



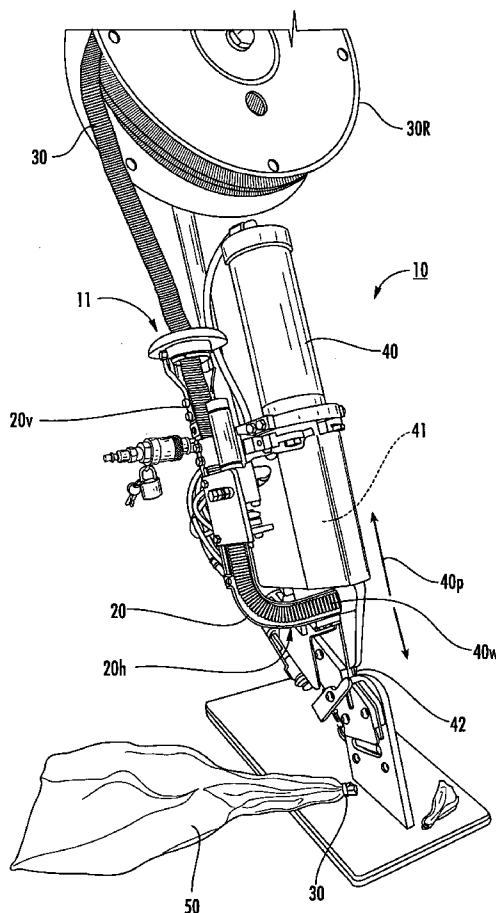
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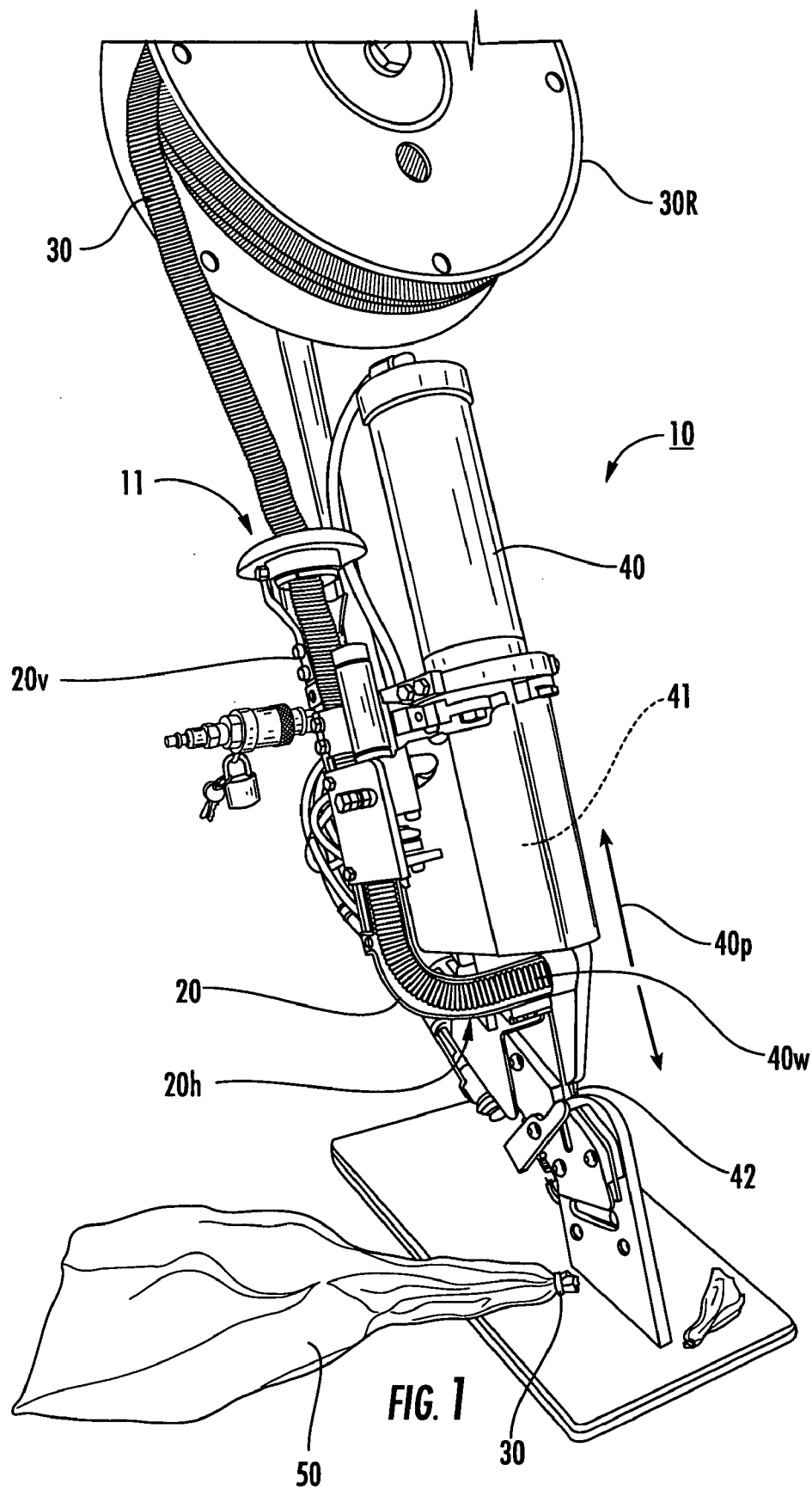
(19) **United States**(12) **Patent Application Publication****Gupton et al.**(10) **Pub. No.: US 2006/0075722 A1**(43) **Pub. Date: Apr. 13, 2006**(54) **CLIPPERS CONFIGURED TO OPERATE
WITH ELASTOMERIC CLIPS, ASSOCIATED
METHODS, SYSTEMS AND COMPUTER
PROGRAM PRODUCTS**(52) **U.S. Cl. 53/417; 53/138.4**(75) Inventors: **David Gupton**, Wake Forest, NC (US);
Greg Gorman, Clayton, NC (US)(57) **ABSTRACT**

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RALEIGH, NC 27627 (US)**(73) Assignee: **Delaware Capital Formation, Inc.**(21) Appl. No.: **11/256,809**(22) Filed: **Oct. 24, 2005****Related U.S. Application Data**(60) Provisional application No. 60/621,703, filed on Oct.
25, 2004.**Publication Classification**(51) **Int. Cl.**
B65B 51/04 (2006.01)

Methods, systems, apparatus and computer program products for applying a non-metallic clip to a target package in an automated or semi-automated manner include: (a) directing a plurality of non-metallic clips, each respective clip having a unitary body with a crown and spaced apart first and second legs, to travel in a clip travel path having a forward direction that merges into a punch path; (b) punching a non-metallic clip in the punch path so that the first and second legs thereof span opposing sides of a trailing and/or leading edge portion of a target package; then (c) deforming the clip so that the leading edge portions of the legs reside proximate each other about the trailing and/or leading edge portion of the target package to thereby close the clip about the target package. The non-metallic clips can be provided as integral elastomeric clip magazines and devices with clip rails configured to hold the elastomeric clips are described.





