

Dec. 19, 1961

E. F. LA SARRE

3,013,367

SYSTEM OF MAKING CORELESS ROLLS

Filed May 3, 1956

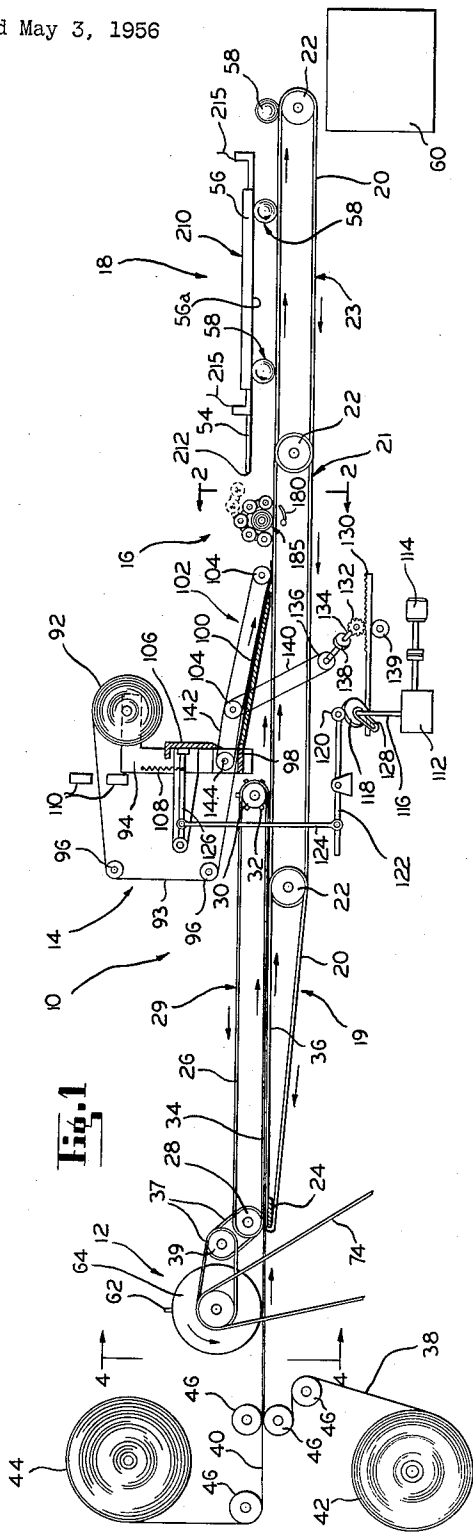


Fig. 1

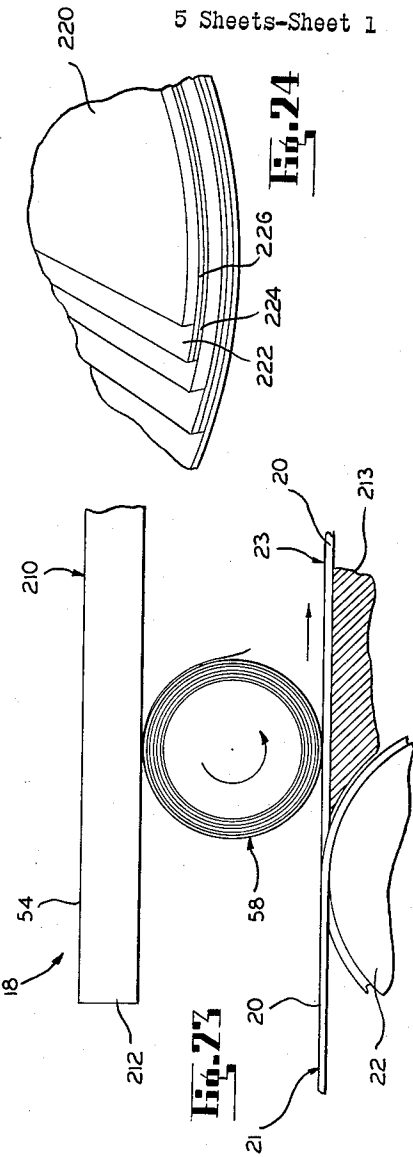


Fig. 23

Fig. 24

5 Sheets-Sheet 1

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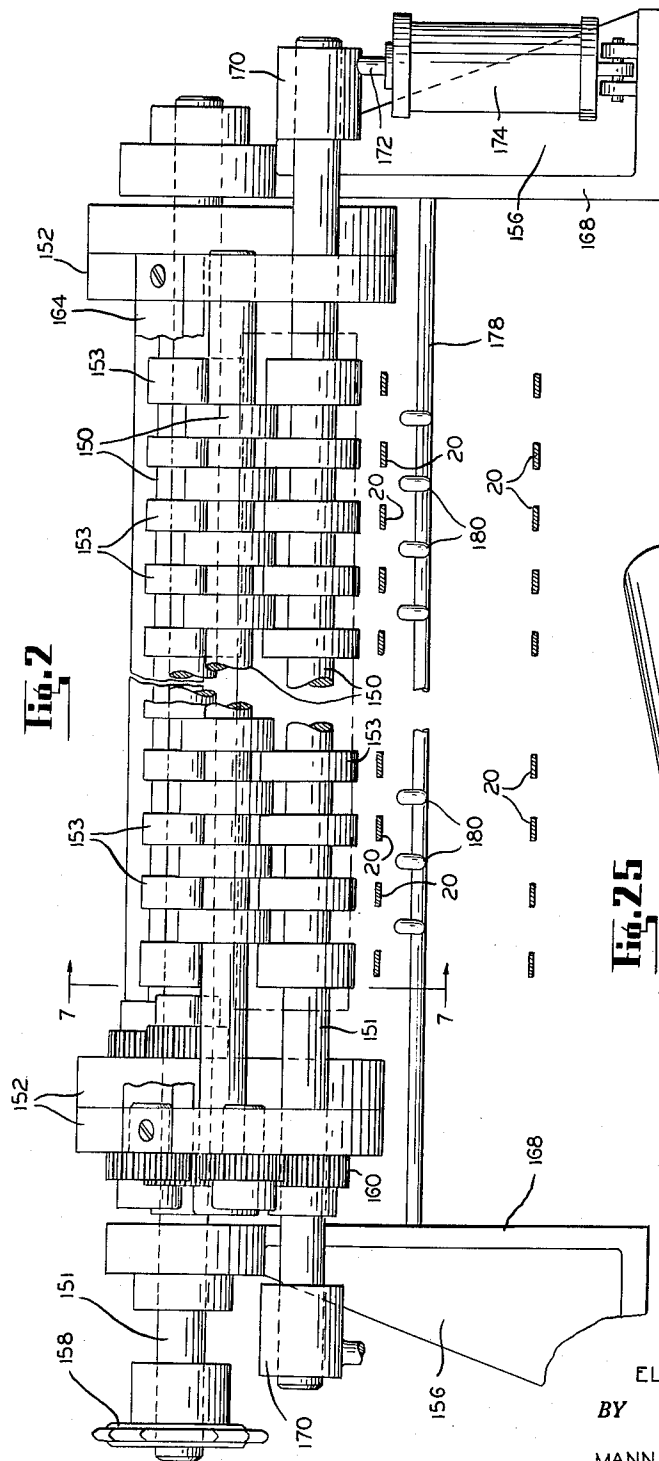


