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(54) **Methods of manufacturing slider-operated string-zippered bags of VFFS machine**

(57) A method of manufacture comprising the following steps: (a) guiding a web material in a machine direction through a vertical form-fill-seal (VFFS) machine with a portion or portions of the web material being wrapped around a tube; (b) joining first and second flangeless zipper strips to first and second portions of the web material

that do not form part of the portion or portions of the web material that are wrapped around the tube; (c) inserting a slider on the first and second flangeless zipper strips joined to the web material; (d) cross sealing the web material at a location downstream from the tube; and (e) dropping product through the tube and onto the most recently formed cross seal.

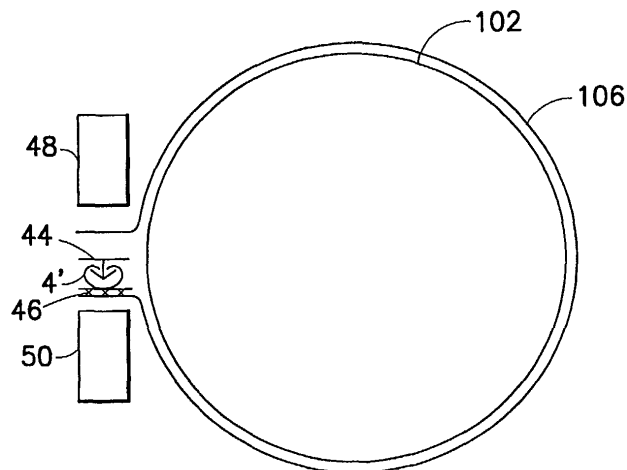


FIG. 6

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Description

Field of the Invention

[0001] The present invention relates to reclosable bags having slider-operated string zippers. More particularly, the present invention relates to a method and apparatus for making slider-operated string-zippered reclosable bags on vertical form-fill-seal (VFFS) machines.

Background to the Invention

[0002] Methods and apparatus for manufacturing reclosable bags on VFFS machines using reclosable zippers are well known in the art. These prior art methods and apparatus are not limited to interlocking zippers which are directly opened and closed by the hands of the bag user, but also include methods and apparatus for making reclosable bags that employ a slider for opening and closing the zipper.

[0003] Reclosable bags having slider-operated zippers are generally more desirable to consumers than bags that have sliderless interlocking zippers since it is much easier for the user to open and close bags having a slider-operated zipper. One class of slider bags employ a flanged zipper, while another class of slider bags employ a flangeless or so-called "string" zipper. As used herein, the term "string zipper" means a zipper comprising two zipper strips having substantially no flanges. Therefore, instead of attaching the zipper strips to a bag by means of extension flanges that are heat sealed to the bag walls, a string zipper is attached to the bag walls at the backs of the zipper strips, in regions directly opposite to the interlocking profiled closure members.

[0004] In general, bags that have a string zipper can be manufactured more cheaply than bags that have a flanged zipper. This is due in part to the following factors: a string zipper uses less material than a zipper with flanges and can be produced faster and in greater multiples, and string zippers are easier to handle and store. It is thus commercially highly desirable and advantageous to provide methods and apparatus for manufacturing slider-operated string-zippered bags in a continuous, automated process. In particular, it is desirable to provide methods and apparatus for making slider-operated string-zippered bags on a VFFS machine.

Summary of the Invention

[0005] The present invention is directed to methods for manufacturing slider-operated string-zippered bags on a VFFS machine.

[0006] One aspect of the invention is a method of manufacture comprising the following steps: (a) guiding a web material in a machine direction through a vertical form-fill-seal (VFFS) machine with a portion or portions of the web material being wrapped around a tube; (b) joining first and second flangeless zipper strips to first

and second portions of the web material that do not form part of the portion or portions of the web material that are wrapped around the tube; (c) inserting a slider on the first and second flangeless zipper strips joined to the web material; (d) cross sealing the web material at a location downstream from the tube; and (e) dropping product through the tube and onto the most recently formed cross seal.

[0007] Another aspect of the invention is a method of automatically manufacturing bags fitted with a slider-operated string zipper, comprising the following steps: (a) intermittently advancing a web along a pathway that partly encircles a tube, whereby after each advancement, first and second portions of the web are wrapped around respective portions of a tube having an axis, while third and fourth portions of the web extend generally radially outward from the tube; (b) during each dwell time, joining respective sections of first and second flangeless zipper strips to the third and fourth portions of the web while the first and second portions of the web are wrapped around the respective portions of the tube, thereby forming a zipper-web assembly; (c) during each dwell time, inserting a slider on the first and second flangeless zipper strips respectively joined to the third and fourth web portions; (d) during each dwell time and after step (b) has been performed, cross sealing the web in a first transverse region at an elevation below an outlet end of the tube; (e) during each dwell time and after step (d) has been performed, dropping product down the tube and onto the most recently cross-sealed portion of the web; and (f) during each dwell time, cutting the zipper and the web along a transverse line that intersects a respective cross-sealed region, thereby severing a finished bag from the zipper-web assembly.

[0008] A further aspect of the invention is a method of manufacture comprising the following steps: (a) guiding a length of web material, having mutually parallel first and second lateral edges when the web material is flat, such that a major portion of the length of web material is wrapped around a tube having an axis, and first and second portions adjacent or near the first and second lateral edges respectively of the length of web material extend in mutually confronting relationship outside the tube, separated by a gap; (b) guiding a length of string zipper comprising interlocked first and second flangeless zipper strips to a position outside the tube and parallel to the tube axis, the length of string zipper being disposed in the gap between the first and second portions of the length of web material; (c) joining the length of string zipper to the length of web material while the major portion of the length of web material is wrapped around the tube, thereby forming a zipper/web assembly, the first flangeless zipper strip being joined to the first portion and the second flangeless zipper strip being joined to the second portion; and (d) inserting a slider onto the zipper/web assembly while the major portion of the length of web material is wrapped around the tube.

[0009] Yet another aspect of the invention is a method

of manufacture comprising the following steps: (a) guiding a length of web material, having mutually parallel first and second lateral edges when the web material is flat, such that: (i) first and second portions of the length of web material are wrapped around respective portions of a tube, (ii) first and second marginal portions adjacent the first and second lateral edges respectively of the length of web material project generally outward and away from the tube in mutually confronting relationship, and (iii) the first and second portions are connected by a loop having mutually opposing first and second walls separated by a gap; (b) guiding a length of string zipper comprising interlocked first and second flangeless zipper strips to a position outside the tube and parallel to the tube axis, the length of string zipper being disposed in the gap between the first and second walls of the loop; (c) joining the length of string zipper to the length of web material while the first and second portions of the length of web material are wrapped around respective portions of the tube, thereby forming a zipper/web assembly, the first flangeless zipper strip being joined to the first portion and the second flangeless zipper strip being joined to the second portion; (d) cutting off a portion of the loop beyond the string zipper; and (e) after step (d), inserting a slider onto the zipper/web assembly while the first and second portions of the length of web material are wrapped around respective portions of the tube.

[0010] A further aspect of the invention is a method of manufacture comprising the following steps: (a) guiding a length of web material, having mutually parallel first and second lateral edges when the web material is flat, such that: (i) first and second portions of the length of web material are wrapped around respective portions of a tube, (ii) first and second marginal portions adjacent the first and second lateral edges respectively of the length of web material project generally outward and away from the tube in mutually confronting relationship, and (iii) the first and second portions are connected by a folded portion having an M-shaped profile with mutually opposing first and second interior walls separated by a gap; (b) guiding a length of string zipper comprising interlocked first and second flangeless zipper strips to a position outside the tube and parallel to the tube axis, the length of string zipper being disposed in the gap between the first and second interior walls of the folded portion; (c) joining the length of string zipper to the length of web material while the first and second portions of the length of web material are wrapped around respective portions of the tube, thereby forming a zipper/web assembly, the first flangeless zipper strip being joined to the first portion and the second flangeless zipper strip being joined to the second portion; and (d) inserting a slider onto the zipper/web assembly while the first and second portions of the length of web material are wrapped around respective portions of the tube.

[0011] Another aspect of the invention is a method of manufacture comprising the following steps: (a) guiding a web material in a machine direction through a vertical

form-fill-seal (VFFS) machine; (b) joining a string zipper to the web material upstream of the VFFS machine; (c) inserting a slider over said string zipper and portions of said joined web material at a location adjacent a tube of said VFFS machine; (d) cross sealing the web material at an elevation below the tube; and (e) dropping product through the tube and onto the most recently formed cross seal.

[0012] A further aspect of the invention is a method of manufacture comprising the following steps: (a) guiding a web material in a machine direction through a vertical form-fill-seal (VFFS) machine with portions of the web material being wrapped around respective portions of a tube of the VFFS machine; (b) joining the web material to two sides of a string zipper to form a web/string zipper assembly, the joining step being performed at locations upstream of the VFFS machine; (c) removing at least a portion of the web material suspended between the zones of web/zipper joiner at a location upstream of the VFFS machine, but downstream of the locations where step (b) is performed; (d) inserting a slider on the string zipper at a location upstream of the VFFS machine, but downstream from the locations where step (b) is performed; (e) cross sealing the web material at a location downstream from the tube; and (f) dropping product through the tube and onto the most recently formed cross seal.

Brief Description of the Drawings

[0013] Examples of the present invention will now be described in detail with reference to the accompanying drawings, in which:-

Fig 1 is a drawing showing a reclosable package having a slider-operated string zipper with end stops; Fig 2 is a drawing showing a partially sectioned view of a slider-string zipper assembly incorporated in a reclosable package. The zipper and receptacle are shown only in a section plane in front of the closing end of the slider. The portions of the zipper and receptacle disposed behind the section plane have not been shown to avoid cluttering the drawing; Fig 3 shows one conventional VFFS machine adapted to make slider-operated reclosable bags wherein the zipper is joined to the film by flanges; Fig 4 shows another conventional VFFS machine adapted to make slider-operated reclosable bags wherein the zipper is joined to the film by flanges; Fig 5 is a drawing showing one side of a string zipper being joined to a flat film web upstream of a VFFS machine (not shown) in accordance with a first method of manufacture; Fig 6 is a drawing showing a sectional view of the web of FIG. 5 wrapped around a tube of a VFFS machine with the other side of the zipper about to be joined to the film web in accordance with the first method of manufacture;

Fig 7 is a drawing showing two zipper strips being joined to opposite marginal portions of a flat film web upstream of a VFFS machine (not shown) in accordance with a second method of manufacture;

Fig 8 is a drawing showing a sectional view of the web of FIG. 7 wrapped around a tube of a VFFS machine with the string zipper being held in an opened state for insertion of a slider in accordance with the second method of manufacture;

Fig 9 is a drawing showing a side view of a portion of a fill tube having adjacent stations for zipper alignment, slider insertion and zipper closure in accordance with the second method of manufacture;

Fig 10 is a drawing showing a sectional view of a string zipper being joined to marginal portions of a film web wrapped around a tube of a VFFS machine in accordance with a third method of manufacture;

Fig 11 is a drawing showing a sectional view of a string zipper being joined to a gusset formed in a film web wrapped around a tube of a VFFS machine with marginal portions of the web being sealed together in accordance with a fourth method of manufacture;

Fig 12 is a drawing showing a sectional view of a string zipper being joined to a loop formed in a film web wrapped around a tube of a VFFS machine with marginal portions of the web being sealed together in accordance with a fifth method of manufacture;

Fig 13 is a block diagram showing various stages of a sixth method of manufacture wherein zipper sealing and slider insertion occurs upstream of the fill tube of a VFFS machine;

Figs 14 and 15 are drawings showing, at different elevations, a sectional view of a portion of a forming collar having a relieved area for providing clearance for a slider inserted on a string zipper/film web assembly in accordance with the sixth method of manufacture;

Fig 16 is a drawing showing a sectional view of a portion of the fill tube with a confronting guide for retaining the slider and string zipper in a vertical position adjacent to the fill tube in accordance with the sixth method of manufacture;

Fig 17 is a drawing showing a fragmentary, partially sectional top view of the components of a slider insertion station as disclosed in U.S. Patent Application Serial No. 10/622,996. In this example, the zipper-film assembly moves from left to right, as indicated by arrow A;

Fig 18 is a drawing showing a fragmentary, partially sectional front view of the slider insertion components for the implementation depicted in Fig 17. Again the zipper-film assembly moves from left to right, while the slider is moved in a direction out of the page during insertion; and,

Fig 19 is a block diagram generally representing programmable control of many of the components of the slider insertion apparatus disclosed in U.S. Patent Application Serial No. 10/622,996.