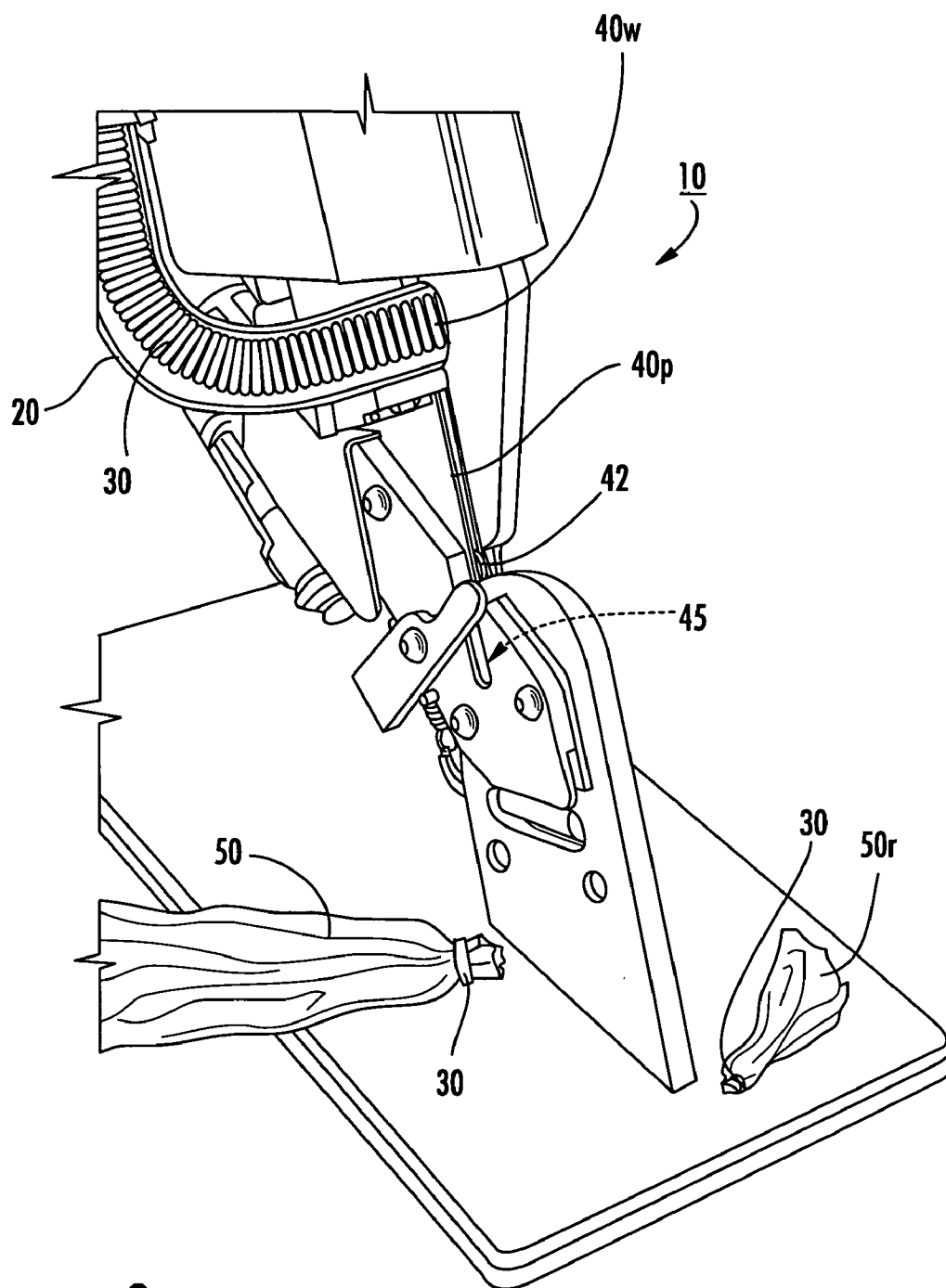


FIG. 2

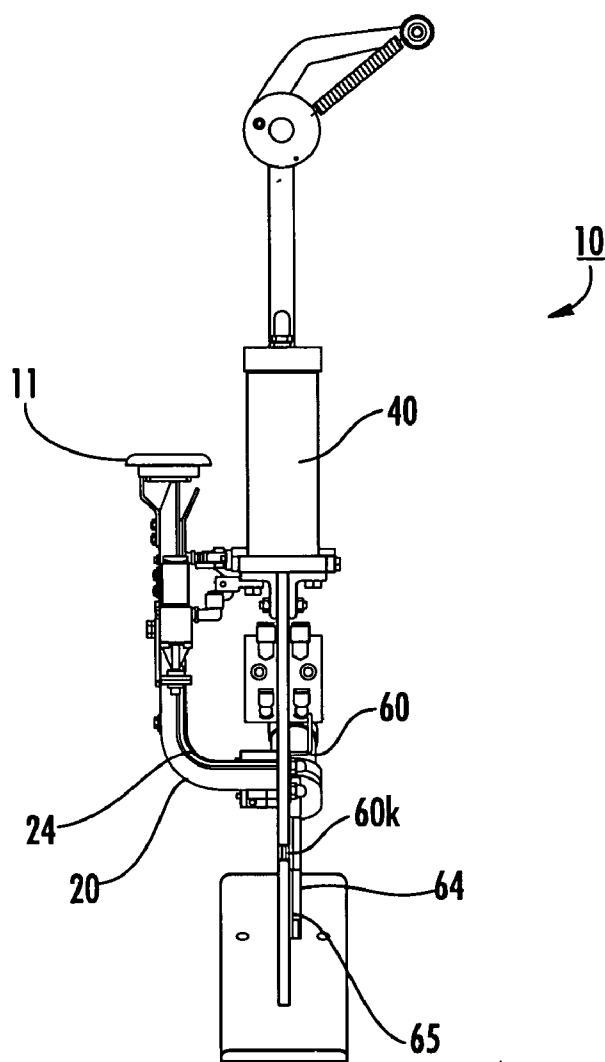


FIG. 3A

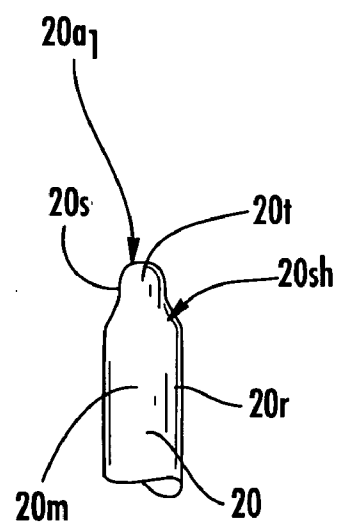


FIG. 3B

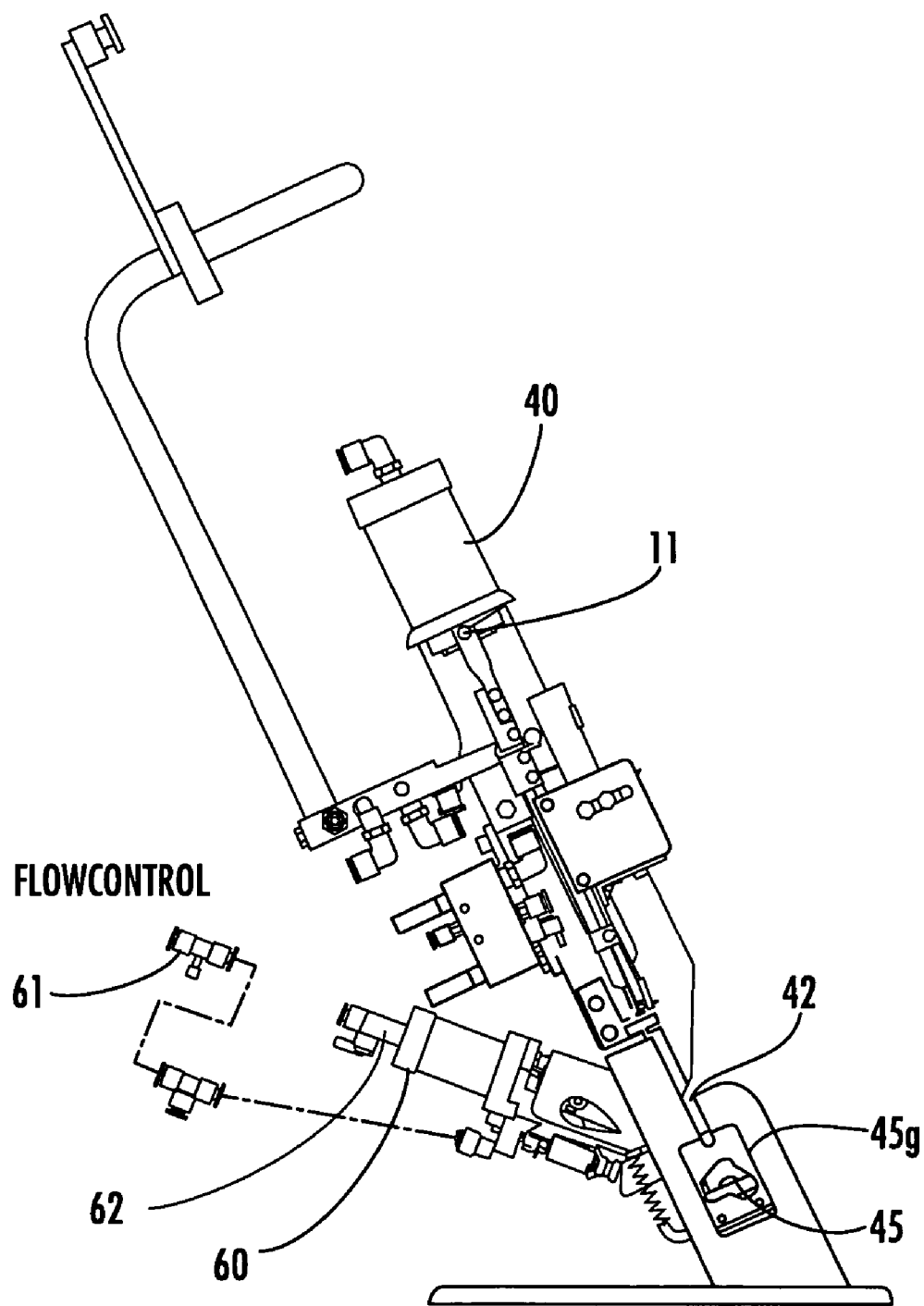