Fig. 2

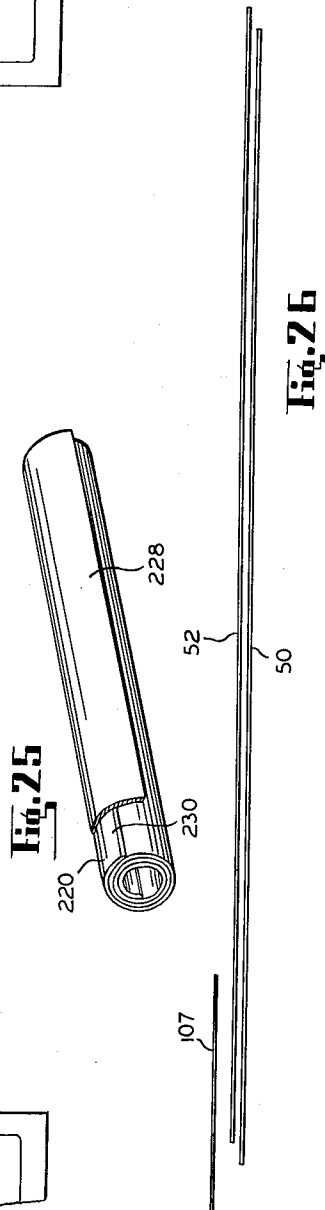


Fig. 25

Fig. 2.6

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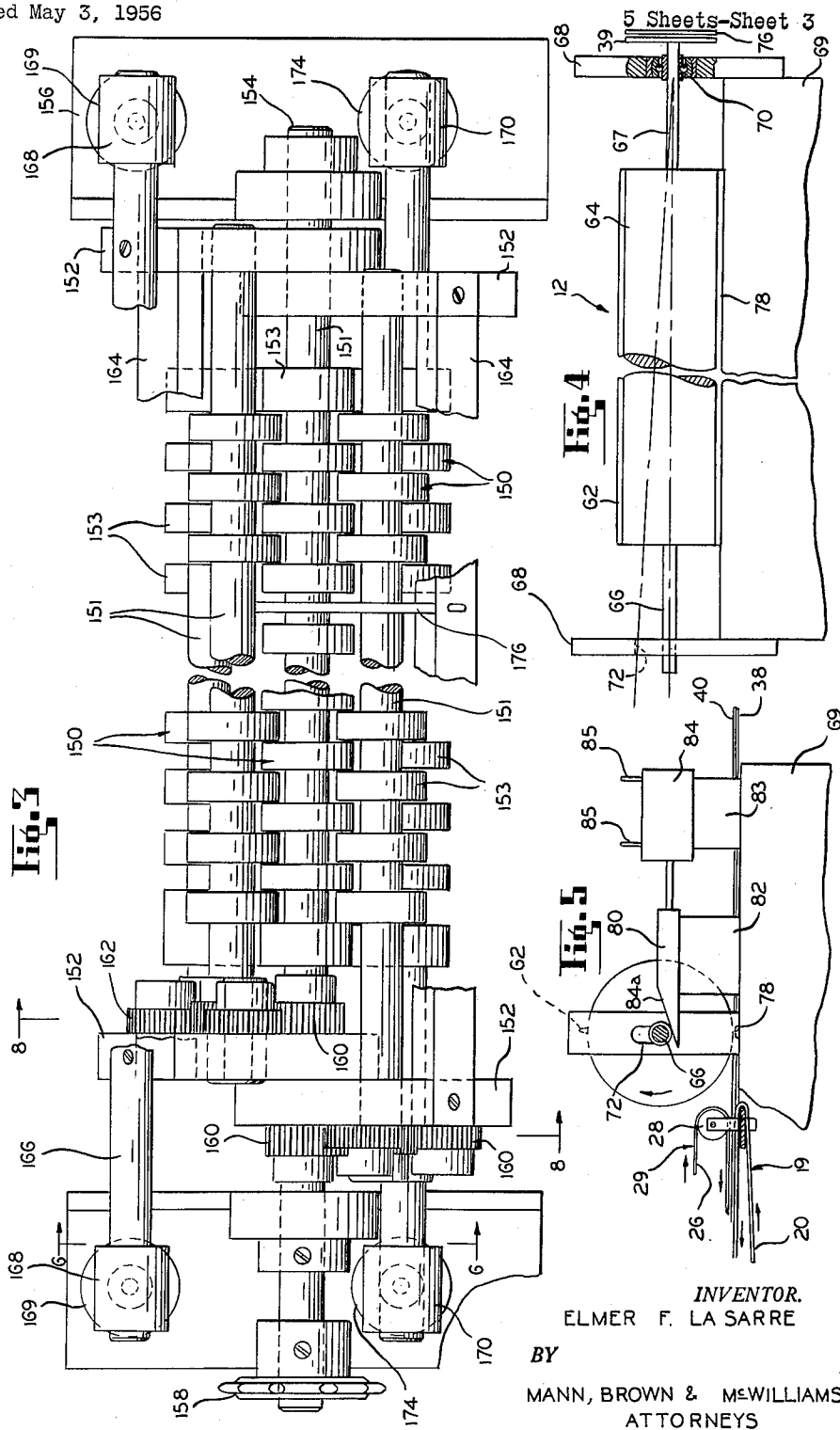
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5 Sheets-Sheet 4

Fig. 6

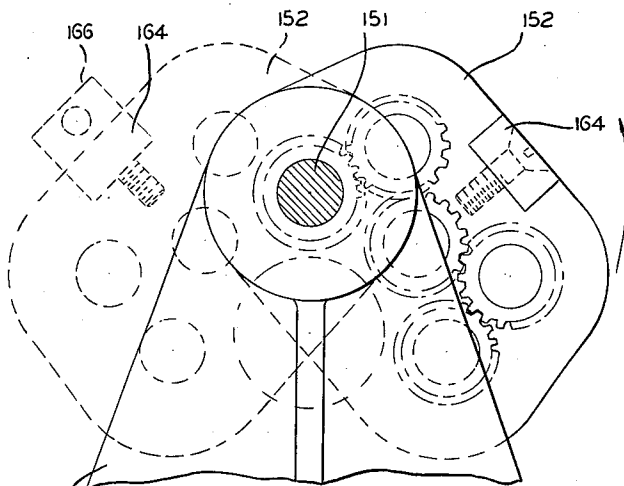


Fig. 7

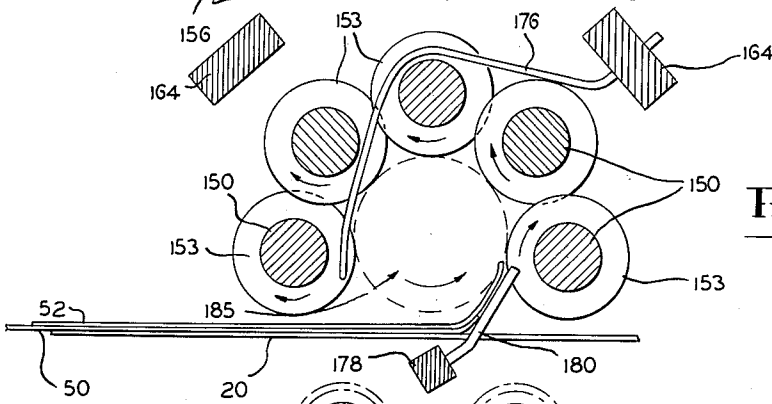
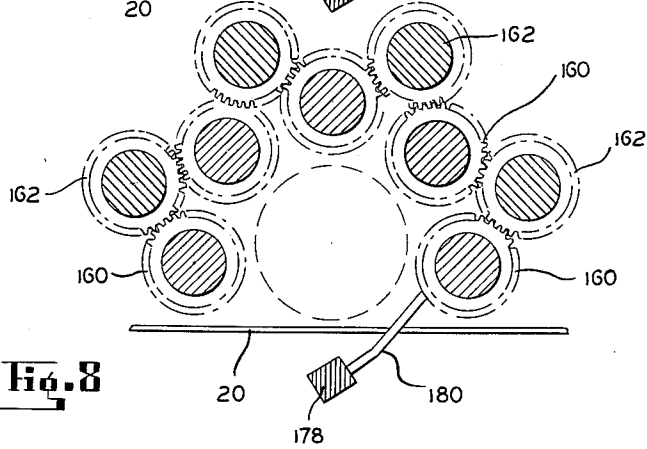


