United States Patent [19]

Walker

[11] **3,879,246**

[45] **Apr. 22, 1975**

[54] **LAMINATING APPARATUS AND METHOD**

[76] Inventor: **Robert J. Walker,** 2942 Linden Ave., Berkeley, Calif. 94705

[22] Filed: **Sept. 11, 1972**

[21] Appl. No.: **287,678**

[52] **U.S. Cl.** **156/265;** 156/519

[51] **Int. Cl.** **B32b 31/00**

[58] **Field of Search** 156/256, 264, 265, 259, 156/519

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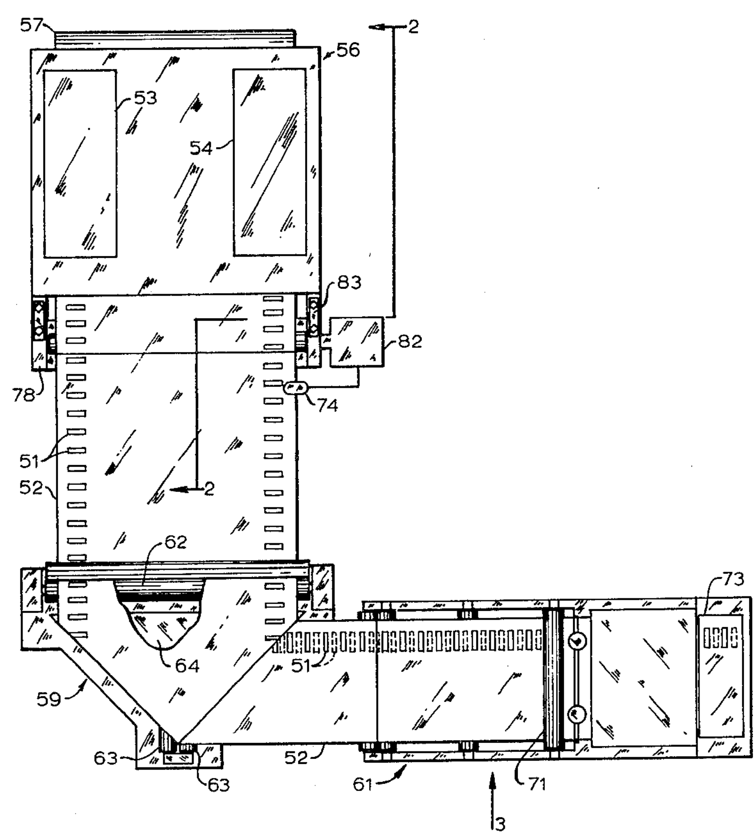
Primary Examiner—Douglas J. Drummond
Attorney, Agent, or Firm—Stanley Bialos

[57] **ABSTRACT**

Laminating apparatus and method, particularly adapted for continuously adhesively bonding relatively narrow elongated strips of flexible material cut from a parent sheet, to a web of material and applying such strips in spaced apart relationship on the web. The parent sheet is continuously fed from a roll in one general direction to a continuously rotating vacuum drum. Cutting means, desirably rotary cutting means, contacts the drum and cuts the strips from the parent sheet in spaced apart relationship on the drum.

16 Claims, 33 Drawing Figures



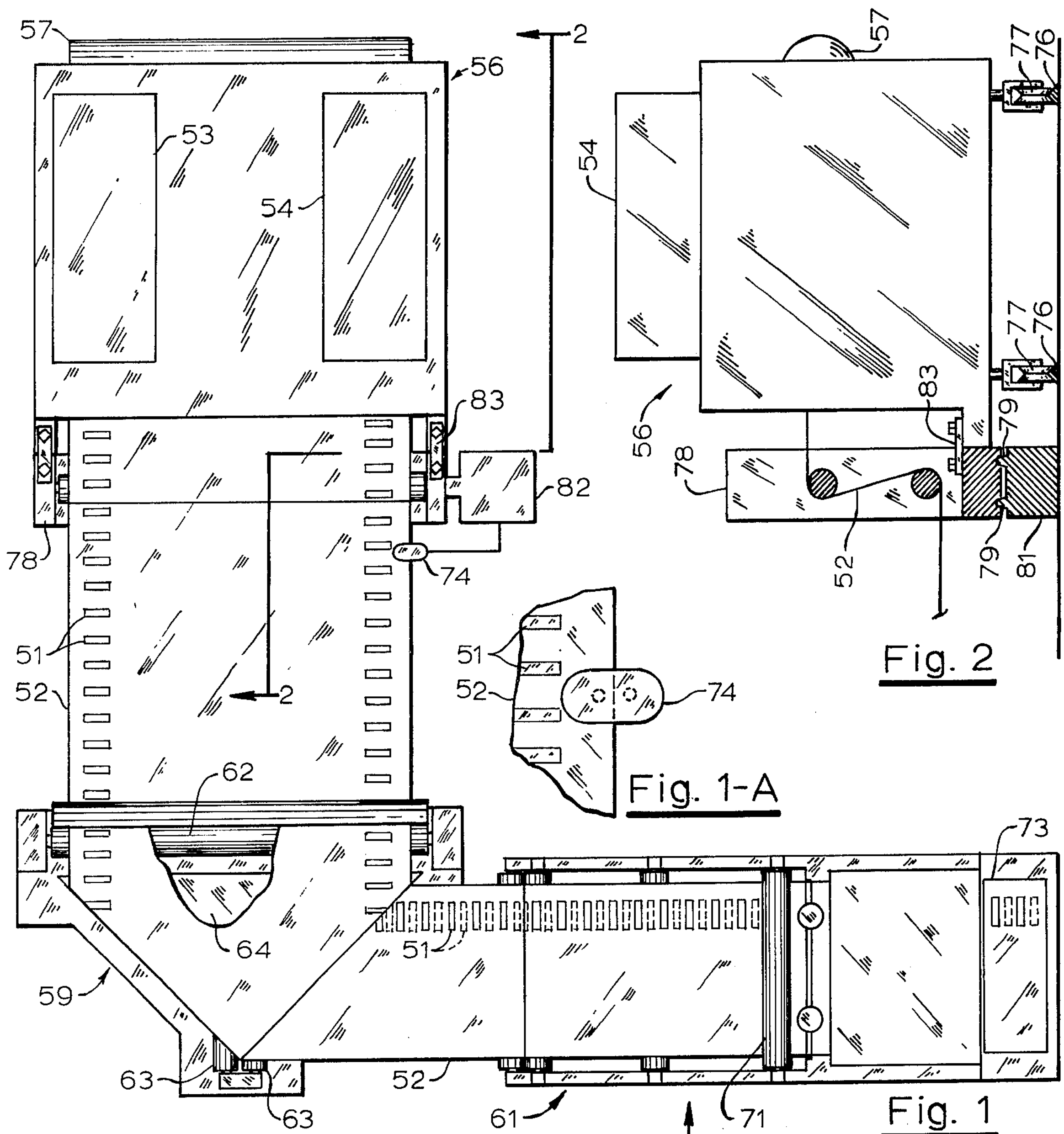


Fig. 2

Fig. 1-A

Fig. 1

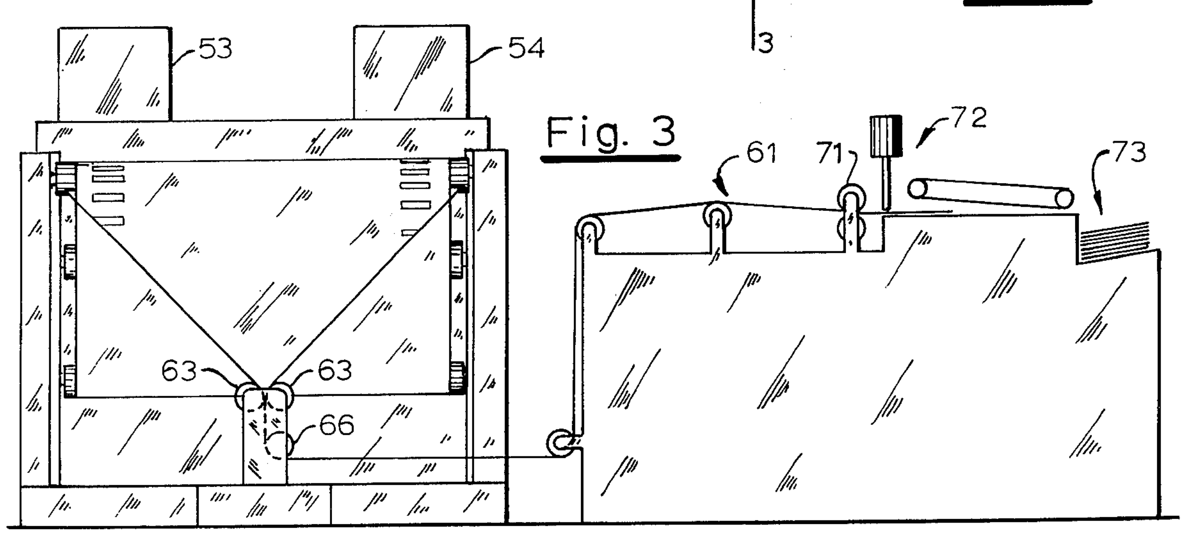


Fig. 3

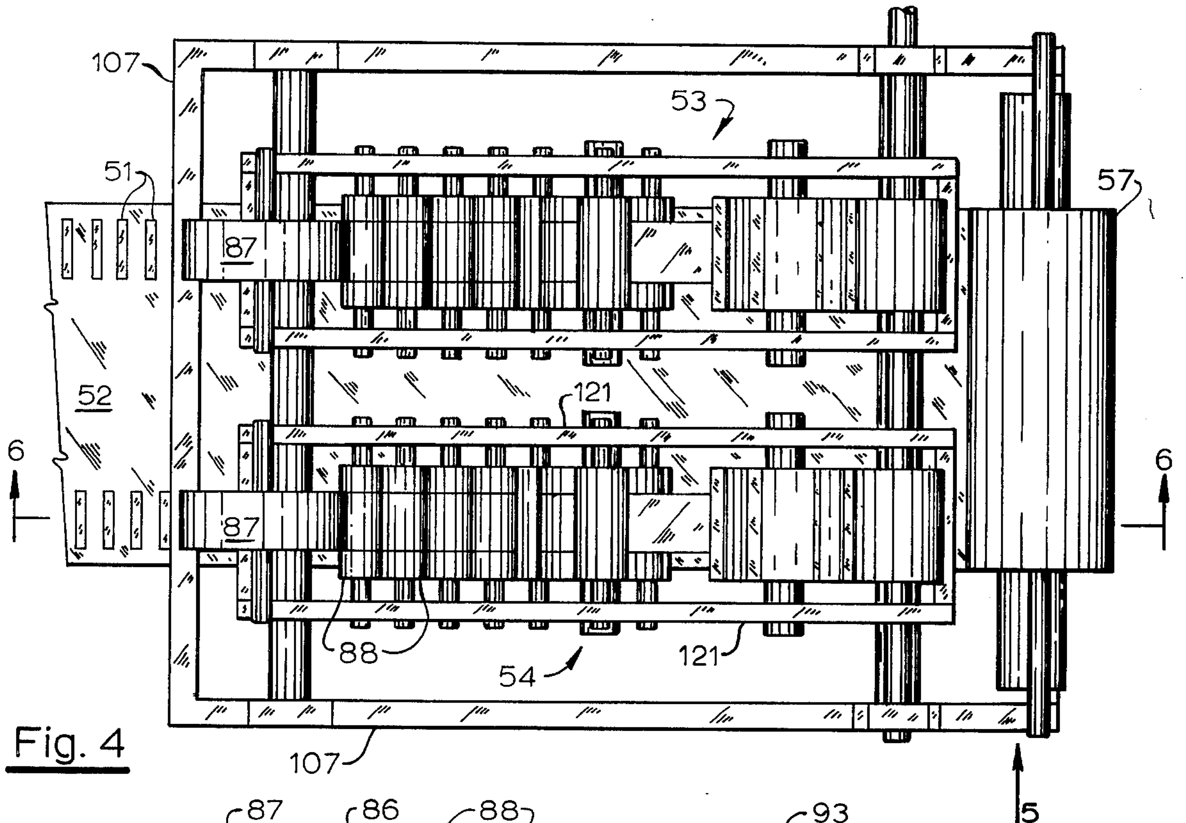

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Fig. 4

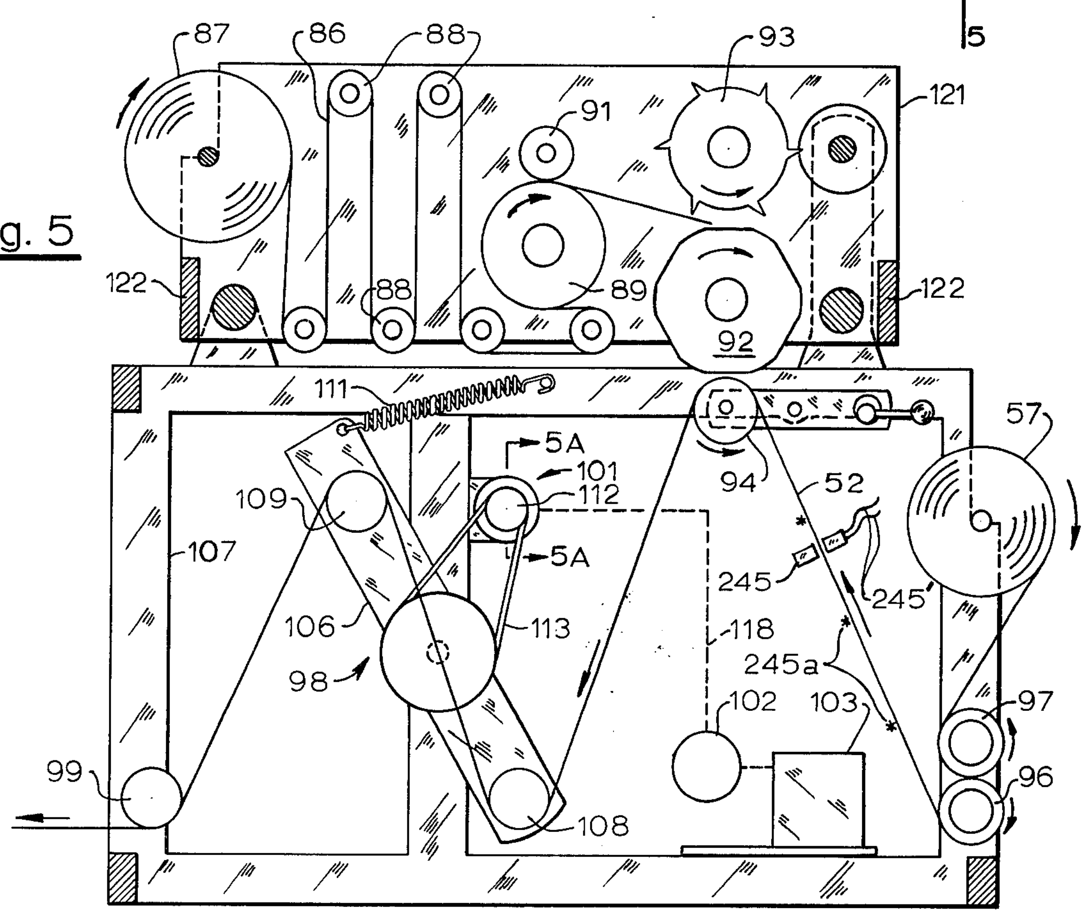
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Fig. 5