FIG. 4

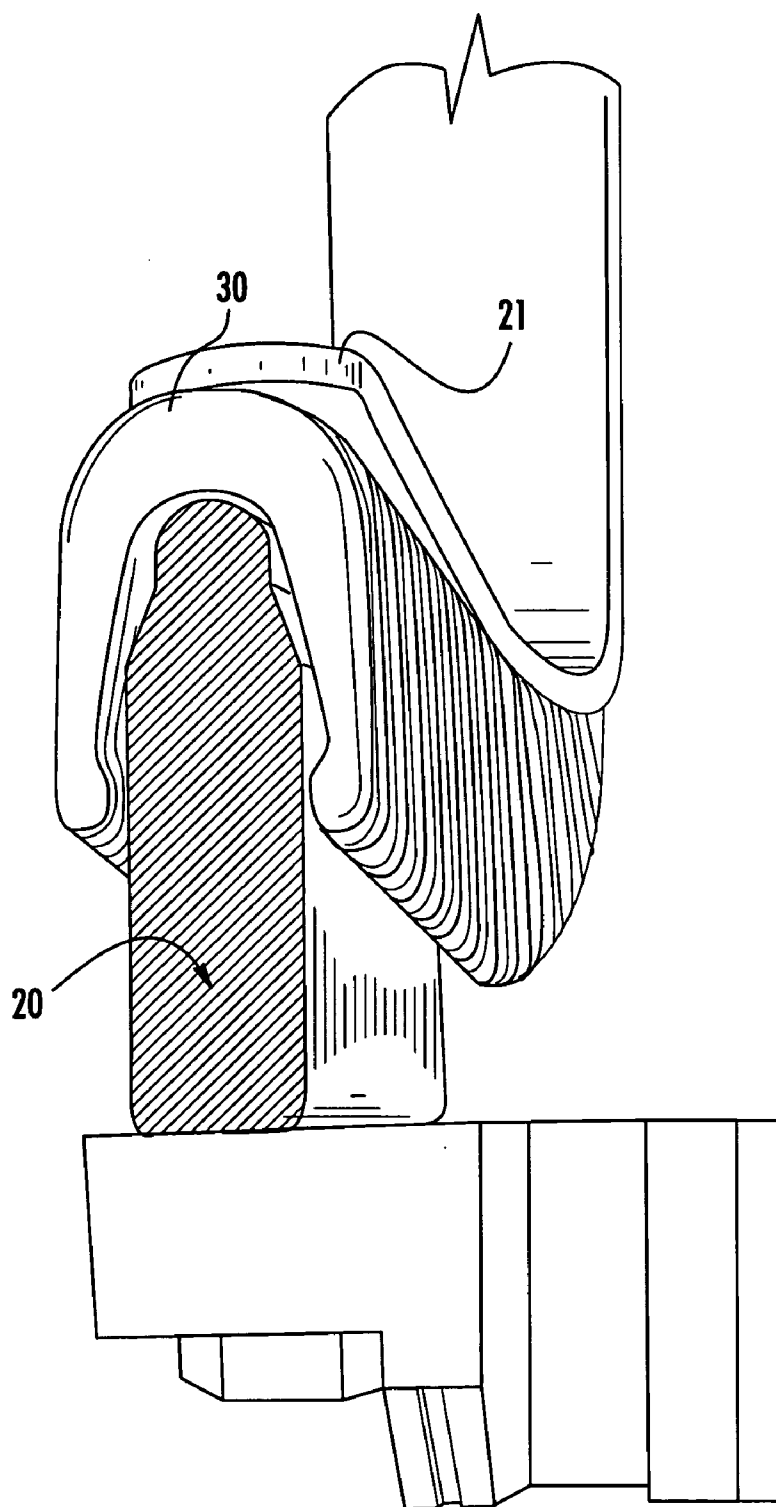


FIG. 5A

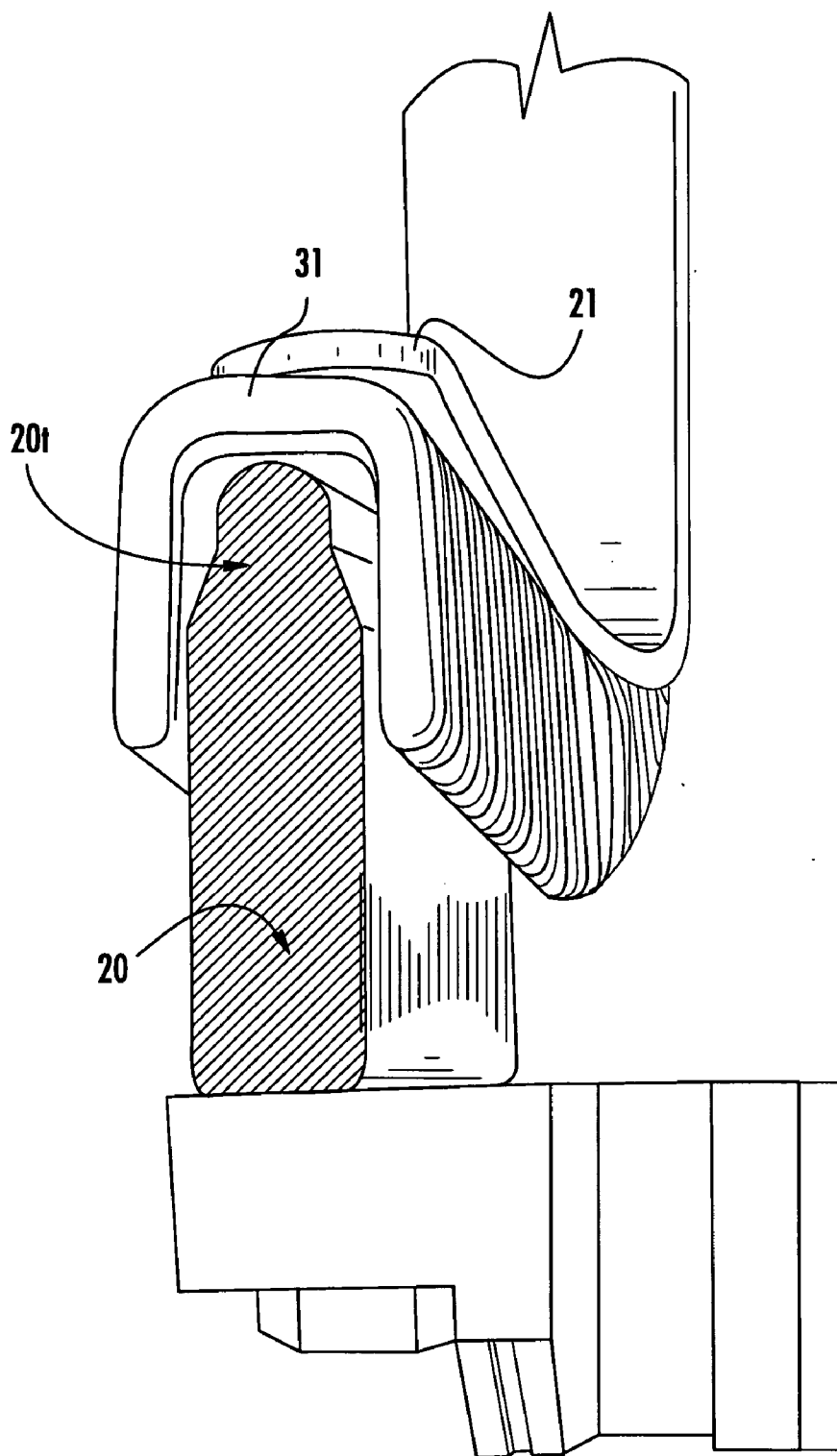


FIG. 5B

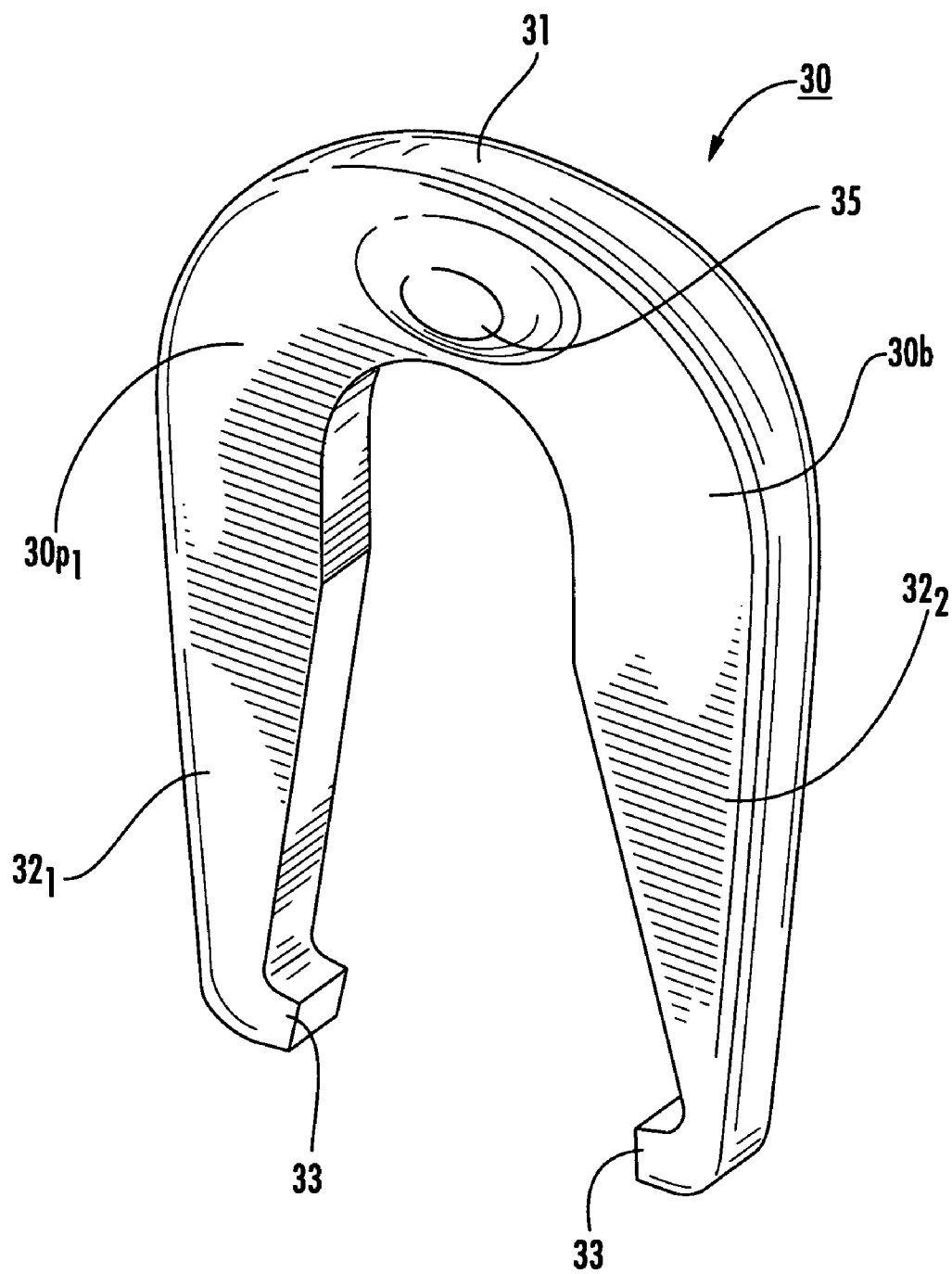
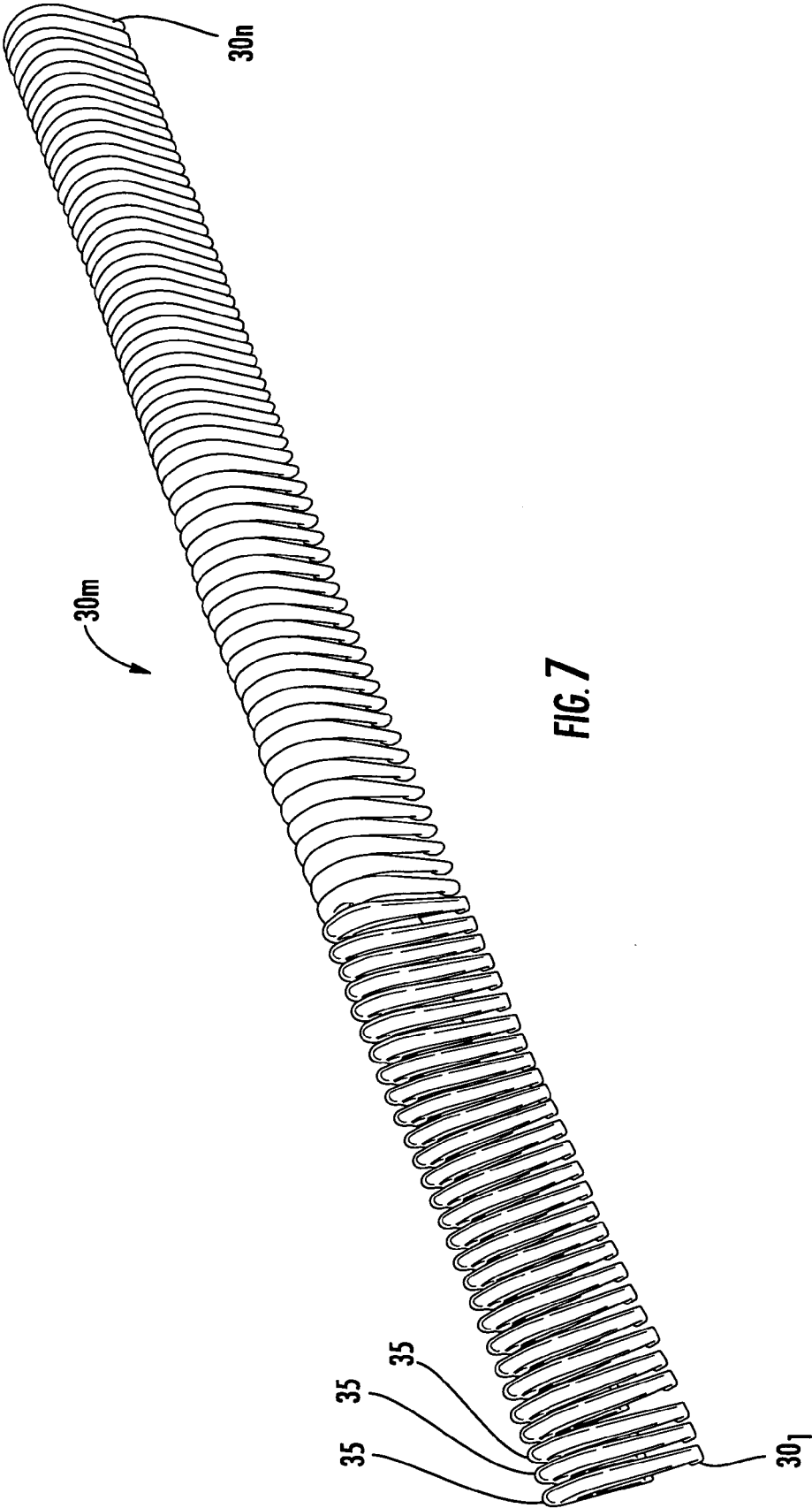