Fig. 8



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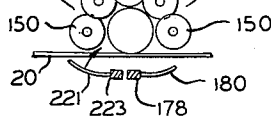
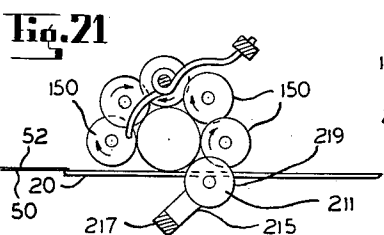
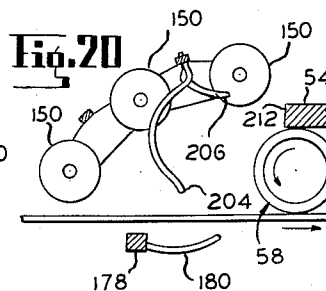
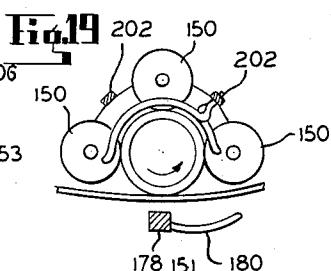
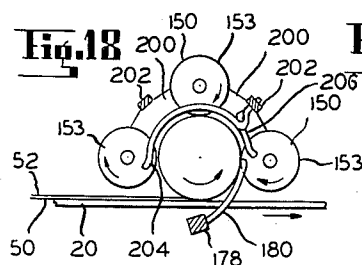
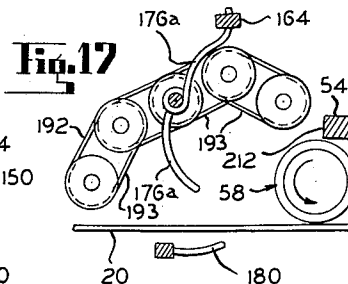
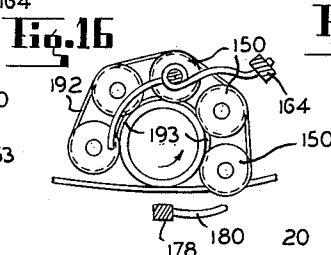
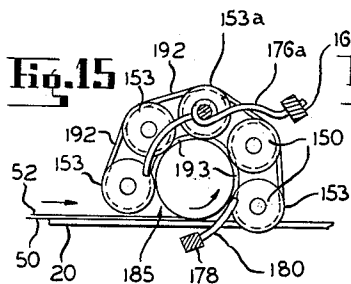
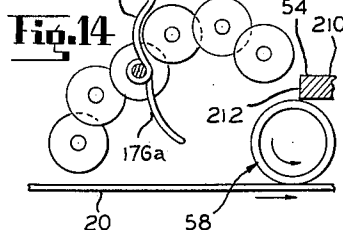
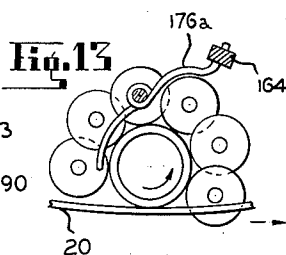
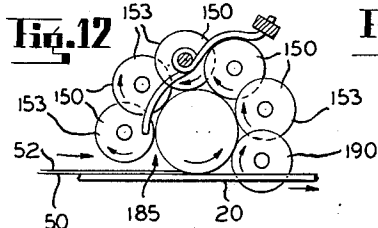
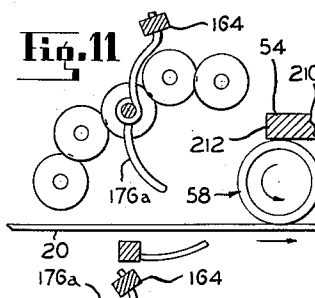
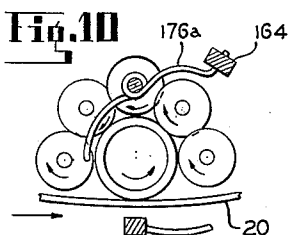
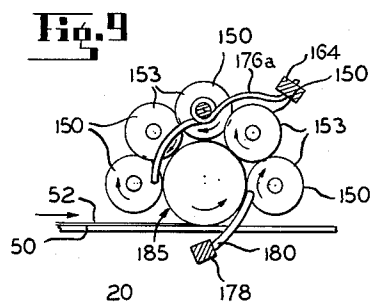
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5 Sheets-Sheet 5



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3,013,367

SYSTEM OF MAKING CORELESS ROLLS

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Filed May 3, 1956, Ser. No. 582,379
18 Claims. (Cl. 53—3)

My invention relates to a system of making coreless rolls, and more particularly, to a method and apparatus of rolling or convoluting web or sheet material into a new commercial rolled web product.

A convenient manner of supplying web or sheet material such as wallpaper, paper towels, cellophane, shelf paper, foil material, and the like, is in the form of a roll. This material conventionally is rolled up either by or on a spindle which is later removed, or on a cardboard cylinder or core which remains with the commercial article. Where a spindle is employed, the end of the sheet material commonly is formed into a tab that is inserted in a slot or hole formed in the spindle, and much of this tab portion as well as the adjacent material is likely to be disfigured or destroyed during winding and removal of the spindle. Where the cardboard core is employed, it is substantially useless after the paper has been unwound therefrom, and the cost of the core alone materially increases the overall cost of producing the rolled product.

In both of these production methods, the individual rolls require considerable handling and in these days of high labor costs, the less handling the better.

Some products of this type, such as gift wrapping paper, have been supplied in folded sheet form to eliminate the need for cores or the expensive spindle winding operation. However, the paper is frequently disfigured by folding and the folded sheet form does not give the customer nearly as much paper for his money as the rolled form.

The principal object of my invention is to provide a system of rolling a web or sheet-like material that provides an inexpensive wound commercially attractive coreless product.

Another principal object of my invention is to provide a web or sheet rolling or convoluting machine that does not require a core or spindle, and which is entirely automatic.

A further principal object of the invention is to provide a new and efficient method of handling and rolling web or sheet material which reduces the cost of labor and handling to a minimum.

Still a further principal object of the invention is to provide an improved rolled web or sheet material product that gives the customer more material for his money and presents an attractive appearance.

Yet a further object of the invention is to provide a rolled or convoluted foil paper product which, when pressed from the side under normal handling and flattened, will snap back to its original rounded shape without disfiguration.

Yet another object of the invention is to provide a rotating cutter for cutting web material into individual sheets which is capable of continuous operation while providing individual sheets of any predetermined length.

In accordance with my invention, I provide a system of rolling, for instance, paper and paper-like products which includes an improved device for performing the actual rolling operation as well as improved methods and apparatus of handling the web material before and after it is rolled. My new system provides a rolled web product having new and unusual characteristics and which

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gives the customer much more for his money than ordinary rolled products will.