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SHEET 03 OF 10

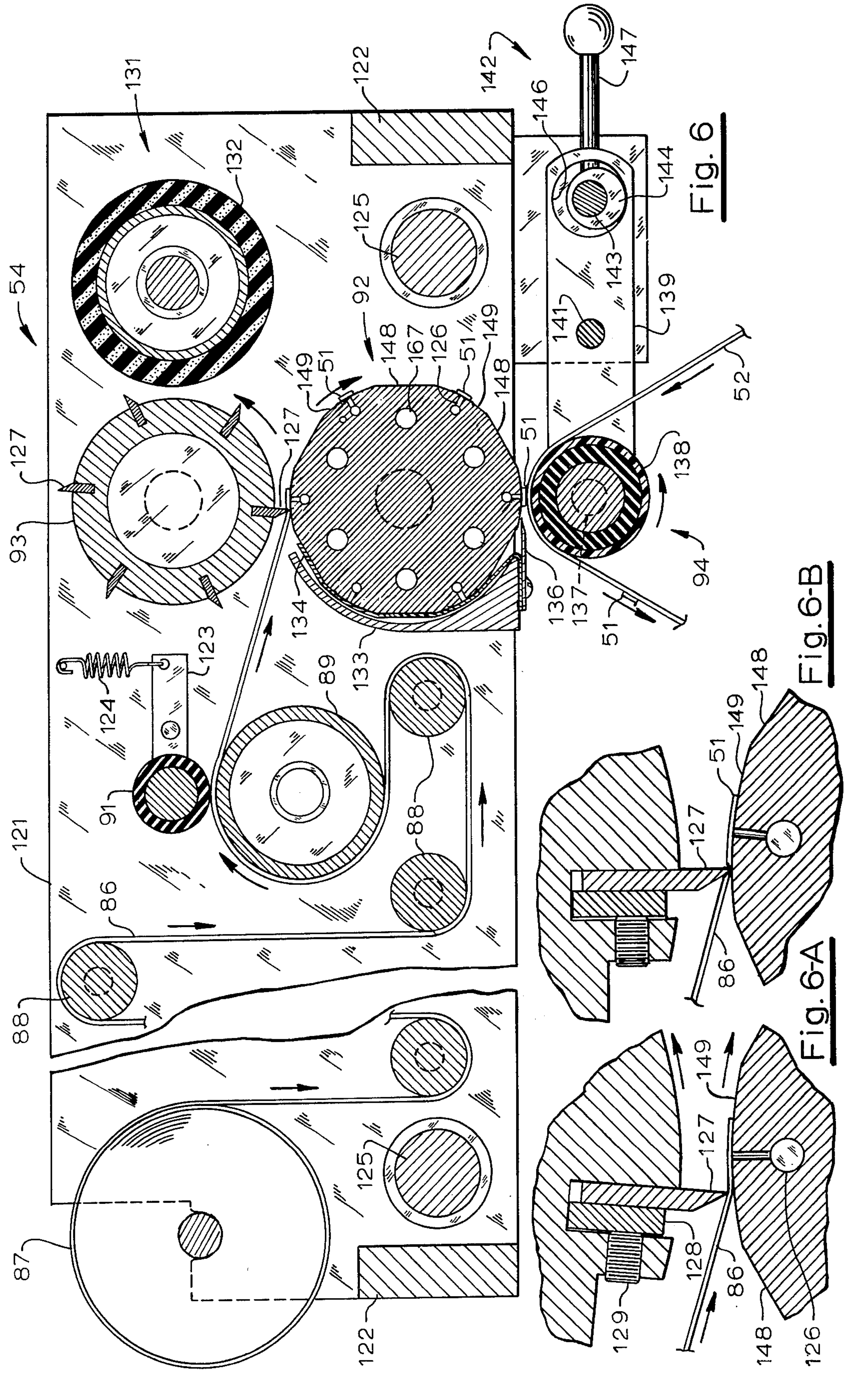

Fig. 6

Fig. 6-B

Fig. 6-A

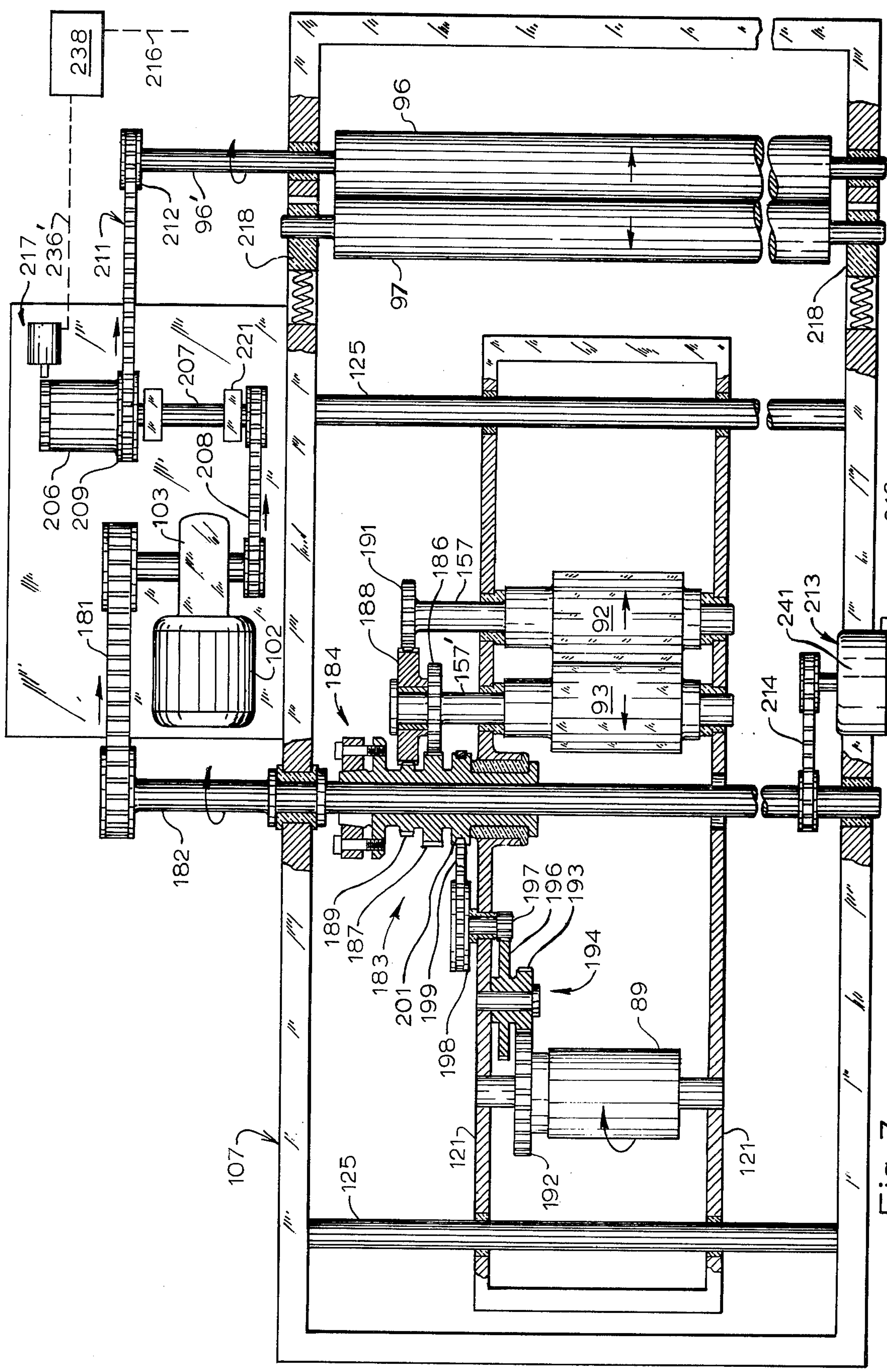
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Fig. 7