FIG. 6



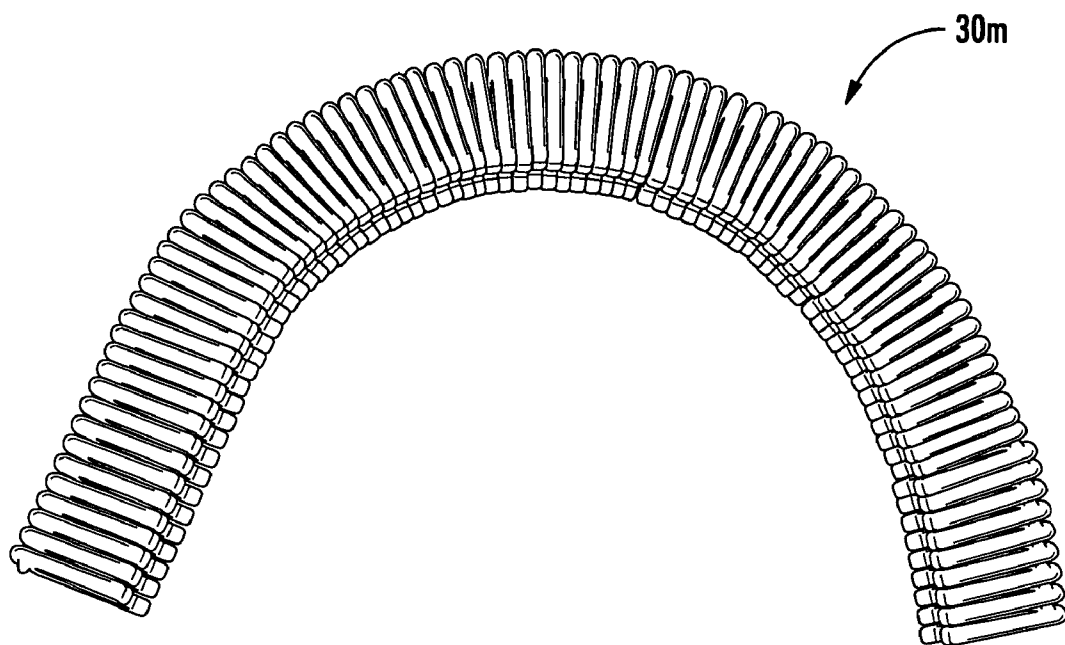


FIG. 8

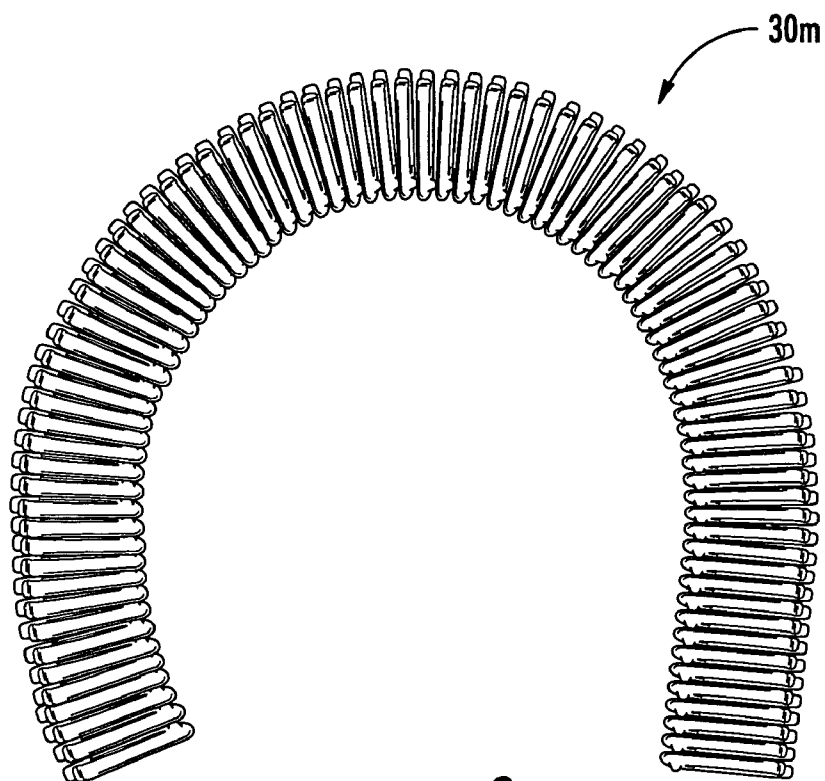


FIG. 9

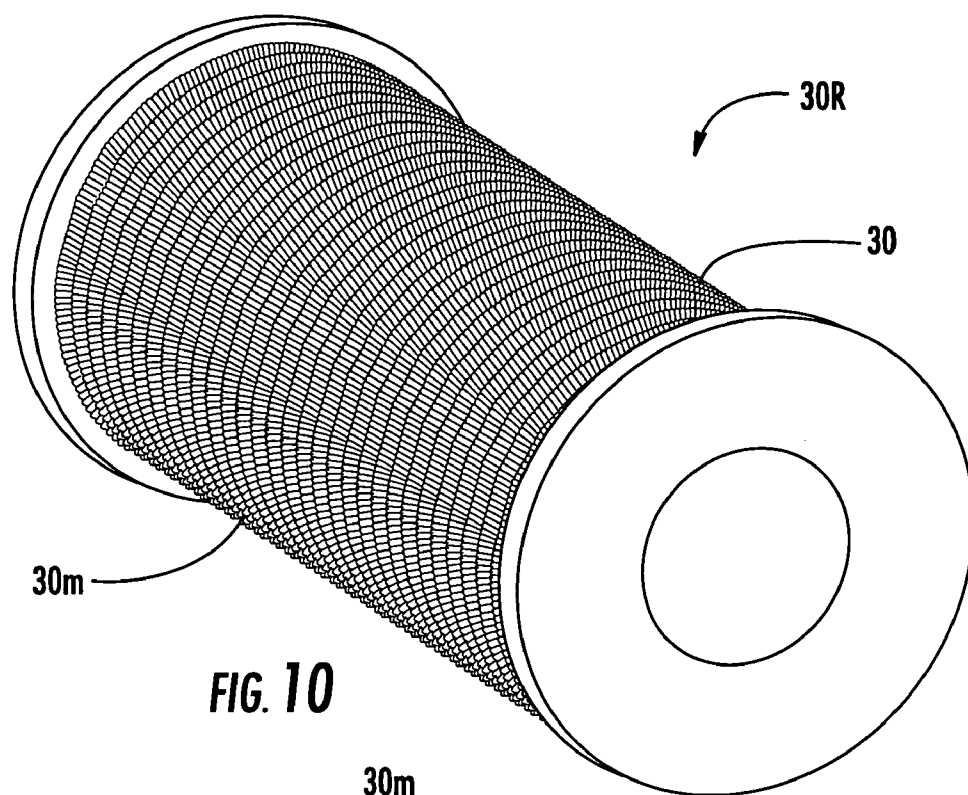


FIG. 10

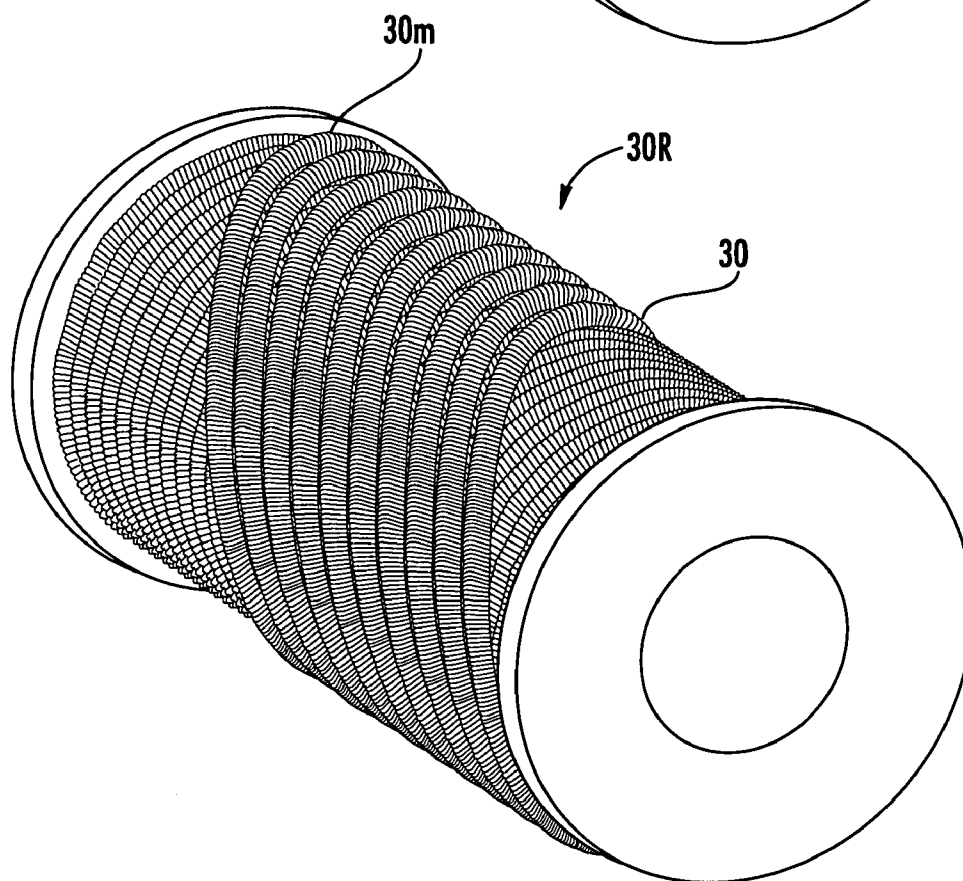


FIG. 11

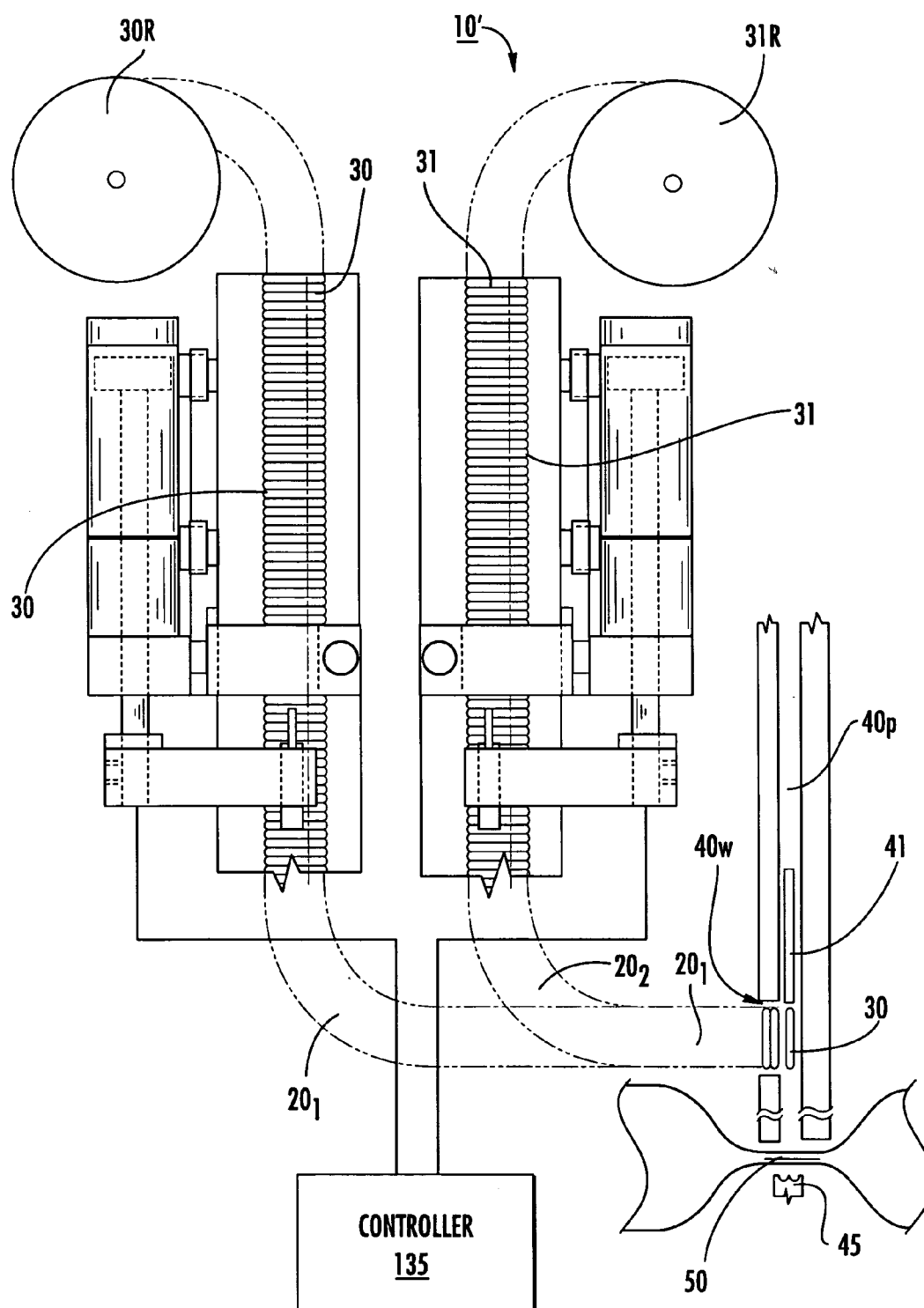


FIG. 12

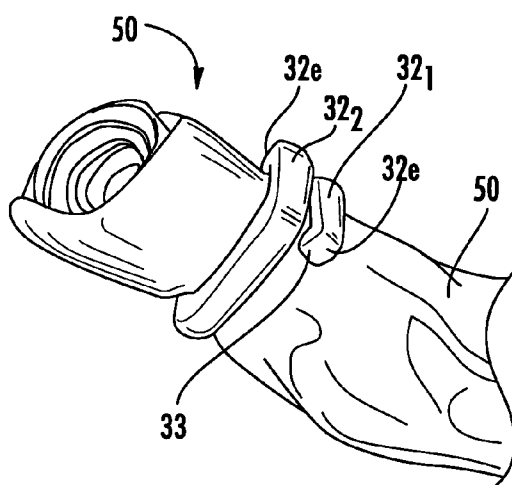


FIG. 13A

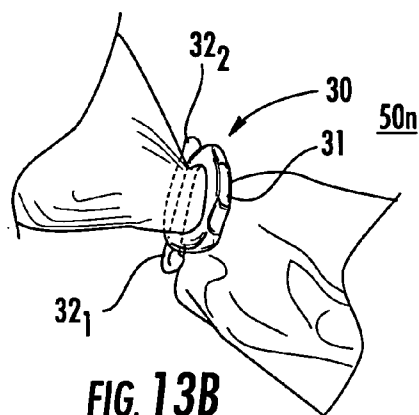


FIG. 13B

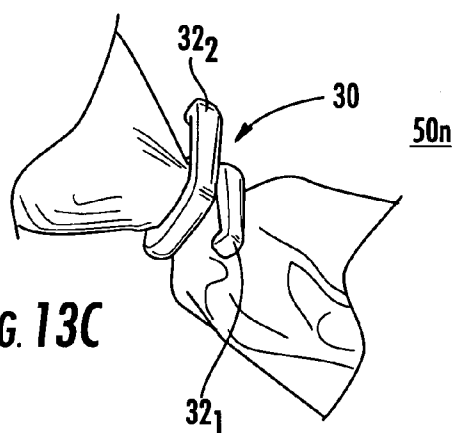


FIG. 13C

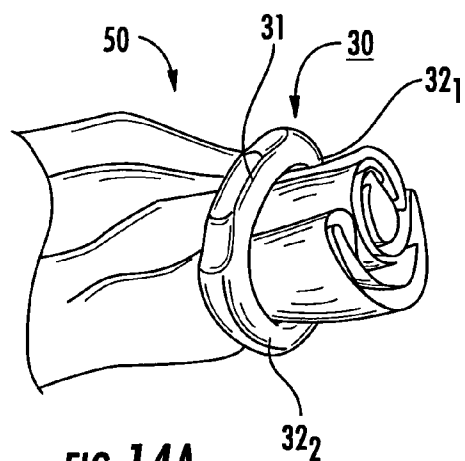


FIG. 14A

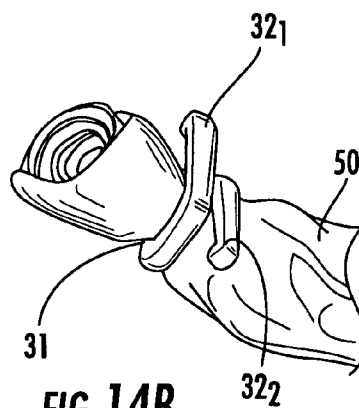
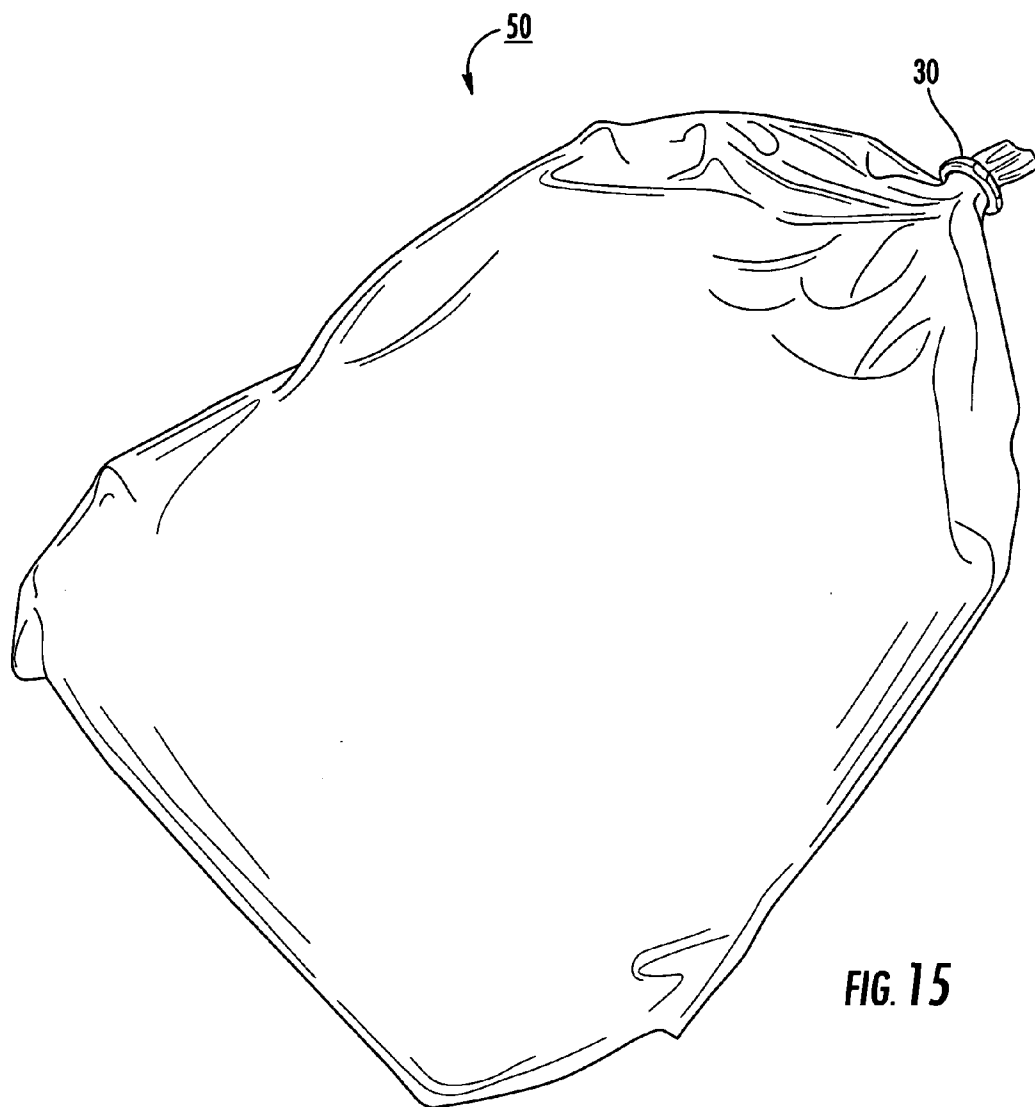
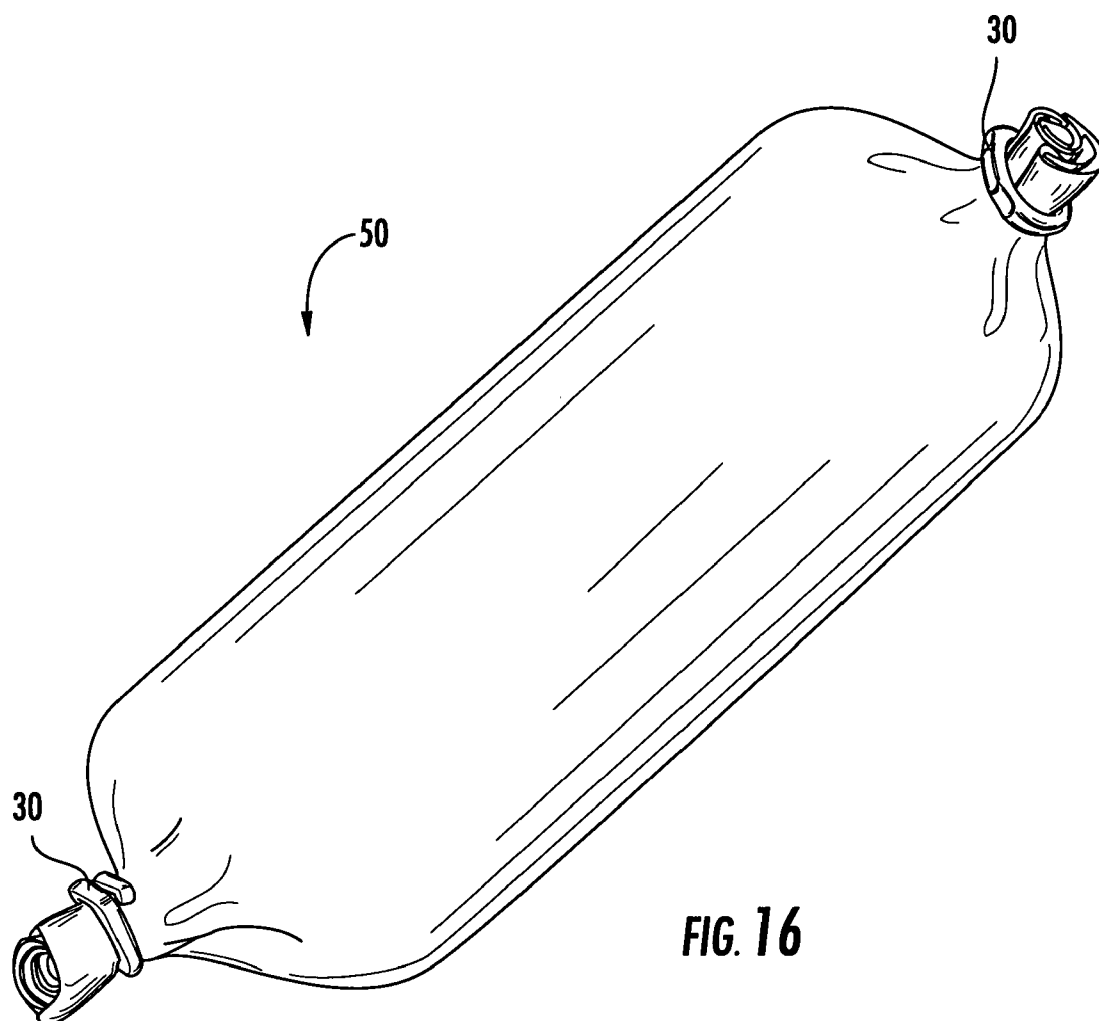