Other objects, uses, and advantages will be obvious or become apparent from a consideration of the following description and the drawings.

In the drawings:

FIGURE 1 is a diagrammatic side elevational view of a machine arranged in accordance with the principles of my invention;

FIGURE 2 is a cross sectional view along line 2—2 of FIGURE 1;

FIGURE 3 is a plan view of the structure shown in FIGURE 2;

FIGURE 4 is a cross sectional view along line 4—4 of FIGURE 1, showing structure in addition to that diagrammatically illustrated in FIGURE 1;

FIGURE 5 is a side elevational view of the structure shown in FIGURE 4 taken from the left hand side of FIGURE 4 and illustrating further structure not shown in FIGURE 1;

FIGURE 6 is a cross sectional view along line 6—6 of FIGURE 3;

FIGURE 7 is a cross sectional view along line 7—7 of FIGURE 2, showing two superposed webs entering the convoluting apparatus;

FIGURE 8 is a cross sectional view along line 8—8 of FIGURE 3;

FIGURES 9, 10, and 11, are diagrammatic side elevational views illustrating the operation of the convoluting apparatus shown more particularly in FIGURES 2, 3, and 6 through 8;

FIGURES 12, 13, and 14 illustrate the operation of a modified form of this apparatus;

FIGURES 15, 16, and 17 illustrate the operation of still a further form of this apparatus;

FIGURES 18, 19, and 20 illustrate the operation of yet another form of this apparatus;

FIGURE 21 illustrates a further form of this apparatus;

FIGURE 22 illustrates a modified manner of operating the apparatus of FIGURES 9—11;

FIGURE 23 is an enlarged side elevational view of a rolled web or sheet passing through the roll diameter maintaining portion of the machine shown in FIGURE 1;

FIGURE 24 is a fragmental perspective view illustrating the components of an improved foil roll provided by my invention;

FIGURE 25 is a perspective view of the foil roll, with the wrapper removed and with parts broken away for clarity of illustration; and

FIGURE 26 is a diagrammatic illustration of the relative positioning of the sheets rolled to form the product provided by my machine and the wrapping or covering that is or may be applied thereto, with these elements shown spaced vertically for clarity of illustration.

General description

Reference numeral 10 of FIGURE 1 generally indicates a successful embodiment of my invention, though it is to be understood that the illustration is highly diagrammatic and that many of the common commercial elements or mechanisms comprising same have either not been shown or are only diagrammatically illustrated. The illustrated machine 10 generally comprises a continuously operating cutter mechanism 12, a cellophane applying mechanism 14, a web or sheet rolling or convoluting mechanism 16 and a combined roll diameter maintainer and cellophane sealer 18.

A plurality of spaced endless tapes or bands 20 (see FIGURE 2) are trained around rotatably mounted spindles 22 (see FIGURE 1) to form adjacent conveyors 19, 21, and 23. The tapes or bands 20 of conveyor 19 are

received over and slidingly engage a stationary retaining element 24 in the illustrated embodiment. One or more of the spindles 22 may be rotated in any suitable manner to move the endless bands in the directions of the arrows of FIGURE 1. A set of similar spaced endless tapes or bands 26 is trained about spindles 28 and 30 to provide a conveyor 29 and spindle 30 is provided with a plurality of axially spaced soft rubber studs or buttons 32 for a purpose hereinafter made clear. The lower runs 34 of the set of bands 26 may be positioned closely adjacent to or in contact with the upper runs 36 of the upstream-most set of bands 20, and conveyor 29 is driven in the direction of the arrows of FIGURE 1 by driving spindle 28, for instance, through pulleys 37 trained about pulley wheels 39 and leading from rotating cutter 12 or otherwise.

These spaced endless tape or band conveyors are conventionally used to convey paper and other web or sheet-like material, so further description and illustration thereof is believed unnecessary. Alternatively, spindles 22 may be replaced by rotatably mounted pulleys for each band driven at the speeds hereinafter indicated.

In accordance with the illustrated embodiment of the invention, two webs 38 and 40 are drawn off the respective rolls 42 and 44 around and by suitable rollers 46, some of which may be driven rollers, and directed under the rotating cutter 12 which operates in the hereinafter described manner to cut the webs into sheets 50 and 52 (see FIGURE 26) of any predetermined or preferred length. Before being severed, the leading ends of the webs 38 and 40 are received between the runs 34 and 36 of the endless band belt conveyors 19 and 29 and pass under the spindle 30 immediately after being severed. The studs or buttons 32 of the spindle 30, which extend slightly beyond the spindle 30 and therefore travel faster, engage the top web or sheet and kick or pull it forwardly of the bottom sheet any desired amount, for instance, the amount indicated in FIGURE 26. The sheets 50 and 52 which were formed by the rotating cutter 12 proceed under the cellophane applying mechanism 14 to the rolling or convoluting mechanism 16, where they are rolled or convoluted in the hereinafter described manner. Just before they are completely rolled up, the end of a sheet of cellophane provided by the mechanism 14 is inserted on top of the sheet 52 and this sheet of cellophane is wound around the rolled webs by the convoluting mechanism 16. After the cellophane is wound up, one side of the convoluting mechanism is lifted upwardly as indicated in FIGURE 1 and the roll is ejected from this mechanism and passes underneath the end 54 of roll diameter maintainer and cellophane sealing mechanism 18 and passes thence under the heating element 56 thereof which seals the cellophane about the roll of webs. The rolled or convoluted webs, generally indicated at 58 in FIGURE 1, then may drop into a suitable receptacle 60 for further processing.

In an alternate arrangement, a separate automatically operated rubber-like shoe kicks or pulls the top web forwardly of the bottom web, and the studs or buttons 32 are eliminated.

Rotating cutter mechanism

The rotating cutter mechanism 12 is more particularly shown in FIGURES 4 and 5 and generally comprises in the illustrated embodiment a transversely extending cutter blade 62 fixed to, for instance, a cylinder 64 or other rigid mounting that includes stub shafts 66 and 67 or their equivalents mounted in or on fixed supports 68 secured to, for instance, a suitable supporting frame work 69. Stub shaft 67 is mounted in a conventional form of self-aligning bearing 70, while the stub shaft 66 is received in a slot 72 formed in the support 68 adjacent it. The cylinder 64 and the blade 62 are continuously rotated in the direction of the arrows of FIGURES 1 and 5 by a suitable mechanism through, for instance, a pulley chain 74 engaging sprocket 76 keyed to stub shaft 67, and the blade 62 cooperates with the smooth surfaced anvil plate

78 to cut the web material as it passes underneath the roller 64 when cutting is desired.

A cam member 80 resting on a suitable base 82 is actuated by a suitable hydraulic cylinder 84 or the like supported on a mounting 83 to raise the stub shaft 66 of FIGURE 4 by engaging the stub shaft with cam surface 84a. The movement of cam member 80 may be guided by base 82 by providing, for instance, an interengaging tongue and groove arrangement. When this end of the cutter mechanism is raised to, for instance, the position indicated by the broken line in FIGURE 4 about the self-aligning bearing 70 as a center, web material may pass under the cutting blade 62 without being cut (in practice less than a half inch lift of stub shaft 66 is required). This is because the cutting blade has been raised sufficiently above the anvil plate 78 to avoid contact with the web. When it is desired to cut the paper, the hydraulic cylinder 84 is actuated through suitable conduits 85 to lower the cutting mechanism into position. Timing of operation of the cutter 12 may be provided by any conventional control device that cooperates with the other mechanisms of the machine. If desired, hydraulic means or the like may be provided to supplement the action of gravity in lowering the cutter.