Detailed Description

[0014] A reclosable package comprising a bag or receptacle 2 and a flexible plastic zipper 4 operated by manipulation of a slider 10 is shown in Fig 1. It should be understood that the method disclosed herein can make be a reclosable package of the type shown in Fig 1 or other types of reclosable packages having different structures, but having in common a slider-actuated string zipper.

[0015] The bag 2 may be made from any suitable bag making film material, including a single layer of thermoplastic material or a laminate comprising two or more layers made of different materials. For example, the laminate could comprise two layers of different thermoplastic materials, a plastic-coated paper or a metallized thermoplastic film. Suitable thermoplastic materials include low-density polyethylene, substantially linear copolymers of ethylene and a C3-C8 alpha-olefin, polypropylene, polyvinylidene chloride, mixtures of two or more of these polymers, or mixtures of one of these polymers with another thermoplastic polymer. The person skilled in the art will recognize that this list of suitable thermoplastic materials is not exhaustive. The thickness of the bag making film is preferably 2 mils or less.

[0016] From a structural standpoint, the bag 2 comprises opposing walls (only the front panel 2a is visible in Fig 1) that may be secured together at opposite side edges of the bag by seams 16 and 18 (indicated by dashed lines), formed in conventional fashion, e.g., by application of heat and pressure. The opposing bottoms of the walls are also heat sealed together to form a bottom seam or cross seal 20. Alternatively, functionally equivalent means can be used. For example, the seams could be made by applying ultrasonic wave energy instead of conductive heat.

[0017] At its top end, the bag 2 has an openable mouth, on the inside of which is an extruded plastic zipper 4. The zipper 4 comprises a pair of interlockable zipper parts. One zipper part 6 is visible in Fig 1. The profiles of the zipper parts may take any form. For example, the zipper may comprise interlocking rib and groove elements, alternating hook-shaped closure elements, or interlocking ball-shaped closure elements. The preferred zipper material is polyethylene, but polypropylene and other plastic materials can be used. Typically the upper margins of the front and rear bag walls are respectively sealed to the respective zipper parts by conduction heat sealing.

[0018] The zipper is operated by sliding the slider 10 along the zipper parts. As the slider moves across the zipper, the zipper is opened or closed. As shown in FIG. 1, the slider is slidable along the zipper in a closing direction "C", causing the zipper parts to become engaged, or in an opening direction "O", causing the zipper parts to become disengaged.

[0019] The bag shown in FIG. 1 further comprises end stops 12 and 14 for preventing the slider from sliding off the end of the zipper when the slider reaches the zipper

closed or fully opened position. Such end stops perform dual functions, serving as stops to prevent the slider from going off the end of the zipper and also holding the two zipper profiles together to prevent the bag from opening in response to stresses applied to the profiles through normal use of the bag. The end stops typically comprise stomped areas on the zipper parts themselves. The stomped end stops comprise sections of the zipper parts that have been fused together and flattened at the ends of the zipper. This is typically accomplished by applying ultrasonic wave energy, but alternatively can be done by applying sufficient heat and pressure. Ultrasonic stomping can be carried out using ultrasonic welding equipment of the type disclosed in U.S. Patent Application Serial No. 10/113,489, entitled "Method and Apparatus for Ultrasonically Stomping Slider End Stops on Zipper".

[0020] A reclosable package or bag comprising a receptacle 2 and a flexible plastic string zipper 4, operated by manipulation of a slider 10, is partially shown in FIG. 2, adapted from U.S. Patent Application Ser. No. 10/367,450. The receptacle 2 comprises mutually opposing front and rear walls 2a and 2b that are joined together on three sides, as previously described with reference to FIG. 1.

[0021] Zipper strip 8 comprises a base and two generally arrow-shaped rib-like male closure elements or members projecting from the base. Zipper strip 6 comprises two pairs of hook-shaped gripper jaws connected by a sealing bridge. The pairs of gripper jaws form respective complementary female profiles for receiving the male profiles of zipper strip 8. Alternatively, one zipper part could have one male profile and one female profile, while the other zipper part has one female profile and one male profile, or the respective zipper parts could each have more than two male or female profiles. The sealing bridge of zipper strip 6 and the base of zipper strip 8 are resiliently flexible self-supporting structures having a thickness greater than the thickness of the bag film. The male closure elements are integrally formed with the base, while the female closure elements are integrally formed with the sealing bridge.

[0022] The upper margins of the walls 2a and 2b of the bag are joined to the backs of the sealing bridge and the base respectively. The upper margins of the bag film may have short free ends, as seen in FIG. 2, provided that the free ends are not so long as to interfere with travel of the slider along the zipper or become entangled with the zipper profiles.

[0023] The slider 10 comprises a top wall 22 and a pair of side walls 24, 26 that form a tunnel for passage of the string zipper therethrough. The width of the tunnel is substantially constant along the section that is divided by the plow 28 and then narrows from a point proximal to the end of the plow to the closing window at one end face of the slider. The closing end of the slider is seen in FIG. 2. The upper margins of the bag walls 2a and 2b, which are joined to the backs of the zipper strips 6 and 8, are disposed between the respective zipper strips 6, 8 and the

respective slider sidewalls 26, 24 of the slider. Also, the slider shown in FIG. 2 has one leg (i.e., side wall 26) longer than the other, to wit, an extension 30 of side wall 26 projects to an elevation lower than the bottom edge of the opposing side wall 24. This design facilitates proper orientation of the slider during automated feeding to a slider insertion device.

[0024] The plow or divider 28 depends downward from a central portion of the top wall 22 to an elevation below the lowermost portions of each sidewall 24, 26. The plow 28 is disposed between opposing sections of the zipper strips that pass through the tunnel. The tip of the plow 28 is truncated and has rounded edges and flattened corners at opposing ends for facilitating insertion of the plow between the zipper profiles without snagging during automated slider insertion. As the slider is moved in the opening direction (i.e., with the closing end leading), the plow 28 pries the impinging sections of zipper strips 6 and 8 apart.

[0025] In the embodiment depicted in FIG. 2, the slider 10 further comprises a retaining projection or ledge 32 that projects inward from the side wall 26 and a retaining projection or ledge 34 that projects inward from the side wall 24. The ledges 32 and 34 project toward each other, forming respective latches for latching the slider onto the zipper, thereby increasing slider pull-off resistance. The ledges 32 and 34 further comprise respective inclined bottom surfaces 36 and 38 that extend downward and outward from the respective inner edges of the generally horizontal surfaces. The inclined surfaces 36 and 38 are each substantially planar and serve to guide the respective zipper strips 6 and 8 into the slider tunnel during automated insertion of the slider onto an open section of the zipper.

[0026] The slider may be made in multiple parts and welded together or the parts may be constructed to be snapped together. The slider may also be of one-piece construction. The slider can be made using any desired method, such as injection molding. The slider can be molded from any suitable plastic, such as nylon, polypropylene, polystyrene, acetal, polyketone, polybutylene terephthalate, high-density polyethylene, polycarbonate, or ABS.

[0027] The present invention is directed to methods for manufacturing slider-actuated string-zippered bags utilizing VFFS machines. FIG. 2 shows a portion of a slider-actuated string-zippered bag having a specific structure. However, the methods of manufacture disclosed herein are not limited in their application to bags of the type having the structure shown in FIG. 2. In particular, the respective structures of the string zippers and the sliders that can be used to construct reclosable bags can be different than those shown in FIG. 2. For example, the string zipper may have a single male profile and a single female profile, instead of having the paired male and female profiles depicted in FIG. 2, or the slider may be of the type that does not have a separating finger.

[0028] While the art of manufacturing slider-operated

reclosable bags having flanged zippers on a VFFS machine is well known, the invention proposes to make slider-operated reclosable bags whose zippers have no flanges. There are several advantages in using string zipper in a VFFS machine that not only relate to the substantially lower cost of the zipper due to the elimination of the flanges, higher speed of extrusion, and extrusion of a greater number of zippers at the same time out of the same die, but also to the process itself. By eliminating the flanges, a substantially larger footage of zipper can be wound on a spool, which in turn results in less lost machine time due to spool change-over. The string zipper is easier to wind on a spool, easier to handle coming off of the spool and easier to guide into the machine because it is no longer necessary to provide for the flanges. However, to take advantage of these improvements, several changes have to be made in the attachment of the film to the string zipper and in the mounting of the slider. These include the guiding and the sealing of the film to the back or base of the string zipper strips and the mounting of the slider over the attached film and zipper elements.

[0029] To better appreciate the invention, several known techniques for manufacturing reclosable bags having slider-actuated flanged zippers will be briefly described. Then the changes to the equipment needed to make reclosable bags having slider-actuated string zippers will be further described in detail.

[0030] Fig 3 shows slider-operated reclosable bags, having flanged zipper strips, being manufactured on a conventional VFFS machine 100. Thermoplastic film 102 is fed from a continuous supply roll (not shown) into the VFFS machine 100 and wrapped around a forming collar 104 and around a filling tube 106 to bring the longitudinal edges 108, 110 of the film 102 together to form a tube. The film passes through a generally circular gap (not seen in FIG. 3) between the forming collar and the top of the forming tube in a well-known manner.

[0031] Still referring to Fig 3, an interlocked flanged zipper 5 having sliders 11 pre-applied thereto (i.e., mounted at spaced intervals along the zipper) is fed from a continuous coil on a supply reel 112. The flanged zipper is guided (by conventional means not shown) between the longitudinal edges 108, 110 of the film 102, after which vertical seal bars 114 seal the zipper flanges (not shown) to the longitudinal film edges 108, 110 to form what will be the top of the bag. The sliders 11 must be clear of the vertical seal bars 114 such that the sliders 11 do not interfere in the sealing of the zipper 5 and are not crushed by the vertical seal bars 114. Accordingly the zipper flanges are made long enough to eliminate any interference between the sliders 11 and the vertical seal bars 114. The zipper flanges also assist the zipper 5 to be guided into the VFFS machine 100 by a set of rollers 116, and thereby keep the zipper aligned with the edges of the film.

[0032] Then, further downstream in the VFFS machine 100, cross seal bars 118 form the sides of the bags by

transversely sealing the tube of film. The cross seal bars 118 simultaneously cross seal the leading side 120 of the bag 122 presently being made from the film 102 and the lagging side 124 of the preceding bag 126 (the leading side seal of the preceding bag had been made during the previous cross sealing operation), capturing a single slider between the two side seals of the preceding bag 126, and cutting the preceding bag 126 from the film 102. After the first side 120 is cross sealed, the bag may be filled, if desired, through a funnel at the top of the tube 106. Cross seal bars 118 may also seal the ends of the zipper 5 together to prevent the slider 11 from becoming detached therefrom. When the film 102 advances once again, the cross seal bars 118 complete the second cross-sealed side of the present bag, capturing a single slider between the two sides, and then cut the present bag from the film and also complete the first cross-sealed side of the succeeding bag. In this manner slider-operated zippered bags are continuously made.

[0033] Another conventional VFFS machine 100' for making slider-operated reclosable bags with flanged zippers is shown in FIG. 4. In this embodiment, the components of the VFFS machine 100' that are designated with the same reference numerals as like components of the VFFS machine 100 shown in FIG. 3 generally function in the same manner. The difference with the embodiment shown in FIG. 4 is that the zipper 5 does not have the sliders 11 pre-applied thereto. Rather, the sliders 11 are applied to the zipper after the zipper is sealed to the longitudinal edges 108, 110 of the film 102.