FIG. 14B





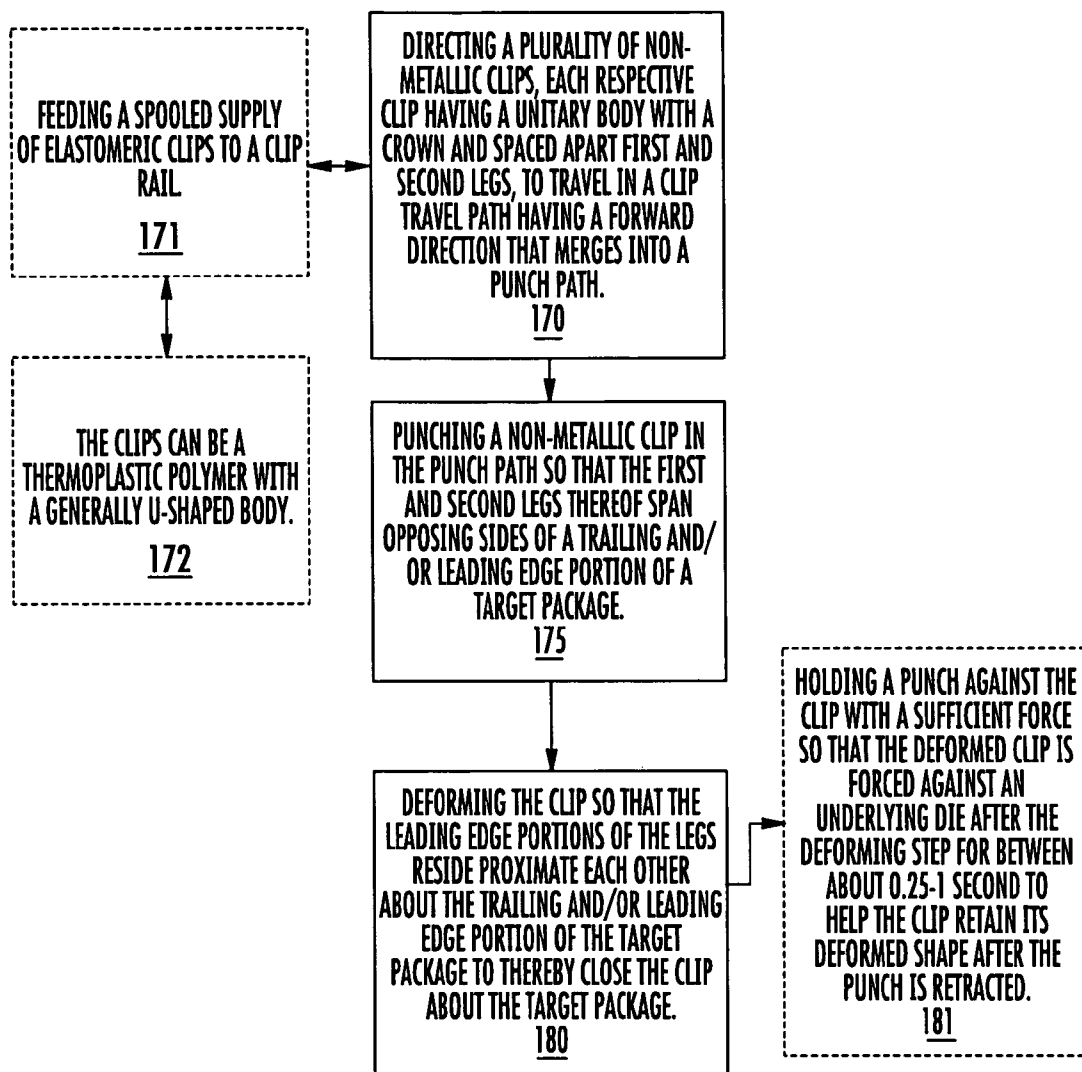
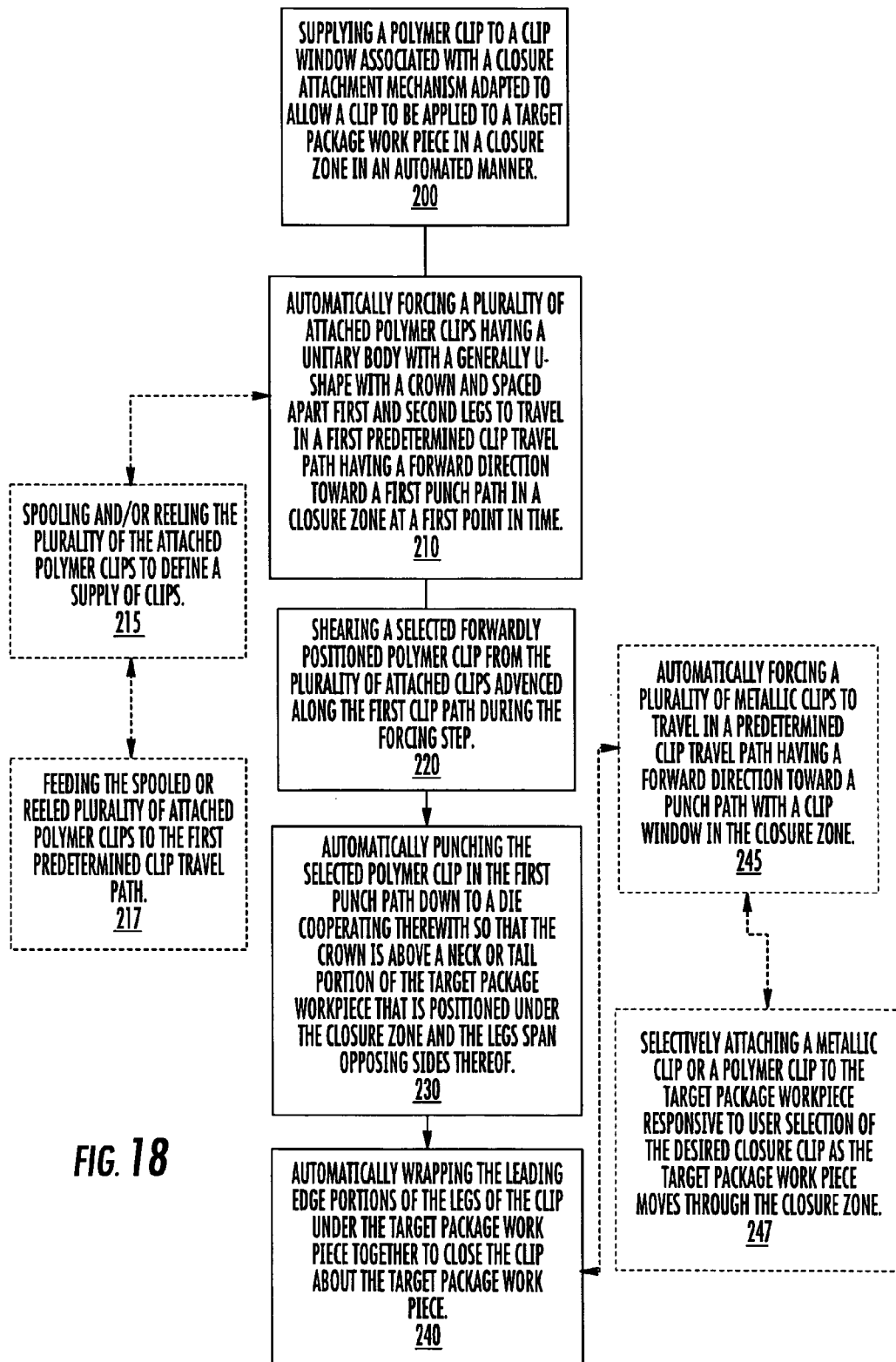


FIG. 17



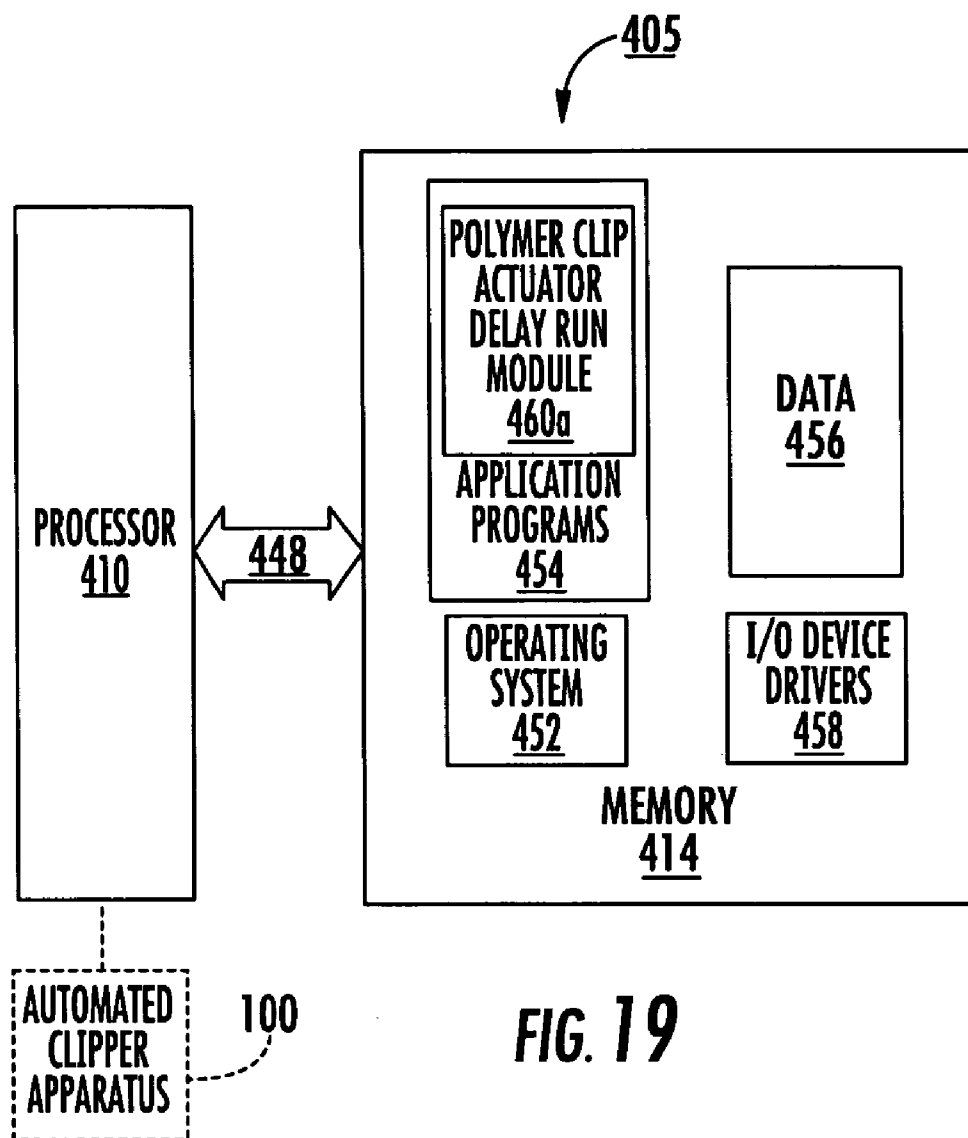


FIG. 19

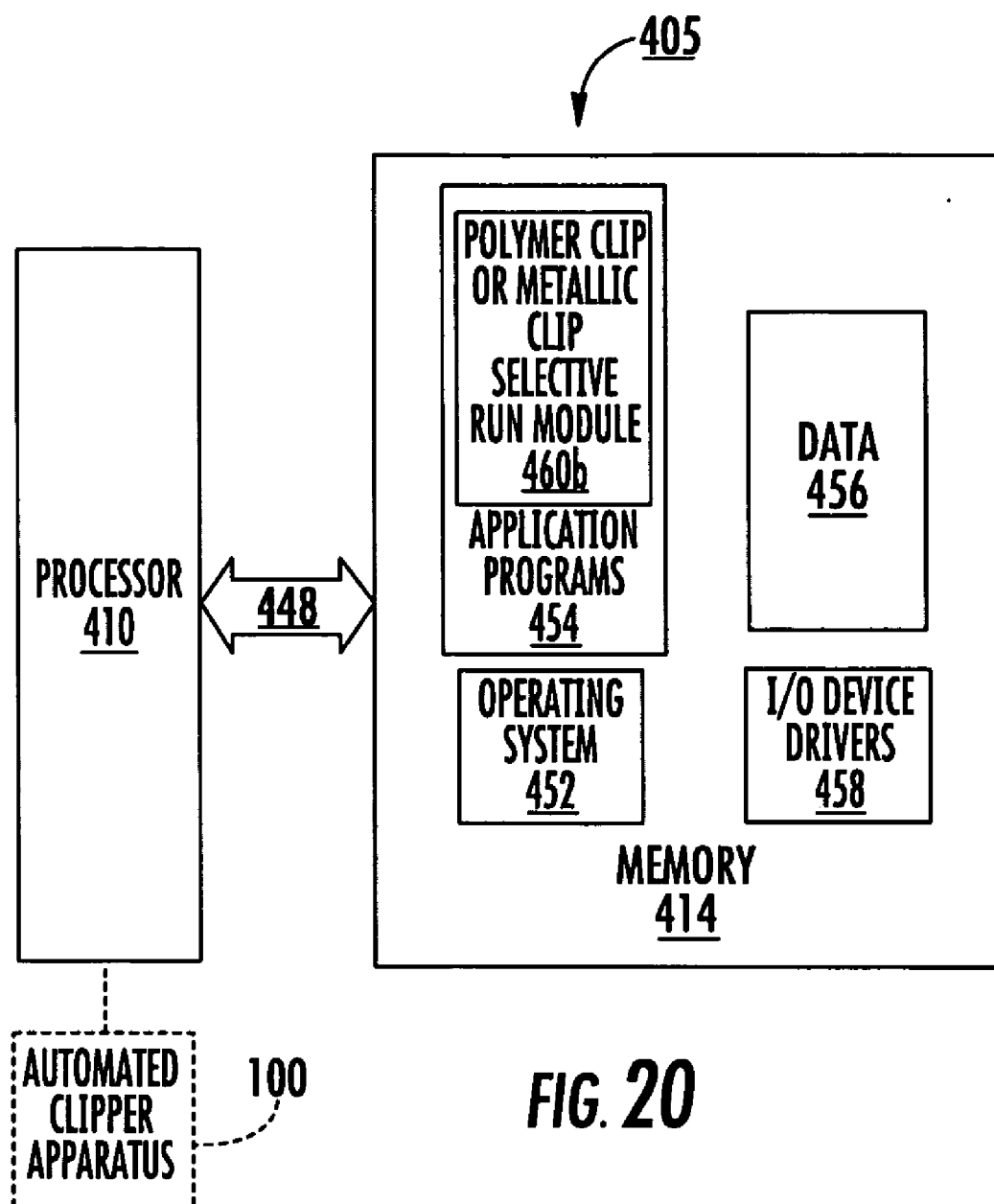


FIG. 20

**CLIPPERS CONFIGURED TO OPERATE WITH
ELASTOMERIC CLIPS, ASSOCIATED METHODS,
SYSTEMS AND COMPUTER PROGRAM
PRODUCTS**

RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application Ser. No. 60/621,703, filed Oct. 25, 2004, the contents of which are hereby incorporated by reference as if recited in full herein.

FIELD OF THE INVENTION

[0002] The present invention relates to closure clips that can be mechanically attached to flexible packaging materials that enclose products therein.

