicated by arrows IV—IV; and

FIG. 5 is a perspective view of a sleeve as provided by the apparatus of the present invention.

Referring to FIG. 1 of the drawing, character 11 denotes a supply spool of a continuous tear strip 13, as for example, of regenerated cellulose film, which is passed over a deflector bar 15 and through an applicator 17, where a liquid adhesive is applied to one side thereof. Simultaneously, a continuous web 19, as for example, a regenerated cellulose film having a coating of heat-sealable material on one side thereof, is drawn from a separate supply spool 21 and, during its passage over a guide roll 23, is engaged by the adhesive-coated side of the tear strip 13. As the web 19 travels over a back-up roll 25, a spring 27 urges an electrically heated shoe 29 against that portion of the web 19 to which the tear strip 13 is attached to provide for rapid setting of the applied adhesive.

From the roll 25 the web, with its attached tear strip, is led by a roll 31 to a mandrel 33 which is supported at only one end thereof. The web is advanced continuously along the mandrel 33 and, during such travel, is engaged by a shaping means 35 which urges the same into a U-shaped configuration about the mandrel 33. With continued travel, one longitudinal edge 37 of the web 19 is urged onto the mandrel 33 and is subsequently overlapped by the opposite longitudinal edge 39 as such web is advanced into and through a sleeve 41. A slot 43 in the sleeve 41 accommodates an electrically heated shoe 45 which engages with and seals the overlapping web edges to thereby provide a continuous tube 47.

Attached to the free end of the mandrel 33 is a spreader 49 which serves to progressively urge the tube 47 into a flattened or collapsed condition, without wrinkling the same, as such tube 47 is continuously advanced relative thereto by cooperating nip rollers 51 and 53. As hereafter described in detail, the roller 51 is positively driven while the roller 53 is an idler which maintains the flattened tube 47 snugly engaged with the roller 53. During passage over the spreader 49, the tube 47 is slit, at longitudinally spaced intervals thereof, simultaneously along opposite sides of the tear strip 13 by pairs of laterally spaced blades 55 projecting from a positively driven rotor 57.

Beyond the nip rollers 51 and 53, the flattened tube 47 is severed transversely into individual sleeves 59 by a blade 61 and cooperating anvil 63 carried by individual rotors 65 and 67, respectively. The rotors 65 and 67 are positively driven in synchronism with each other and with the rotor 57 to insure that severance of the tube 47 is effected between, and preferably midway between, the ends of each pair of slits formed in the tube 47 by the pairs of blades 55.

Referring now to the more detailed FIGS. 2–4, the apparatus of the present invention includes a table 69 to which are fixed a pair of laterally spaced, vertically disposed side plates 71 and 73 which extend the full length of the apparatus. A support 75 is fixed to the side plate 73 by a suitable bolt and spacers 77 and 79 and has attached thereto a bracket 81 from which projects a vertical shaft 83. The spool 11 of continuous tear strip material 13 is rotatably supported on the shaft 83, while the spool 21 of the continuous web material 19 is rotatably mounted on a similar shaft 85 extending horizontally from the support 75.

The deflector bar 15 serves to change the path of the tear strip 13 and to direct the same to an adhesive applicator 17, which includes an adhesive supply chamber 87 fixed to the side plates 71 and 73, an idler guide roll 89 supported from the chamber 87 by a bracket 91, and a dip roll 93 which rotates within the liquid adhesive contained within the chamber 87 and deposits the same onto the tear strip 13 as it travels thereover. Adhesive is delivered into the chamber 87 as needed through a suitable opening which is maintained covered by a plug 95.

As heretofore mentioned, the adhesive-coated side of the tear strip is engaged with the web 19 as the latter

travels over the guide roll 23 and, during its passage about the back-up roll 25, is firmly set in place under the heat applied to the combined web and tear strip by the electrically heated shoe 29. With continued travel, the now combined web and tear strip is delivered by the guide roll 31 to the mandrel 33 and shaping means 35. The rolls 23, 25 and 31 are all supported between the side plates 71 and 73 and are driven solely by the movement of the web 19.

The mandrel 33 is positioned substantially parallel to and midway between the side plates 71 and 73 and is supported at only one end thereof by the cross-piece 97. Preferably, the mandrel 33 extends through the cross-piece 97, with its leftmost end serving as a mount for an adjustable cup 99 from which the deflector bar 15 projects. This deflector bar 15 is positioned eccentrically relative to the cup axis and thus, with only a slight rotation of such cup 99, variation in the path of the tear strip 13 to the guide roll 89 is readily achieved. Once such adjustment is completed, the cup 81 is fixed in place.