[0034] As shown in FIG. 4, the sliders are supplied from a continuous coil 128 to a slider inserter mechanism 130. Each slider 11 is connected to its adjacent slider via a connector 132. This connection may be achieved in any number of ways. For example, the sliders may be mechanically connected. Alternatively, the sliders may be connected by a carrier adhesive tape. Still alternatively, the sliders may be connected by a metal or plastic wire or molded together by a plastic "runner". The connected sliders 11 are fed into the slider inserter 130. As the film 102 advances through the VFFS machine 100' and as bags are made, a slider 11 is removed from the connector 132 and applied to the zipper 5 of the bag 122 presently being made. After the slider 11 is applied to the zipper 5, the connector scrap 132 exits the slider inserter 130 and the first side seal of the bag is made by the cross seal jaws 118. The bag is then completed in the manner described above.

[0035] Alternatively, it is known to connect a box magazine (not shown in the drawings) of individual stacked sliders to the slider insertion mechanism. As the film advances through the machine and as the zipper is attached to the film, the sliders are automatically applied to the zippers of the individual bags by the slider inserter. The magazine is interchangeable with other magazines and may be replaced by another magazine when it becomes empty. Other types of commonly used magazines may also be employed, such as a coil type magazine wherein

the sliders are attached to each other.

[0036] In accordance with a further known alternative, a vibratory feeder bowl (not shown in the drawings) can be used to orient and deliver sliders to the slider inserter. Bulk sliders are loaded by the bag maker into the vibratory feeder bowl. The vibratory feeder bowl then orients the sliders and feeds them to the slider inserter, which then applies the sliders to the zippers. The vibratory feeder bowl may vibrate in either a translational manner (back and forth) or in a rotational manner. Generally, when the VFFS machine is running at a slow speed, such as less than 60 bags per minute, a translational device may be used. When faster speeds are desired, however, the rotational type of feeder bowl should be used to adequately provide for high speeds.

[0037] The operation of a conventional VFFS machine has been generally described with reference to FIGS. 3 and 4 because similar components are incorporated in the embodiments of the inventions disclosed herein. In its broad concept, the method of manufacture disclosed herein comprises the following steps: (a) guiding a web material in a machine direction through a vertical form-fill-seal (VFFS) machine with a portion or portions of the web material being wrapped around a fill tube; (b) joining a pair of flangeless zipper strips to respective other portions of the web material; (c) inserting a slider on the flangeless zipper strips with web material joined thereto; (d) cross sealing the web material at a location downstream from the fill tube; and (e) dropping product through the fill tube and onto the most recently formed cross seal. Six embodiments of this method will now be described with reference to FIGS. 5 through 16, without any intention of limiting the scope of patent coverage to those specific embodiments. Then a representative slider insertion apparatus, which can be employed in any one of the disclosed methods of manufacture when the slider has a plow (i.e., separating finger), will be described in detail with reference to FIGS. 17 through 19, with the understanding, however, that any other suitable slider insertion apparatus can be used. In particular, if the sliders do not have plows, then a conventional means for inserting a slider having no plow onto an extruded plastic zipper can be employed in place of the slider insertion apparatus depicted in FIGS. 17 through 19.

[0038] In each of the six methods disclosed hereinafter, the film web is advanced intermittently through the VFFS machine, with all operations that are performed alongside or below the fill tube being performed during dwell times. All of the six methods have in common the steps of: wrapping portions of a film web around respective portions of the fill tube; joining a pair of flangeless zipper strips to the film web; inserting a slider onto the string zipper; cross sealing the film web at spaced intervals therealong; filling the bag precursor through the fill tube; and then severing the filled bag from the remainder of the zipper/web assembly in process. The methods vary, however, as to the locations where the zipper strips are joined to the web and the locations where the sliders

are inserted (although, as will be seen, the sliders are inserted at a station alongside the fill tube in five of six disclosed methods).

[0039] In accordance with the first two methods of manufacture disclosed herein, the string zipper is applied and sealed to the bag making film upstream or in front of the forming collar and the fill tube. In accordance with a first method partly depicted in FIG. 5, a pair of interlocked flangeless zipper strips 44 and 46, making up a string zipper 4', are guided to a position parallel to a lateral edge of a web 102 of bag making film and confronting a marginal portion of the web (as seen in FIG. 5) or a band-shaped portion of the web separated from the lateral edge by a marginal portion (not shown in FIG. 5). [As used herein, the term "marginal portion" means an edge and the area immediately adjacent to it, i.e., a border.] In the former case, there will be no need to trim excess web material on the consumer side of the zipper since the edge of the web is generally aligned with the top of the zipper and there is substantially no excess web material or the amount of excess web material will not interfere with slider travel along the string zipper. In the latter case, the excess web material on the consumer side of the string zipper will be trimmed to prevent interference with the slider. As seen in FIG. 5, the string zipper 4' is guided into position by a zipper guide 40 having a channel that guides the string zipper as it is fed in the machine direction by means not shown. At the same time, the web 102 is advanced in the machine direction. In the case where both the zipper and web are advanced continuously, the zipper sealing operation is performed continuously by conventional means, in which case a conventional dancer assembly (not shown) is provided between the zipper sealing station and the VFFS machine for converting the continuous web motion into intermittent web motion in synchronism with the intermittent operation of the VFFS machine. Alternatively, the zipper sealing operation can be performed intermittently in synchronism with the intermittent operation of the VFFS machine. In either case, the zipper sealing station is conventional apparatus. For example, sealing can be accomplished using an electrically heated sealing bar 42. In the example depicted in FIG. 5, the heated sealing bar 42 is shown in a position whereat a marginal portion of the web 102 can be joined to the back of the flangeless zipper strip 46. In the case of a continuous zipper sealing operation, the heat is conducted through an endless barrier strip (not shown) made of Teflon or similar material, which circulates on a set of rollers (not shown). The Teflon barrier strip moves with the web and zipper and prevents the bag making film from sticking against the stationary heated sealing bar during conduction heat sealing.

[0040] Now referring to FIG. 6, after the string zipper has been attached to the film web, the web 102 is moved over the forming collar (not shown in FIG. 6) and around the fill tube 106, with the other lateral edge of the web being guided and aligned with the base of the flangeless zipper strip 44. A marginal portion of the web (as seen

in FIG. 6) or a band-shaped portion of the web separated from the lateral edge by a marginal portion (not shown in FIG. 6) is then joined to the back of the flangeless zipper strip 44. In one implementation of this method, the respective guides also guide the film edges and align them with the edges of the bases of the flangeless zipper strips. The slider is then mounted to the string zipper. If the slider has a separating finger or plow, the moving zipper is opened by a stationary separator plate and kept in aligned position by the guides. The slider is then inserted onto a section of zipper that is partially opened and partially closed. In one implementation, a set of rollers (not shown) then closes the zipper behind the slider. The rollers separate as necessary to allow the slider to pass through. Alternatively, a roller and a retaining plate can be used. Another implementation of an apparatus for inserting a slider having a plow will be described in more detail hereinafter with reference to FIGS. 17-19.

[0041] In accordance with a second method partly depicted in FIG. 7, separated flangeless zipper strips 44 and 46 are guided to respective positions parallel to the respective lateral edges of a web 102 of bag making film and confronting a respective marginal portion of the web (as seen in FIG. 7) or a respective band-shaped portion of the web separated from the lateral edge by a marginal portion (not shown in FIG. 7). Any excess web material on the consumer side of the string zipper can be trimmed as needed to prevent interference with the slider. As seen in FIG. 7, the flangeless zipper strip 46 is guided into position by a zipper guide 40a having a channel that guides the zipper strip as it is fed in the machine direction by means not shown, while the flangeless zipper strip 44 is guided into position by a zipper guide 40b having a channel that guides the zipper strip as it is fed in the machine direction by means not shown. At the same time, the web 102 is advanced in the machine direction. The zipper strips 44 and 46 are then sealed to the respective marginal portions of the web 102 by means of respective heated sealing bars 42.

[0042] Now referring to FIG. 8, after the zipper strips have been attached to the film web, the web 102 is moved over the forming collar (not shown in FIG. 8) and wrapped around the fill tube 106, with the zipper strips 44 and 46 being guided and aligned with each other by a guide 52 having respective channels for the respective flangeless zipper strips. The string zipper is open within the guide 52. Referring now to FIG. 9, downstream of the guide 52, a slider is mounted to the open string zipper 4' by a slider insertion device 54. Downstream of the slider insertion device 54, the string zipper 4' is closed by a zipper closure mechanism 56 having retractable means for allowing the mounted slider to pass through as the zipper/web assembly advances.

[0043] FIG. 10 is a drawing showing a sectional view of a string zipper 4' being joined to marginal portions of a film web 102 wrapped around a tube 106 of a VFFS machine in accordance with a third method of manufacture. In this method, the string zipper is attached to the

film web alongside the fill tube 106. First, the film web 102 is paid out from a supply roll (not shown) and moved over the forming collar (not shown). The web 102 is then wrapped around the fill tube 106. The width of the web is greater than the circumference of the fill tube. The respective marginal portions of the web are guided into mutually confronting positions away from the tube, with a gap therebetween and with the lateral edges of the web as close to being aligned with each other as possible. The string zipper 4' is then introduced into the gap between the marginal portions of the web 102 with the top edges of the zipper strips generally aligned with the lateral edges of the web. Typically, the string zipper, as it advances, is guided by contact with the walls of a channel of a zipper guide (not shown). When the string zipper 4' is in an aligned position with the film edges, the bases of the zipper strips are joined to the marginal portions of the web by means of a pair of reciprocating heated sealing bars 48a and 48b. Thereafter a slider is inserted onto the string zipper, the film web is cross sealed, and product is dropped onto the cross seal, filling the interior volume of the receptacle formed by the sealed web. The next cross seal formed will be cut to sever the filled bag from the zipper/web assembly in process.

[0044] In accordance with a fourth method of manufacture shown in FIG. 11, respective portions of the web are wrapped around respective portions of the fill tube 106. At the same time, a portion of the web not wrapped around the fill tube is folded three times to form an M-shaped gusseted end alongside a portion of the fill tube, while the marginal portions (starting at the lateral edges) of the web are guided into mutually confronting positions alongside another portion of the fill tube. Then the string zipper is introduced into the central fold of the gusseted end, and the bases of the flangeless zipper strips are sealed to the opposing walls of the central fold by heated sealing bars 48a and 48b. The zipper sealing operation is performed with double layers of film being merged and joined to the backs of the respective flangeless zipper strips. [Details of this operation can be found in U.S. Patent Application Ser. No. 10/617,234 filed on July 10, 2003 and entitled "Tamper-Evident Reclosable Bag Having Slider-Actuated String Zipper". At the same time, the free marginal portions of the film web are sealed together, e.g., by conventional heated sealing bars 58 and 60, whether at 90° or 180° from the fold.

[0045] The central fold in the M-shaped gusseted end forms a tamper-evident membrane in the interior of the bag on the product side of the string zipper. The ends of the membrane are sealed at the side seals. To gain access to the contents of the bag, the user must first open the zipper by moving the slider and then tear open or breach the membrane disposed inside the bag. To facilitate breaching, the membrane may be provided with a line of weakened tear resistance, which may, for example, comprise a line of spaced perforations or a scoreline running the length of the membrane. The perforations may be capped, as taught in U.S. Patent No. 5,063,639.

The merged marginal portions of the membrane and the receptacle walls may be respectively sealed to the backs of the zipper strips. Then any excess film at the outer folds of the gusseted end (i.e., film extending beyond the edges of the zipper strips) is trimmed. Thereafter, a slider is mounted to the string zipper.