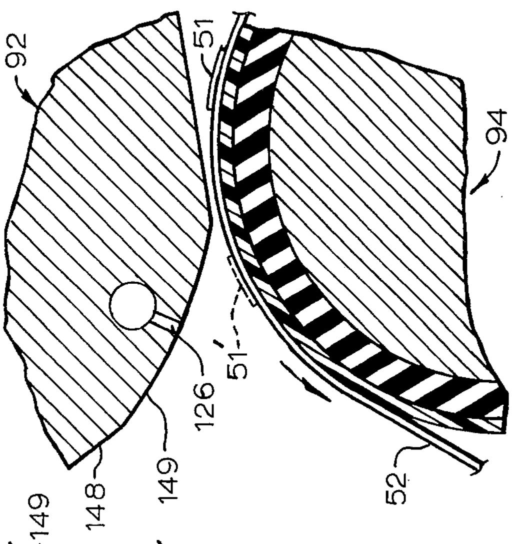


Fig. 11

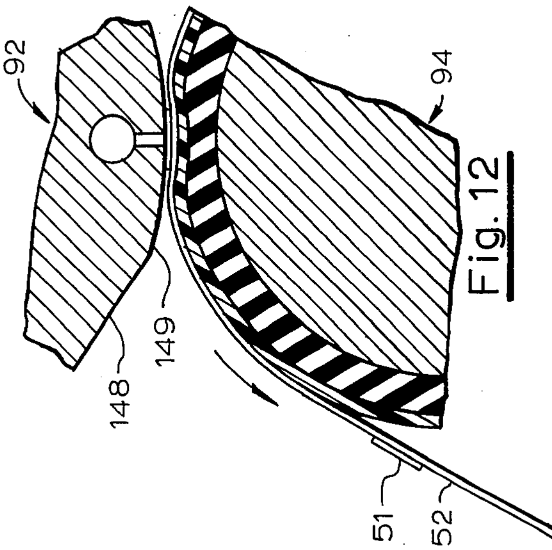


Fig. 12

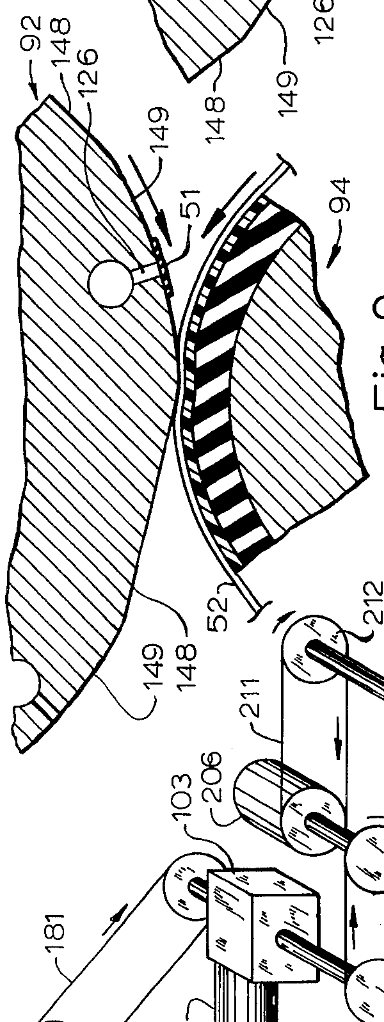


Fig. 9

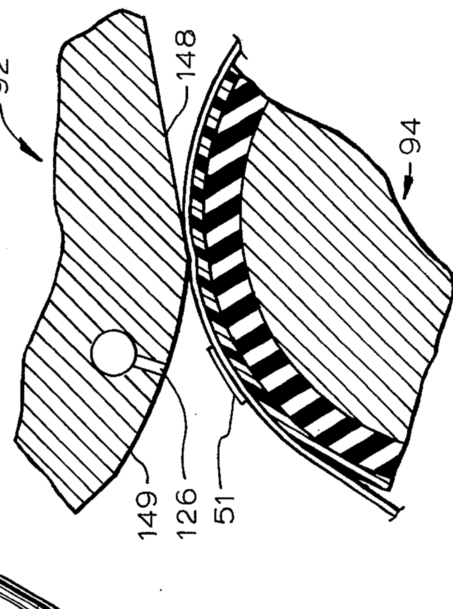


Fig. 10

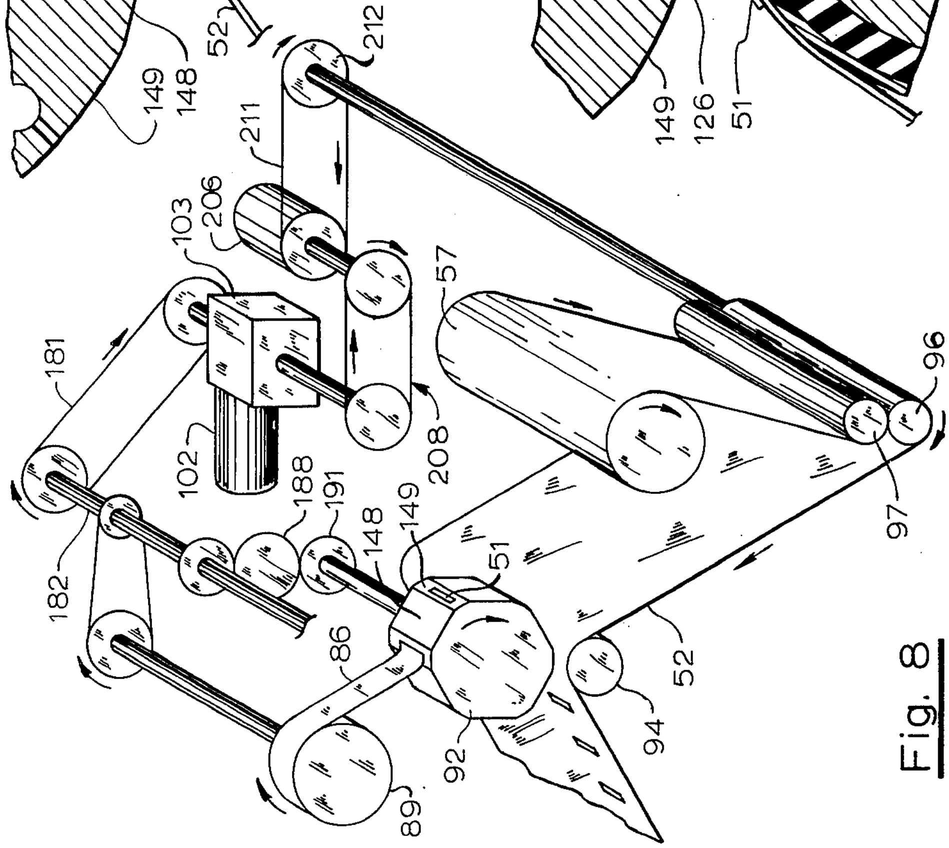


Fig. 8

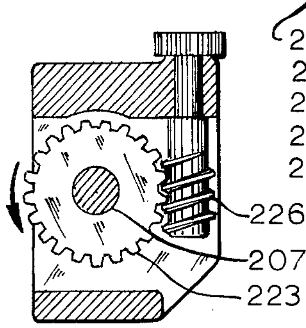


Fig. 13 A

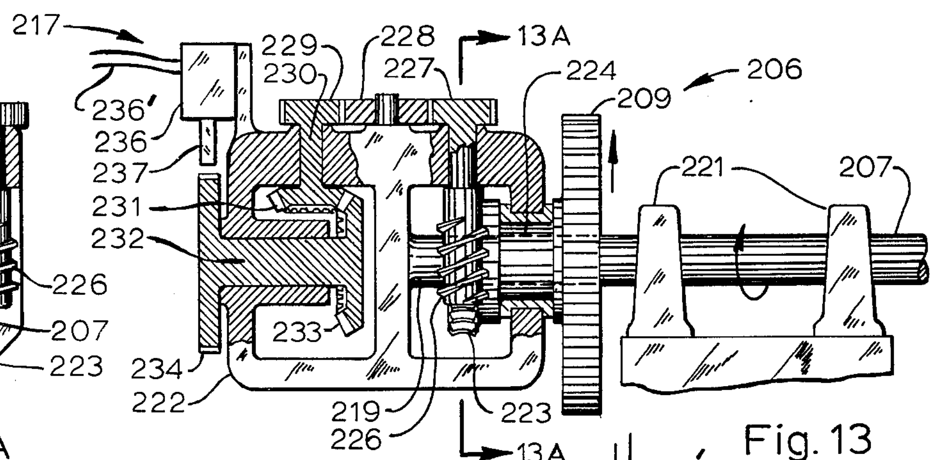


Fig. 13

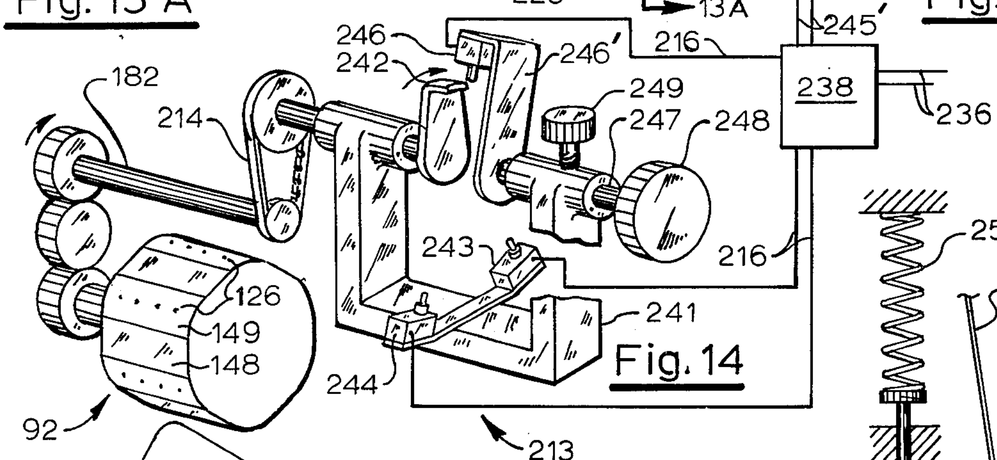


Fig. 14

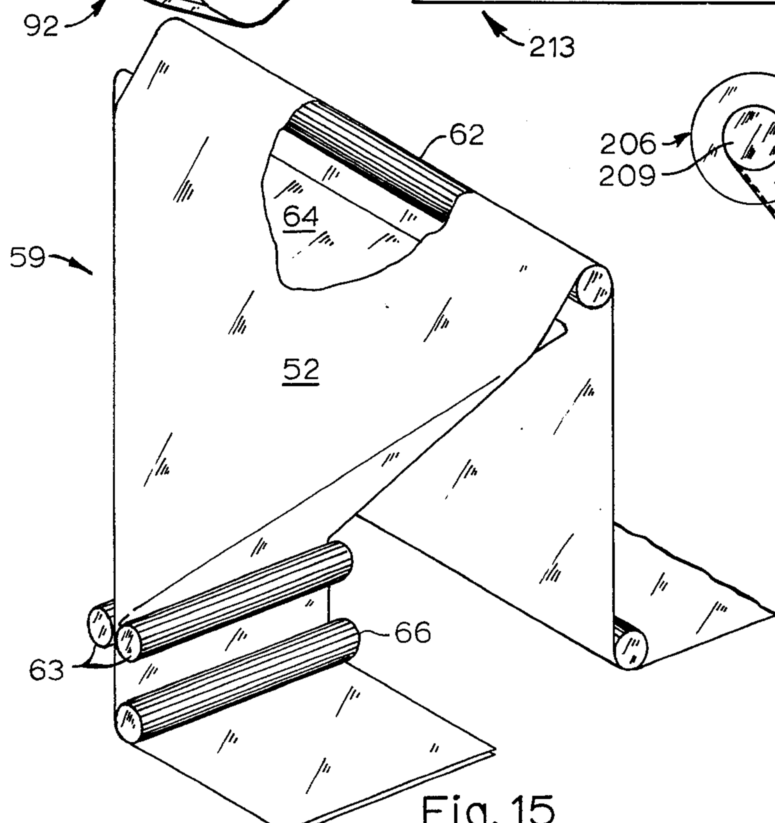


Fig. 15

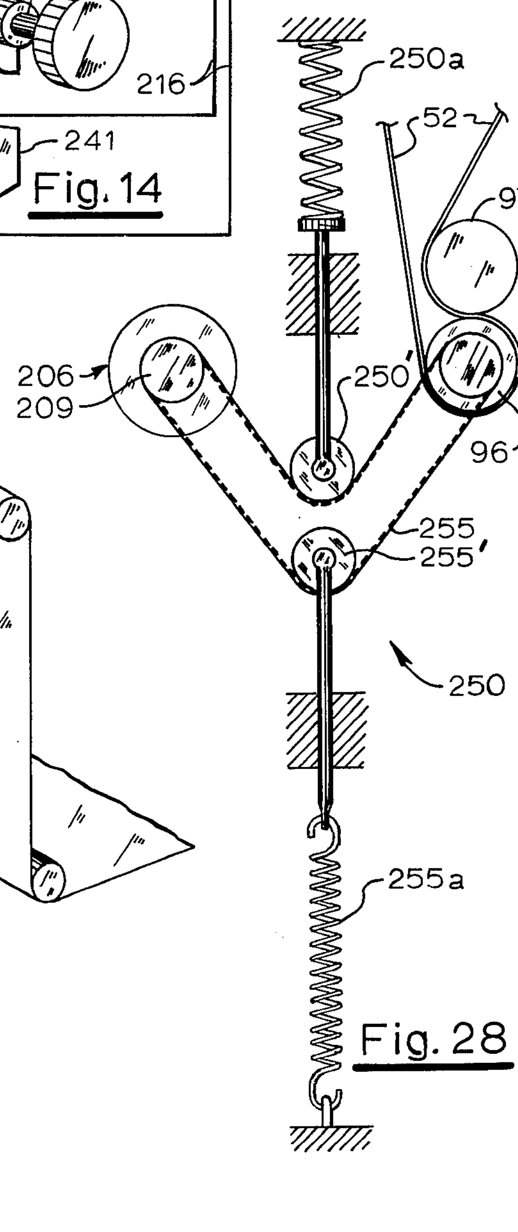
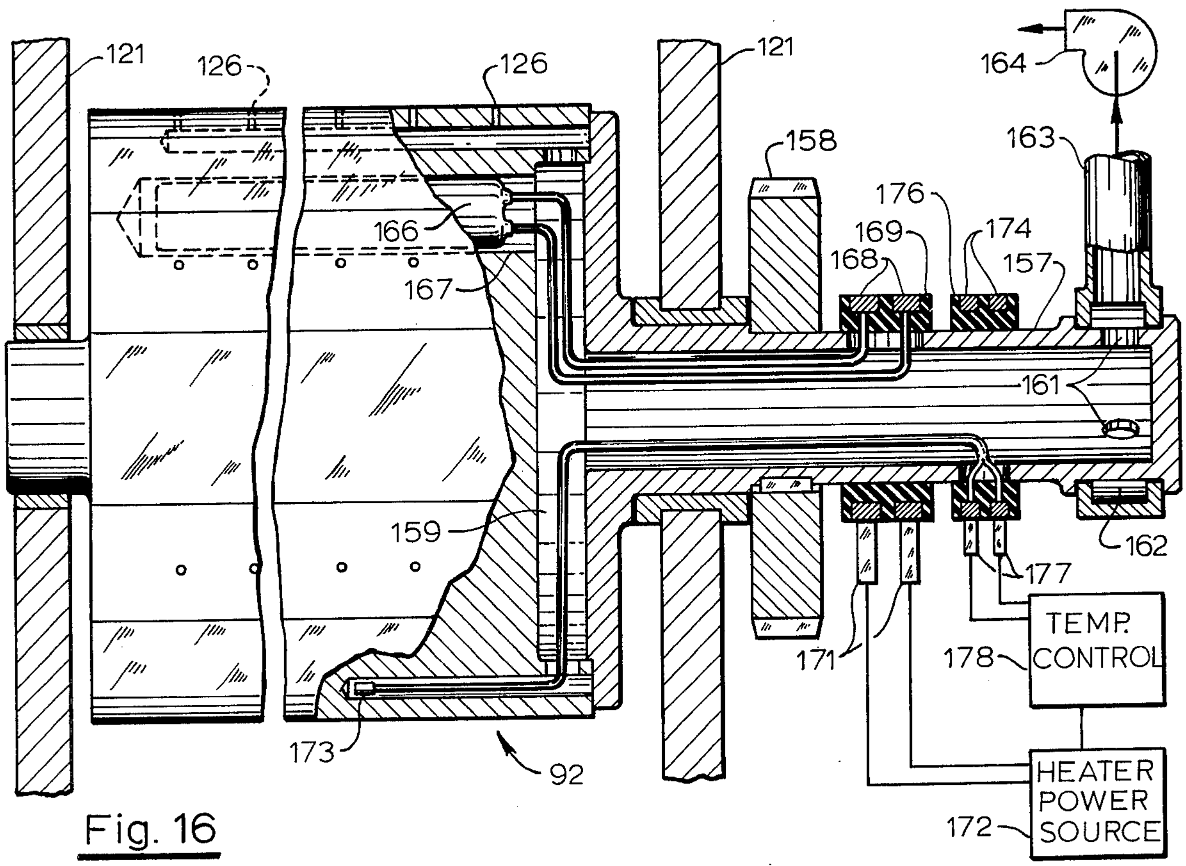


Fig. 28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HEATER POWER SOURCE
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Fig. 16

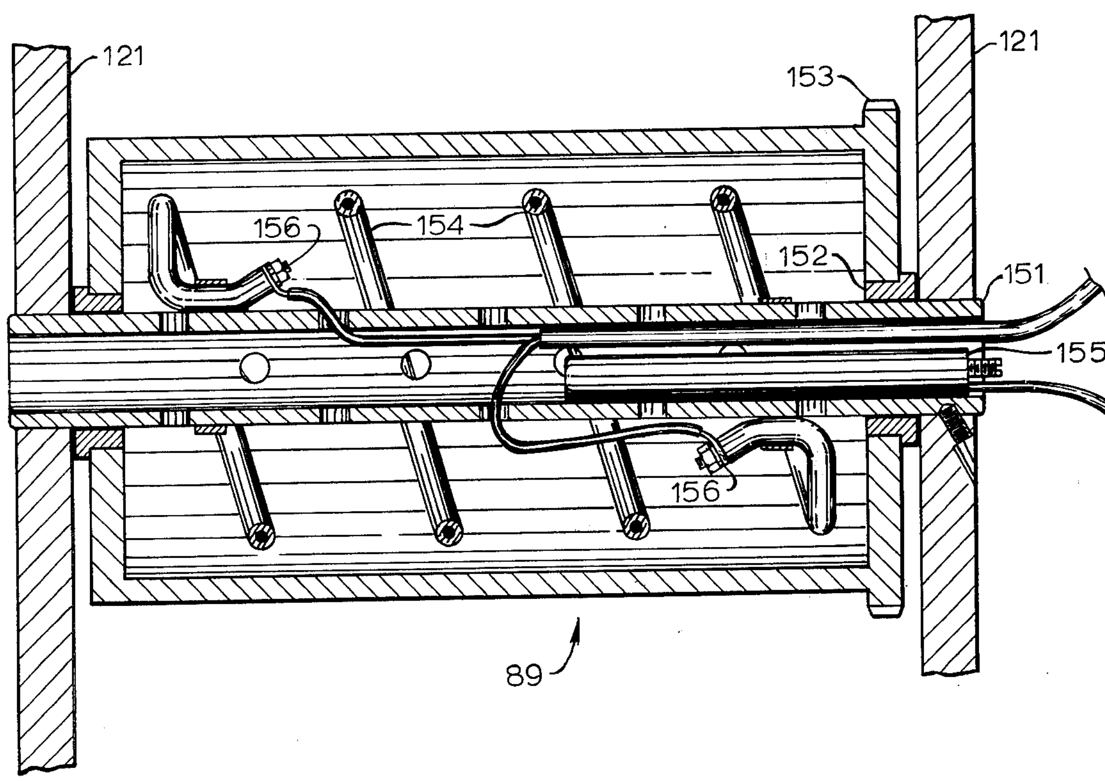
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Fig. 17

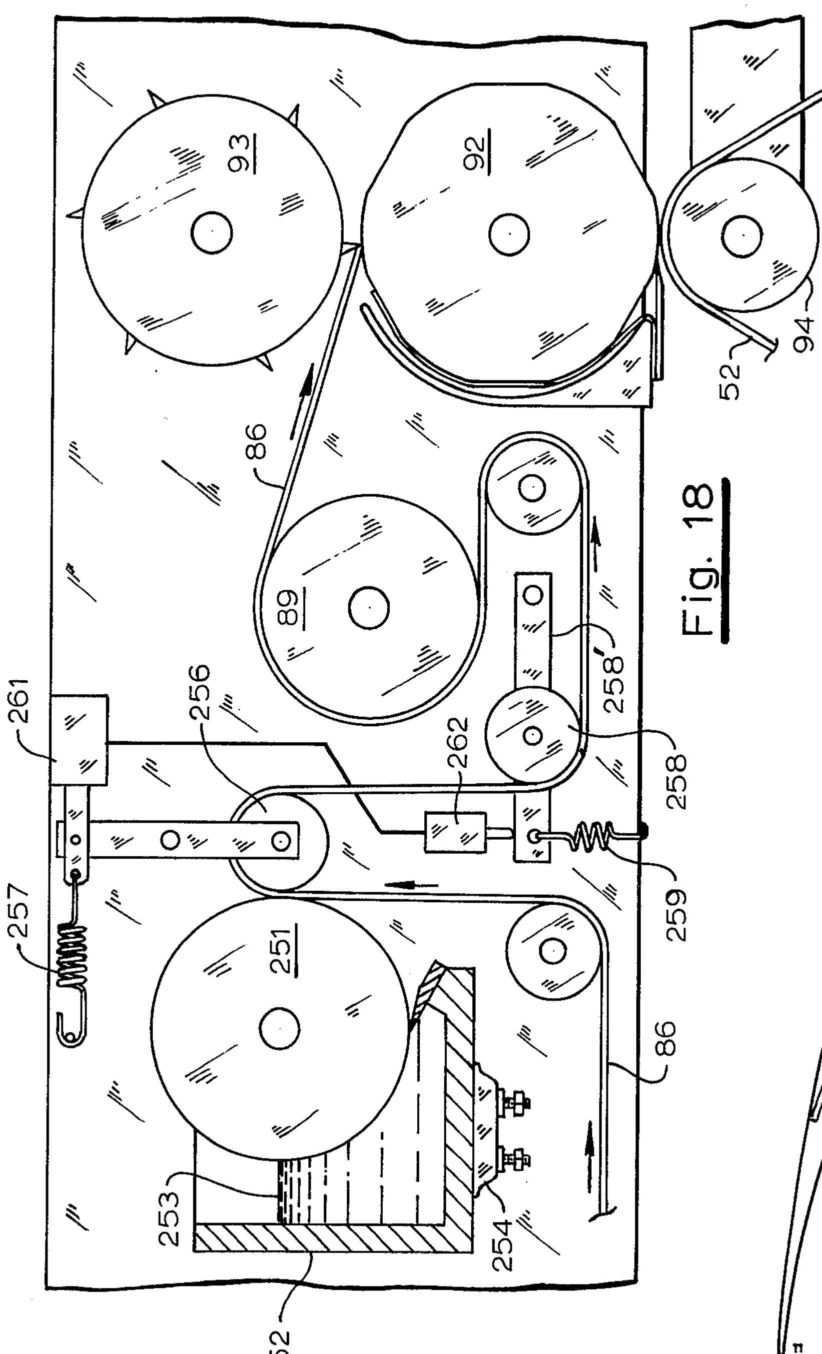
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Fig. 18

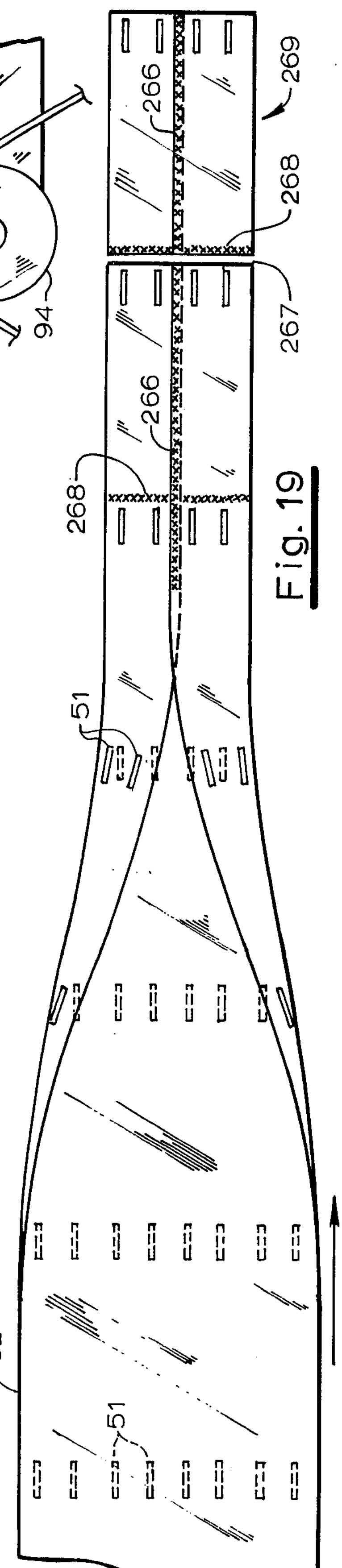
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Fig. 19