BACKGROUND OF THE INVENTION

[0003] Conventionally, metallic clips have been used to secure the edge/end portions of bags and tubular casings together. Examples of conventional generally "U" shaped metal clips are described in U.S. Pat. Nos. 2,880,419, 3,400,433, 4,525,898, and 4,944,172. Automated or semi-automated clippers can be used to feed the clips along a clip rail, then punch the clip through a clip window over and around gathered casing or bag material. U.S. Pat. No. 5,495,701 proposes a clip attachment mechanism for fastening a single clip or two clips simultaneously. The mechanism has two punches, one of which is driven directly by a pneumatic cylinder, and the other of which is connected to the first punch using a pin and key assembly. The pin and key assembly allows the punches to be coupled or decoupled to the pneumatic cylinder drive to apply one single clip or two clips simultaneously. U.S. Pat. No. 5,586,424 proposes an apparatus for movement of U-shaped clips along a rail. The apparatus includes a clip feed for advancing clips on a guide rail and the arm is reciprocally driven by a piston and cylinder arrangement. The contents of each of these patents are hereby incorporated by reference as if recited in full herein.

[0004] Some packaging applications prefer to use non-metallic clips to enclose certain products such as food products. In the past, certain one-piece and two-piece non-metallic clips have been proposed to secure flexible bags. Examples are discussed in U.S. Pat. No. 6,637,075 and U.S. Patent Application Publication No. 20030168868, the latter of which is particularly suitable for ultrasonic sealing. Another example of a thermoplastic clip is described in JP Patent Publication No. 2002-019735. This reference proposes a unitary body polymer clip.

**SUMMARY OF EMBODIMENTS OF THE
INVENTION**

[0005] Embodiments of the present invention provide devices, systems, methods and computer program products for dispensing and/or attaching non-metallic clips to target packages.

[0006] In some embodiments, the present invention provides automated and/or semi-automated clippers that can apply thermoplastic generally "U" shaped clips to a package. In particular embodiments, the clipper has a rail that can support either a thermoplastic polymer or metallic clip magazine to allow production alternatives.

[0007] Some embodiments are directed to methods for applying a non-metallic clip to a target package in an automated manner. The methods include: (a) directing a plurality of non-metallic clips, each respective clip having a unitary body with a crown and spaced apart first and second legs, to travel in a clip travel path having a forward direction that merges into a punch path; (b) automatically punching a non-metallic clip in the punch path so that the first and second legs thereof span opposing sides of a trailing and/or leading edge portion of a target package; then (c) automatically deforming the clip so that the leading edge portions of the legs reside proximate each other about the trailing and/or leading edge portion of the target package to thereby close the clip about the target package.

[0008] In some embodiments, the clips comprise a polymer and have a general U-shaped body with a tapered inner perimeter profile with an upper portion having a smaller width than a medial portion thereof. The directing step may include sliding the clips along the clip travel path on a rail with the first and second legs extending from opposing side portions of the rail. The rail can have a tapered sectional profile with a top portion having a smaller width than a medial portion.

[0009] The methods may include automatically severing gathered casing (which includes polymer and/or natural materials) and/or netting material proximate the deformed clip after the deforming step by actuating a knife to advance to cut gathered casing and/or netting material after delaying the actuation of the knife for about 0.25-1 second after the deforming step to thereby hold the deformed clip in the punch path against the die for a holding period. In particular embodiments, the deforming and/or severing step may be carried out at ambient conditions without active heating and/or cooling of the clip in the punch path.

[0010] Other embodiments are directed to methods of selectively attaching metallic or non-metallic clips using a common clipper. The methods include: (a) selectively feeding a spool and/or reel of attached elastomeric clips or a spool and/or reel of metallic clips along a static rail with a generally downwardly extending portion that merges into a laterally extending portion that merges into a punch path; (b) forcing the clips to travel along the rail so that the laterally extending portion thereof delivers a forwardmost clip from the selected spool and/or reel through a clip window of a clipper into a punch path; and (c) attaching at least one clip from the selected spool by punching the clip in the punch path onto a gathered portion of a target package so that the legs of the clip travel toward each other.

[0011] The elastomeric and metallic clips may be fed along a common rail that has a tapered sectional shape with a top portion widening to a lower portion.

[0012] Other embodiments are directed to automated or semi-automated clippers. The clippers include: (a) a clip rail configured and sized to hold a plurality of unitary body non-metallic clips, each clip having a crown and opposing spaced apart first and second legs, the clip rail configured to define a portion of a clip travel path that merges into a punch path; (b) a punch configured to controllably travel in the punch path to direct a clip in the punch path to span opposing sides of a trailing and/or leading edge portion of a target package; (c) a die cooperatively aligned with the punch to deformably shape the clip in the punch path about the target

package to thereby attach the clip thereto; and (d) a knife member having an actuator associated therewith operatively associated with the punch, wherein the actuator is configured to advance and retract the knife member to sever the trailing and/or leading edge of the target package downstream of the attached clip. The actuator is configured to advance the knife member on a delay after the clip is attached to the target product thereby allowing the punch to forcibly hold the attached clip in the punch path against the die for a holding period so that the attached clip retains its deformed shape after the punch is retracted and the knife member severs the target package.

[0013] In particular embodiments, the clippers can also include a flow control in fluid communication with the actuator. The flow control can be configured to provide the delay in actuation of the knife member. The time delay and/or holding period is typically between about 0.25-1 second, and may be about 0.5 seconds. In some embodiments, the die and/or punch path can be devoid of active heating and/or cooling sources.

[0014] Other embodiments are directed to automated or semi-automated clippers. The clippers include: (a) a reel and/or spool of attached elastomeric unitary body clips, each clip having a crown and opposing spaced apart first and second legs; (b) a clip rail in communication with the reel and/or spool of clips configured and sized to hold a plurality of the unitary body non-metallic clips, the clip rail configured to define a portion of a clip travel path that merges into a punch path; (c) a punch configured to controllably reciprocally travel in the punch path to direct a clip delivered from the clip rail into the punch path to span opposing sides of a trailing and/or leading edge portion of a target package; and (d) a die cooperatively aligned with the punch to deformably shape the elastomeric clip in the punch path about the target package to thereby attach the clip thereto.

[0015] The clips may comprise a polymer and may have a general U-shaped body with a tapered inner perimeter profile with an upper portion having a smaller width than a medial portion thereof.

[0016] Still other embodiments are directed to clip rails that have a metallic curvilinear elongate body with a first generally vertical segment merging into a laterally extending generally horizontal second segment, the body having a tapered sectional profile increasing in width from a top to medial portion.

[0017] In some embodiments, the top profile portion of the body may have a generally arcuate medial segment with sides that extend down and merge into a wider shoulder portion that then merges into a generally rectangular perimeter shape. In particular embodiments, the shoulder may have a lower radial arc segment of between about 0.24-0.26 inches that transitions between the top and lower portions of the body.

[0018] Still other embodiments are directed to clipper apparatus for selectively supplying a polymer clip or a metallic clip to a clip window associated with an automated closure attachment mechanism for attaching at least one clip to a target casing or flexible package. The apparatus include: (a) a clip rail having a shaped body with a top portion having a smaller cross-sectional width than a medial and lower portion, the clip rail configured and sized to selectively

deliver generally U-shaped unitary body polymer and metallic clips having about the same width, the clip rail configured to define a portion of a clip travel path that merges into a punch path; and (b) a punch and corresponding die anvil configured to communicate with a clip in the clip path to serially attach the selected clips to a target package during operation.

[0019] In some embodiments, the apparatus can also include a flow control in fluid communication with the knife member actuator. The flow control can be configured to slow the actuation of the knife member after the punch is actuated to provide the delay and holding period.

[0020] Yet other embodiments are directed to computer program products for operating an automated and/or semi-automated clipping apparatus having a punch and die configured to attach generally U-shaped unitary body non-metallic clips to target packaging material. The computer program product includes computer readable storage medium having computer readable program code embodied in the medium. The computer-readable program code is configured to delay actuation of a cutting actuator after an elastomeric clip is clipped about a target product. The delay being sufficient to allow the punch to forcibly hold the attached clip against the die for a holding period so that the attached clip retains a clipped deformed shape after the punch is retracted and the knife member severs the target package.

[0021] Other computer program products for operating an automated and/or semi-automated clipping apparatus having an automated cooperating punch and die and knife member can be configured to selectively apply generally U-shaped unitary body elastomeric clips or metallic clips. The computer program products can include computer readable storage medium having computer readable program code embodied in the medium. The computer-readable program code can include a control module that directs the actuation of the punch and/or knife member in a respective different deployment mode responsive to whether elastomeric clips or metallic clips are being applied from the clipping apparatus.

[0022] In particular embodiments, the elastomeric clips can be formed into a clip magazine can be spooled or reeled onto a support member for dispensing. In some embodiments, the elastomeric and/or polymer clips can be single-use disposable clips configured so that once the closed clip is removed from the package, the used clip may not hold the closed shape again sufficiently to seal the bag and may not be reusable.

[0023] These and other objects and/or aspects of the present invention are explained in detail in the specification set forth below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] FIG. 1 is a front perspective view of a clipper assembly according to embodiments of the present invention.

[0025] FIG. 2 is an enlarged front perspective view of the device shown in FIG. 1 with an elastomeric clip applied to a package according to embodiments of the present invention.

[0026] FIG. 3A is a front view of the device shown in FIG. 1 with the spool of clips omitted.

[0027] FIG. 3B is a front view of a rail shown in FIGS. 1 and 3A.

[0028] FIG. 4 is a side view of the device shown in FIG. 3.

[0029] FIG. 5A is a greatly enlarged view of a clip rail used to hold elastomeric clips according to embodiments of the present invention.

[0030] FIG. 5B is a greatly enlarged view of the clip rail shown in FIG. 5A used to hold metallic clips according to embodiments of the present invention.

[0031] FIG. 6 is a greatly enlarged front perspective view of a polymer clip according to embodiments of the present invention.

[0032] FIG. 7 is an enlarged side perspective view of an integral clip magazine according to embodiments of the present invention.

[0033] FIGS. 8 and 9 are side views of an integral clip magazine illustrating that the elastomeric clip magazine shown in FIG. 7 is flexible.

[0034] FIGS. 10 and 11 are side perspective view of spools and/or reels of elastomeric clips according to embodiments of the present invention.

[0035] FIG. 12 is a side elevation view of an apparatus configured to selectively apply polymer and metal clips via a clip punch attachment mechanism according to embodiments of the present invention.

[0036] FIGS. 13A-13C and 14A-14B are side perspective views of an elastomeric clip that has been deformed to close a target package according to embodiments of the present invention.

[0037] FIGS. 15 and 16 are side perspective views illustrating the deformed clip on exemplary target packages according to embodiments of the present invention.

[0038] FIGS. 17 and 18 are flow charts of exemplary operations that may be carried out according to embodiments of the present invention.

[0039] FIGS. 19 and 20 are block diagrams of a data processing (clipper operational control) system according to embodiments of the present invention.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0040] The present invention will now be described more fully hereinafter with reference to the accompanying figures, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Like numbers refer to like elements throughout. In the figures, certain layers, components or features may be exaggerated for clarity, and broken lines illustrate optional features or operations unless specified otherwise. In addition, the sequence of operations (or steps) is not limited to the order presented in the claims unless specifically indicated otherwise. Where used, the terms “attached”, “connected”, “contacting”, “coupling” and the like, can mean either directly or indirectly, unless stated otherwise. The term “concurrently” means that the operations are carried out substantially simultaneously.

[0041] In the description of the present invention that follows, certain terms are employed to refer to the positional relationship of certain structures relative to other structures. As used herein, the term “front” or “forward” and derivatives thereof refer to the general or primary direction that the clips travel toward a target product for closure; this term is intended to be synonymous with the term “downstream,” which is often used in manufacturing or material flow environments to indicate that certain material traveling or being acted upon is farther along in that process than other material. Conversely, the terms “rearward” and “upstream” and derivatives thereof refer to the directions opposite, respectively, the forward and downstream directions.

[0042] The present invention is particularly suitable for applying closure clips to seal products held in casings and/or flexible enclosures, typically elastomeric and/or netting enclosures. The casing can be any suitable casing (edible or inedible, natural or synthetic) such as, but not limited to, collagen, cellulose, plastic, elastomeric and/or polymeric casing. The term “netting” refers to any open mesh material in any form including, for example, knotted, braided, extruded, stamped, knitted, woven or otherwise. Typically, the netting is configured so as to be elastic and/or stretchable in both axial and lateral directions (isotropically elastic).

[0043] The term “non-metallic” refers to materials that are not metallic and includes elastomeric, fiber reinforced resin, ceramic and other sufficiently structurally rigid and malleable materials that can generally simulate conventional unitary body metallic clips.

[0044] The product can be a meat product. Exemplary meat products include, but are not limited to, strands of meat (that may comprise pepperoni, poultry, and/or beef or other desired meat), and processed meat products including whole or partial meat mixtures, including sausages, hot dogs, and the like. Other embodiments of the present invention may be directed to seal or package other types of food such as clams, hamburgers, whole chickens, cheese, pre-packaged salad, soups, sauces or other products in casing materials. Examples of yet other products that can be packaged using embodiments of the invention include granular materials including grain, sugar, sand and the like or other materials including dry or wet pet food (similar to that held conventionally in cans) or other powder, granular, solid, semi-solid or gelatinous materials. The packaged product may be packaged for any suitable industry including food, aquaculture, agriculture, environmental, chemical, explosives, automotive, recreational (such as bicycles or components thereof), electronic, medical or surgical, or other application.

[0045] FIG. 1 illustrates a clipper 10 that can be automated or semi-automated to apply one or more clips 30 to a target package 50. As shown, the clipper 10 includes a clip rail 20 that holds a plurality of non-metallic clips 30 and a punch actuation cylinder 40 that operates a punch 41 to travel reciprocally in a punch path 40p. The actuation cylinder 40 can be any fluidly operated cylinder, such as a pneumatic or hydraulic cylinder, but is typically a pneumatic cylinder. The punch 41 can operate with a punch pressure of between about 40-90 psi, and typically of about 80 psi for some embodiments. The pressure may vary depending on the size of clip and clip material.