[0046] In accordance with a fifth method of manufacture shown in FIG. 12, respective portions of the web are wrapped around respective portions of the fill tube 106. At the same time, a fold or loop 86 is formed in a portion of the web not wrapped around the fill tube, while the marginal portions (starting at the lateral edges) of the web are guided into mutually confronting positions. Then the string zipper is introduced into the loop 86, and the bases of the flangeless zipper strips are sealed to the inside of opposing walls of the film fold by heated sealing bars 48a and 48b. At the same time, the free marginal portions of the film web are sealed together, e.g., by conventional heated sealing bars 58 and 60, whether at 90° or 180° from the fold. Then the excess film of the film fold 86 beyond the edges of the zipper strips is trimmed. Thereafter, a slider is mounted to the string zipper.

[0047] After sealing the string zipper to the film web and then trimming the excess film portions extending beyond the edges of the string zipper, optionally any remnant portions may be respectively sealed to the respective zipper strips by a specially designed heated sealing bar that is fully disclosed in U.S. Patent Application Ser. No. 10/655,991 entitled "Method and Apparatus for Making Reclosable Bags Having Slider Actuated String Zippers". In that patent application, the operation whereby the free remnants are sealed to the zipper is referred to as "lip sealing". Alternatively, if the cutting lines are located close enough to the respective zipper strips that the remnants of film projecting beyond the zipper are not long enough to interfere with operation of the slider as it moves along the zipper, lip sealing need not be done.

[0048] In accordance with a sixth method of manufacture generally depicted in the block diagram of FIG. 13, the closed string zipper is applied and the slider is inserted upstream of the VFFS machine. First, the film web is folded to form a loop. Then the string zipper is inserted inside the fold and the backs of the zipper strips are joined to mutually confronting band-shaped portions of the fold or loop by a zipper applicator 62. Then most of the portion of the loop that connects the band-shaped zones of zipper/web joiner is removed by a trimmer 64 by cutting along two lines that are as close to the edges of the respective zipper strips as possible. A slider insertion device 66 then opens a section of the string zipper and inserts the slider so that the opening end of the slider overlies a portion of the open section of the string zipper. After slider insertion, an ultrasonic welding station 68 deforms the string zipper into a slider end stop structure by application of ultrasonic wave energy, causing the zipper strips to be come fused together when the thermoplastic zipper material cools. [Alternatively, the zipper strips could be ultrasonically stomped in the VFFS machine

alongside the tube.] The web is unfolded with the string zipper and slider below the plane of the web. The zipper/web assembly then processes through the VFFS machine 70 as normal except for a relieved area on the forming collar that provides a channel for the slider, as shown in FIGS. 14 and 15. The hatched area shown in FIG. 14 represents a section at a first elevation through the channel of the forming collar 104, while the hatched area shown in FIG. 15 represents a section at a second elevation through the channel, the second elevation being lower than the first elevation. The relieved portion of the forming collar comprises a groove 105 designed to guide the zipper and slider as the zipper/web assembly moves over the forming collar and down through a gap between the forming collar and the fill tube. The film web is advanced with the string zipper (and mounted slider) folded in a horizontal position against the film web because the zipper, due to its construction, cannot form an arc when it is in a vertical position.

[0049] As seen in FIGS. 14 and 15, the channel is designed to guide the slider and dictate its orientation as it advances in the machine direction. As seen in FIG. 14, the flexible string zipper must be disposed on its side to allow it to bend freely, without opening, as it passes over the forming collar. The channel then gradually turns with decreasing elevation along the fill tube until the slider is generally oriented along a radial line alongside the fill tube. During this transition, the slider is rotated about 90°. FIG. 15 shows the channel 105 at a particular point in the transition. The final positions of the zipper and slider relative to the fill tube are shown in FIG. 16. Where the forming collar 104 ends, the channel 105 continues downward in the form of a retaining guide 72 that encompasses and traps the zipper and slider adjacent the fill tube 106 and constrains the slider to be disposed as shown in FIG. 16. In this particular implementation, the retaining guide 72 comprises a vertical channel that guides the zipper 4 and slider 10 as they progress downward.

[0050] For each of the methods of manufacture disclosed herein, a slider with or without a separating finger can be used. One method for inserting a slider with separating finger or plow onto a string zipper joined to a web was fully disclosed in U.S. Patent Application Serial No. 10/622,996, substantial portions of which are set forth below in a manner that conforms to the scheme of the present disclosure, namely, with reference to FIGS. 17-19.

[0051] Referring to FIG. 17, at the first station after the dancer assembly, the slider (e.g., slider 10 shown in FIG. 2) is inserted onto the zipper-film assembly. The slider insertion station comprises three assemblies (namely, a separator assembly, a pusher assembly and a clamping assembly) that cooperate to insert the slider on the zipper while the zipper is being held open on one side of the slider insertion zone and closed on the other side of the slider insertion zone.

[0052] In accordance with the disclosed embodiment

of the invention shown in FIG. 17, a zippered portion of a folded web 102, comprising a string zipper 4, is pulled through a separator assembly 80. The separator assembly 80 disengages the zipper strips during advancement of the zipper-film assembly, thereby opening the string zipper 4. As best seen in FIG. 17, the separator assembly 80 comprises a central splitter plate 82 separated by gaps from upper (84) and lower (86) guides disposed above and below the splitter plate 82. Only the splitter plate 82 and the upper guide 84 of the separator assembly 80 are visible in FIG. 17. The splitter plate has a pair of mutually parallel grooves (not shown in FIG. 17) on opposite sides thereof, the grooves being aligned with the machine direction. In FIG. 18, the hatched region designated 82 represents a section through the splitter plate along a plane intersecting and parallel to the grooves. The leading edge (not shown) of the portion of the splitter plate between the grooves pries open the advancing interlocked zipper strips. The upper and lower guides 84 and 86 hold the respective separated zipper strips 6 and 8 in the grooves as the zipper strips advance, thereby maintaining the zipper strips in a straight orientation parallel to the machine direction. The upper and lower guides can be separated from the splitter plate to facilitate aligning the zipper in the inserter.

[0053] As the zipper-film assembly is pulled in the machine direction through the bag making machine (by conventional means not shown), the grooves and the upper and lower guides 84, 86 (best seen in FIG. 18) prevent cross-directional wandering of the separated zipper strips 6, 8.

[0054] Referring again to FIG. 17, the pusher assembly 96 comprises a pusher 98 that pushes a slider 10 onto an open section of the zipper in a slider insertion zone. The pusher displacement is driven by an air cylinder 92. The pusher is fixed to a distal end of a rod 94 of a piston slidable inside the cylinder 92. The pusher 98 is alternately extended and retracted by actuation of the air cylinder 92, which has two separate ports (not shown) for intake of compressed air from separately controlled air lines. The pusher 98 travels along a straight tunnel or channel 88, shown in section in FIG. 17. One sidewall of the channel 88 has an opening that communicates with the end of a slider track 90. A succession of sliders 10' are fed periodically along track 90 by a conventional pneumatic slider feeding system (not shown). When the pusher 98 is retracted, the next slider (designated by 10' in FIG. 5) must be automatically fed to a pre-insertion position directly in front of the pusher 98.

[0055] Referring to FIG. 18, upstream and downstream of the slider insertion zone, the zipper strips 6, 8 are clamped by the clamping assembly 140, which comprises a U-shaped upper clamp 142 and a U-shaped lower clamp 144. The upper clamp 142 comprises an upstream arm 146, a downstream arm 148 and a cross member 150 that is connected to and supports arms 146 and 148. [Arms 146 and 148 are shown in section in FIG. 17.] Similarly, the lower clamp 144 comprises an up-

stream arm 152, a downstream arm 154 and a cross member 156 that is connected to and supports arms 152 and 154. Each of the four arms of the clamping assembly has a textured end face to provide additional holding force. A portion of the splitter plate 82 is disposed in the space between the confronting end faces of the upstream clamp arms 146 and 152. The downstream arms 148 and 154 are longer than the upstream arms by roughly one-half the thickness of the splitter plate at the grooves. In the disclosed embodiment, the end faces of the upstream clamp arms 146 and 152 each have a surface comprising a respective plurality of mutually parallel ridges aligned with the cross direction, while the downstream clamp arms 148 and 154 each have a surface comprising a respective plurality of mutually parallel ridges aligned with the machine direction. This upper and lower clamping arrangement fixes the respective positions of the zipper strips at each end of the slider insertion zone. In particular, the cross-directional ridges on the end faces of the upstream clamp arms, in combination with the splitter plate grooves aligned with the machine direction, fix the positions of the separated zipper strips in both directions. Alternatively, the surface of each clamp arm end face may comprise a multiplicity of projections or teeth arranged in a two-dimensional array. For example, such an array of teeth can be formed by providing a lattice of grooves on the end face.

[0056] The upper clamp 142 is moved between retracted and extended positions by an air cylinder 168 mounted on a cylinder mounting block 160. The upper clamp 142 is mounted to the end of a piston rod 166. The cylinder mounting block 160 has a guide channel 158 for guiding the upper clamp 142 during its transit. Similarly, the lower clamp 144 is moved between retracted and extended positions by an air cylinder 172 mounted on a cylinder mounting block 164. The lower clamp 144 is mounted to the end of a piston rod 170. The cylinder mounting block 164 has a guide channel 162 for guiding the lower clamp 144 during its transit. The cylinder mounting blocks 160 and 164 are fixed to a support frame not shown. The same support frame supports the tunnel 88 and the slider track 90 and the cylinder 92 depicted in FIG. 17.

[0057] As best seen in FIG. 18, on the upstream side of the slider insertion zone, the clamp arms 146 and 152 clamp the zipper strips 6 and 8 in the grooves of the splitter plate 82. Due to the thickness of the intervening splitter plate, the section of the zipper near the trailing edge of the splitter plate is clamped in an opened state. Conversely, on the downstream side of the slider insertion zone, the clamp arms 148 and 154 clamp the adjoining section of the zipper closed. Thus, the upper and lower clamps of the clamping assembly 140 serve to stabilize the zipper during slider insertion in the zone between the upstream and downstream arms of the clamps. The zipper strips are held in respective positions such that the slider plow 28 enters the gap between the zipper strips and then the slider sidewalls respectively pass over the zipper strips during slider insertion. The slider is

pushed onto the zipper until the retaining ledges on the slider interior latch under the zipper strips to hold the slider securely on the zipper. The proximity of closed zipper to the closing end of the slider and the presence of open zipper at the opening end of the slider and adjacent the plow facilitates insertion of the slider onto the zipper. In particular, one function of the splitter plate and clamp arrangement is to create a funnel shape with the zipper opening so that the slider plow can project between the zipper strips during insertion.

[0058] The interior surfaces of the arms of the U-shaped clamps can be mutually parallel and separated by a distance slightly greater than the width of the pusher. This enables the interior surfaces of the clamp arms to act as extensions of the sidewalls of the pusher channel. This will provide further confinement and alignment of the slider in the pusher as the pusher extends during slider insertion.

[0059] During the same dwell time that a slider is being inserted, a slider end stop structure is being formed on the zipper at an ultrasonic stamping station (not shown) downstream from the slider insertion zone. This slider end stop structure will be bisected later during cutting by a hot knife (not shown) to form two slider end stops, i.e., the end stop at the zipper fully closed slider park position for one package and the end stop at the zipper fully open slider park position for the next package. The end stop structure is typically formed by an ultrasonic stamping assembly comprising a hom and an anvil (not shown in the drawings). The hom transmits sufficient ultrasound wave energy into the plastic zipper material that the material is fused into a structure (e.g., a vertically extending hump) defined by the surfaces of the hom and anvil. The hom and anvil may be of the reciprocating or rotary variety.

[0060] The separator assembly 80 comprises a central splitter plate 82 having a pair of grooves or channels formed on either side thereof that guide the respective zipper strips as the neck (the hatched strip in FIG. 18) between the grooves pries the moving zipper strips apart. The splitter plate 82 may have parallel sides or may taper linearly from the neck to the distal edge thereof. As previously described, the separator assembly further comprises an upper guide 84 and a lower guide 86, which are positioned on opposing sides of the splitter plate 82 with respective gaps therebetween for passage of the respective walls of the film web. The upper and lower guides 84 and 86 hold the respective zipper strips in the respective grooves formed in the splitter plate 82. Thus, as the zipper-film assembly is pulled through the bag making machine, the splitter plate 82 will pry open successive package-length sections of zipper during successive zipper-film advancements, assuming that each advance is equal to one package length.