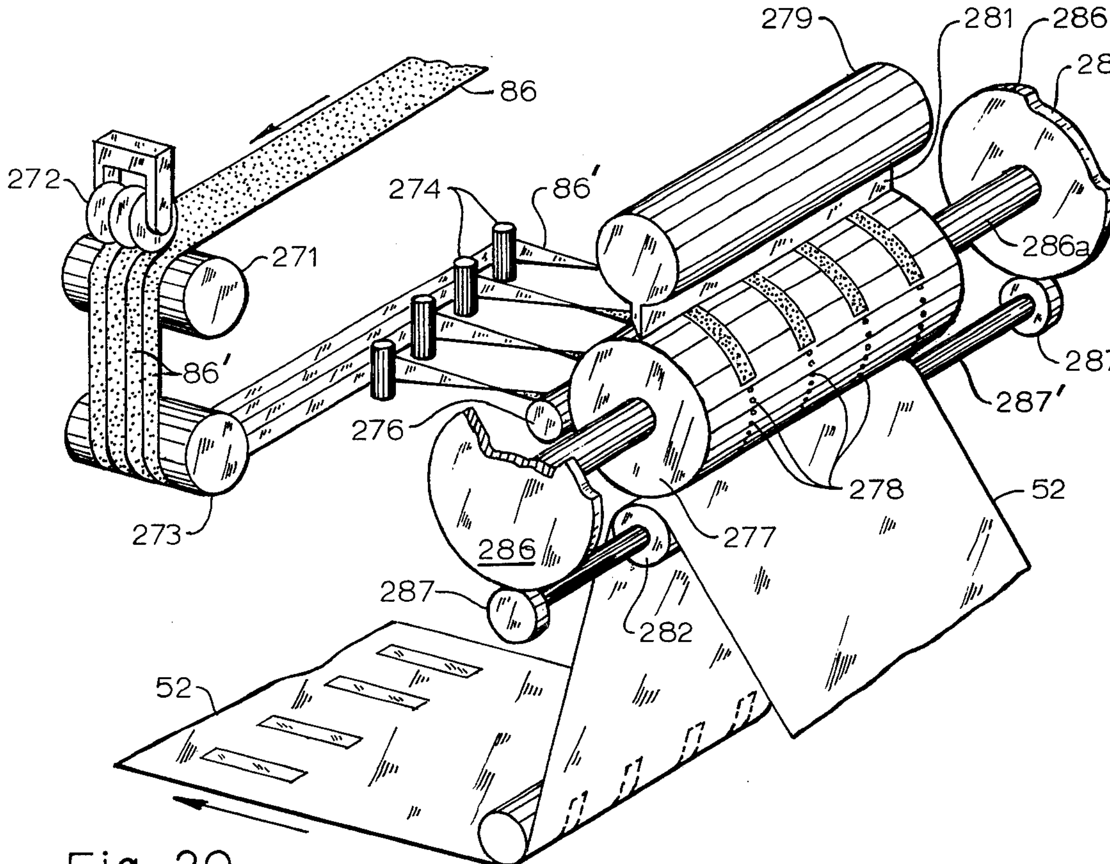


Fig. 20

Fig. 21

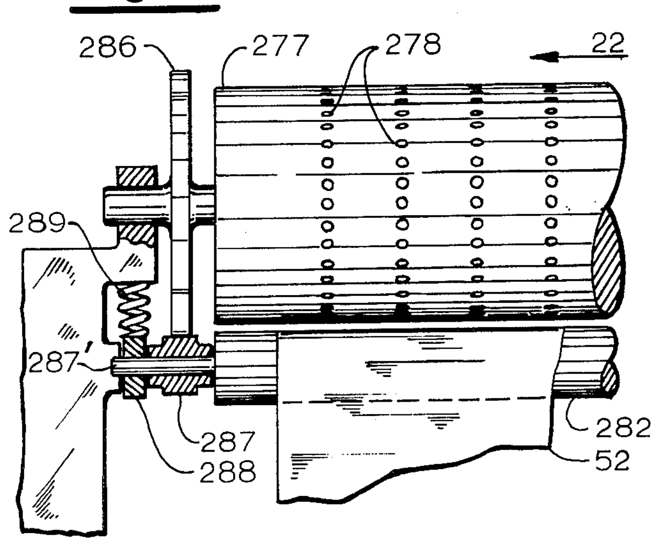
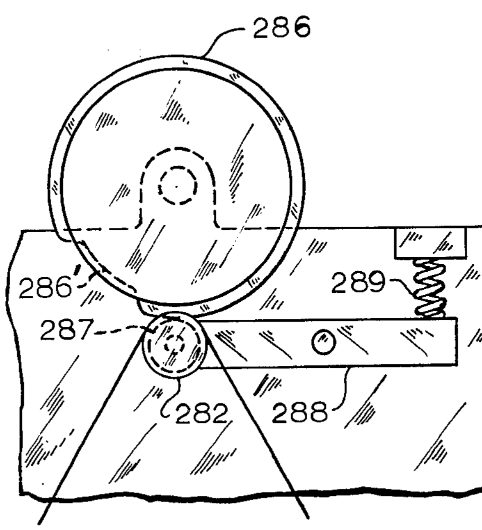


Fig. 22



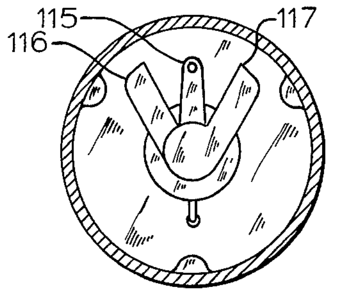


Fig. 5B

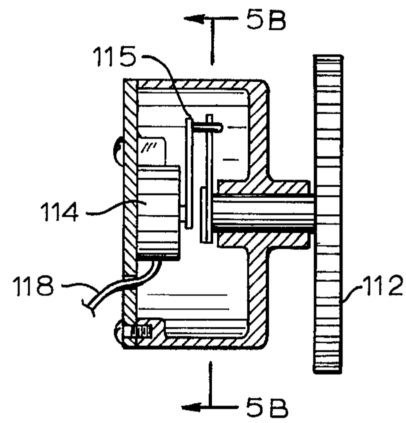


Fig. 5A

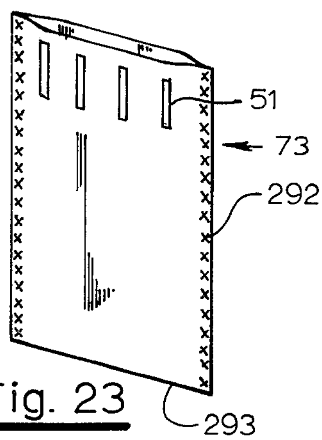
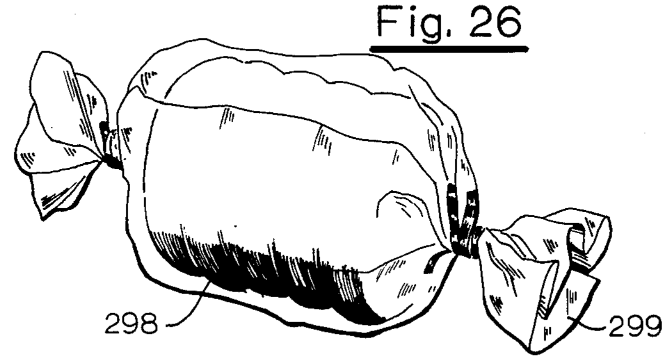


Fig. 23

Fig. 26



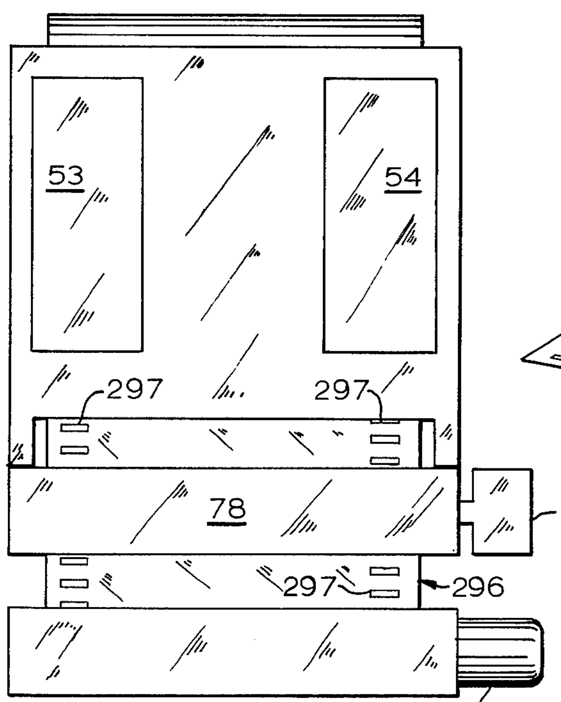


Fig. 27

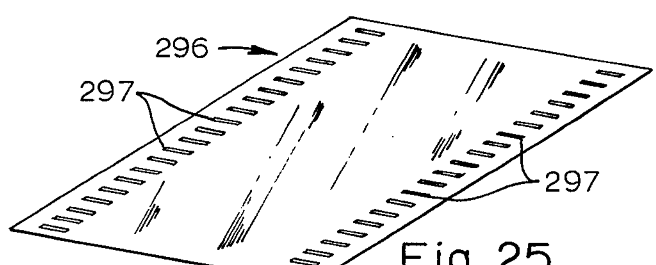


Fig. 25

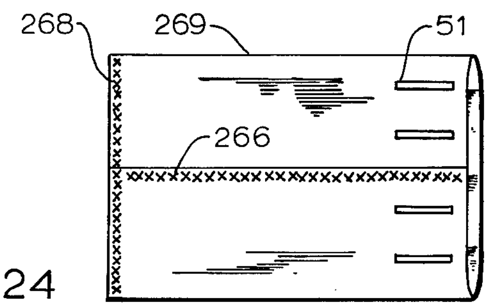


Fig. 24

LAMINATING APPARATUS AND METHOD

Pressure applying mechanism, desirably a freely rotatable pinch roll between which and the drum the web is constantly fed, effects transfer of successive strips onto the web by the pinching action of the pinch roll. Thus, the vacuum and the drum releasably retain the strips on the drum until transfer onto the web is effected by the pinch roll. Spacing between the center lines of adjacent strips on the drum is determined by the relative peripheral velocity between the cutting means and the drum, which controls the time intervals between intermittent contacting of the cutting means on the drum. Arcuate length of the strips on the drum is determined by the feed velocity of the parent sheet relative to the peripheral velocity of the cutting means. Adjustment of the spacing on the web can be effected by varying the web speed relative to the peripheral velocity of the drum.

The freely rotatable pinch roll has the same velocity as the peripheral velocity of the drum when in pinching engagement therewith. Web distortion will occur when the web velocity is not the same as the peripheral velocity of the drum. Stress caused by such distortion is relieved by spaced apart flat portions on the drum between spaced apart arcuate portions so that the web may return quickly (snap) to a neutral position intermittently during dwell periods which the flats provide. As an alternative, the pinch roll may be intermittently moved up and down, into and out of engagement with the drum in timed relationship to provide such dwell periods.

In the case of non-stretchable film or other non-stretchable web material, stress is relieved by including yieldable drive means in the drive mechanism for feeding the web, in combination with means for intermittently providing dwell periods. Where spaced rows of strips are applied to the web, individual rolls of parent sheet material may be provided for the strips. As an alternative, a single roll may be provided and split into narrower bands which are subsequently spaced apart and then individually cut into the strips.

In an embodiment of the invention, the laminating apparatus may be used in combination with a conventional so-called side-weld bag making machine, the strips being adhered to opposite faces of the bag adjacent its mouth to form a twist type closure. Means is provided for synchronizing operation of laminating apparatus with the bag making machine.

In another embodiment, the apparatus may be in combination with a conventional so-called back seal type bag making machine wherein the bottom of the bag is welded with which the laminating apparatus is also synchronized. In a further embodiment, the web to which the strips are applied adjacent each edge thereof, is continuously wound into a roll which may be severed into lengths for the forming of twist type wrappers.

SUMMARY AND OBJECTS OF THE INVENTION

Summarizing the invention, flexible strips are applied in spaced apart relationship onto a continuously moving web. They are relatively narrow, usually about ⅛ inch to ⅜ inch in width, generally about ¼ inch in width, and elongated in length of about 1-½ to 3 inches. Although they may be of any suitable material, the apparatus and method are particularly adapted for making twist type closures on wrappers or bags, wherein elongated strips of flexible, inelastic and bendable material which will assume a dead-set position when folded, are employed, as is disclosed in applicant's U.S. Pat. No. 3,402,052, dated Sept. 17, 1968. Metal foil, desirably aluminum foil, is most suitable.

A problem exists in cutting said material into such narrow strips from a parent sheet, and handling the strips. To overcome this problem, a rotary vacuum drum is provided which releasably retains the strips, and on which the strips are cut by a crush-cutting action (non-shearing action). Advantageously, a continuous uninterrupted vacuum is employed, thus eliminating valving and automatic controls for applying and releasing the vacuum. Cutting means at one location, advantageously rotary cutting means, which includes at least one cutting blade, intermittently contacts the drum and cuts the parent sheet into the strips when it is held on the drum by the vacuum. The center to center line spacing between adjacent strips on the drum is determined by the relative peripheral velocity between such rotary cutting means and the drum, while the arcuate length of the strips on the drum is determined by the velocity of the parent sheet relative to the peripheral velocity of the cutting means.

At the time the parent sheet is fed to the drum it has adhesive on its outer face with reference to the drum. The adhesive may be initially precoated on the parent sheet, such as a heat activatable adhesive, or an adhesive coating may be applied by the apparatus, such as a hot melt adhesive applied in liquid form or any other suitable adhesive.

When the successive strips on the vacuum drum are moved by the drum to another location, spaced from the cutting location, they are transferred to the web by means of a pinch roll, which presses the web against the adhesive coating. This pinch roll is advantageously freely journalled so that its peripheral velocity is the same as the peripheral velocity of the drum at the location where the pinching and strip transfer occur.

In order to vary the center line to center line spacing between the strips on the web, provision is made to vary the feed velocity of the web relative to the peripheral velocity of the vacuum drum. At the time of pinching, such difference in drum and web velocity will cause web distortion consisting of tension or slack in the web. To prevent such distortion of the web, stress caused by tension or slack is intermittently relieved by providing flats between arcuate portions on the vacuum drum which provide dwell periods allowing the web to assume intermittently a neutral position. Such means may also be a pinch roller mounting which is automatically moved intermittently into and out of engagement against the drum, thus, providing the neutral dwell periods when the web is not being pinched. Under certain circumstances, yieldable means is provided in the drive for the web which is employed in combination with the aforementioned flats or intermittently reciprocating pinch roll.

As previously mentioned, the spacing between the strips on the web can be varied by altering the speed of the web relative to the peripheral velocity of the vacuum drum. A variable speed transmission could be used for this purpose but, advantageously, the transmission is a fixed gear transmission which drives the web at a constant speed, and differential mechanism is employed which is of a common type providing up to about 6 percent continuous speed variation. For greater variation, different change gear combinations may be substituted in the fixed gear transmission while still employing the differential mechanism.

In one embodiment of the invention, the laminating apparatus lays the strips in elongated form at each side of a moving web transversely to its edges with their axes substantially parallel to the vacuum drum axis (transverse lamination), in association with a so-called side-weld bag making machine. In such machine, a web of plastic material is moved in the same direction as a fold line which provides a hinge connection for two opposite sides of the web; and the web is severed and heat-sealed transversely to form the side-welds. In the invention hereof, where the laminating apparatus is employed in combination with such side-weld bag making machine, means is provided for longitudinally folding the web after the strips have been applied thereto, and feeding the thus folded web into the side-weld machine, the operation of the laminating apparatus being coordinated or synchronized with the bag making machine.

In another embodiment of the invention, the strips are cut in elongated form and bonded to the web with their lengthwise direction extending transversely to the axis of the vacuum drum and with groups of spaced apart strips, spaced apart longitudinally of the direction of movement of the web (longitudinal lamination). It is then folded and longitudinally sealed into tube form in a conventional bag making machine wherein the bag side edges are folds and the bottom is sealed and severed from the resultant tube.

The parent sheets from which the strips are formed may be on individual rolls, or it may be on a wide roll which is cut into narrower bands which are then separated and fed to the vacuum drum. For transverse lamination of the relatively narrow elongated strips, a relatively wide sheet of parent material is employed and the elongated strips are formed by crosswise cutting of the sheet with their lengthwise direction extending transversely of both the web and its direction of travel; and the vacuum drum has rows of vacuum holes extending parallel to the drum axis.

For longitudinal lamination, the vacuum drum has rows of circumferential vacuum holes extending transversely to the drum axis to which the individual bands are fed and which retain the cut strips thereon. For the manufacture of wrappers, the web to which transversely extending strips have been applied may be wound into a roll which is then severed by the consumer into individual sections to form the wrapper.