Cellophane applying mechanism

The cellophane applying mechanism 14 is an intermittently operating device and includes a roll 92 of cellophane (see FIGURE 1) suitably mounted on supports 94 from which a web 93 of cellophane is drawn over rollers or spindles 96, one or more of which may be powered, and leads over anvil plate 98 and across inclined platform 100 down on top of the sheets 50 and 52 passing therebeneath. A spaced endless tape or band conveyor 102, composed of a plurality of endless bands received about spindles 104 in spaced apart relation and similar to, for instance, conveyors 19, 21 and 23, draws the cellophane across and down the platform 100. A reciprocating cutter blade 106 shears sheets 107 (see FIGURE 26) of cellophane when moved downwardly against the cellophane. A spring 108 may bias this cutter blade upwardly.

The operation of the cellophane applying mechanism is controlled by a conventional spot registration control unit, for instance, that made by Machine-O-Matic Inc. of Chicago, Illinois. Generally speaking, one edge of the cellophane is provided with a plurality of equally spaced spots that are adapted to pass under an electric eye mechanism 110 which is electrically connected to an electric eye variable speed control gear box 112, which may be driven by a conventional motor 114. This gear box rotates a shaft 116 on which a cam 118 is keyed. The cam 118 is engaged by a cam wheel 120 carried by a pivoted lever 122 which moves the blade 106 upwardly through a link 124 connected to the pivotally mounted arm 126 that the blade 106 is fixed to.

On the far side of the cam 118 (as shown in FIGURE 1) a link 128 fixed to cam 118 is pivotally connected to one end of a reciprocating rack 130 which engages a gear 132 keyed to a shaft 134 that rotates a pulley wheel 136 through an overrunning clutch 138. A rotatably mounted guide wheel 139 may be employed to hold the rack in meshing engagement with gear 132, as may any other suitable guiding or camming device. A pulley belt 140 looped about the pulley 136 and one of the spindles 104 or a pulley wheel (not shown) fixed thereto operates the bands of conveyor 102 and a pulley 142 trained about a spindle 104 or a pulley wheel (not shown) fixed thereto and a roller 144 adjacent anvil plate 98 helps draw the cellophane off the roll 92.

The overrunning clutch 138 may be of a conventional type and since it only operates when the driving element thereof rotates or is driven in its drive transmitting direction, this clutch will transmit power only when the rack 130 moves in one direction. The cellophane there-

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fore moves intermittently through the cellophane applying mechanism. A specific showing of clutch 138 is omitted since it may be any standard type of overrunning clutch.

The dots or spots on the cellophane are so arranged and the operation of the variable control speed box is so controlled that the leading edge of a sheet of cellophane is positioned somewhat as shown in FIGURE 26 when the sheets 50 and 52 have been substantially wound up by the mechanism 16. The intermittent operation of mechanism 14 in the machine 10 is so timed that a severed sheet 107 of cellophane is freed from conveyor 102 during each period of operation. The period of operation preferably starts when the sheets 50 and 52 are positioned approximately as shown in FIGURE 26 with respect to the leading edge of a sheet 107, and lasts until the leading end of the next succeeding sheet 107 is positioned approximately where the corresponding end of the preceding sheet was with respect to the end of platform 100 and convoluting mechanism 16.

It may be added that while cellophane is applied by the illustrated apparatus 14, any form of wrapping material may be substituted for the cellophane with appropriate changes to adapt the spot control device to operating conditions. A suitable label feeding device, similar in nature to the cellophane feeding device described above, may be employed. In the apparatus 10 the cellophane is employed for protection and display purposes.

The convoluting mechanism

The convoluting mechanism is of particular significance. It is more particularly illustrated in FIGURES 2, 3, and 6 through 22. One commercially successful embodiment of this mechanism is shown in FIGURES 2, 3, 6 through 11 and 22.

As shown in these latter figures, the convoluting mechanism may comprise a plurality of rollers 150 (five in the embodiment of these figures) comprising shafts 151 journaled in mounting plates 152 and provided with flanges or ridges 153. The shafts of two of the illustrated rollers 150 are somewhat longer than the others and one is journaled at its ends in any suitable manner in angled brackets 156. This latter shaft 151, which is the uppermost shaft in this embodiment (see FIGURES 6 and 7), may be continuously rotated by or through a chain drive engaging sprocket wheel 158 or by any other suitable device or mechanism. The rollers 150 are each provided with suitable gears 160 that mesh with gears 162 journaled in the mounting plates on one side of the apparatus (see FIGURE 8). These gears 162 could also be journaled on the other side of the apparatus and corresponding gears 160 there provided if so desired. Tie bars 164 respectively interconnect the upstream and downstream (with respect to the direction of travel of the sheet material through the machine) mounting plates 152 and the upstream mounting plates 152 are fixed to a bar 166 that is in turn secured to the tie bar 164 that is fixed to these mounting plates. The ends of bar 166 are mounted in bearings 168 secured to piston rods (not shown) actuated by suitable hydraulic cylinders 169 (see FIGURE 3). The upstream and downstream mounting plates 152 form two banks of rollers, and the other relatively long shaft of the rollers 150, which is mounted in the downstream bank of rollers, extends outwardly of the sides thereof and is journaled in suitable bearings 170 (see FIGURE 2) that are fixed to piston rods 172 actuated by hydraulic cylinders 174. Cylinders 169 and 174 may be pivotally mounted if so desired, as indicated in FIGURE 2. As seen more particularly in FIGURES 3 and 7, one or more fingers 176 (or modified fingers 176a, see FIGURES 9-11) may be fixed to the downstream tie bar 164 and extend in between the rollers somewhat as shown in FIGURE 7. An elongate bar 178 is journaled beneath these rollers 150 and

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is provided with a plurality of fingers 180 extending from one side thereof. The bar 178 is journaled for pivotal movement and the fingers 180 are so spaced that they may be raised between the upper run of the center set of endless bands 20 (see FIGURE 2).

As seen in FIGURES 7, 9, 10, and 11, the rollers 150 are arranged in a generally concave substantially semi-circular arc with the ends of the arc being directed toward the upper run of the endless bands 20 of conveyor 21, which define a substantially level conveying and supporting surface that is positioned under these rollers. The rollers 150 and the upper run of this center set of endless bands define a convoluting chamber 185 in which the sheets 50, 52, and 107 are received as now to be described. While the actual number of rollers employed or the spacing between the rollers is not critical, the flanges 153 thereof should be overlapped or guiding fingers employed (see FIGURES 18-20) to keep the leading ends of sheets 50 and 52 within chamber 185.