[0061] As previously mentioned, the extension and retraction of the pusher 98, the upper clamp 142 and the lower clamp 144 are achieved in the disclosed embodiment by means of respective air cylinders 92, 168 and

172, generally represented in FIG. 19. Alternatively, hydraulic cylinders could be used. Operation of the cylinders is controlled by a programmable controller 180, which selectively activates the supply of fluid to the cylinders in accordance with an algorithm or logical sequence. The controller may also take the form of a computer or a processor having associated memory that stores a computer program for operating the machine. The controller 180 is programmed to actuate the cylinders in the following order: first, cylinders 168 and 172 are actuated to extend the clamps 142 and 144; then the cylinder 92 is actuated to extend the pusher 98. These operations are performed during a dwell time, i.e., while the zipper is stationary. After each dwell time, the zipper is advanced (with or without attached bag making film) by a conventional zipper advancement mechanism 184 that is also controlled by the controller 180. In the case where bag making film is attached to the zipper, the zipper advancement mechanism may comprise drive rollers that pull the film forward. During zipper advancement, the controller 180 may also activate a slider feeding mechanism 182, causing the next slider in line to be moved to a pre-insertion position on the pusher.

[0062] A person skilled in the art of machinery design will readily appreciate that displacing means other than cylinders can be used to displace the clamps and the pusher. Any other known mechanical displacement means can be used. For the sake of illustration, such mechanical displacement devices include a rack and pinion arrangement, rotation of the pinion being driven by an electric motor, or a linear actuator with ball screw driven by an electric motor.

[0063] While the disclosed embodiments make reclosable bags using thermoplastic film, the continuous web of bag making material fed to the VFFS machine can be implemented in a wide variety of ways. It can be constituted merely by a single film of thermoplastic material, or by a composite film of thermoplastic material, i.e. a film built up by juxtaposing layers of different kinds.

[0064] As used in the claims, the verb "joined" means fused, bonded, sealed, adhered, etc., whether by application of heat and/or pressure, application of ultrasonic energy, application of a layer of adhesive material or bonding agent, interposition of an adhesive or bonding strip, etc. As used in the claims, the term "string zipper" means a zipper comprising two interlockable strips that have substantially no flange or fin portions. As used in the claims, the terms "upstream" and "downstream" refer to the relationship of various positions along a process pathway traveled by an advancing web of flexible material. As a portion of the web advances, it moves "downstream", whereas work stations already passed by that portion of the web are said to lie "upstream" of the present location of the web portion. Stations that perform work on the web material before it reaches the tube of a VFFS machine are said to be "upstream of the tube".

Claims

and second portions of said web material are at or near respective lateral edges of said web material.

1. A method of manufacture comprising the following steps:
 - (a) guiding a web material in a machine direction through a vertical form-fill-seal (VFFS) machine with a portion or portions of said web material being wrapped around a tube; 5
 - (b) joining first and second flangeless zipper strips to first and second portions of said web material that do not form part of said portion or portions of said web material that are wrapped around a fill tube of said VFFS machine; 10
 - (c) inserting a slider on said first and second flangeless zipper strips joined to said web material; 15
 - (d) cross sealing said web material at a location downstream from said fill tube; and
 - (e) dropping product through said fill tube and onto the most recently formed cross seal. 20
2. The method as recited in claim 1, wherein steps (b) and (c) are performed at stations upstream of said tube, further comprising the step of guiding said slider in a channel in a forming collar of said VFFS machine as said web material advances. 25
3. The method as recited in claim 1, wherein steps (b) and (c) are performed at stations adjacent said tube. 30
4. The method as recited in claim 1, wherein step (b) is performed at stations upstream of said tube and step (c) is performed at a station adjacent said tube. 35
5. The method as recited in claim 1, wherein said first flangeless zipper strip is joined to said web material at a station upstream of said tube and said second flangeless zipper strip is joined to said web material at a station adjacent said tube. 40
6. The method as recited in claim 3, further comprising the steps of:
 - guiding a portion of said web material to form a loop, said looped portion comprising said first and second portions to which said first and second flangeless zipper strips are respectively joined; 45
 - aligning said first and second flangeless zipper strips with each other; and 50
 - guiding said first and second flangeless zipper strips to positions whereat said aligned first and second flangeless zipper strips are disposed between said first and second portions of said web material. 55
7. The method as recited in claim 1, wherein said first