The shaping means 35 consists of a series of idler rolls 101, 103, 105, 107, 109 and 111 which are rotatably supported between the side plates 71 and 73 with their axes in a common plane. As illustrated, the rolls 103, 105, 107, 109 and 111 are each of greater outside diameter than the preceding roll or rolls, and aligned grooves 113 are provided in all of the rolls of the series of rolls for receiving the mandrel 33. While the innermost portions of the grooves 113 are of like diameter, the grooves 113 are of greater depth in the successive rolls 101, 103, 105, 107, 109 and 111. Thus, as the web 19 is progressively advanced relative to the mandrel 33, its opposite longitudinal edges 37 and 39 are gradually and progressively urged upwardly into a U-shaped configuration, as illustrated in FIG. 4, by the walls of the grooves 113 in the successive rolls 101 through 111.

Once beyond the shaping means 35, the longitudinal edges 37 and 39 of the web are overlapped as they are advanced into the sleeve 41 which is supported from the side plate 71. If desired, a conventional folding finger 115 also fixed to the side plate 76 may be employed in urging the web edge 37 against the mandrel prior to the travel of the web into the sleeve 41.

The overlapping longitudinal edges 37 and 39 of the web 19 are sealed to each other by the electrically heated shoe 45 during web travel through the sleeve 41. A linkage 117 supports the shoe 45 from a bracket 101 projecting from the side plate 71 and permits such shoe 45 to be elevated from the web in the event web travel is interrupted.

The spreader 49 attached to the free end of the mandrel 33 is merely a flat plate having diverging side edges 119 and 121 which effect a flattening of the tube 47 as it travels relative thereto. Concomitantly with its collapse, the tube 47 is simultaneously slit along opposite sides of the tear strip 13 by the pairs of laterally spaced blades 55, such as razor blades, projecting from the rotor 57.

As heretofore mentioned, the rollers 51 and 53 serve to advance the web 19 and resulting tube 47 through the apparatus and are preferably formed with rubber covered peripheral surfaces to insure firm frictional engagement with the collapsed tube 47.

At ends, the roller 53 is rotatably supported in bearing blocks 123, each of which is adapted to slide along a frame fixed to the respective side plates 71 and 73 and consisting of guide plates 125 and 127 and a top plate 129. Rods 131, fixed at their lowermost ends to the bearing blocks 123, project up through the top plates 129, and at their uppermost ends, are rotatably connected to a shaft 133. Springs 135 are interposed between the respective bearing blocks 123 and top plates 129 to normally urge the roller 53 toward the roller 51. However, cam plates 137 are fixed to the opposite ends of the shaft 119 and are provided with suitable levers 139 which permit the bearing blocks 123, and the roller 53 carried thereby, to be elevated when it is desired to interrupt the advancement of the web 19 and tube 47.

The tube 47 is severed into desired sleeve lengths by the cooperating blade 61 and anvil 63 carried by the rotors 65 and 67, respectively. The rotor 67 is supported between the side plates 71 and 73, while the rotor 65 is preferably mounted within bearing blocks 141. Plates 143, together with the adjacent plates 127, provide guideways for the bearing blocks 141 so to facilitate movement of the rotor relative to the rotor 67. Bolts 145, extending through the top plate 129, are threaded into the respective bearing blocks 145 and permit the opposite ends of the rotor 65 to be adjusted so as to insure proper cutting action transversely across the tube 47.

As shown in FIG. 2, the rotor 57, roller 51 and rotor 67 are each supported by bearings 147 fixed to the side plates 71 and 73, and are formed with shaft extensions 149, 151 and 153, respectively, to which are fixed gears 155, 157 and 159. An idler gear 161, carried by a shaft 163, meshes with the gears 155 and 157 and a similar idler gear 165, carried by a shaft 167 is in meshing engagement with the gears 157 and 159. The rotor 65 is also provided with a shaft extension 169 having fixed thereto a gear 171 which meshes with the gear 159. With the arrangement of gears described, a positive rotary movement is applied to the shaft extension 153 by a suitable movement, not shown, and is transmitted to the shafts 149, 151 and 169 to thereby drive the rotor 57, roller 51, and rotors 65 and 67 in synchronism with each other.

As illustrated at the right side of FIG. 1, the sleeves 59 relax from their collapsed condition as they are severed from the tube 47 and rapidly assume the desired cylindrical configuration.

Shown in FIG. 5 is a sleeve formed with the apparatus of the present invention, which sleeve includes at each end thereof slits located along opposite sides of a longitudinally extending tear strip. These slits provide ready access to the tear strip and permit the sleeve 59 to be easily ruptured from either end thereof.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. Apparatus for making individual sleeves each having a longitudinally extending tear strip for use in effecting sleeve rupture, said apparatus including means for longitudinally advancing a continuous web having attached to one side thereof a continuous tear strip which is spaced from and substantially parallel to the longitudinal edges of the web, a mandrel, means supporting said mandrel at only one end thereof, means between said mandrel supporting means and the free end of said mandrel for enveloping the combined web

and tear strip about said mandrel with the longitudinal edges of the web in substantially parallel overlapping relationship, means between said enveloping means and the free end of said mandrel for sealing the overlapping longitudinal edges of the web to each other to thereby provide a continuous tube, means for simultaneously slitting the web along opposite sides of the tear strip at intervals spaced longitudinally of the continuous tube, and means beyond the free end of said mandrel for severing the continuous tube transversely thereof at locations extending across and between the ends of the web slits to provide individual sleeves.