[0046] The non-metallic clips 30 can be a magazine of attached clips 30 that travel in-concert along the rail 20. As

shown in **FIG. 1**, the clipper **10** can include a clip guide feed **11** in communication with a reel and/or spool of clips **30R**. As shown in **FIGS. 1, 2** and **12**, the rail **20** is aligned with a clip window **40w** that allows a forwardmost (downstream most) clip **30** to enter through the clip window **40w** into the punch path **40p**, as is well known to those of skill in the art. In operation, the punch **41** forces the clip **30** to travel in the punch path **40p** so that its legs straddle a target gathered portion of a package held in a clip closure zone **42**. The punch **41** is in cooperative alignment with a die **45** (**FIG. 12**) positioned on the opposing side of the closure zone **42**. The die **45** is also known as a die anvil. **FIG. 4** also shows the die **45** and an associated die guard **45g**. In operation, the punch **41** travels along the punch path **40p** and forces the clip **30** against the die **45** (**FIG. 12**). As the clip **30** contacts the die **45** it is deformed, i.e., forced to bend and close about the package **50** so that the legs of the clip travel together and the crown faces the closed legs and the non-metallic clip retains its deformed configuration to securely close the package **50**. The clipper **10** can be configured to apply the non-metallic clips without employing active heating and/or cooling sources (i.e., the die, punch path and/or punch can operate at normal ambient conditions) to form the clip into a closure configuration.

[0047] The mechanical heat and natural cooling can be sufficient to form and cause the clip to maintain its closure configuration. The non-metallic clip **30** will be discussed further below.

[0048] **FIGS. 3A, 5A** and **5B** illustrate that the clipper **10** can have a guide **21** closely positioned above the rail **20** to help guide the clips **30** along the rail **20** to the clip window **40w**. The guide **21** can help keep the non-metallic clips trapped between the rail **20** and the guide **21**, particularly as the clips approach the clip window **40w**.

[0049] **FIG. 3B** illustrates one embodiment of a non-metallic clip rail **20**. As shown, the rail **20** has a tapered sectional profile with a top portion **20t** having a smaller width than a medial (and/or lower) portion **20m**. The top profile portion of the body **20t** can have a generally arcuate medial segment **20a₁** with sides **20s** that extend down and merge into a wider shoulder portion **20sh** that then merges into a generally rectangular perimeter shape **20r**. In particular embodiments, the shoulder portion **20sh** has a lower radial arc segment **20a₂** of between about 0.24-0.26 inches.

[0050] As shown in **FIG. 1**, the clip rail **20** can have a metallic curvilinear body with a first generally vertical segment **20v** merging into a laterally extending generally horizontal second segment **20h**. The vertical segment **20v** can be configured to deliver the clips from above the target product as shown. However the clipper **10** may be alternatively configured to supply and apply the clips from other orientations, including, but not limited to, from beneath (not shown) the target product with the punch rising from the bottom. In some embodiments, the rail **20** is configured to hold a thermoplastic polymer clip having a generally U-shaped body with a tapered inner perimeter profile with an upper portion having a smaller width than a medial portion thereof (see **FIGS. 5A** and **6**).

[0051] **FIG. 3A** also illustrates that the clipper **10** can have a knife member **60k** and associated actuation cylinder **60** that can sever the clipped package after the clip is attached. The clipper **10** can also have a knife guard **64** and a shear

plate **65**. For metallic clip application, the knife member **60k** is typically extended automatically by the actuator **60** almost instantaneously with the punch actuation (i.e., substantially right after the clip is attached to the package **50**). In some embodiments, for applying non-metallic clips **30**, the clipper **10** can be configured to allow the punch **40** to apply force to the clip **30** by forcibly holding the clip against the die **45** after the clip **30** is attached to the package and/or deformed thereabout for a holding period. The holding period can be associated with the punch retraction and/or knife member actuation. The holding period can be between about 0.25-1 second, and is typically about 0.3-0.7 seconds, and is more typically about 0.5 seconds.

[0052] **FIG. 4** shows that the clipper **10** can include a flow control **61** and a valve (such as a ball valve **62**) that are in fluid communication with knife actuator **60**. The flow control **61** can delay activation of the actuator **60** after deployment of the punch **41** by restricting or delaying the air flow into the actuator **60**. This allows the punch **40** to remain forcibly in contact with the applied clip for a holding period of between about 0.25-1 seconds, and more typically at about 0.5 seconds as noted above. The flow control **61** can be any suitable flow restriction member(s) that can restrict airflow to the knife actuation valve that controls the actuation of the knife member actuator **60**. Examples of some suitable flow valves are compressed air flow control valves that have fine-adjustment dials, available from McMaster-Carr®.

[0053] **FIGS. 5A** and **5B** illustrate that the same clipper **10** can be used to apply either non-metallic clips **30** or metallic clips **31**. Although the non-metallic clips **30** may, in some particular embodiments, have an inner spacing that varies over its length (tapering from top to bottom) while providing a generally constant outer perimeter along the legs, the metallic clips **31** can be configured with a generally constant inner spacing and outer perimeter shape. As shown, the clips **30, 31** may be dispensed from a common clip rail **20**. In other embodiments the clipper **10** can accept modular clip assemblies (typically comprising the clip rail **20**, the clip guide **21**, and the feed **11**) that allow a clip specific rail **20** to be used and aligned with the same clip window **40w** using the same punch **41** and knife member **60k**. The clips **30, 31** can be applied using the same punch pressure and die **45**. In other embodiments, the clips **30, 31** may use different punches and/or drive pressured depending on the type of clip output. Similarly, the die anvil **45** may be modularized and changed in a tooling set-up responsive to the type of clip being applied.

[0054] Referring to **FIG. 6**, an example of an elastomeric clip **30** is shown. The polymer clip **30** has a crown **31** and two spaced apart legs **32₁, 32₂** defining a generally "U" shape clip body **30b**. The term "elastomeric" means that the clip **30** comprises at least one polymer and is sufficiently rigid to define a first self-supporting configuration and sufficiently malleable to deform into a second closed configuration to thereby secure a gathered portion of the target enclosure material. The term "polymer" includes copolymers, polymer blends and derivatives thereof. In some embodiments, the clip **30** can comprise a thermoplastic polymer.

[0055] As shown in **FIG. 6**, the legs **321, 322** may merge into a lowermost lip portion **33** where the respective lip

portions 33 face each other across the open gap space of the clip body. The lip portions 33 may provide additional gripping or closing force. The lip portions 33 may be configured to define blunt hook portions that face each other across the clip body.

[0056] In some embodiments, the polymer clip 30 can be configured to have a width and/or separation distance between the legs 32₁, 32₂ so as to be able to selectively travel on a clip rail and/or through a common clip punch path selectively shared with a metallic clip using a common automated or semi-automated clipper (an example of which is generally represented as 10' in FIG. 12 or 10 in FIG. 1).

[0057] As is also shown in FIG. 6, the clip 30 may include a bead 35 that protrudes a distance beyond at least one primary surface 30p₁ of the clip body 30b. As shown, the bead 35 is generally medially located on the crown 31 and extends generally orthogonally to the primary surface 30p₁. The term "bead" refers to a relatively small piece of material that protrudes from the clip 30. The bead 35 can attach two neighboring clips such that the clips 30 are held face to face. The bead 35 can be formed integrally to the clip body 30b. The bead 35 can be used to form an integral clip magazine 30m (FIG. 7). The term "clip magazine" refers to a plurality of attached clips 30 that can be separated during use. The bead 35 can be a polymer bead, but other materials including adhesives or tape can also be used to join the clips 30 to form a magazine 30m. In particular embodiments, the bead 35 is formed of the same material as the clip 30 and is molded integrally thereon during fabrication of the clip 30.

[0058] In some embodiments, when closed, the leading edge portions of the legs 32₁, 32₂ of the clip 30 reside adjacent each other spaced apart a distance from the crown 31 across the gathered portion of the package material as shown in FIGS. 13A-13C and 14A-14B. The size of the clip 30 may vary corresponding to the size of the package or casing being closed.

[0059] In the closed configuration shown in FIGS. 13A and 14A, the leading edge 32e portions of the legs 32₁, 32₂ can be positioned side by side with a respective leading edge portion of one leg 32₁ contacting the other leg 32₂ and with the leading edge portions 32e overlapping (but typically not crossing under or over) in a length (lateral) direction to reside abutting the other leg in side-by-side alignment. In other words, the legs 32₁, 32₂ of the clip 30 are wrapped around a gathered portion of a target casing and/or bag. The clip configuration can be selected such that the legs 32₁, 32₂ enclose a gathered edge portion of a target bag or casing, but do not puncture the target enclosed bag/casing material.

[0060] In some embodiments, the clip 30 is a single-use disposable clip that is deformed after the clip takes on the second configuration and may remain in at least a partially deformed shape after removal. Hence, in certain embodiments, once removed from the package after it is closed, the clip 10 may not be reusable. The clip 30 can have sufficient mechanical strength, structural rigidity and malleability to allow an automated clipper 10 to automatically serially dispense the clips 30 through a clipper window 40w and allow a punch 41 to force the clip 30 against the die anvil 45 to apply the clip 30 to the package, typically at pressures between about 40-85 psig.

[0061] FIGS. 13B and 13C illustrate that for smaller packages such as netting packages 50n, the punch 41 and die

45 may compress the clip 30 closer with the crown 31 and legs 32₁, 32₂ spaced closer across the package and with the legs overlapping (typically without actually crossing over) each other a greater distance than other packages such as that shown in FIG. 13A. The clip 30 can be configured to close a range of different sized bags, package materials, and package thicknesses. In particular embodiments, the clip 30 may have an outside length or height (measured from the top of the crown to the bottom of leg) of between about 0.3-0.7 inches.

[0062] In some embodiments, the clippers and methods of the present invention can clip a unitary body polymer clip having sufficient rigidity to have a first pre-deformation general "U" shape with a crown and first and second legs extending from opposing sides of the crown and spaced apart a distance to define an open gap space therebetween, and sufficient malleability to form a post-deformation shape with the leading edges of the legs overlapping and the crown and leading edges of the legs compressed together across a gathered (typically the neck or tail) portion of a casing, netting or bag. In some embodiments, the polymer clip 30 can be configured to generally simulate a metallic clip used in automated or semi-automated clippers.

[0063] As shown in FIG. 7, a plurality of elastomeric clips 30 can be configured as an integrated magazine 30m of clips that are held together and in alignment by the polymer beads 35 that are disposed between adjacent clips. The polymer beads 35 (FIG. 6) can be disposed on a generally medial portion of both faces of the crown 31 to join neighboring clips. The integrated clip magazine 30m can be a flexible magazine clip as shown in FIGS. 8 and 9. The beads 35 can be formed from the same material as the clips 30 and molded substantially concurrently with the clips. The beads 35 can be sized and configured to allow the clips 30 to be relatively easily serially separated from adjacent clips for application onto a bag or packaging 50 (typically via shearing with the punch 41).

[0064] As shown in FIG. 6, upon separation of adjacent clips, the bead 35 may fragment or separate so that at least a portion of the bead 35 typically remains on at least one primary face of the clip 30. In some embodiments, the clip 30 includes both front and rear bead portions 35 that are substantially aligned front to back. One bead fragment or portion may be larger than the other. The bead 35 can be any shape, and is typically a generally small round shape. Other bead shapes may also be used.

[0065] Although shown as a single integral bead 35 used to hold two adjacent clips in an integral clip magazine 30m (FIGS. 7-9), other configurations can be used. In any event, the bead 35 is typically frangible in use and/or in production. The bead 35 may fragment to provide bead portions on both opposing primary faces of the clip body 30b. Other bead configurations can be used. If more than one bead 35 is employed to attach adjacent or neighboring clips, the beads 35 may be located adjacent each other or spaced apart about locations on the clip body 30b. Thus, instead of a single bead on the medial portion of the crown as shown in FIG. 6, two adjacent smaller beads may be used (not shown).

[0066] Typically, at least 50 clips 30 are integrally attached to form the clip magazine 50. More typically, between about 100-10,000 clips, and even more typically between about 1000-3000 clips are integrally attached,

depending on the size of the clip and/or reel/spool. The bead 35 is frangibly configured to yield, release and/or detach a desired one or more clip 30 upon application of suitable force, typically a shearing force, although torsional and/or tensile forces can also be used. The bead 35 and clips 30 are configured with sufficient structural strength and size so as to allow the magazine 30m to flex while holding the clips 30 together as shown in FIGS. 8 and 9.

[0067] One or more clip magazines 30m can be mounted onto a spool 30R and/or reel to form a wound generally continuous (attached) supply of clips (either elastomeric/polymer or metal) as shown in FIGS. 1, 2, 10 and 11. For reel configurations, a single row of clips can be wrapped top over bottom over a narrower reel support member (not shown).

[0068] In certain embodiments, the clips 30 can be fabricated with color and/or decorative accents thereon to allow for visual date coding and/or manufacture specific coding (the color may be used to represent a particular lot, manufacturer and/or supplier) of products. The color can be a dye or color added during molding.

[0069] FIG. 12 illustrates an automated or semi-automated clipper attachment apparatus 10'. In the embodiment shown, the clipper 10' is configured to selectively dispense metal clips (also a generally "U" shaped clip) 31 or the polymer clips 30. In other embodiments, as noted above the clipper 10' can be configured to dispense the selected clips using a single changeable or common clip rail. As shown, two separate clip rails 20₁, 20₂ with respective clip travel paths are used, each merging into a common clip window 40w and package closure 42. In addition, although the polymer and metal clips 30, 31 are shown in FIG. 12 as being fed from a common clip window 40w to a common clip closure zone 42, the clips 30, 31 may be fed from different sides to the same or different clip closure zones 42. The commonly configured polymer and metallic clips can have similarly sized outer perimeter dimensions.

[0070] As noted above, in operation, the clip 30 is typically fed from a clip rail 20 through a clip window 40w into the closure path 42 so that a respective one of the clips 30 can be aligned in the path 40p. The punch 41 travels down and shears or otherwise separates the forward clip from its neighbor and the remainder of the clip magazine 30m. The clip 30 is closed over the gathered bag or enclosure 50 as the punch 41 forces the clip down and over the bag and against the underlying die anvil 45. FIGS. 13A-C and 14A-B illustrate examples of the deformed closed clip configuration. As shown in FIG. 14A, after closure, the crown 31 is compressed and flares out so that the arcuate crown shape (pre-deformation) has a more elongate shape (post-deformation) than that shown in FIG. 6. As shown in FIG. 13A, the legs 32₁, 32₂ are wrapped together with the lips 33 facing the target material 75. FIGS. 15 and 16 illustrate examples of packages 50 with a polymer clip 30.