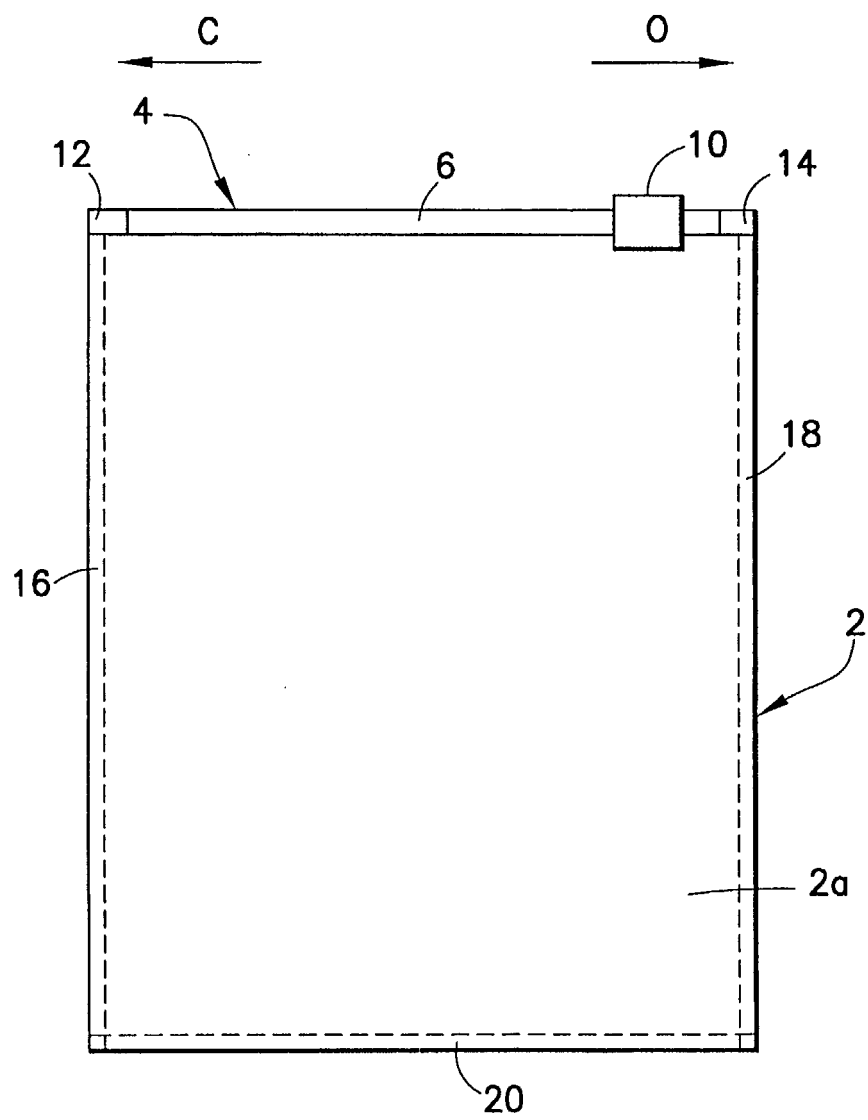


FIG.1

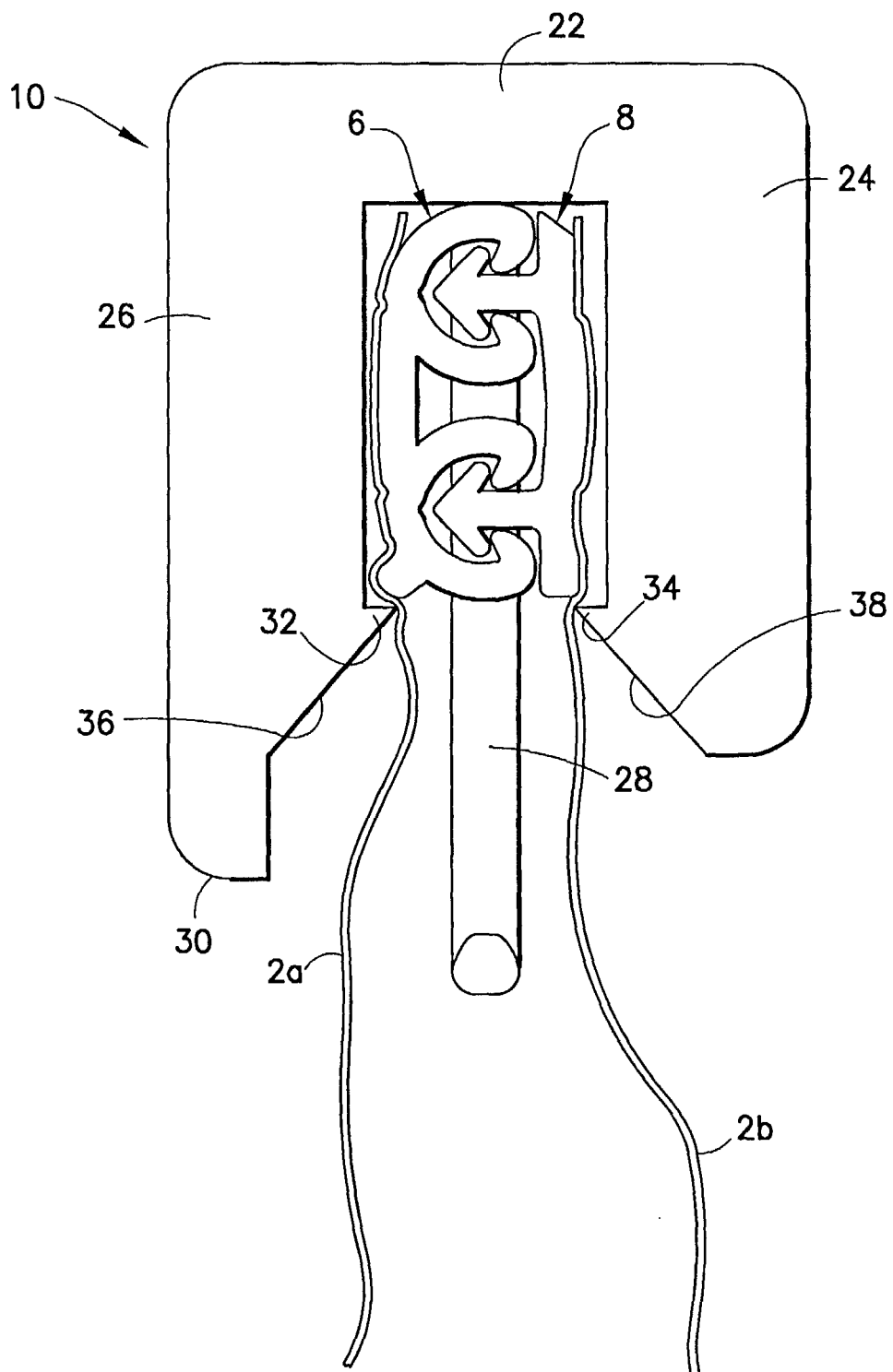


FIG.2

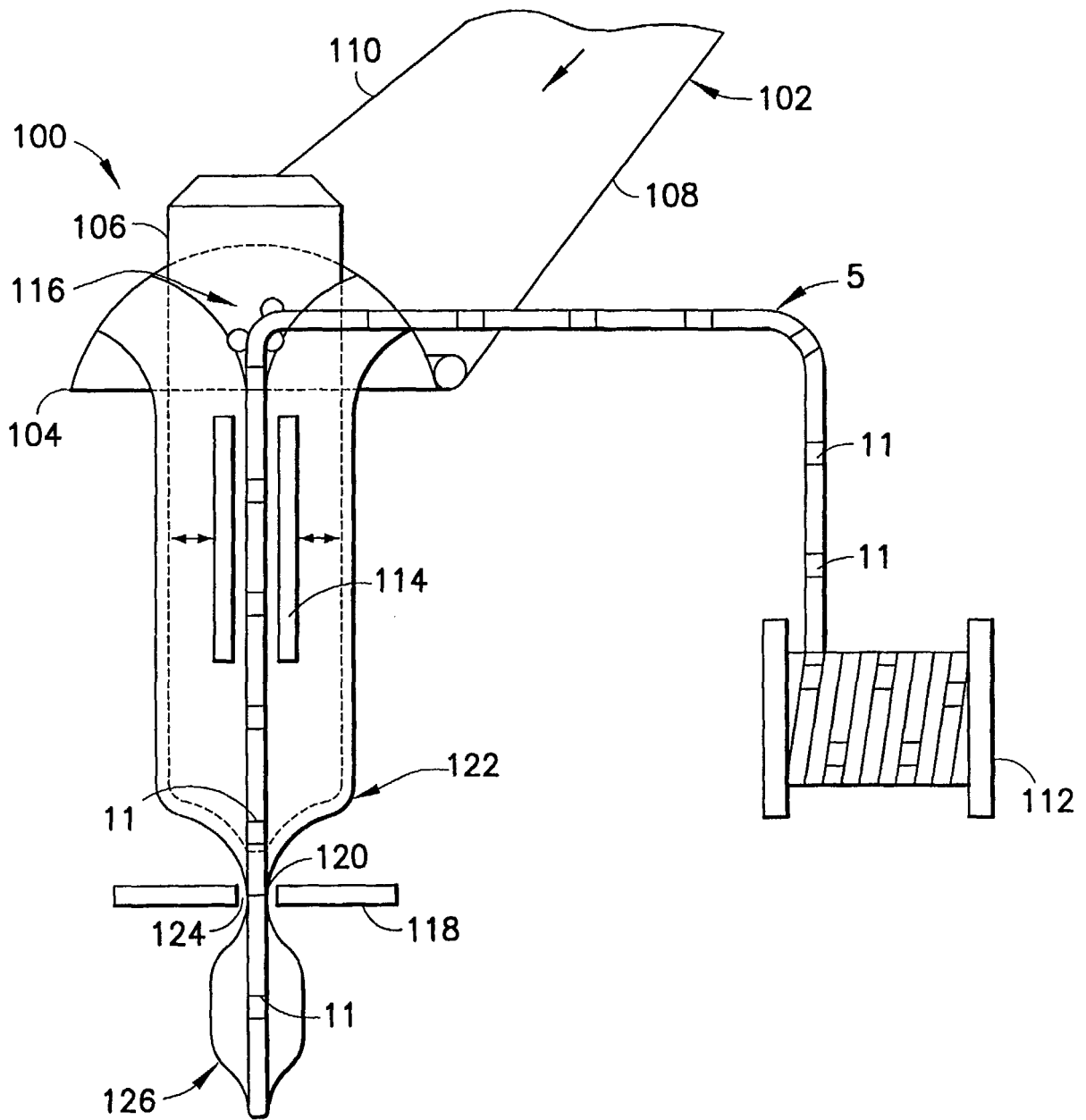


FIG.3
PRIOR ART

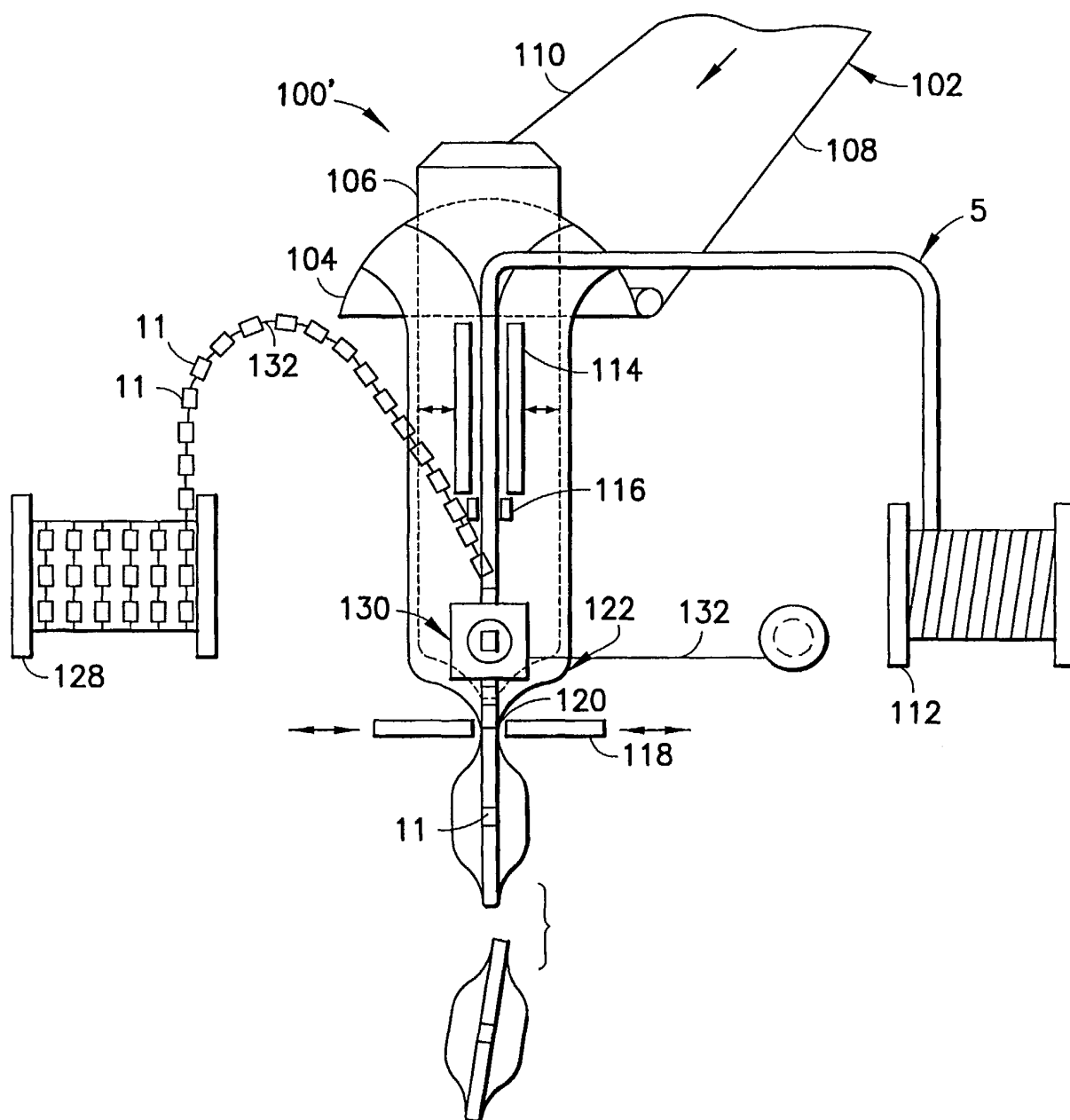


FIG. 4
PRIOR ART

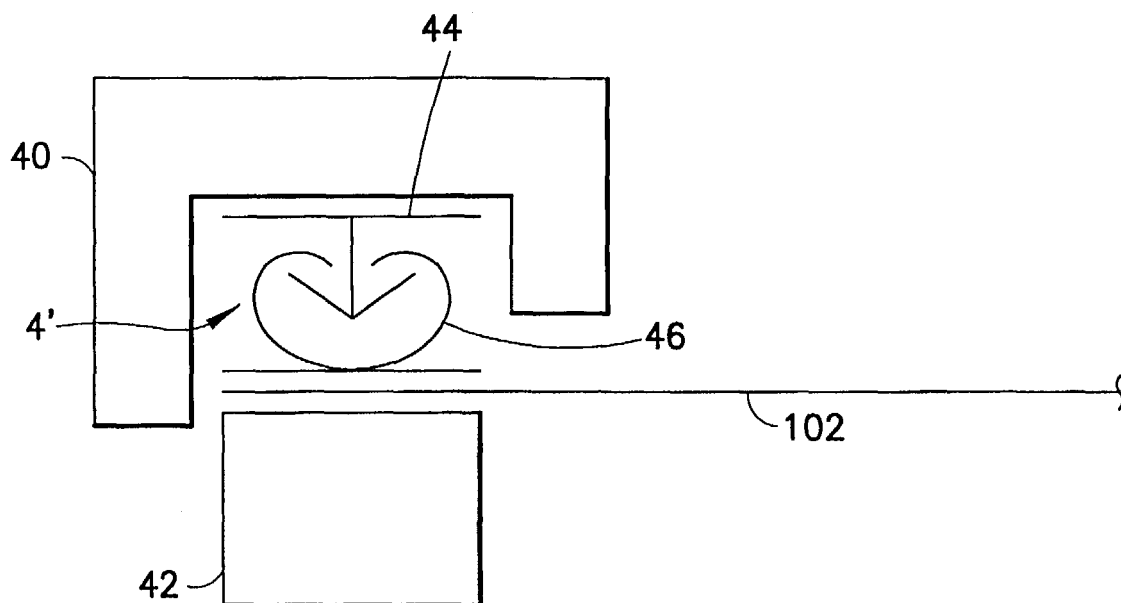


FIG. 5

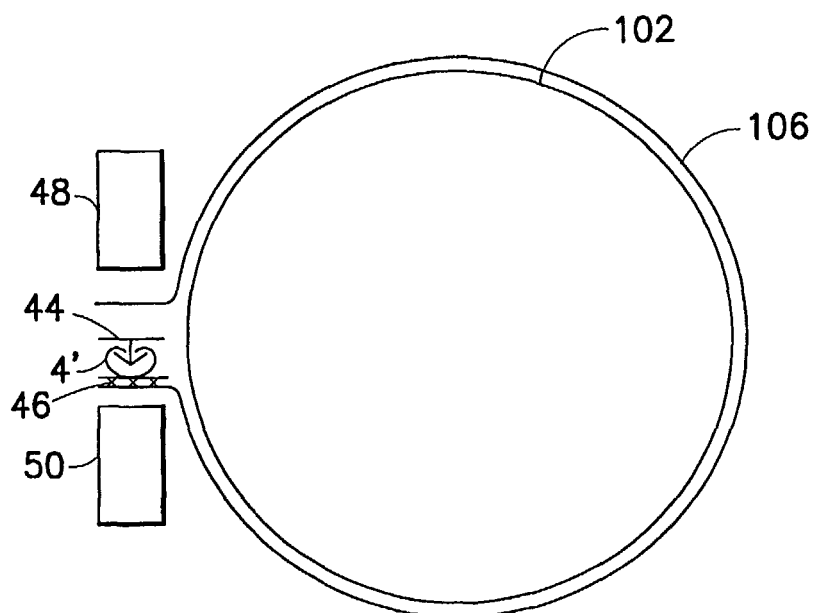
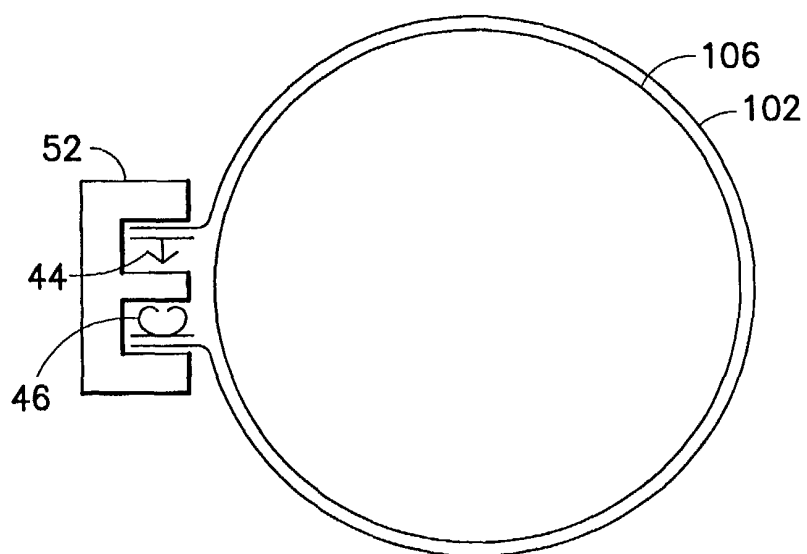
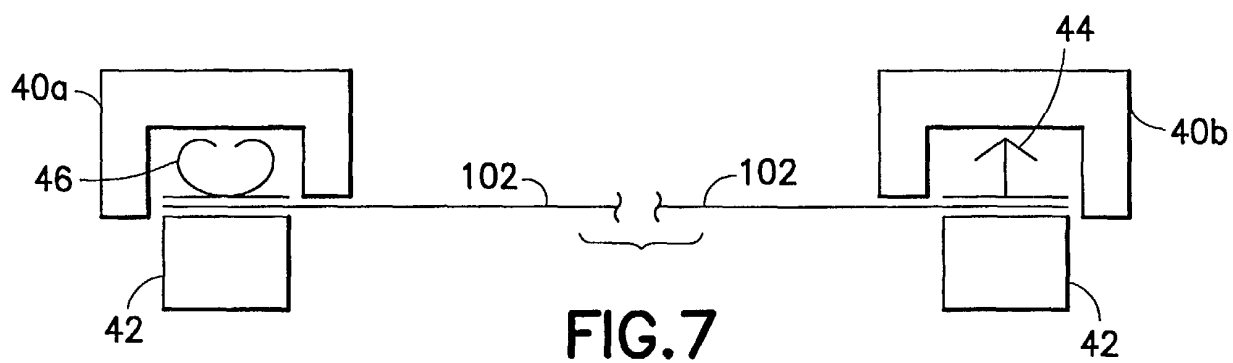