As aforesaid, the sheets 50 and 52 are disposed with respect to each other approximately as shown in FIGURE 26 when they pass under the downstream end of conveyor 102. As the leading ends of sheets 50 and 52 enter the convoluting chamber 185, the bar 178 is pivoted by any suitable automatic means to position the fingers 180 approximately as shown in FIGURES 7 and 9. This deflects the leading ends of sheets 50 and 52 upwardly against the flanges or ridges 153 of the lowermost roller 150 on the downstream side of chamber 185. This lowermost roller 150, as are all of the rollers 150, is rotating in the direction indicated by the arrows of FIGURES 7 and 9, and the surfaces presented by the flanges or ridges 153 of these rollers in the convoluting chamber 185 are all moving in generally the same direction, which direction is generally opposite to the direction of movement of the upper run of bands 20 of the conveyor 21. The leading edges of the sheets 50 and 52 engage these surfaces consecutively and the sheets 50 and 52 are looped about the convoluting chamber 185 somewhat as indicated in FIGURE 9. The friction of the rapidly rotating rollers on the outer surface of the lower sheet 50 rapidly rolls up the sheets to a roll of approximately the size indicated in FIGURE 10, the bands underneath the rollers 150 deflecting downwardly somewhat to compensate for the increase in size of the roll. These bands 20 in being deflected downwardly press the roll against the rollers 150 and thereby increase the frictional contact between the rollers and the sheet 50. After the sheets have been turned or looped approximately one and one-half times, the fingers 180 may be positioned as shown in FIGURE 10 as the rollers 150 will now have complete control over the convoluting action.

As mentioned hereinbefore, in the illustrated apparatus, cellophane wrapping paper is wound around the roll before it is ejected from the convoluting chamber 185. The leading end of the sheet 107 of cellophane formed by the cellophane insertion apparatus 14 is carried around the convoluting chamber by the trailing ends of sheets 50 and 52 and after the sheets 50 and 52 are completely rolled or convoluted, the rollers engage the cellophane sheet to completely roll it about the rolled or convoluted sheets 50 and 52. The ejecting action of the apparatus 14 will help insert the leading end of sheet 107 into the convoluting chamber 185.

It is not necessary that the leading end of sheet 107 be inserted into the convoluting chamber 185 by having the sheets 50 and 52 convey its leading end into this chamber. If desired, the sheet 107 may be inserted into the convoluting chamber 185 after sheets 50 and 52 have been completely rolled up. Of course, in either case the speed of operation of the conveyors 19, 21, and 26 is controlled with respect to the speed of the webs 38 and 40 to provide sufficient gapping between the separated superposed sheets 50 and 52 to permit wrapping of the sheets 107 and ejection of the wrapped rolls 58.

After the sheets 50 and 52 and the cellophane sheet 107 have been completely rolled or convoluted, the downstream bank of rollers 150 is lifted to approximately the position shown in FIGURE 11 by the action of lifting devices 174. The lifting of the downstream bank of rollers also actuates the ejecting fingers 176, and this in combination with the movement of the upper run of the conveyor 21 moves the rolled or convoluted sheets under the end 54 of roll diameter maintainer device 18.

In the embodiment illustrated in FIGURES 12 through 14, the bar 173 and the fingers 180 are eliminated and an additional roller 190, shaped similarly to rollers 150, is mounted on the downstream bank of the rollers, the mounting plates 152 being appropriately modified to receive same. As indicated in FIGURE 12, the flanges 153 of roller 190 are positioned in the spaces that separate the bands of the upper run of the conveyor 21, and through which the fingers 180 in the embodiment described above passed. This roller 190 is driven in the same direction that the others are driven through an additional gear similar to gears 162. The roller 190 is positioned low enough so that the leading ends of sheets 50 and 52 will engage the surfaces its flanges 153 present in the convoluting chamber 185 and deflect these leading ends upwardly against the other rollers of the convoluting apparatus. This embodiment of the invention is otherwise similar to that described above.

In the embodiment of FIGURES 15 through 17, the flanges 153 of rollers 150 are aligned transversely of the apparatus and a plurality of spaced endless bands 192 mounted in grooves 153a formed in flanges 153 interconnect these rollers. These rollers 150 are spaced apart somewhat as shown and their flanges do not overlap. The inner runs 193 of these bands present the surfaces in the convoluting chamber 185 that all move in the same direction. The fingers 180 carried by bar 178 are shown employed with this embodiment of the invention, though they are not essential here as the lowermost roller 150 of the downstream bank of rollers is positioned to act in the same manner as roller 190 of FIGURE 12. Fingers 180 swing between the flanges 153 of this roller as well as tapes 20, which share the space between flanges 153 of this roller with fingers 180. Alternately, rollers 150 may be cylindrical with bands 192 mounted in spaced apart relation along the rollers, downstream most roller 150 being raised to the position of the upstream most roller 150. Suitable grooves should, of course, be formed in the cylindrical rollers to accommodate fingers 176 (or 176a).

An important feature of the embodiment of FIGURES 15 through 17 is that by applying the bands 192 with considerable tension and by making the endless bands 192 quickly dismountable (by conventional means, as by conventional belt lacing), the size of the convoluting chamber 185 may be changed or varied. This is particularly true where cylindrical rollers are employed as the bands extend radially outwardly of the individual rollers. It will be appreciated that in the embodiments where the surfaces of the rollers 150 define the convoluting chamber, the convoluting chamber is larger than where the endless bands 192 define it, though in FIGURES 15 and 16 the inner runs of bands 192 are shown deflected and thus are not under much tension. This embodiment of the invention otherwise operates in a manner similar to those described above.

FIGURES 18 through 20 illustrate a further form of convoluting apparatus wherein only three rolls 150 are employed. These rolls may be mounted in mounting plates 200, similar to mounting plates 152, and these rollers 150 are all driven in the same direction by an appropriate gearing arrangement. Tie bars 202, similar to tie bars 164 of FIGURE 3, are employed. In this embodiment of the invention, the rollers 150 are spaced apart a substantial distance, so fingers 204 and 206 are employed to guide the leading edges of the sheets 50 and 52.

A plurality of these fingers 204 and 206, shaped approximately as shown in FIGURES 18 through 20, are fixed in any suitable manner to the tie bar 202 of the movable roller bank of this embodiment. The fingers 180 of FIGURES 9 through 11 are also employed in this embodiment of the invention.

The rolling or convoluting of the sheets 50 and 52 by the apparatus of FIGURES 18 through 20 is similar to that of the other embodiments of the invention, except that the leading edges of the sheets 50 and 52 are guided between the rollers 150 by the fingers 204 and 206 which are positioned to extend between the flanges 153 of these rollers. The flanges 153 of these three rollers 150 would, of course, be axially aligned, and the peripheries of the flanges 153 would project beyond these fingers 204 and 206 into the convoluting chamber. After the sheets are convoluted, the fingers 204 act as ejecting fingers when the downstream roller bank is lifted to the position of FIGURE 20.

In a modification of the embodiment of FIGURES 18-20, the endless bands 192 described above are employed on the flanged rollers 150. By so doing, the fingers 204 and 206 may be eliminated, in addition to providing the changeability of chamber size described above.

FIGURE 21 illustrates a modification of the apparatus of FIGURES 9-11 wherein a flanged roller 211 is substituted for fingers 180. The roller 211, which is similar to rollers 150, may be journaled between arms 215 fixed to pivotally mounted bar 217, similar to bar 178, and rotated in the direction of the arrow by any suitable mechanism. Preferably the flanges 219 of roller 211 overlap the flanges 153 of the lowermost roller 150 adjacent it in the uppermost position of roller 211, as shown in FIGURE 21.

In operation, suitable automatic means positions roller 211 where shown and the leading ends of sheets 50 and 52 on engaging the flanges 219 are deflected toward rollers 150. After the sheets have been rolled approximately one and one-half times, the roller 211 may be lowered as in the case of fingers 180.