2. Apparatus as defined in claim **1** wherein said enveloping means includes a series of idler rolls each having a peripheral groove within which said mandrel is positioned, each roll of said series of idler rolls being of greater diameter than the adjacent preceding roll with the roll nearest to said mandrel support means being smallest in diameter, the axes of said series of rolls and the innermost portions of said roll peripheral grooves lying in planes which are substantially parallel to each other and to the axis of said mandrel.

3. Apparatus as defined in claim **1** wherein said web advancing means includes a positively driven pair of nip rollers one of said nip rollers being driven and the other of said nip rollers being an idler roller mounted for selective movement toward and away from said driven roller.

4. Apparatus as defined in claim **1** wherein said mandrel is substantially round in cross-section, and further including a flat blade-like member fixed only at one end thereof to the free end of said mandrel, said member terminating between said slitting and web advancing means and having its longitudinal edges arranged in diverging relationship so as to urge the continuous tube into a flattened condition as it is advanced toward and beyond said slitting means.

5. Apparatus as defined in claim **1** wherein said slitting means includes a positively driven rotor, and at least one pair of like parallel blades projecting from the periphery of said rotor, said blades being spaced longitudinally of said rotor a distance at least equal to the width of the tear strip.

6. Apparatus as defined in claim **1** further including separate means for supplying the continuous web and continuous tear strip, and further including means for sealing the tear strip to the web.

7. Apparatus as defined in claim **1** wherein said severing means includes a pair of positively driven rotors, one of said rotors having a longitudinally extending blade projecting from its outermost surface, the other of said rotors having a longitudinally extending anvil, and means for positively driving said rotors in synchronism so that said blade and anvil together nip and sever the continuous tube.

8. Apparatus as defined in claim **3** wherein said enveloping means includes a series of idler rolls each having a peripheral groove within which said mandrel is positioned, each roll of said series of idler rolls being of greater diameter than the adjacent preceding roll with the roll nearest to said mandrel support means being smallest in diameter, the axes of said series of rolls and the innermost portions of said roll peripheral grooves lying in planes which are substantially parallel to each other and to the axis of said mandrel.

9. Apparatus as defined in claim **4** wherein said enveloping means includes a series of idler rolls each having a peripheral groove within which said mandrel is positioned, each roll of said series of idler rolls being of greater diameter than the adjacent preceding roll with the roll nearest to said mandrel support means being smallest in diameter, the axes of said series of rolls and the innermost portions of said roll peripheral grooves lying in planes which are substantially parallel to each other and to the axis of said mandrel.

10. A method of making individual sleeves each having a longitudinally extending tear strip for use in effecting sleeve rupture including the steps of longitudinally advancing a continuous web having attached to one side thereof a continuous tear strip which is spaced from and substantially parallel to the longitudinal edges of the web, progressively deflecting successive longitudinal portions of the continuously advancing web first into a U-shaped configuration and then into a tubular form in which the longitudinal edges of the web are in overlapped relationship, sealing the overlapped longitudinal edges of the continuously advancing web to each other to provide a continuous tube, progressively urging successive portions of the continuous tube into a flattened condition without wrinkling the same, slitting the advancing tube simultaneously along opposite sides of the tear strip at intervals spaced longitudinally of the tube, and concomitantly with the advancement thereof intermittently severing the continuous tube in a transverse direction at locations extending across and between the ends of the slits therein to provide individual sleeves.

11. A method as defined in claim **10** wherein the continuous tube is slit concomitantly with the flattening thereof.

12. A method as defined in claim **10** wherein the tube is severed while in a collapsed condition and the individual sleeves are permitted to relax immediately after their formation to assume a tubular configuration.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,777,632 Dated December 11, 1973

Inventor(s) Carl R. Pepmeier

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 4, line 48, "73" should read --71--; "and 79" should be deleted. Col. 5, line 20, "81" should read --99--; line 42, "76" should read --71--; line 49, delete "101"; line 52, after "49" insert a comma -- , --; line 53, after "33" insert a comma -- , --; line 65, after "At" insert --its opposite--. Col. 6, line 33, after "167" insert a comma -- , --. Col. 7, line 24, delete "positively driven"; line 25, after "being" insert --positively--.

Signed and sealed this 30th day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.