FIG. 6



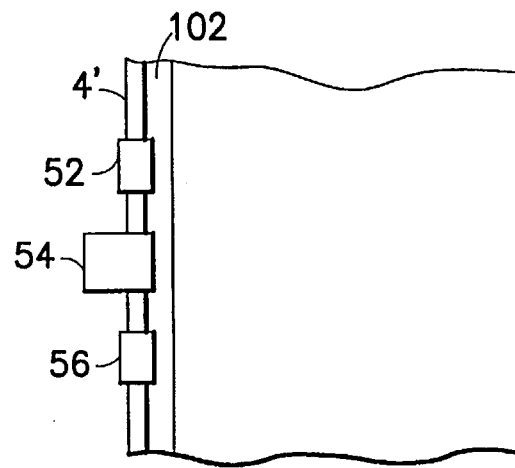


FIG. 9

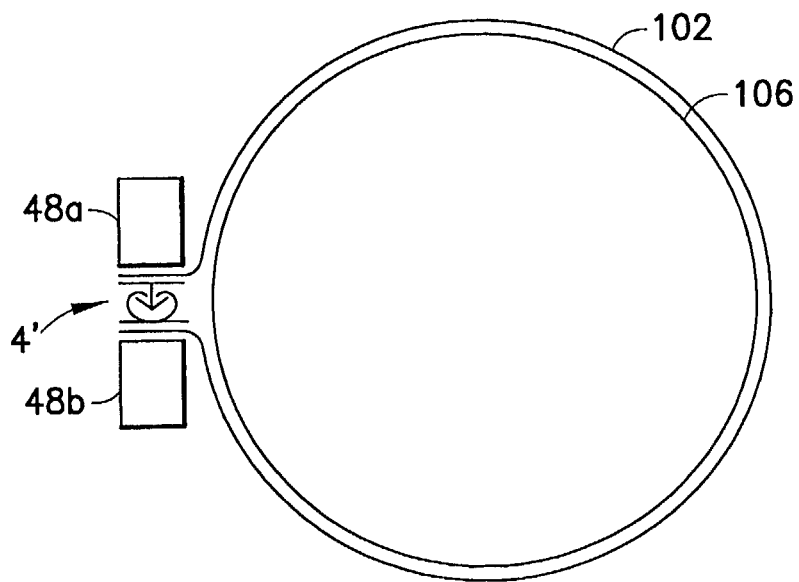


FIG. 10

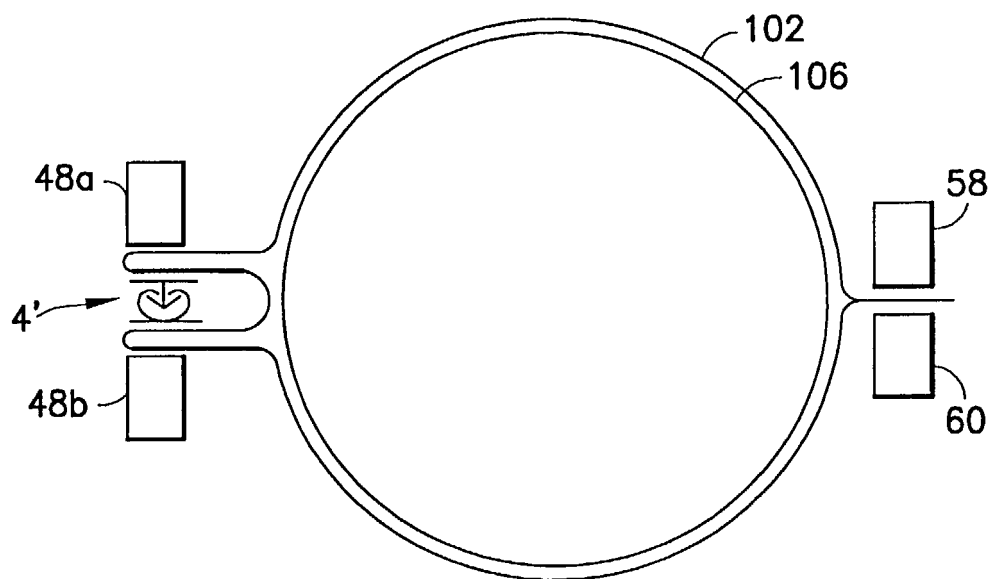


FIG.11

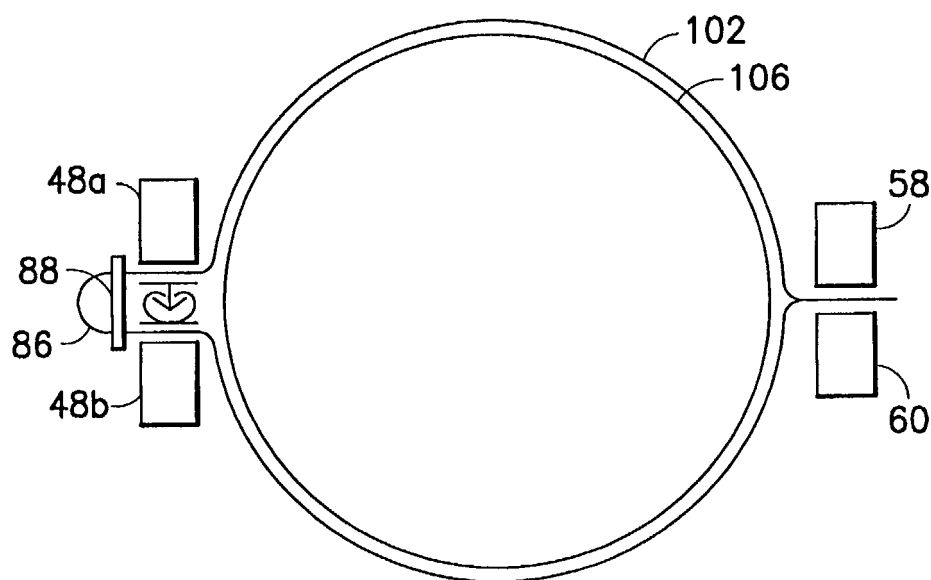


FIG.12

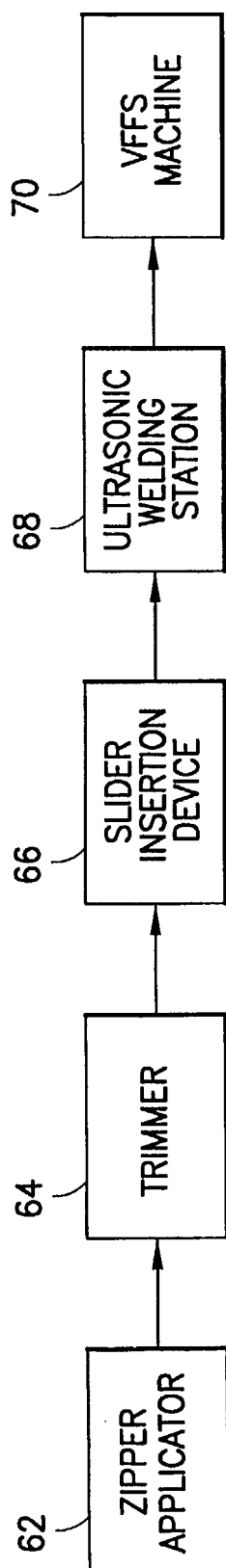


FIG.13