From the preceding, it is seen that the invention has as its objects, among others, the provision of an improved simple and economical apparatus and method for the lamination by adhesive bonding of elongated and narrow strips of flexible material, especially metal foil, in spaced apart relationship to a continuously moving web, particularly plastic film, either in a direction extending transversely to the direction of movement of the web or longitudinally of such direction; which are particularly adapted for the manufacture of twist type closures for wrappers, and for bags in association with conventional bag making machines; performable at a high speed; and in which the apparatus is provided with means for varying the spacing between the strips on the web and also the width of length of the strips.

Other objects will become apparent from the following more detailed description and accompanying drawings, in which:

DESCRIPTION OF FIGURES

The present invention is illustrated as to particular preferred embodiments thereof in the accompanying drawings wherein:

FIG. **1** is a schematic plan view of a laminating and bag making machine in accordance with the present invention;

FIG. **1A** is a partial enlarged view illustrating edge detecting mechanism;

FIG. **2** is a side elevational view taken in the planes **2—2** of FIG. **1**;

FIG. **3** is an end elevational view taken in the direction of arrow **3** of FIG. **1**;

FIG. **4** is a top plan view of a pair of laminating heads as employed in the mechanism of FIG. **1**;

FIG. **5** is a schematic elevational view of a laminating head and web handling apparatus of the present invention; looking in the direction of arrow **5** in FIG. **4**;

FIG. **5A** on sheet **10** is a sectional view of laminating speed control apparatus taken in the plane **5A** of FIG. **5**;

FIG. **5B** on sheet **10** is a sectional view taken in the plane **5B** of FIG. **5A**;

FIG. **6** is an enlarged longitudinal vertical sectional view of a laminating head taken in the plane **6—6** of FIG. **4**;

FIGS. **6A** and **6B** are enlarged illustrations of cutting means of the laminating head immediately prior to and at the point of severing a foil strip for laminating;

FIG. **7** is a developed plan illustration partially in section illustrating drive elements and connections for a laminating head in accordance with the present invention;

FIG. **8** is a schematic perspective view illustrating the relationship of certain of the drive means of the present invention;

FIGS. **9, 10, 11** and **12** are enlarged partial schematic sectional illustrations of actual laminating steps with the apparatus illustrated in FIG. **6**;

FIG. **13** is a longitudinal elevational view partially in section of a conventional differential drive mechanism as may be employed in the present invention;

FIG. **13A** is a sectional view taken in the plane **13A** of FIG. **13**;

FIG. **14** is a schematic perspective illustration of speed control means as may be employed with the differential of FIG. **13** to control the feed speed of a web to the laminating heads of the present invention;

FIG. **15** is a perspective view of web folding mechanism as may be employed between the laminating mechanism and bag making machine of the present invention;

FIG. **16** is a longitudinal view partially in section of a vacuum drum of the laminating head of the present invention;

FIG. **17** is a central longitudinal sectional view of the foil feed roll of FIG. **6**;

FIG. **18** is a schematic illustration of a hot melt adhesive applicator and associated mechanism in accordance with the present invention;

FIG. **19** is a schematic illustration of conventional back seal type (bottom-weld) bag manufacture;

FIG. **20** is a schematic perspective illustration of alternative foil handling and laminating apparatus in accordance with the present invention;

FIG. **21** is a partial side elevational view of the pinch roller and vacuum drum engagement in the embodiment of FIG. **20**;

FIG. **22** is a partial schematic end elevational view of the vacuum drum and pinch roller of the embodiment of FIG. **20**, looking in the direction of arrow **22** in FIG. **21**;

FIG. **23** is a perspective illustration of a side-weld bag as may be formed in carrying out the present invention;

FIG. **24** is a perspective illustration of a bottom-weld bag as may be formed in carrying out the present invention;

FIG. **25** is a perspective illustration of a wrapper sheet formed in accordance with the present invention;

FIG. **26** is a perspective illustration of the wrapper sheet of FIG. **25** secured about an object;

FIG. **27** is a schematic plan view of laminating and handling equipment producing the sheet of FIG. **25**; and

FIG. **28** on sheet **6** is a schematic illustration of what may be termed a yieldable drive mechanism applicable to the apparatus of the present invention wherein a non-stretchable web is laminated in the apparatus.

DESCRIPTION OF PREFERRED EMBODIMENT

The present invention is particularly applicable to the laminating of flexible elongated strips, such as a metallic foil, to a flexible web of film, such as, for example, stretchable polyethylene film or non-stretchable biaxially oriented polyester film, for the manufacture of bags with twist type closures as disclosed in applicant's aforementioned U.S. Pat. No. 3,402,052, or for the manufacture of wrappers disclosed in applicant's copending application, Ser. No. 261,315, filed June 9, 1972, for "Wrapper For Comestibles Or The Like, And Method And Package Therefor." The strips are capable of assuming a dead set position when folded, to thus provide a tight closure by interlocking.

However, the invention has a wide range of applicability in laminating by adhesive bonding other types of strips to webs. The utility of the resultant product has been briefly noted above and is again commented upon in connection with certain figures in the drawings. There are encountered certain problems in the application of narrow, elongated, small pieces of flexible material, such as foil, to a moving web, and the mechanism of the present invention is particularly directed to the facile accomplishment of such application or lamination, and to overcoming the problems associated therewith.

Referring now to FIGS. **1** through **3**, there will be seen to be illustrated therein mechanism for affixing or laminating small elongated strips of foil **51** to a moving web **52** of a thin plastic film for the production, for example, of thin film bags or sheets having the foil strips thereon in particular predetermined spaced apart locations. In FIGS. **1** through **3** there is illustrated means for producing conventional side weld bags having foil strips disposed about the bag mouth and extending longitudinally from adjacent the opening.

Referring further to FIGS. **1** through **3**, it will be seen that there are provided laminating heads **53** and **54** comprising a portion of a laminating unit **56** through which there is fed a web of plastic film **52** and within which there are applied the foil strips **51** as described below. The web passes from a supply roll **57** through the laminating unit **56** onto web conveying means where the web is folded longitudinally and the direction of travel changed 90° by a plow mechanism **59** for feeding the folded web longitudinally in the direction of the fold into a conventional side weld bag making machine **61**. In this embodiment of the present invention the bag making machine **61** receives the web from the laminating unit and through the conveyor means. The plow mechanism **59**, as illustrated in FIG. **15** will be seen to be comprised as a top roller **62** over which the web passes with a pair of closely adjacent parallel rollers **63** disposed below the top roller perpendicularly thereto at the center of the web. A V-shaped plate **64** is disposed with the end thereof extending from the upper roller **62** downward and away from such roller. The point of the plate **64** is disposed adjacent the far end of the pair of transversely disposed rollers **63**. The web **52** is drawn over the plate **64** and and downwardly between the rollers **63** to thus fold the web in half and this folded web is then passed about a further roller **66** to enter the bag making machine **61**.

The bag making machine **61** is a conventional so-called side weld bag making machine, and includes a plurality of rollers, including pinch rollers **71**, between which the laminated web is passed. Conventional cutting and sealing means **72** are provided for transversely cutting the folded web and sealing the cut folded edges to form a succession of bags generally indicated at **73**, having, as shown in FIG. **23**, a bottom formed with a fold **293** and sealed side edges **292**.

One of the problems of handling a web of material **52** fed from a laminating unit **56** is the necessity of maintaining edge alignment of the web. This is herein accomplished by the provision of a conventional edge guide vacuum sensor **74** illustrated in FIG. **1A** as comprising inner and outer vacuum holes to produce control signals upon variation of the web edge a predetermined amount from a desired position as the web moves past the sensor. The laminating unit **56** is mounted for transverse movement upon V-shaped rails **76** by caster wheels **77** each formed with a peripheral V-groove fitting the V-shaped rail. The laminating unit is rigidly affixed by brackets **83** to an unwind stand **78** which is used with a bag making machine, and which has freely rotatable rollers extending thereacross. Stand **78** is mounted upon slide rails **79** on base **81** for controlled lateral movement together with the laminating unit **56**. The web leaving the laminating unit passes about rollers on the unwind stand and thence about roller **62** on the V-former shown in FIG. **15** which is disposed in fixed position. The edge guide sensor **74** produces signals indicating lateral movement of the web in either direction from a predetermined edge line, with such signals being transmitted to conventional edge guide control means **82**, which is connected to the conventional unwind stand and through brackets **83** to the laminator to move same laterally in either direction to the extent required to maintain the web centered in passage through edge guide sensor **74**.

Considering now the laminating unit **56** and referring to FIGS. **4** and **5** there will be seen to be illustrated one preferred embodiment of the laminating apparatus. It is noted at this point that numerous variations and modifications of the present invention are possible and thus the illustrations of FIGS. **4** and **5** relate only to one embodiment. For example, in FIG. **4** there are shown two laminating heads **53** and **54** for the purpose of applying foil strips to opposite edges of a web passing through the laminating unit. However, it is noted that these strips may also be applied in accordance with the present invention in a manner generally illustrated in FIG. 20 and described subsequently. Additionally, the embodiment of FIGS. 4 and 5 employs a foil strip having a heat activatable adhesive coating on one side thereof, and alternatively, the strips may be affixed to the web by a hot melt operation by employing for example, structures such as illustrated in FIG. 18 of the drawings. At least certain other variations in the embodiment of the present invention illustrated in the FIGS. 4 and 5 are noted in the course of the description thereof.

A flexible laminating material, such as a parent sheet of metal foil **86**, is provided on a rotatably mounted supply roll **87** and fed about a plurality of rotatable guide rollers **88** and thence about a drive roll **89** with a spring pressed pinch roll **91** pressing against sheet **86** as it passes about the drive roll for withdrawing the sheet from supply roll **87**. The sheet is passed from the drive roll **89** to a vacuum laminating drum **92** where it is cut into strips by a cutter roller **93** having cutting blades engaging the surface of the vacuum drum **92**, as is subsequently described in more detail. Strips **51** cut from the parent sheet **86** are carried by vacuum drum **92** into engagement with web **52** passing over a freely rotatable laminating pinch roll **94** disposed to press the web against arcuate portions on the vacuum drum to be described. Adhesion of the strips to the moving web may be accomplished with a variety of different types of adhesives, such as, for example, heat activatable adhesive precoated on the foil or a liquid adhesive applied by the apparatus.

The web of film **52** is fed from rotatably mounted supply roll **57** between film drive and pinch rolls **96** and **97**, respectively, and thence over the laminating pinch roll **94** to pass through a dancer mechanism **98** and thence about a guide roller **99** out of the laminating unit **56**. Dancer mechanism **98** is provided for controlling the web feed from the laminating unit to a bag making machine and includes speed control mechanism **101** connected to control the speed of a variable speed main laminating unit drive motor **102** through a gear box **103**. This main drive motor drives all parts of the laminating unit including the film drive roller **96**.

Although dancer mechanisms are known in the art, it is believed of interest at this point to briefly comment upon the mechanism **98** of FIG. **5**. This dancer mechanism **98** includes a pair of parallel arms **106** pivotally mounted on opposite sides of a frame **107** carrying the web rollers. A pair of freely rotatable rollers **108** and **109** is mounted between the pivotally mounted arms **106** with the web passing beneath the lower roller **108** and over the upper roller **109**. The arms **106** are spring loaded as by means of springs **111** to tension the tops of the arms toward the laminating pinch roller **94** and the web passes first about the lower dancer roller **108** and thence about the upper roller **109** from whence it passes into the bag making machine where it is drawn by web drive means therein from the laminating unit initially faster than it is fed by the film feed or drive roll **96**. This pivots the arms **106** counterclockwise in FIG. **5** by the pull of the web and this is herein employed to control the speed of the main drive motor **102** of the laminating unit, and also stopping and starting of the laminating apparatus by pull of the web through the dancer mechanism.

The speed control may be accomplished by a simple speed control mechanism **101** additionally illustrated in FIGS. 5A and 5B appearing on sheet **10** of the drawings. This mechanism may simply include a pulley wheel **112** connected by a belt **113** about a wheel on the axle of the dancer mechanism arms **106** so that this pulley wheel will be angularly displaced in accordance with angular displacement of the dancer arms **106**. The speed control mechanism itself may be comprised as a housing within which there is disposed a conventional speed control device **114** such as a potentiometer in the circuitry of a common silicon control rectifier variable speed motor control unit. Control device **114** has extending therefrom an operating arm **115**; pulley wheel **112** is mounted on the housing by a shaft extending therethrough and carrying a pair of angularly separated arms **116** and **117** extending radially outwardly of the pulley wheel shaft in position to engage the operating arm **115** upon angular displacement of pulley wheel **112**.

Movement of the pulley wheel will thus rotate the arms **116** and **117** in an arc to thus engage the operating arm **115** to move same to the left or right to increase or decrease the speed of the main drive motor **102**. In this connection, the provision of the angularly separated arms **116** and **117** obviates hunting of main drive motor **102** which might otherwise occur by insignificant motions of dancer mechanism **98**. Electrical connection from the control device **114** may be provided by electrical conductors **118**. In the illustrated embodiment of the present invention counterclockwise pivoting of the dancer arms **106** will rotate the pulley wheel **112** in a counterclockwise direction to thus swing the arm **117** to the left in FIG. 5B to engage the operating arm **115** and speed up main drive motor **102**. This will then feed the web of film at a slightly greater rate to thus return the dancer mechanism to normal position and, consequently, swing the arms **116** and **117** back to a neutral position such as illustrated. Clockwise rotation will produce slowing of the motor drive.

Considering now actual lamination of foil strips to a moving web of plastic film, or the like, reference is made to FIGS. **6, 6A** and **6B**. An individual laminating head **54** includes the rollers, drums and the like described in connection with FIG. **5** in general, mounted for rotation between a pair of parallel vertically disposed side plates **121** with integral crosspieces **122** forming a rigid frame. The laminating unit **54**, for example, is slidably mounted upon a pair of transverse shafts **125** secured to the frame **107**, so that the lateral position of the laminating heads may be adjusted to laminate strips in predetermined relation to the edges of film **52** passed beneath the laminating heads.

The parent sheet of foil **86** is withdrawn from foil supply roll **87** by driven rotation of the driver roller **89**. The foil pinch roll **91** is mounted for free rotation upon pivoted arms **123** biased by one or more springs **124** to urge the pinch roll against the foil passing about the drive roll **89**. Pinch roll **91** preferably has a rubber cover, as illustrated. The foil passes from drive roll **89** to vacuum drum **92** which is rotated by means described below. In the embodiment of the invention illustrated in FIG. **6**, it is desired to cut narrow transverse strips **51** from the foil sheet **86** and to this end the vacuum drum **92** is provided with spaced axially extending rows of vacuum openings **126** about the periphery of vacuum drum **92**. Foil engaging the vacuum drum will be held flat upon the surface thereof and successive strips of foil are cut from the sheet on the drum by cutter blades **127** mounted on the rotatable cutter roll **93.**

In FIG. **6** there is illustrated six blades **127** on the cutter roll **93** and these blades may be mounted on the roll, as illustrated in FIG. **6**A, for example, by placing each blade in a peripheral groove in the roll together with a clamp bar **128** and tightening a set screw **129** against the clamp bar. This provides means for adjusting the blades for contact with the drum. The vacuum drum **92** and cutter roll **93** are driven to rotate in synchronism, and a freely rotatable blade wiper roll **131** is provided with a soft wiping surface such as oil impregnated felt **132** in position to be lightly engaged by the tips of the blades **127** as the cutter roll **93** is rotated, for lubricating the blades.

In the interests of simplicity of manufacture and operation, vacuum drum **92** has a continuous uninterrupted vacuum drawn through the peripheral parallel rows of openings **126** and with the drum rotating in a clockwise direction, as indicated in FIG. **6**, there is preferably provided a vacuum shield **133** extending about the lefthand portion of the drum, as illustrated, in relatively close proximity thereto and preferably carrying a flexible sheet **134** of cloth or the like secured to the lower portion of the shield and extending about the concave side thereof to be held against the rotating vacuum drum by the vacuum connections thereof in order to limit loss of vacuum on the side of the drum which is not carrying foil strips. There may be also provided a thin scraper blade **136** secured, for example, to the bottom of shield **133** and disposed to lightly engage the periphery of the vacuum drum in order to remove any foil strips that may not have been transferred to web **52** from the vacuum drum because of possible operation failure to engage pinch roll **94** against the vacuum drum by the mechanism described as follows.