FIGURE 22 illustrates the operation of the upstream and downstream banks of rollers when it is desired to expand the convoluting chamber to allow for the increasing diameter of rolls during the course of formation. Both cylinders 169 and 174 are actuated by suitable apparatus to pivot both banks of rollers about the center shaft 151 at the rates required to allow for the growth in diameter of the web roll being formed. To operate the machine in this manner, the fingers 176 should be eliminated and ejecting fingers 221, secured to pivotally mounted bar 223, employed which are similar to fingers 180 and bar 178. The fingers 221 extend in the opposite direction, however, and when ejection of a roll is desired, suitable automatic means pivots fingers 221 in the direction of the arrow of FIGURE 22 to eject the roll from the machine.

In the normal operation of illustrated machine 10, cylinders 169 merely hold the upstream bank of rollers in the illustrated position and fingers 221 are not employed.

Roll diameter maintainer and heating sealing apparatus

The roll maintainer and heat sealing device 18 generally comprises an elongate element 210, which comprises a roll diameter maintainer portion and includes, in the illustrated embodiment, a heater element 56 which acts as a heat sealer and glue sealer. As shown in FIGURE 23, after the individual roll 58 is moved under the extremity 212 of end 54, the movement of the spaced endless bands 20 on which it is supported rotates it in the direction of the arrow and also tends to roll it toward the right of FIGURE 23. This tends to tighten the roll and keep it that way during its passage underneath this element 210. A rigid platform 213 may be mounted immediately under the upper run of conveyor 23 (see FIGURE 23) to aid in this operation.

The element 210 may be in the form of a relatively narrow assembly that is positioned approximately in the

center of the conveyor 23, as in the illustrated embodiment, or a relatively wide assembly that extends all the way across the conveyor 23.

When the sheets 50 and 52 being rolled comprise material such as gift wrapping paper or the like, the outer surface which is not affected by heat, the heating element 56 is turned on. This heater 56 may comprise a conventional resistance element, having flat undersurface 56a and energized through suitable leads 215 or the like, which preferably is an integral part of device 18 and likewise may be narrow and extend above the center of conveyor 23, as in the illustrated embodiment. The heater is preferably energized to provide enough heat to bind the layers of cellophane together across the middle of the roll, or any other heat sealing material that may be employed.

The amount of heat employed for sealing purposes may be varied according to various materials being employed. The speed of operation of conveyor 23 may also be varied in accordance with the time factor in sealing requirements. This is possible as bands 20 will slide on spindles 22 without damage. Instead of employing heat seal means, the rolls of foil could be sealed by any other conventional mechanism or method and a suitable form of pressure sensitive tape or glue dispenser or the like is contemplated.

I also contemplate that tucking devices may be employed along the conveyor 23 to tuck the ends of the cellophane or other wrapping sheets employed into the ends of the rolls 58 to eliminate all manual handling of the rolls during processing.

Improved articles of manufacture

The product produced by my machine and method may take several novel forms. It will be obvious, of course, that a single web may be rolled by my machine and that where this is done, a single sheet coreless roll is provided. However, the illustrated arrangement provides a two-sheet coreless roll which has several other novel features. For instance, where it is desired to provide rolls of gift wrapping paper, the gift wrapping paper comprises roll 42 arranged so that the printed surface thereof faces downwardly as it passes through machine 10 and kraft paper or any other suitable wrapping paper comprises the roll 44. The webs from these rolls 42 and 44 proceed through my machine 10 to provide a roll of gift wrapping paper having a paper backing, the trailing end of which is covered by the trailing end of the sheet of gift wrapping paper so as not to expose in the finished roll such paper, as this would detract from the appearance of the roll. This provides an additional sheet of plain paper for the customer while at the same time providing a stronger roll of paper that requires no core and readily resists crushing. The trailing end of the kraft paper is covered since the sheet 52 (which would be, for instance, the kraft paper) is displaced forwardly of the sheet 50 by operation of the machine.

Where it is desired to provide rolls of foil, the foil web would comprise the roll 42 with the web mounted so that the finished surface of the foil faces downwardly. After the sheets of foil and paper backing have passed through my machine, the roll illustrated in FIGURES 24 and 25 is provided, which has the same configuration as the roll of gift wrapping paper. In FIGURE 24, the backing paper is indicated at 220, the foil is indicated at 222, and the latter comprises the foil material 224 which may be conventionally applied to a backing 226, though the benefits of my invention are provided even though it is not. As shown in FIGURE 25, the trailing end 228 of the foil which comprises the outer end of the foil, overlies or overlaps the trailing end 230 of the paper backing 220.

The foil roll illustrated in FIGURES 24 and 25 solves an old problem in the art of foil rolls. It is common knowledge that when a foil roll is pressed from the side and flattened, it will not snap back to its former rounded configuration, but will remain flat and permanently kinked.

I have found that with the kraft paper or its equivalent backing 220 employed in the roll of foil, the roll of foil is not permanently dented when crushed or flattened from the side, but immediately reassumes its original rounded configuration without being permanently deformed. It will be appreciated that this eliminates substantial waste during sales of this type of product since normally rolls of this type are frequently inadvertently crushed during handling and prospective customers are not interested in deformed rolls.

It will thus be seen that I have provided a machine that automatically rolls or convolutes a web or several webs into a novel coreless roll. Not only are the objectionable cores and spindles eliminated from the rolling operation, but required worker handling of the rolls is substantially eliminated, and in fact, the whole operation can be efficiently run by one operator completely automatically from start to finish. My method and apparatus can be employed to roll all paper or paper-like products such as toilet paper, wax paper, freezer paper, as well as those already named and plastic, cloth, metal or other products having similar characteristics.

The foregoing description and the drawings are given merely to explain and illustrate my invention and the manner in which it may be performed, and the invention is not to be limited thereto, except insofar as the appended claims are so limited since those skilled in the art who have my disclosure before them will be able to make modifications and variations therein without departing from the scope of the invention.

I claim:

1. A machine for convoluting flexible webs comprising conveyor means for feeding a web lengthwise thereof, means for cutting the web into sheets of predetermined length, means defining a convoluting chamber, said last mentioned means including a generally flat flexible element in series with said conveyor means and a plurality of rotatable elements positioned adjacent said element and arranged to define a generally concave substantially semi-circular arc with the ends of said arc extending in the direction of said element, said rotatable elements presenting surfaces in said chamber that all move in generally the same direction, which direction is generally opposed to the direction of movement of said sheets, said conveyor means feeding the individual sheets into said chamber, means for deflecting the leading end of each sheet onto said surfaces, said element deflecting outwardly of said chamber as the individual sheets are convoluted by said surfaces, and means for ejecting the convoluted sheets from said chamber.

2. A machine for convoluting flexible webs comprising endless conveyor means adapted to convey a web on one run thereof, a plurality of rotating elements positioned adjacent said one run of said conveyor means, said elements being arranged to define a generally concave arc with the ends of the arc extending toward said one run of said conveyor means, said elements and said one run defining a convoluting chamber and said elements presenting surfaces in said chamber that all move in generally the same direction, which direction is generally opposite to the direction of movement of said one run, said conveyor means feeding the web into said chamber, means for deflecting the leading end of the web onto said surfaces, said one run deflecting outwardly of said chamber as the web is convoluted in said chamber, and means for ejecting the convoluted web from said chamber.

3. A machine for convoluting flexible webs comprising endless conveyor means adapted to convey a web on one run thereof, a plurality of elongate, generally parallel, rotating rollers positioned adjacent said one run of said conveyor means and extending transversely thereof, means for rotating said rollers in the same direction, said rollers being arranged to define a generally concave arc with the ends of the arc extending toward

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said one run of said conveyor means, said rollers and said one run defining a convoluting chamber and said rollers presenting surfaces in said chamber that all move in generally the same direction, which direction is generally opposite to the direction of movement of said one run, said conveyor means feeding the web into said chamber, means for deflecting the leading end of the web onto said surfaces, said one run deflecting outwardly of said chamber as the web is convoluted in said chamber, and means for ejecting the convoluted web from said chamber.