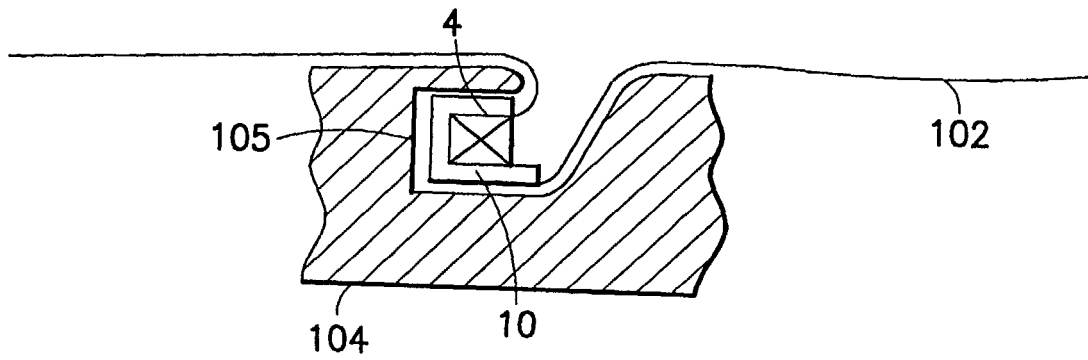


FIG. 14

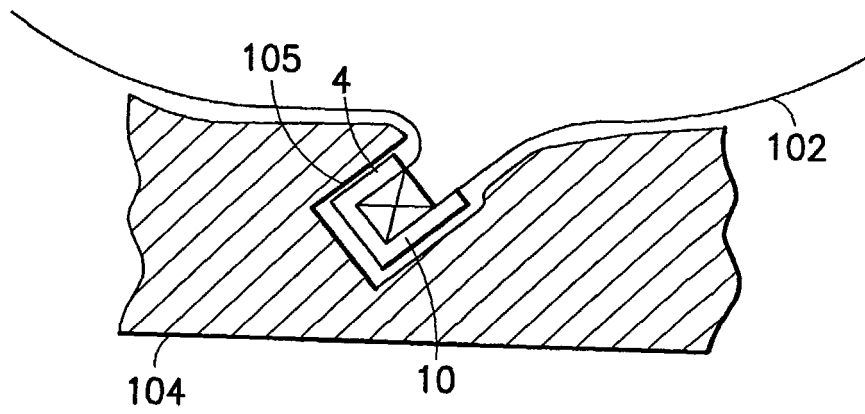


FIG. 15

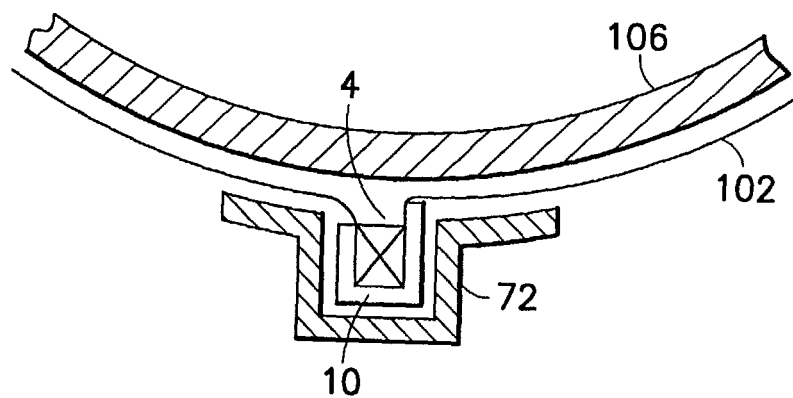
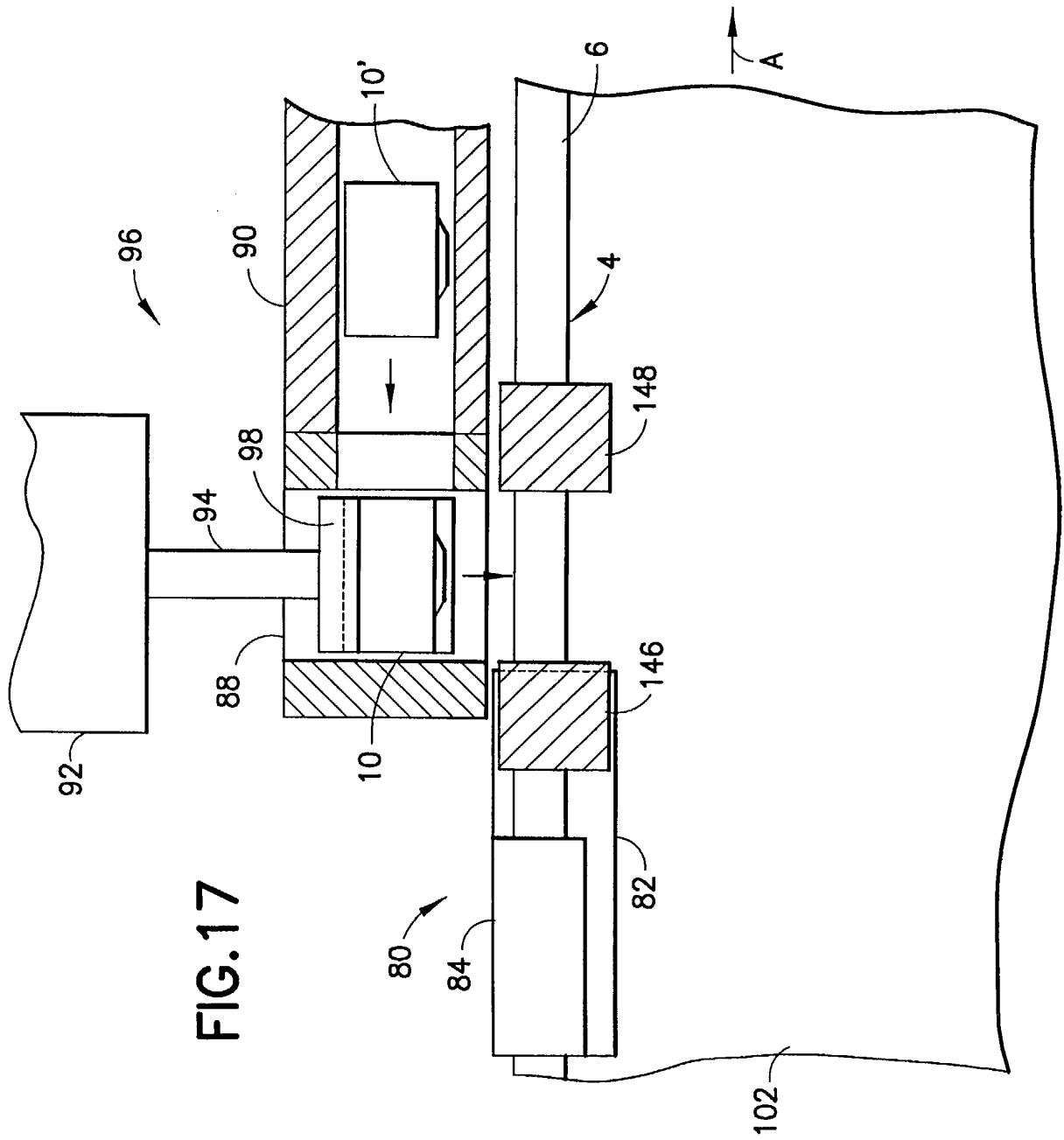


FIG. 16



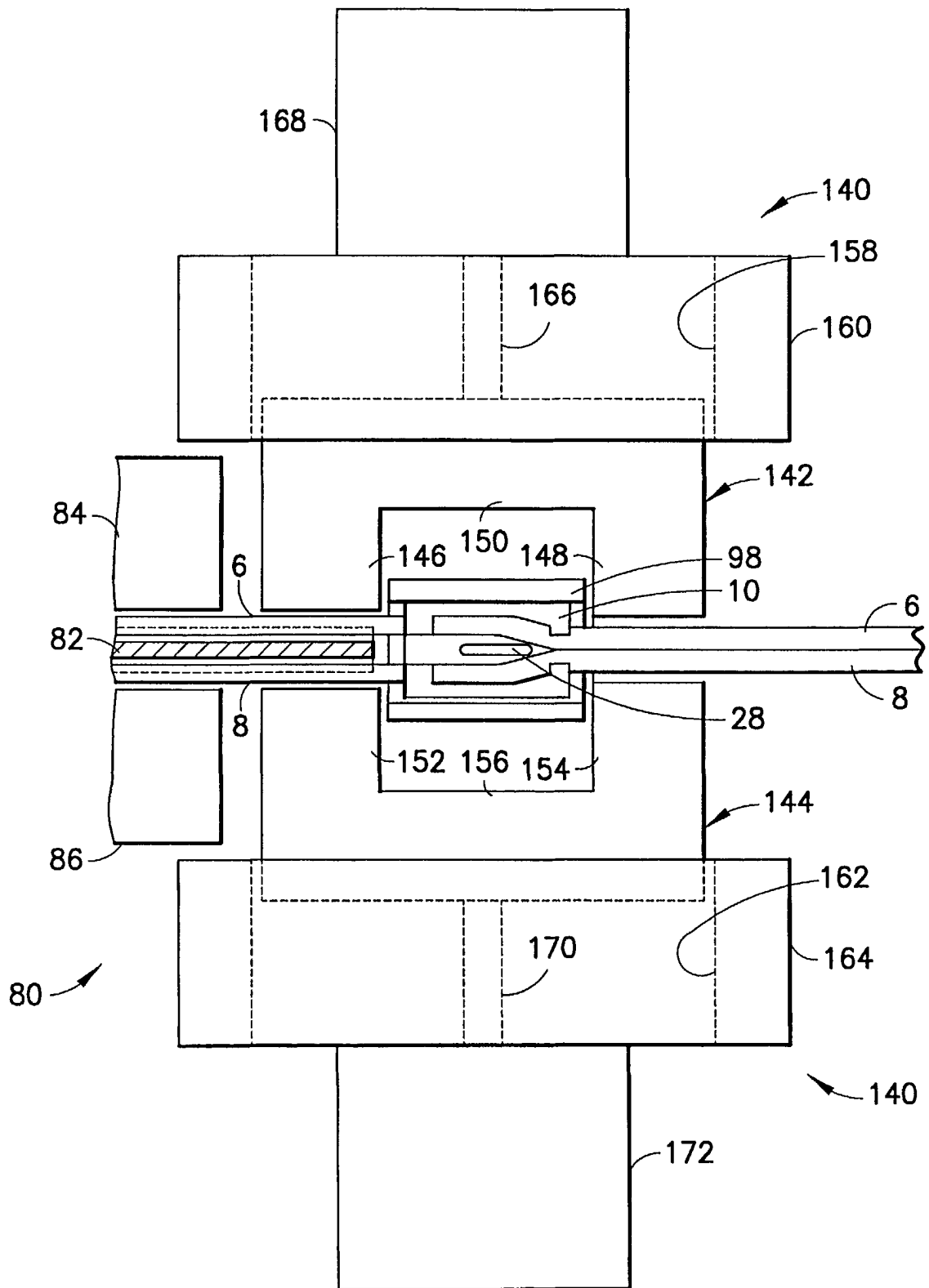


FIG.18

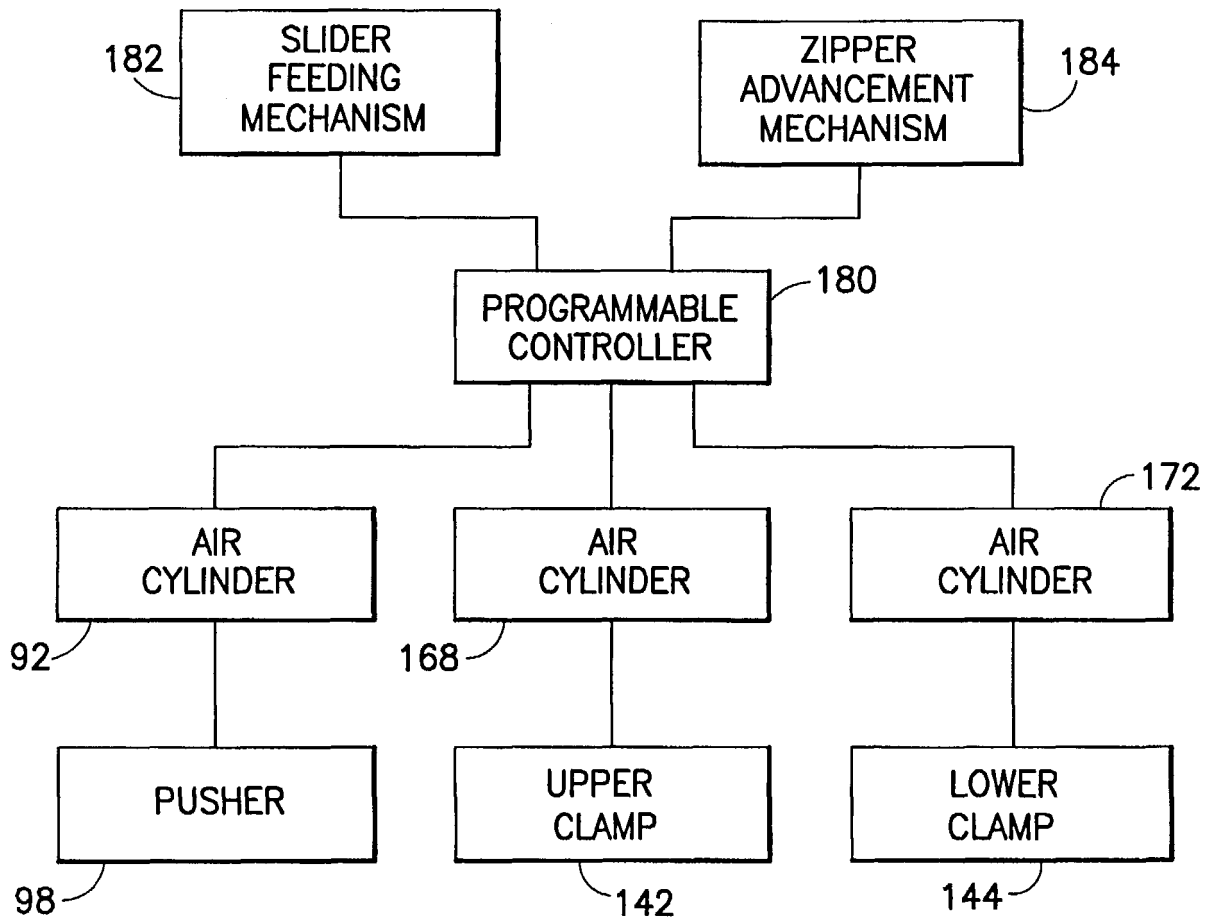


FIG.19