Laminating pinch roll **94** is mounted for free rotation upon a shaft **137** and preferably has a resilient cover of rubber, or the like, and a slick surface formed, for example, of a Teflon cover **138** to provide minimum web friction. Pinch roll shaft **137** is mounted upon one or more pivot arms **139** carried by a pivot pin **141** and adjusted by an eccentric mechanism **142.** This mechanism **142** is provided for the purpose of adjustably fixing the position of the laminating pinch roll **94** against the vacuum drum to apply adequate pinching pressure, and to allow disengagement of the pinch roll to permit threading of the web through the laminator as well as to relieve pressure when the apparatus is shut down. For this purpose, a fixed shaft **143** is provided having a circular cam **144** eccentrically mounted thereon for rotation within a circular bearing aperture **146** in pivot arm **139.** A handle **147** extending from cam **144** provides for manual rotation of the cam to thus pivot the arm **139** to move pinch roll **94** toward or away from vacuum drum **92.**

In operation, the pinch roll is disposed in position to press web **52** passing over the pinch roll against the vacuum drum or at least portions thereof, as described later. The degree of pressure is adjustable by the eccentric mechanism **142.** The strips to be successively laminated to the web have tacky adhesive coated on their outer faces with reference to the vacuum drum; consequently, the pinch roll pressure effects transfer of the successive strips to the web. In this connection, the vacuum which is maintained is insufficient to overcome the bonding strength of the tacky adhesive.

In the illustrated embodiment of FIGS. **6, 6**A and **6**B, the vacuum drum **92** has a circular exterior configuration with flat or planar portions **148** disposed between equally spaced arcuate portions **149.** The vacuum connections **126** extend to the peripheral arcuate portions **149** of the vacuum drum which as the drum rotates hold successive leading edges of the foil sheet being fed to the drum for cutting into strips, as well as holding the cut strips in place until they are carried by the drum to the location of lamination onto the web at pinch roll **94.** The provision of six cutter blades on cutter roller **93** and six arcuate flat portions on the vacuum drum **92** is not critical, but has been found desirable.

Before proceeding with a description of the laminating procedure with the apparatus illustrated in FIG. **6**, it is noted that attachment of foil strips to a film is accomplished by the provision of adhesive in tacky state, herein provided upon the foil strips. As previously noted various types of adhesives may be employed, such as pressure sensitive adhesive or heat activatable adhesive. In the circumstance wherein the foil is precoated with a heat activatable adhesive, provision is herein made for heating the foil prior to lamination and maintaining the foil at a sufficiently elevated temperature upto the point of lamination so that the adhesive is tacky and bonds the foil strips to the film. In this respect, reference is made to FIGS. **16** and **17,** which illustrate details of a vacuum drum and foil drive drum incorporating heating means. The foil drive drum **89** may, as illustrated in FIG. **17**, be mounted for rotation upon a fixed hollow shaft **151** extending between the laminating head side plates **121** as by means of bushings **152** which may also be employed as thrust bearings to maintain the roller in position between the side plates.

The feed roller **89** is driven by a gear **153** connected to one end of the roller. Heating of the foil feed roller **89** may be accomplished by the provision of a heating element **154** coiled about the shaft **151** and mounted thereon. Electrical connections **156** for heater **154** may extend through an open end of the fixed shaft **151** with the wires thereof connected to opposite ends of the heater through openings in the shaft as illustrated. A conventional thermostat **155** is employed for controlling temperature. It is noted at this point that foil feed roller **89** may be provided with heating means under those circumstances wherein it is necessary to apply heat to the foil in passage about such roller; however, for many applications of the present invention, it is either not necessary to apply heat to the foil or sufficient heat may be applied by the vacuum drum itself.

Reference is now made to FIG. **16** wherein the vacuum drum **92** is illustrated as including a hollow shaft **157** extending from one end of the drum and closed at the other end of the shaft. The drum shaft **157** is journalled in the side plates **121** of the laminating unit frame, and carries a drive gear **158** secured to the shaft. The peripheral vacuum openings **126** of vacuum drum **92** are connected to an end chamber **159** in the drum which communicates with the interior of hollow shaft **157.** At the outer end of this hollow shaft there are provided radial openings **161** in the shaft into an annular vacuum chamber **162** having the housing thereof sealed to the shaft in rotatable relation thereto. Vacuum chamber **162** communicates through a vacuum pipe **163** to a vacuum source **164** so that there is continually drawn a vacuum through the parallel rows of vacuum openings **126** in the arcuate portions **149** of the periphery of the vacuum drum.

Also provided within drum **92** are electrical heater elements **166** disposed, for example, in longitudinal bores **167** in the solid material of the drum and communicating with the end chamber **159** of the drum. Electrical connections from heater elements **166** extend through this chamber **159** and through hollow shaft **157** radially outward of the shaft into connection with annular slip rings **168** mounted in an annular insulating connector block **169** secured to the shaft for rotation therewith. Exteriorly of the vacuum drum shaft there are provided a pair of fixed brushes **171** disposed in position to engage the electrically conducting slip rings **168** as the vacuum drum shaft rotates, and brushes **171** are electrically connected to a heater power source **172** for energizing heater elements **166**.

In order to control the temperature of the vacuum drum there may also be provided one or more temperature sensors **173** disposed within the drum adjacent the periphery thereof and connected, similarly to the connection of the heater elements, through hollow shaft **157** to slip rings **174** in an insulating connector block **176.** Exteriorly of the drum and shaft there are provided electrical brushes **177** engaging slip rings **174** as they rotate with the vacuum drum shaft and electrically connected to temperature control means **178** that in turn controls the output of the heater power source **172.** It is again noted at this point that it may only be necessary for particular types of adhesives to provide for heating of the vacuum drum and that heating of the foil feed roll **89** is optional.

Considering now the general operation of the lamination unit as primarily illustrated in FIGS. **5** and **6,** at the location of the freely journalled pinch roll **94** where it presses web **52** against arcuate portions **149** of the vacuum drum, the web will be driven by the vacuum drum and thus be moved over the laminating pinch roll **94** at the same velocity as the peripheral velocity of vacuum drum **92.** With the foil feed roll **89** driven at a predetermined velocity foil sheet **86** is fed to the vacuum drum. As the leading edge of the foil touches an arcuate portion **149** of vacuum drum **92** having a row of vacuum openings **126,** it is gripped by the vacuum applied to such openings and held to the drum. As vacuum drum **92** rotates cutter roll **93** also rotates and in FIG. **6A** there is illustrated the condition of these elements just before a strip **51** of the foil is cut from the parent sheet **86** thereof. In FIG. **6B** there is illustrated the relationship of a blade **127** and vacuum drum at the instant strip **51** is cut from the parent sheet, from which it will be noted that the strip is cut while it is over a row of vacuum holes **126.**

It will be noted that the present invention provides for crush cutting on the drum in immediate proximity to a row of vacuum openings, rather than shear cutting. Actual severing of the strip from parent sheet **86** occurs by cutter blade **127** crushing the sheet to engage the vacuum drum surface, thereby cutting from the sheet a strip **51** which has necessarily been firmly gripped by the vacuum prior to its severance as shown in FIG. 6A, and maintained gripped during severance as shown in FIG. 6B. This then obviates one of the major problems in handling of very narrow elongated strips of flexible material in transverse lamination inasmuch as the strips may be as narrow as approximately ⅛ inch in width, and the foil of very light gauge of about 0.001 to 0.002 inch (1 to 2 mils). It is to be understood that the vacuum opening **126** diameter is less than the width of a strip **51** to be cut.

After severance, a strip **51** cut from the sheet is retained by the vacuum of the vacuum drum as it rotates to thus move the strip around into position for engagement with web **52** which is pressed against the outer surface of the strip with reference to the drum by laminating pinch roll **94.** As previously noted, a suitable adhesive is provided on the outer surface of foil strip **51.** When the strip and web are pressed together this adhesive in tacky state attaches the strip to the web, and thus as the web passes beyond pinch roll **94** it carries the strip with it. The strip is thus releasably retained on the vacuum drum, and becomes adhesively bonded to the web and is thus transferred from the vacuum drum against the force of the vacuum. The foil sheet **86,** although flexible, has sufficient rigidity that the cut leading end of the sheet adjacent the vacuum drum remains supported on the drum as is illustrated in FIG. **6B.**

Actual lamination of a strip **51** to a web of film **52** is illustrated in FIGS. **9** and **10** wherein strip **51** held on the vacuum drum **92** by the vacuum applied through openings **126,** is illustrated to approach the film as drum **92** and pinch roller **94** rotate together. It is again noted that the pinch roller **94** is journalled for free rotation and is thus driven by the vacuum drum when the two are in engaging relationship. This relationship pertains during each period that an arcuate portion **149** of the vacuum drum is in position to engage the pinch roll through film **52** over the pinch roll. The pinch roll, being formed of a resilient material such as rubber, or the like, is actually compressed at the area of engagement with the vacuum drum as indicated in FIG. **9,** and a pressure is exerted between foil strip **51** and film **52.** This then transfers the foil strip from the vacuum drum to the web of film **52** by the bonding action of the adhesive.

The foil sheet **86** is fed toward the vacuum drum by foil feed roll **89** at a constant predetermined velocity less than the peripheral velocity of the drum, to thus dispose the same predetermined length of parent sheet upon each arcuate section **149** of the vacuum drum as the drum rotates. It is to be noted that the width (arcuate length on the vacuum drum) of each strip of foil **51** to be laminated on the web is basically determined by the relative peripheral velocities of the foil feed drum **89** and cutter roll **93,** although a synchronous fixed relationship exists between the peripheral velocities of the cutter roll and vacuum drum in order that the successive severed strips **51** will always be held by a row of vacuum holes.

The center line to center line spacing between strips on the vacuum drum is determined by the frequency of cutting of the strips by the cutting blades intermittently contacting the vacuum drum, as the vacuum drum rotates. In the embodiment of FIG. **6** this then is determined by the relative rotational velocity of the cutter roll with respect to the vacuum drum and the peripheral spacing of the cutting blades on the cutter roll. In this embodiment these elements (the tips of the cutting blades, and the periphery of the vacuum drum) are rotated at the same peripheral velocity, and are substantially the same diameter. Further, in the embodiment of FIG. **6** if, for example, the peripheral spacing between the six tips of adjacent cutting blades is **2** inches, the center line spacing between strips **51** on the vacuum drum will be an arcuate distance of 2 inches. With every other blade omitted, the frequency of cutting becomes less, and the center to center line spacing will be increased to 4 inches; with only two oppositely positioned blades the spacing will be 6 inches; and with only one blade, the spacing will be 12 inches. Alternatively, varying the relative speed of rotation between the cutter roll and the vacuum drum will produce similar effects of varying the center to center line spacing of strips on the vacuum drum.

The center to center line spacing between strips affixed to the web is determined by the peripheral or circumferential spacing between strip positions on the vacuum drum and the relative velocity of the web to the vacuum drum. Thus, by varying the speed of the web, spacing of the strips on the web may be varied, such that if the average rate of travel of the web as determined by the velocity of web feed roll **96**, is less than the peripheral velocity of the drum, the center to center spacing of the strips on the web will be increased as compared with their spacing on the vacuum drum prior to transfer onto the web. Conversely, if the average rate of travel of the web is more than that of the drum, the spacing of the strips on the web will be decreased.

It will be understood that during the repetitive intervals when the web is intermittently pressed or pinched by the arcuate portions **149** of the vacuum drum against pinch roll **94** whereby the pinch roll is intermittently driven, such differences in velocities between the web and the drum necessarily result in web tension or slack being created in that portion of the web between drive roller **96** (FIG. **5**) and pinch roll **94.** In order to avoid the disadvantageous effects of tension or slack accumulating in the web, such as nonregistry of the strips relative to printed matter on the web, the flats **148** between the arcuate drum portions **149** serve such purpose by providing breaking of contact between the vacuum drum and the pinch roll **94** following each strip lamination onto the web passing over the pinch roll and whereby the web is intermittently in non-driving engagement with the drum and the freely journalled pinch roll becomes an idler roll, thus allowing the web to return to a neutral position.

While an arcuate drum portion **149** is in pressure contact with the web and pinch roll beneath for transfer of a strip onto the web, and additionally under such conditions that the average web feed velocity is less than the peripheral velocity of the vacuum drum, the web will be placed under tension on the input side of the pinch roll. Under such circumstances, if the web is formed of a material having elasticity such as, for example, polyethylene film or the like, the web will be stretched between pinch roll **94** and the film feed roller **96.** In the instance wherein the web is formed of a material having substantially no elasticity or stretchability such as, for example, biaxially oriented polyester film (Mylar), there may be provided a yieldable drive connection such as a lost motion system to relieve partially stress caused by such web tension. Apparatus providing such capabilities is illustrated in FIG. **28** as described later.

Similarly it will be understood that while an arcuate portion of the vacuum drum is pressing against the web and pinch roll, but the average web feed velocity is however, in this instance, greater than the peripheral velocity of the vacuum drum, slack will be produced in the web on the input side of the pinch roll.

As the vacuum drum rotates slightly further, a flat portion **148** of the drum faces the pinch roll so that a neutral state or dwell period occurs wherein the web is no longer pressed against the drum and forced to travel at the drum's peripheral velocity. During such dwell period, and depending upon which of the two states of web velocity to drum velocity obtains, the web will "snap" (move quickly) either forward by the pull of the spring loaded dancer mechanism **98,** relieving slack produced in the web, or the web will "snap" back through its elastic properties or by reason of a yieldable drive connection relieving, in this case, tension produced in the web. The web thereby regains its original unstressed or unstretched condition.

By such cooperating features discussed above, successive strips can be placed on the web at relatively increased or decreased center to center spacing as compared with their spacing on the vacuum drum prior to transfer onto the web.

For example, referring to FIGS. **9** through **12,** it will be seen that rotation of the vacuum drum rotates the laminating pinch roll **94** and presses strip **51** onto the web **52** over the pinch roll to attach the strip to the web. FIG. **10** illustrates strip **51** laminated on the film web **52.** In the circumstance wherein the average rate of travel of the web is less than the peripheral velocity of the vacuum drum, during each laminating operation the web will be pulled toward the left in the drawings, and the web tensioned on the right or input or feed side of the pinch roll. As soon as the vacuum drum has rotated sufficiently to present a flat surface **148** to the pinch roll, the web is freed from constraint between drum and roll so that it resiliently contracts or snaps back toward the right thereby actually moving the laminated snaps back around the pinch roll as illustrated in FIG. **11** by the solid strip **51** on the web **52.** It is to be appreciated that the illustration in FIG. **11** is exaggerated to show a marked difference between the strip **51** and the strip position **51'** that would have been the strip location if the drum and the web were at all times moving at the same velocity. FIG. **12** illustrates the next lamination operation following the one illustrated in FIGS. **9** through **11,** the just laminated strip being closer to the previously laminated strip **51** than would have been the case if the web and drum velocity were the same.

It will be seen that the present invention provides dwell time wherein the web is not maintained in tight contact against the vacuum drum. These dwell times may be provided by the aforementioned flats or flat areas **148** on the vacuum drum, as illustrated and described above, or may be alternatively provided. Thus, for example, it is possible to move the pinch roll into and out of engagement with the drum as by a reciprocating motion of the pinch roll by structure as illustrated in FIG. **22** and described subsequently.

The present invention is particularly adapted to the continuous application of spaced strips to a moving web of material that then may be formed into a bag or the like. The embodiment of the present invention described above incorporates drive means and speed control means to provide the described capabilities of the laminating apparatus. The relationship of driving and driven elements of a laminating head **54** is schematically illustrated in FIG. **8** wherein the same numerals are employed as in FIG. **5.** FIG. **7** illustrates additional components of the drive mechanism. The elements of the laminating head are powered or driven from the main drive motor **102** through the gear box or transmission **103.**

As schematically illustrated in FIG. **7,** the vacuum drum shaft **157** and the cutter drum shaft **157'** are rotated at the same velocity, and in the above described embodiment of theh present invention the foil sheet feed roll **89** is rotated to feed the foil substantially one-eighth of the peripheral velocity of the blade tips on the cutter roll **93** to provide the desired width (arcuate length on the drum) of strips **51** to be cut from the parent foil sheet **86.**

Using the parameters given before as an example of possible spacing of cutting blades **127** on cutter roll **93** of **2** inch peripheral separation between blade tips, it will be seen that when foil feed roll **89** feeds the foil at substantially one-eighth of the velocity of the blade tips which intermittently contact vacuum drum **92** at regular **2** inch intervals on its surface, the strips of foil cut from the parent sheet will be substantially ¼ inch in width upon severance.