4. The machine set forth in claim 3 wherein at least one of said rollers is swingably mounted, and including means for swinging said one roller away from the other rollers to open said chamber when the web has been convoluted, and finger means operable to engage the convoluted web as said one roller is swung away from said other rollers, said finger means comprising the means for ejecting the convoluted web from said chamber.

5. The machine set forth in claim 4 including stationary elongate means positioned downstream of said chamber and adjacent to but spaced from said one run of said conveying means and extending generally parallel thereto, said finger ejecting the convoluted web into the space between said one run and said stationary means and said one run rolling said convoluted web across said stationary means.

6. The machine set forth in claim 5 including means for wrapping a web of heat sealing material around the convoluted web, and said stationary means including heating means adapted to contact said heat sealing material as the convoluted web passes across said stationary means and seal the convoluted heat sealing material about the convoluted web.

7. A convoluting device for flexible webs and the like comprising a moving laterally deflectable relatively flat surface, a plurality of elongate, generally parallel, rotatable rollers positioned adjacent said surface and extending generally crosswise to its direction of movement, means for rotating said rollers in the same direction, said rollers being arranged to define a generally concave arc with the ends of the arc extending in the direction of said surface, said rollers and said surface defining a convoluting chamber and said rollers presenting surfaces in said chamber that all move in generally the same direction, which latter direction is generally opposed to the direction of movement of said surface, said surface conveying a web into the convoluting chamber, means for deflecting the leading end of the web into engagement with said surfaces, said surface deflecting outwardly of said chamber as the web is convoluted in said chamber, at least one of said rollers adjacent the downstream side of said chamber being mounted to swing away from said surface, means for swinging said one roller away from said surface when the web is convoluted, and finger means operable to engage the convoluted web as said one roller is swung away from said surface to eject the convoluted web from the chamber.

8. The device set forth in claim 7 wherein said rollers are formed with equally spaced flanges, and wherein the flanges of adjacent rollers are intermeshed, said surfaces being formed by the peripheries of said flanges.

9. The device set forth in claim 7 wherein said means for deflecting the leading end of the web comprises finger means mounted for movement into and out of the path of movement of the web, and positioned adjacent the downstream side of said chamber.

10. The device set forth in claim 7 wherein said means for deflecting the leading end of the web comprises rotatable roller means mounted for movement into and out of the path of movement of the web, and positioned adjacent the downstream side of said chamber.

11. The device set forth in claim 7 wherein said sur-

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face is composed of a plurality of spaced parallel endless bands, and wherein the roller most closely adjacent the downstream side of said chamber is provided with a plurality of flanges positioned to correspond to the positioning of the spaces between said bands, the last mentioned roller being positioned closely adjacent said bands with said flanges thereof positioned in said spaces that are aligned with said flanges, said last mentioned roller comprising said means for deflecting the leading end of the web into engagement with said surfaces.

12. The device set forth in claim 7 wherein a plurality of endless elements interconnect said rollers, with the inwardly facing sides of the inner runs thereof comprising said surfaces.

13. The device set forth in claim 7 wherein said rollers are spaced relatively far apart, and wherein guide means is provided for guiding the leading edge of the web between said surfaces of said rollers.

14. A convoluting device for flexible webs and the like comprising a moving laterally deflectable relatively flat surface, a downstream bank of rollers, an upstream bank of rollers, means pivoting said banks of rollers for movement about a common axis extending crosswise to said surface, said banks of rollers extending downwardly toward said surface, means for rotating the rollers of said banks of rollers, said rollers and said surface defining a convoluting chamber and said rollers presenting surfaces in said chamber that all move in generally the same direction, which latter direction is generally opposed to the direction of movement of said surface, means for deflecting the leading end of the web into engagement with said surfaces, means for pivoting said banks of rollers about said axis away from said surface to expand said chamber as the web roll grows in diameter, and means for ejecting the rolled web from said chamber.

15. A machine for convoluting and wrapping flexible webs comprising endless conveyor means adapted to convey a web on one run thereof, a plurality of rotating elements positioned adjacent said one run of said conveyor means and extending generally transversely thereof, said elements being arranged to define a generally concave arc with the ends of the arc extending toward said one run of said conveyor means, said elements and said one run defining a convoluting chamber and said elements presenting surfaces in said chamber that all move in generally the same direction, which direction is generally opposite to the direction of movement of said run, said conveyor means feeding the web into said chamber, means for deflecting the leading end of the web into said surfaces, said one run deflecting outwardly of said chamber as the web is convoluted in said chamber, conveying means for conveying a wrapping strip spaced from, generally parallel to, and on the same side of said one run that the web is on, cutting means for cutting the wrapping strip into sheets, said conveying means directing the leading end of a sheet of wrapping strip in the direction of movement of said one run and toward and into contact with the web adjacent to but upstream of said chamber, the operation of said last mentioned conveying means being timed to direct the leading end of a sheet of wrapping strip toward said chamber in advance of the trailing end of the web to be wrapped, and means for ejecting the convoluted and wrapped web from said chamber.

16. A machine for convoluting two superposed webs comprising means for conveying said webs lengthwise thereof, cutting means for simultaneously cutting said webs into sheets, endless conveyor means for conveying said sheets on one run thereof, a plurality of rotating elements positioned adjacent said one run of said conveyor means and extending generally transversely thereof, said elements being arranged to define a generally concave arc with the ends of the arc extending in the direction of said one run of said conveyor means, said elements and said one run defining a convoluting chamber and said elements presenting surfaces in said chamber that all move

in generally the same direction, which direction is generally opposed to the direction of movement of said one run, said conveyor means feeding the sheets into said chamber, said chamber being spaced from said cutting means a distance greater than the length of said sheets, and means for positioning one of said sheets out of longitudinal alignment with the other before they enter said chamber, said one run deflecting outwardly of said chamber as the sheets are convoluted in said chamber, and means for ejecting the convoluted sheets from said chamber.

17. The method of rolling a pair of superposed flexible webs including the steps of conveying the webs lengthwise and at the same time simultaneously cutting the webs into sheets, moving the top web ahead of the lower web a short distance, and rolling the two webs into a single roll with the top web positioned inwardly of the bottom web in the roll.

18. The method of rolling a web of paper superposed on a web of foil including the steps of conveying the webs lengthwise and at the same time simultaneously cutting the webs into sheets, moving the top web ahead of

the lower web a short distance, and rolling the two webs into a single roll with the top web positioned inwardly of the bottom web in the roll.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 13,267	Griffin	July 11, 1911
500,115	Crowell	Jan. 27, 1893
699,419	Sheldon	May 6, 1902
1,124,114	Davis et al.	Jan. 5, 1915
1,136,412	Blonay	Apr. 20, 1915
1,150,156	Swift et al.	Aug. 17, 1915
1,269,969	Smith et al.	June 18, 1918
2,283,255	Holtz	May 19, 1942
2,338,132	Sandberg	Jan. 4, 1944
2,580,060	Zimmerman	Dec. 25, 1951
2,643,487	Parker	Jan. 30, 1953
2,732,063	Dedek et al.	Jan. 24, 1956
2,774,018	Weiss	Dec. 11, 1956

FOREIGN PATENTS

1,042,640	France	Nov. 3, 1953
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