Considering now the drive mechanism of the present invention in somewhat greater detail, reference is made first to FIG. **7** which is a developed view illustrating drive connections. The same numbers are employed in FIG. **7** as in FIGS. **6** and **8**; and it will be seen that the main drive motor **102** and attached gear box **103** are connected by a belt or chain **181** to a main drive shaft **182** that is mounted for rotation in the frame **107** in extension transversely thereacross. This shaft **182** extends rotatably through laminating head side plates **121.** A multiple gear element **183** is disposed about main shaft **182** and is adapted to be releasably affixed thereto by clamping means **184.** As previously noted, the laminating head is adapted to be moved laterally of the main frame **107** upon transverse shafts **125.** This lateral adjustment of the laminating head is accommodated by the drive mechanism by means of gear element **183** which may be slid longitudinally of the main drive shaft, and then clamped by clamping means **184** to the drive shaft for rotation therewith. Gear element **183** is rotatably mounted in one side plate **121** of the laminating head so as to move with the head along the shaft when the lateral position of the head is adjusted.

Cutter roll **93** has the shaft **157'** thereof rotatably mounted in side plates **121** of the laminating head, and a gear **186** on the cutter shaft meshes with gear **187** of main gear element **183.** This provides for rotation of cutter roll **93.** Rotation of the vacuum drum **92** is provided by an idler gear **188** mounted for free rotation on cutter roll shaft **157'** and meshing with a gear **189** of gear element **183** and a gear **191** on the end of vacuum drum shaft **157.** The vacuum drum is mounted for rotation in side plates **121** of the laminating head, as illustrated. As previously explained, in the embodiment of the present invention described above, cutter roll **93** and vacuum drum **94** have the same operative diameter and are rotated at the same angular velocity by the means described above.

Also mounted for rotation between side plates **121** is the foil feed roll **89.** This roll **89** has a gear **192** affixed to the shaft and engaging a first gear **193** of an idler gear unit **194** mounted for free rotation on one of the side plates **121.** This idler gear unit also includes a second gear **196** which meshes with a drive gear **197** on one end of a shaft journalled in one side plate **121** and carrying a sprocket wheel **198** connected by a chain drive **199** about a sprocket wheel **201** of the main gear element **183.** It will be seen that, with rotation of the main drive shaft and and consequent rotation of the gear unit **183,** foil feed drum **89,** cutter roll **93,** and the vacuum drum **92** will be rotated in synchronism.

The main drive motor **102** also rotates the web feed roll **96,** and provision is herein made for varying the rate of rotation of the web feed roll in relation to the rate of rotation of the main drive shaft and previously mentioned drums and rolls. To this end there is provided a conventional controlled differential unit **206** (shown in detail in FIGS. **13** and **13A**) having an input shaft **207** rotated by a chain or belt drive **208** from the gear box **103** and an output sprocket wheel **209** connected by a chain drive **211** to a sprocket wheel **212** on the shaft **96'** of web feed roller **96.** Differential **206** does not reverse directions of rotation but does provide a limited adjustement of the speed of rotation of web drive roller **96** relative to the rate of rotation of vacuum drum **92.**

It will be seen from referring to FIGS. **7** and **8** that clockwise rotation of the main drive shaft **182** will produce a clockwise rotation of the vacuum drum **92** and counterclockwise rotation of the cutter roll **93** so that foil fed onto the vacuum drum by clockwise rotation of the foil feed drum **89** intermittently cut into strips for transportation by the vacuum drum into engagement with the web of film fed by the clockwise rotation of the web feed roll **96.** Provision is made for urging th freely rotatable web drive pinch roll **97** against web feed roll **96** as, for example, by spring biased slide blocks **218** (FIG. **7**) mounted in the frame **107.** It will be seen that the directions of rotation of the drums and rolls described immediately above coincide with the directions of rotation identified in FIGS. **5** and **6,** for example. It is again to be noted that the drive train is illustrated in FIG. **7** by a developed view wherein certain elements are moved from their normal position in order to be able to illustrate in a single drawing the relationship of elements in their driven connections.

Differential **206** may be controlled from differential control unit **213** (FIG. **14** described later in detail) mounted on frame **107** (FIG. **7**) and rotated or driven by a chain or belt **214** from main drive shaft **182.** The output of control unit **213,** as schematically illustrated in FIG. **7,** is applied by electrical means **216, 238** and **236',** to ratchet means **217** of th differential for varying the differential output velocity relative to the input velocity thereof. This differential and the control afforded thereby are described in further detail later.

It has been briefly noted above that provision is herein made for varying the speed of rotation of web feed roll **96** by differential control unit **206.** It is possible with this control means to vary the center to center spacing between strips on the web (not on the vacuum drum) in the embodiment of the present invention under discussion. Although it will be appreciated that various types of means may be employed for this purpose, the conventional one illustrated in FIGS. **13, 13A** and **14** is found highly desirable. Referring to these Figures, there will be seen to be illustrated a differential mechanism and control therefor. This particular system is a well-known type commercially identified as "Mark III - Control System", manufactured by Deitz Company, Inc. of Wall, New Jersey.

The input shaft 207 is mounted for rotation in bearing mounts 221, and this shaft extends into integral connection at 219 to a frame or housing 222 for rotation of the same with the shaft; shaft 207 being driven from main gear box 103 (FIG. 7). A worm gear 223 is rotatable about shaft 207 within the housing, and worm gear 223 and output gear 209 are integrally connected together by a hollow shaft 224. Thus output gear 209 and worm gear 223 rotate in unison. The frame 222 will be seen to be journalled for rotation about hollow shaft 224.

Within the frame 222 there is provided a worm 226 mounted for rotation in the frame in position to mesh with worm gear 223 and extending through the frame to terminate in a small gear 227 at the end of the worm shaft. Exteriorly of the frame gear 227 is connected through an idler gear 228 to a gear 229 having a shaft 230 thereof extending into the frame and rotatably mounted in the frame thereby. The inner end of the shaft 230 is provided with a bevel gear 231. A differential drive shaft 232 extends through the opposite end of the frame from the input shaft 207 and is provided at the inner end thereof with a bevel gear 233 meshing with the bevel gear 231 within the frame. At the outer end of differential shaft 232 there is provided a toothed wheel 234 secured to the shaft which is in turn rotatably mounted in frame 222. In order to control the rotation of output gear 209 there is provided, as a portion of this control unit 206, a solenoid actuated latching mechanism. This latching mechanism is fixedly mounted and includes a solenoid 236 connected to wiring 236′, and reciprocal latch member 237 adapted to be moved into and out of engagement with teeth in the wheel 234 so as to prevent it from rotating. At any time the toothed wheel 234 is prevented from rotating by the latch mechanism, there is produced a relative rotation between frame 222 and differential drive shaft 232. This then causes the bevel gear 231 to travel about the differential shaft bevel gear 233 as the frame is rotated by input shaft 207; and this motion is transmitted back to rotate worm 226. Rotation of worm 226 is transmitted through worm gear 223 and shaft 224 to output gear 209. It will be seen that with this structure it is possible to change the relative speed of rotation of output gear 209 with reference to input shaft 207, and thus adjust the web speed. Such adjustment is accomplished by controlling the solenoid operated latching mechanism by control means 213 illustrated in FIG. 14 and described below.

Such control means 213 includes a frame or housing 241 within which there is provided a rotatable cam 242 having a curved outer surface. This cam is mechanically connected to the drive 214 from main drive shaft 182. It will thus be seen that rotary cam 242 is rotated in synchronous relationship with vacuum drum 92. There is also provided in control unit 213 a pair of fixed spring-return switches 243 and 244 along the arc of the circle described by the movement of rotary cam 242. There is additionally provided an adjustable spring-return switch 246 which is shown to be mounted on an arm 246′ carried by shaft 247 extending from frame 241 and having a control knob 248 thereon for manually adjusting the angular position of switch 246. A set screw or the like 249 may be provided for fixing the position of switch 246. It will be seen from FIG. 14 that angularly adjustable switch 246 is movable along an arc coinciding with the path of rotary cam 242, and thus the angular position of switch 246 at the time of its actuation by cam 242 may be adjusted by the operator of the machinery.

Further reference to FIG. 14 will indicate electrical connections from switches 243, 244 and 246 to control amplifier 238, which is of any suitable design to actuate differential 206 by amplifying signals from control means 213 and from a photoelectric sensor 245 (FIG. 5) for a purpose to be described, such amplifier being part of the aforementioned Deitz - Mark III system. From the control amplifier wires 236′ lead to solenoid 236 of FIG. 13, and wires 245′ lead from photosensor 245.

With the main drive shaft rotating in a clockwise direction, movable cam 242 will actuate in succession switches 246, 243 and 244. Actuation of switch 244 causes solenoid 236 to actuate reciprocal latch member 237 thereby producing a difference in speed between input shaft 207 and output gear 209. The difference in speed so produced is such that the output speed will be decreased relative to the input speed, with the result that the film web speed will be retarded relative to the peripherial velocity of the vacuum drum. This actuation of the differential will continue until cam 242 has further rotated to actuate switch 246, which discontinues operation of the solenoid and allows the input and output speeds of the differential 206 to return to their normal relationship. Therefore, by positioning movable switch 246 in different angular positions relative to switch 244, the duration of the period during which the web velocity is retarded relative to the vacuum drum may be controlled by the operator.

In the present embodiment of the invention, the conventional units employed in the Deitz - Mark III system are so chosen as to provide an amount of web velocity retard reltive to that of the vacuum drum which is continuously variable from approxitmately zero to 6 percent depending upon the angular disposition of movable switch 246 as well as the condition of photoelectric sensor unit 245 when it is utilized, as will be explained subsequently. Such possible variations in the amount of web retard (slowing of web velocity) provides means for adjusting the center line to center line distance between strips on the web to any desired spacing within the limits of the particular embodiment of the invention. This is important in obtaining proper registry with printed matter on the web.

Thus, as was taken as an example noted previously with regard to the embodiment in FIG. 6, the peripheral disposition of the cutting blades may be on 2 inch centers between their tips, thereby placing the individual strips on 2 inch centers on the vacuum drum. With no velocity differences between the web and the vacuum drum, the distance between strips on the web will also be 2 inches after their transfer and lamination thereon.

It follows, however, from the above description of the differential control means that up to a 6 percent retard in velocity of the web relative to the vacuum drum may be introduced by the angular positioning of switch 246 relative to switch 244 of the control mechanism 213 (FIG. 14). This amount of retard is continuously variable up to the approximate 6 percent limitation. Consequently, the strips on the web may be positioned from their normal 2 inch spacing up to 6 percent less in center to center distance, or 1.88 inch by the snap laminating principle described previously.

If greater amounts of retard are desirable to bring the strips even closer together on the web, conveniently multiples of change gearing (for example 5 percent) may be introduced in the drive **208** (FIGS. **7** and **8**) between gear box **103** and differential **206.** For example, a **19** tooth gear to a **20** tooth gear will retard the web velocity by 5 percent, thus "undersnapping" and spacing the strips on 1.9 inch centers on the web. The Deitz control means may then be utilized to continually vary the spacing even closer together by adding up to approximately 6 percent additional retard or a total of 11 percent. Consequently, with the above chosen 5 percent change gears installed, the strip spacing on the web may be varied from 1.9 inch to 1.78 inch. Increasingly closer spacing may be achieved by utilizing larger change gear ratios with the differential control mechanism being utilized to provide continuous adjustment of spacing in the ranges between adjacent change gear choices.

The above explanation is also descriptive of the process of "oversnapping" whereby the web velocity is increased relative to that of the vacuum drum with the resultant placement of strips on the web on greater than 2 inch centers. In this regard, it will be noted that the particular conventional Deitz control mechanism employed in this embodiment allows only retard of the web velocity. Consequently, to obtain greater than **2** inch strip placement on the web, the web velocity is increased by the utilization of appropriate change gears at drive **208** such as, for example, a **20** tooth to a **19** tooth gear ratio providing a 5 percent increase in web velocity. Such change gears alone will thereby place the strips on the web on 2.1 inch centers. Utilization of the 6 percent retard action of the differential control means makes this spacing continuously adjustable down to 1.974 inch. Greater separation in strip spacing may be accomplished by the choice of appropriately greater gear ratios.

It will be thus noted that by incorporation of the appropriate change gear ratios with utilizaiton of the differential control means and stress relieving means allowing undersnapping or oversnapping of the web, considerable variations in strip placement on the web may be accomplished without havng to resort to complex means such as, for example, substitution of different knife rolls of different diameters with knife blade tip separations equal to the exact web strip placement desired. This is very important where it is desired to have flexibility of strip placement.

In this invention the versatility of the apparatus enables bags, for example of various widths, to be produced since the techniques described allow for the positioning of strips in desirable center to center spacings.

Note is now made of conventional photoelectric sensor **245** (FIG. **5**) connected by wires **245'** to control amplifier **238** (FIG. **14**) as mentioned previously. Sensor **245** is employed when printed web material is being utilized. In this case, it is important that the positioning of strips laminated onto the web be so spaced on the web as to be in correct relationship to the printed material. In this connection, in manufacturing printed bags, specific registration marks on the preprinted web as schematically illustrated by the crosses **245***a* in FIG. **5,** or some portion of the repeated print material on the web, are utilized for registering the web to the operation of the bag machine through conventional photosensor devices so as to position the bag seals and cuts in proper orientation to the printing. The same printed registration points may be employed in this invention to provide a signal from photosensor **245** to control amplifier **238.** Such signal is passed on and actuates the retard action of differential unit **206** (FIG. **13**) if rotating cam **242** contacts switch **243** simultaneously to the photosensor signal. When this occurs, the retard action of the differential is maintained for a longer period before being stopped by switch **246** as previously described, because it is initiated earlier in the cycle at switch **243** rather than **244.**

This increase in retard action results in automatic maintenance of registry since, in operation, position of switch **246** is so set by knob **248** by the operator as to cause the web velocity to be slightly faster than required by the repeat pattern of the printing. However, such purposeful "overdraw" of the web causes the registration points to slowly advance to where the photosensor detects a registration and, in combination with the control unit, introduces the additional retard to slow the web. Such hunting action thereby keeps the printed web in registration.

It will now be noted that adjustment of web velocity by the differential control means is employed both to permit choice of strip to strip placement on the web as well as to keep the web in registration in the case of printed web material. From the foregoing description it will be seen that the differential control unit **213** (FIG. **14**) in order to serve its purpose should make one revolution for each registration point passing the photosensor. This will occur with appropriate selection of change gear ratio at drive **214** between main drive shaft **182** and the control unit. For example, with one to one ratio of change gears at drive **214,** as well as one to one at drive **208** (FIGS. **7** and **8**), and control knob **248** of differential control unit **213** set fully counterclockwise so that no retard action of the web is introduced, web strips will be on **2** inch centers and control unit will make one revolution for every six strips transferred to the web from vacuum drum **92.** Such change gear ratios would be appropriate choices for a print repeat pattern of approximately 12 inches, as well as for a sideweld bag (printed or unprinted) of 12 inch width having 6 strips on both sides of its neck, the strips being on 2 inch centers. Even for unprinted film it is desirable to choose the proper change gear ratio in the drive to the differential control unit in accordance with the total number of strips required per finished bag. Such ratio is chosen as to cause the control unit to make one revolution for each print pattern or number of strips per bag.

In order to better distinguish the various change gears employable in the particular embodiment under consideration (FIGS. **1** through **7**) and to summarize their specific functions it may be noted that (1) strip width may be readily varied by changing the size of sprocket gear **198** (FIG. **7**) to determine velocity of parent sheet **86**, a larger diameter providing narrower strips than a smaller diameter; (2) variation in strip center to center spacing on the web may be obtained by varying the velocity of web **52** by choice of change gear ratios at drive **208** (FIGS. **7** and **8**) in combination with differential control unit **213** (FIG. **14**) for adjustments, but a variable speed transmission could be employed for this purpose as was previously noted and; (3) the number of strips desired between registration marks on printed web material or the number of strips desired per bag on unprinted material may be accomodated by the appropriate change gear ratio selection at drive **214** (FIGS. **7** and **14**) which rotates the differential control cam **242.** As noted previously, when the web is substantially nonstretchable, such as biaxially oriented polyester film, the structure shown in FIG. **28** (sheet **6**) is desirably employed to relieve stress. Such structure comprises what may be termed a yieldable drive system **250.** This system may be incorporated in the present invention between web drive roll **96** and the output from differential **206.** A belt **255** drives web drive roll **96** from output gear **209** of differential **206.** Such belt is connected with initial slack between drive roll **96** and gear **209,** but is continually maintained taut in driving relationship by tensioning means acting on its upper and lower reaches.

This tensioning means includes upper tension roll **250'** urged downwardly by a compression spring **250***a* against the upper reach of the belt **255.** A lower tension roll **255'** is urged downwardly by a tension spring **255***a* and bears upon the lower reach of the belt. When the web is pinched against successeive arcuate portions **149** on the vacuum drum by pinch roll **94,** the web may be placed under tension but it will not break because the yieldable drive will give to relieve stress; and when the successive flats **148** on the vacuum drum pass over the pinch roll, the film web and the yieldable drive will intermittently assume a neutral state.

In connection with the types of adhesive that may be employed in the laminating process and apparatus of the present invention, reference is made to FIG. **18** (sheet **8**) illustrating a hot melt adhesive applicator. In this FIG. there is provided a continuously rotated conventional intaglio applicator drum **251** having a portion thereof extending into a reservoir **252** containing an adhesive **253** maintained in liquid condition by electrical heating means **254** associated with the reservoir. Pinch roll **256** has the parent sheet **86** passed thereover the presses the sheet against drum **251** during operation of the apparatus. However, when the apparatus is not operating a spring **257** connected to solenoid **261** effects disengagement of pinch roll **256.** The solenoid is actuated to maintain engagement against the spring action during operation.

A pivotally mounted dancer roll **258** on arm **258'** is provided for passage of the adhesively coated sheet thereover toward the foil feed drum **89** and arm **258'** is tensioned by a spring **259.** Solenoid **261,** operable in opposition to spring **257,** is actuated by a switch **262** engaging the pivot arm **258'** carring roll **258.** Pull of the web on dancer roll **258** maintains engagement of arm **258'** to maintain switch **262** closed and actuate solenoid **261** to hold pinch roll **256** against the web. When the web is not being fed, spring **259** results in opening of switch **262.**

In the embodiment thus far described wherein the laminating apparatus **56** may be combination with a side-weld bag making machine **61,** as shown in FIGS. **1** and **3,** the web is fed in one general direction, folded by plow means **59,** and the folded web is fed in a transverse direction in the direction of the fold line into the bag making machine. The type of bag **73** which is formed is illustrated in FIG. 23 (sheet **10**) wherein side edge seals or welds **292** are formed by the sealing and severing means **72** (FIG. 3) and the fold forms bottom **293** of the bag. The laminating principle is equally applicable for the manufacture of conventional socalled back seal bags having a bottom weld (not a fold) illustrated in FIG. **24** wherein the bag **269** has a longitudinal back seal **266,** a sealed bottom **268,** and folded side edges instead of side edge seals **292** as in the bag of FIG. **23.**

FIG. **19** (sheet **8**) illustrates how such bottom weld bags are made from heat sealable film in the bottom weld bag making machine. The web **52** is conveyed or fed in one general direction, indicated by the arrow, its side edges are folded over to overlap each other to thus form a bag tube, the overlapped edges are sealed to form back weld **266,** the tube is sealed transversely at **268** to form the bottom welds, and then is cut at **267** adjacent the bottom welds **268** to provide open bag mouths. This is a continuous operation as the web before and after being folded is fed continuously in one general direction. Instead of cuts **267,** the tube may be perforated and wound into a roll to provide for separation of individual bags from the roll along the lines of perforation.

With the bottom weld type of bag, it will be noted that elongated strips **51** extend longitudinally of the direction of movement of the web. Hence, the laminating apparatus is so constructed as to bond the elongated strips to the web in spaced apart groups extending longitudinally of the web as can be seen from the left portion of FIG. **19.** Thus, after individual bags are severed, such strips extend longitudnally from adjacent the bag mouth as in the side-weld bag embodiment of FIG. **23.**

FIGS. **20** through **22** illustrate schematically an embodiment of the laminating apparatus wherein the bottom weld bags can be readily manufactured in the bottom weld bag making machine, in which bag making machine the web is in tube form when it is sealed and severed, as previously described. In principle such apparatus is the same as that previously described. The parent sheet **86** of foil is relatively wide and is cut into a plurality of narrower bands **86'** by driven rotatable slitting blades **272** as it is continuously fed over a rotatable drive and anvil roll **271.** After slitting, bands **86'** pass over a guide roll **273,** and thence to spaced apart upright guide rolls **274** which spreads the bands **86'** apart to separate them and change their direction of movement. Also, in cooperation with horizontal guide roll **276,** they twist the bands to bring their adhesive face (indicated by stippling in FIG. **20**) uppermost.

The separated narrower bands **86'** are thus continuously fed to rotatable vacuum drum **277** provided, in the case of a heatactivatable adhesive, with heating means as previously described for vacuum drum **92.** Circumferential parallel rows of vacuum openings **278** are provided in the drum and a rotatable cutting roll **279** has at least one cutting blade **281** which cuts the strips in elongated form with their lengthwise direction extending transversely of the axis of the vacuum drum whereby the strips become bonded to the continuously moving web **52** by laminating pinch roll **282** in the manner previously described. Although only one cutting blade is shown, which intermittently engages vacuum drum **277,** a plurality of such blades may be employed, and the velocity of the drum relative to roll **279,** the velocity of bands **86'**, and the velocity of web **52** may be correlated to provide strips of desired arcuate length and spacing on the vacuum drum.

In the embodiment of FIG. **20,** the continuous vacuum applied to the rows of vacuum openings **278** serves to pull the bands and transport them with the drum to the point of severance into elongated form and after severance the drum transports the strips to the location of bonding to web **52** by a freely journalled laminating pinch roll **282.** Therefore, to insure such pulling of the bands onto the vacuum drum, its surface is made cylindrical, and the roll **282** is moved up and down into and out of engagement with the vacuum drum to provide the aforementioned dwell periods and stress relief, instead of the previously described flats **148.**

For such purpose, a cam having a single arcuate lobe **286** and a cam recess **286'** is fixedly secured to each end of vacuum drum shaft **286*a*,** and is engageable with a circular cam follower **287** journalled at each end of pinch roll shaft **287'.** As seen in FIGS. **21** and **22,** shaft **287'** is mounted on pivot arms **288** which are thrust by springs **289** to urge the pinch roll into engagement with vacuum drum **277,** as the cam rotates with the vacuum drum, cam lobes **286** will periodically force the pinch roll out of engagement with the vacuum drum so as to release the spring pressure urging the pinch roll against the vacuum drum, to provide the aforementioned dwell periods. When cam followers **287** engage in cam recesses **286'**, the web will be pressed into engagement with the vacuum drum for effecting the adhesive bonding of the elongated strips to the web.

The described arrangement of intermittently bringing the freely journalled pinch roll into and out of driving engagement with the vacuum drum to relieve stress and provide dwell periods when stretchable film is laminated, functions the same and hence may be employed in the modification shown in FIG. **6** instead of providing flats on the vacuum drum in cooperation with a bodily fixed freely rotatable pinch roll. Also when the modification of FIG. **20** is employed for laminating non-stretchable film, then the yieldable drive connection shown and described with reference to FIG. **28** may be employed.

Instead of having a plurality of parent rolls of sheet material **87** from which strips are cut, as shown in FIG. **4,** a single roll may be employed in such form of the apparatus as in FIG. **20,** and then slit into narrower bands, spread apart, and fed to laminating drum means, either a single vacuum drum wide enough to handle all the narrower bands or a plurality of such drums, one for each narrower band.

I claim:

1. The method of continuously applying and bonding to a web strips of flexible, inelastic, bendable material having adhesive on a face thereof and which is capable of assuming a dead set folded position when bent to provide a twist type closure of the strips and the web, which comprises providing rotary drum means and rotary cutting means, continuously rotating said drum means and said cutting means, continuously feeding a parent sheet of the material between the drum means and the cutting means with the adhesive coated face on the outside with reference to the drum means; cutting successive strips on the drum means at a location at the periphery of the drum means, effecting retention of the strips the drum means as the strips are moved to a second location, continuously moving the web in engagement with the drum means at said second location, at said second location applying intermittent pressure to the web to intermittently pinch the web into driving and non-driving engagement with the drum means to thus effect transfer of successive strips to the web at the intervals of such pinchings and to intermittently relieve stress imposed on the web during successive pinchings when the peripheral velocity of the drum means varies from the feed velocity of the web.

2. The method of claim **1** further comprising varying the feed velocity of the web relative to the peripheral velocity of the drum means to vary the spacing of the strips on the web.

3. Apparatus for applying strips of flexible material in spaced apart relationship onto a moving web comprising a rotatably mounted drum having means for releasably retaining said strips thereon, movable cutting means for intermittently contacting said drum and cutting such strips from a parent sheet thereof, means for continuously rotating said drum and moving said cutting means, the spacing between the center lines of adjacent strips on the drum being determined by the intermittent contacting of said cutting means on said drum, means for feeding said parent sheet to said drum at such relative velocity to the cutting means as to determine the arcuate length of said strips on said drum, pressure applying mechanism for intermittently pinching said web against said drum with intervals between such pinchings wherein the web is in non-driving engagement with the drum, and means for feeding said web between said drum and said pressure applying mechanism to effect transfer of successive strips onto said web during the intervals of said intermittent pinchings.

4. The apparatus of claim **3** wherein the pressure applying mechanism includes a freely rotatable pinch roll engageable with the web and having a peripheral velocity substantially the same as the peripheral velocity of the drum when the roll is in pinching engagement with the web, means is provided to alter the relative velocity between said web and the peripheral velocity of the drum to vary the spacing of strips on the web which results in stress being imposed on the web, said non-driving engagement of the web with the drum intermittently relieving such stress.

5. The apparatus of claim **4** wherein such stress relieving means comprises flats on the drum between spaced apart arcuate portions to provide dwell periods allowing the web to return to a neutral position after pinching thereof.

6. The apparatus of claim **4** wherein the stress relieving means comprises means for intermittently moving the pinch roll into and out of engagement with the drum to provide dwell periods allowing the web to return to a neutral position after pinching thereof.

7. The apparatus of claim **4** wherein such stress relieving means includes yieldable drive means for feeding the web between said drum and said pressure applying mechanism which will yield when stress is applied to the web as a result of such pinching, in combination with means allowing the web to assume a neutral state after pinching thereof.

8. The combination with a bag making machine wherein bags are formed from flexible sheet material, of apparatus for applying strips of flexible material in spaced apart relationship to the sheet to form twist closures on the bags, comprising means for moving the sheet in one general direction, rotatably mounted drum having means for releasably retaining strips thereon, rotary means having a cutting blade for contacting said drum and cutting such strips from parent material, mechanism for effecting spacing of the strips on the drum and securing of the same to the moving sheet in said spaced apart relationship including pressure applying means for intermittently pinching the web against the drum with intervals between such pinchings wherein the web is in non-driving engagement with the drum, means for feeding said sheet between said drum and said pressure applying means to effect transfer of successive strips onto said sheet during the intervals of said intermittent pinchings, and means for feeding the sheet to the bag making machine with the strips applied thereto.

9. The combination with a machine for making side weld bags wherein a web of flexible material is folded along a continuous line, moved in the direction of said fold line, and severed and sealed transversely to said fold line at spaced intervals to form individual bags with mouths opposite the fold; of apparatus for applying strips of flexible material in spaced apart relationship to the web to form twist closures extending from adjacent the mouths of the bags comprising means for moving the web in unfolded condition in one general direction, a rotatable drum adjacent the unfolded web having means for releasably retaining said strips thereon, rotary means having a cutting blade for contacting said drum and cutting such strips from a parent sheet thereof, mechanism for effecting spacing of the strips on said drum and securing of the same to the moving web in said spaced apart relationship including pressure applying means for intermittently pinching the web against the drum with intervals between such pinchings wherein the web is in non-driving engagement with the drum, means for feeding said sheet between said drum and said pressure applying means to effect transfer of successive strips onto said sheet during the intervals of said intermittent pinchings, and mechanism for longitudinally folding the web between its edges for the feeding of said folded web to said bag making machine.

10. The combination of claim **9** wherein a rotatable drum is mounted adjacent each edge of the unfolded web, rotary means having a cuttng blade is provided for each drum, mechanism is provided for effecting spacing of the strips on each drum and securing the strips to the moving web along each edge thereof, and the mechanism for longitudinally folding the web between its edges cooperates with means changing the direction of movement of the folded web transversely of said one general direction for the feeding of said folded web to the bag making machine.

11. The combination of claim **8** wherein said apparatus for applying said strips of flexible material includes a dancer mechanism through which the web passes, and means is provided for automatically controlling operation of the apparatus from the bag making machine by pull of the web through the dancer mechanism.

12. Apparatus for making a wrapper of flexible sheet material having opposite substantially parallel edges and spaced apart strips of flexible material capable of assuming a dead set condition when folded extending transversely with respect to at least one of said edges to provide a twist closure of the wrapper at such edge, comprising means for moving the sheet in one general direction, a rotatably mounted drum adjacent such edge of the sheet having means for releasably retaining strips thereon, rotary means having a cutting blade for contacting said drum and cutting such strips from parent material, mechanism for effecting spacing of the strips on the drum and securing the same adjacent said edge of the moving sheet in said spaced apart relationship including pressure applying means for intermittently pinching the web against the drum with intervals between such pinchings wherein the web is in non-driving engagement with the drum, means for feeding said wrapper sheet between said drum and said pressure applying means to effect transfer of successive strips onto said sheet during the intervals of said intermittent pinchings; and means for winding said sheet with the strips thereon into a roll.

13. The combination with a machine for making bottom weld bags wherein a web of flexible material in tube form in the bag making machine is moved in one generally longitudinal direction, and is severed and sealed at spaced intervals transversely to said direction of movement to form sealed bag bottoms and mouths opposite thereto; of apparatus for applying strips of material in spaced apart relationship to the web to form twist closures extending from adjacent the mouths of the bags, comprising means for feeding a parent sheet of material from which the strips are cut, means for slitting the parent sheet into a plurality of narrower bands, means for spacing the bands apart, rotatably mounted drum means having means for releasably retaining said strips thereon, rotary cutting means for contacting said drum and cutting strips from each of said bands, mechanism for effecting spacing on the drum means between successive strips cut from each band, means for feeding a web of material to said drum means, and means for effecting transfer to the web of the strips cut from the bands in lateral spaced apart relationship and with groups of such strips spaced apart longitudinally of the web, said transfer means including pressure applying mechanism for intermittently pinching the web against the drum means with intervals between such pinchings wherein the web is in non-driving engagement with the drum means.

14. The method of claim **1** wherein the strips are cut in elongated form from the parent sheet of material and are retained on the drum means with their lengthwise dimensions extending axially of the drum means whereby they become bonded to the web with their lengthwise dimensions extending transversely with respect to an edge of the web.

15. The method of claim **1** further comprising feeding a plurality of parent sheets in spaced apart relationship between the drum means and the cutting means, and simultaneously cutting the strips from each sheet in elongated form with their lengthwise dimensions extending transversely to the drum axis whereby they become bonded to the web with their lengthwise dimensions extending in the direction of movement of the web.

16. Apparatus for applying strips of flexible material in spaced apart relationship onto a moving web comprising a substantially cylindrical vacuum drum having a fixed immovable peripheral surface provided with spaced apart rows of vacuum holes and which is rotatable about its axis, means for applying a constant uninterrupted vacuum to the drum, a cutting blade support rotatable about an axis and having a cutting blade the cutting edge of which can contact said vacuum drum, means for rotating the cutting blade support in timed predetermined relationship to the vacuum drum to cut the flexible material from a parent sheet thereof with individual strips at locations over the respective rows of vacuum holes and be held on the drum by the vacuum, the spacing between the center lines of adjacent strips on the drum being determined by the relative peripheral velocity between the cutting blade and the drum, means for feeding said parent sheet onto said vacuum drum at such relative velocity to the peripheral velocity of the cutting blade as to determine the arcuate length of the strips on the drum, said strips on said drum having adhesive on the outer faces thereof with reference to the drum, a freely rotatable pinch roll engageable with the web, means for intermittently pinching the web against the drum by said pinch roll with intervals between such pinchings wherein the web is non-driving engagement with the drum and the pinch roll is an idler roll and during the intervals of pinching the pinch roll has substantially the same peripheral velocity as that of the vacuum drum, and means for feeding said web between said drum and said pinch roll to effect transfer of successive strips onto the web during the intervals of said intermittent pinchings.

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