[0071] Turning now to FIG. 17, exemplary operations that can be used to carry out embodiments of the invention are shown. A plurality of non-metallic clips can be directed to travel in a clip travel path having a forward direction that merges into a punch path (block 170). The clips can have a unitary body with a crown and spaced apart first and second legs. The non-metallic clip is punched in the punch path so that the first and second legs of the clip span opposing sides

of a trailing and/or leading edge portion of a target package (block 175). The clip is deformed so that the leading edge portions of the legs reside proximate each other about the trailing and/or leading edge portion of the target package to thereby close the clip about the target package (block 180).

[0072] In some embodiments, the non-metallic clips are a spooled supply of elastomeric clips that are automatically fed onto a rail in the clip path (block 171) and the clips may be a thermoplastic polymer having a generally U-shaped body (block 172). The punch can be held against the clip with sufficient force so that the deformed clip is forced against an underlying (or overlying) die after the deforming step for between about 0.25-1 seconds to help the clip retain its deformed shape after the punch is retracted (block 181).

[0073] FIG. 18 illustrates other exemplary operations that can be used to carry out some embodiments of the present invention. Polymer clips are supplied to a clip window associated with a closure attachment mechanism adapted to allow a clip to be automatically applied to a target package or work piece in a closure zone (block 200). The plurality of clips, having a generally U-shaped unitary body, can be automatically forced (by gravity and/or active propulsion) to travel in a first predetermined clip travel path having a forward feed direction toward a first closure delivery path (such as a punch path) in the closure zone (block 210). A selected forwardly positioned polymer clip can be sheared from the plurality of attached clips (block 220). The selected polymer clip can be automatically punched in the first punch path down to a die cooperating therewith so that the crown is above a neck or tail portion of the target work piece that is located under the closure zone so that the legs of the clip span opposing sides thereof (block 230). The leading edge portions of the polymer clip can be automatically wrapped together about the work piece to close the clip (without puncturing same) (block 240).

[0074] In certain embodiments, the operations can include automatically selectively forcing a plurality of metallic clips along a predetermined travel path toward a punch path with a clip window in the closure zone (block 245). A metallic or polymer clip can be selectively attached to the target package and/or workpiece responsive to user selection of a desired closure clip as the target package moves through the closure zone (block 247). The method can also include automatically adjusting the punch pressure depending on whether a polymer or metallic clip is used.

[0075] In certain embodiments, the plurality of polymer clips can be spooled or reeled and supplied to the predetermined travel path (block 215). The spooled or reeled clips can be automatically fed to the clip travel path during operation (block 217).

[0076] The clipper can be configured as an automated and/or semi-automated device. In some embodiments, operation of the clipper and/or a sequence of events can be controlled by pneumatic and/or electronic circuitry. In particular embodiments, the clipper can be configured as a standalone bench top clipper, which includes self-contained and/or integrated air logic circuitry.

[0077] In other embodiments, the clipper can include a programmable logic controller. The type of clip and/or type of packing being produced can be selected by an operator input using a Human Machine Interface (HMI) to commu-

nicate with the controller **135** (**FIG. 12**) as is well known to those of skill in the art. "Automated" means that the clipper is configured to carry out the clipping actions without requiring manual actuation of the punch or knife. "Semi-automated" means that the clipper can be configured to allow a user to place the target product in position. For the HMI based embodiments, a user can select certain instructions using an HMI. However, in either the bench top or HMI embodiments, most of the active clipping actions are carried out via automated control of the clipper.

[0078] **FIGS. 19 and 20** are block diagrams of exemplary embodiments of data processing systems that illustrate systems, methods, and computer program products in accordance with embodiments of the present invention. The processor **410** communicates with the memory **414** via an address/data bus **448**. The processor **410** can be any commercially available or custom microprocessor and can be the same processor as that used for the controller **135** (**FIG. 12**) or a separate processor that communicates with same. The memory **414** is representative of the overall hierarchy of memory devices containing the software and data used to implement the functionality of the data processing system **405**. The memory **414** can include, but is not limited to, the following types of devices: cache, ROM, PROM, EPROM, EEPROM, flash memory, SRAM, and DRAM.

[0079] As shown in **FIG. 18**, the memory **414** may include several categories of software and data used in the data processing system **405**: the operating system **452**; the application programs **454**; the input/output (I/O) device drivers **458**; the elastomeric and/or polymer clip delay run module **460a** (**FIG. 19**) and/or the selectable polymer or metallic clip selective run module **460b** (**FIG. 20**); and the data **456**.

[0080] The data **456** may include a look-up chart of different products, rates, selectable packaging material and/or size and the like corresponding to particular or target products for one or more producers, the type of clip for adjustment of the punch power, delay of the knife or retraction of the punch for an elastomeric clip holding period in the die, or a change out of the die anvil **45** (**FIG. 12**), and the like, which may be displayed to allow an operator to select desired operational parameters and/or run type at the start of each shift and/or production run and the like.

[0081] As will be appreciated by those of skill in the art, the operating system **452** may be any operating system suitable for use with a data processing system, such as OS/2, AIX, DOS, OS/390 or System390 from International Business Machines Corporation, Armonk, N.Y., Windows CE, Windows NT, Windows95, Windows98 or Windows2000 from Microsoft Corporation, Redmond, Wash., Unix or Linux or FreeBSD, Palm OS from Palm, Inc., Mac OS from Apple Computer, LabView, or proprietary operating systems. The I/O device drivers **458** typically include software routines accessed through the operating system **452** by the application programs **454** to communicate with devices such as I/O data port(s), data storage **456** and certain memory **414** components. The application programs **454** are illustrative of the programs that implement the various features of the data processing system **405** and preferably include at least one application which supports operations according to embodiments of the present invention. Finally, the data **456** represents the static and dynamic data used by the applica-

tion programs **454**, the operating system **452**, the I/O device drivers **458**, and other software programs that may reside in the memory **414**.

[0082] While the present invention is illustrated, for example, with reference to the modules **460a**, **460b** being an application program in **FIGS. 19 and 20**, as will be appreciated by those of skill in the art, other configurations may also be utilized while still benefiting from the teachings of the present invention. For example, the modules **460a** and/or **460b** may also be incorporated into the operating system **452**, the I/O device drivers **458** or other such logical division of the data processing system **405**. Thus, the present invention should not be construed as limited to the configuration of **FIG. 19 or 20**, which is intended to encompass any configuration capable of carrying out the operations described herein.

[0083] The I/O data port can be used to transfer information between the data processing system **405** and the clipper (such as for chubbied linked product) **420** or another computer system or a network (e.g., the Internet) or to other devices controlled by the processor. These components may be conventional components such as those used in many conventional data processing systems which may be configured in accordance with the present invention to operate as described herein.

[0084] While the present invention is illustrated, for example, with reference to particular divisions of programs, functions and memories, the present invention should not be construed as limited to such logical divisions. Thus, the present invention should not be construed as limited to the configurations of **FIG. 19 or 20** but is intended to encompass any configuration capable of carrying out the operations described herein.

[0085] The flowcharts and block diagrams of certain of the figures herein illustrate the architecture, functionality, and operation of possible implementations of selective implementation of methods for attaching elastomeric and/or selective application of polymer and metallic clips according to the present invention. In this regard, each block in the flow charts or block diagrams represents a module, segment, or portion of code, which comprises one or more executable instructions for implementing the specified logical function(s). It should also be noted that in some alternative implementations, the functions noted in the blocks may occur out of the order noted in the figures. For example, two blocks shown in succession may in fact be executed substantially concurrently or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved.

[0086] The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although a few exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the claims. In the claims, means-plus-function clauses, where used, are intended to cover the structures described herein as performing the recited function and not only structural equivalents but also equivalent structures. Therefore, it is to be understood that

the foregoing is illustrative of the present invention and is not to be construed as limited to the specific embodiments disclosed, and that modifications to the disclosed embodiments, as well as other embodiments, are intended to be included within the scope of the appended claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

1. A method for applying a non-metallic clip to a target package in an automated or semi-automated manner using a clipper, comprising:

directing a plurality of non-metallic clips, each respective clip having a unitary body with a crown and spaced apart first and second legs, to travel in a clip travel path having a forward direction that merges into a punch path;

punching a non-metallic clip in the punch path so that the first and second legs thereof span opposing sides of a trailing and/or leading edge portion of a target package; then deforming the clip so that the leading edge portions of the legs reside proximate each other about the trailing and/or leading edge portion of the target package to thereby close the clip about the target package.

2. A method according to claim 1, wherein the clips comprise a polymer and have a general U-shaped body with a tapered inner perimeter profile with an upper portion having a smaller width than a medial portion thereof.

3. A method according to claim 2, wherein the directing step comprises sliding the clips along the clip travel path on a rail with the first and second legs extending from opposing side portions of the rail, and wherein the rail has a tapered sectional profile with a top portion having a smaller width than a medial portion.

4. A method according to claim 3, further comprising holding the clips on the rail so that the crown is proximate the top portion of the rail and upper portions of the legs travel closely spaced to the top portion of the rail.

5. A method according to claim 1, further comprising:

feeding a spooled or reeled cartridge of a plurality attached elastomeric clips to the clip travel path, wherein the directing step comprises moving the attached clips forward in concert with one another;

then separating a selected forwardly positioned clip from the plurality of attached clips and introducing the separated clip into the punch path before the punching step.

6. A method according to claim 1, wherein the punch path is configured to punch the clip against a die cooperating therewith so that the crown is above or below a neck or tail portion of a target package and the legs span opposing sides thereof and wrap about the neck or tail portion on a side of the target package opposing the crown.

7. A method according to claim 1, wherein the deforming step comprises forcing the clip into a generally closed perimeter shape with the outermost portion of the legs extending past each other in opposing directions spaced across from the crown without puncturing the target packaging material.

8. A method according to claim 7, wherein the clip comprises a thermoplastic material, and wherein the deforming step shapes the clip into a curvilinear configuration with one leg extending transversely proximate and past the other.

9. A method according to claim 5, wherein the separating step comprises shearing the forwardly positioned clip from the other clips in the punch path.

10. A method according to claim 1, wherein the automatically deforming step is carried out to enclose gathered casing material associated with the target package without puncturing the casing material.

11. A method according to claim 1, wherein the automatically deforming step is carried out to enclose gathered netting material associated with the target package without puncturing the netting material.

12. A method according to claim 1, wherein the elastomeric clips are single-use disposable thermoplastic polymer clips.

13. A method according to claim 1, further comprising feeding a spool and/or reel of attached elastomeric clips along a static rail with a generally downwardly extending portion that merges into a laterally extending portion that merges into the punch path, the rail having a tapered sectional shape with a top portion widening to a lower portion, wherein the directing step comprises forcing the clips to travel along the laterally extending portion to deliver a forwardmost clip from the spool and/or reel into a clip window to engage a punch attachment mechanism held thereabove in the punch path.

14. A method according to claim 13, further comprising feeding a spool and/or reel of attached metallic clips along the tapered rail, each respective clip having a unitary body with a crown and spaced apart first and second legs to travel in a clip travel path having a forward direction that merges into a punch path;

punching a metallic clip in the punch path so that the first and second legs span opposing sides of a trailing and/or leading edge portion of a target package; and

deforming the clip so that the leading edge portions of the legs reside proximate each other about the trailing and/or leading edge portion of the target package to thereby close the clip about the target package.

15. A method according to claim 6, further comprising automatically severing gathered synthetic or natural casing and/or netting material proximate the deformed clip after the deforming step to provide a discrete packaged product.

16. A method according to claim 15, wherein the severing step comprises actuating a knife to cut the gathered casing and/or netting material, the method further comprising delaying the actuation of the knife for about 0.25-1 second after the deforming step to thereby hold the deformed clip in the punch path against the die for a holding period.

17. A method according to claim 16, wherein the deforming and/or severing step is carried out at ambient conditions without active heating and/or cooling of the clip in the punch path.

18. A method according to claim 17, wherein the target package encloses a meat product.

19. A method of selectively attaching metallic or non-metallic clips using a common clipper, comprising:

selectively feeding a spool and/or reel of attached elastomeric clips or a spool and/or reel of metallic clips along a static rail with a generally downwardly extending portion that merges into a laterally extending portion that merges into the punch path;

forcing the clips to travel along the rail so that the laterally extending portion thereof delivers a forwardmost clip from the selected spool and/or reel through a window to a punch path; and

punching a clip in the punch path onto a gathered portion of a target package so that the legs of the clip travel toward each other.

20-28. (canceled)

29. An automated or semi-automated clipper, comprising:

a clip rail configured and sized to hold a plurality of unitary body non-metallic clips, each clip having a crown and opposing spaced apart first and second legs, the clip rail configured to define a portion of a clip travel path that merges into a punch path;

a punch configured to controllably travel in the punch path to direct a clip in the punch path to span opposing sides of a trailing and/or leading edge portion of a target package;

a die cooperatively aligned with the punch to deformably shape the clip in the punch path about the target package to thereby attach the clip thereto; and

a knife member having an actuator associated therewith operatively associated with the punch, wherein the actuator is configured to advance and retract the knife member to sever the trailing and/or leading edge of the target package downstream of the attached clip, and wherein the actuator is configured to advance the knife member on a delay after the clip is attached to the target product thereby allowing the punch to forcibly hold the attached clip in the punch path against the die for a holding period so that the attached clip retains its deformed shape after the punch is retracted and the knife member severs the target package.

30-36. (canceled)

37. An automated or semi-automated clipper, comprising:

a reel and/or spool of attached elastomeric unitary body clips, each clip having a crown and opposing spaced apart first and second legs;

a clip rail in communication with the reel and/or spool of clips configured and sized to hold a plurality of the unitary body non-metallic clips, the clip rail configured to define a portion of a clip travel path that merges into a punch path;

a punch configured to controllably reciprocally travel in the punch path to direct a clip delivered from the clip rail into the punch path to span opposing sides of a trailing and/or leading edge portion of a target package; and

a die cooperatively aligned with the punch to deformably shape the elastomeric clip in the punch path about the target package to thereby attach the clip thereto.

38-42. (canceled)

43. A clip rail comprising a metallic curvilinear body with a first generally vertical segment merging into a laterally extending generally horizontal second segment, the body having a tapered sectional profile increasing in width from a top to medial portion.

44-45. (canceled)

46. A clipper apparatus for selectively supplying a polymer clip or a metallic clip for attaching at least one clip to a target casing or flexible package, comprising:

a clip rail having a shaped body with a top portion having a smaller cross-sectional width than a medial and lower portion, the clip rail configured and sized to selectively deliver generally U-shaped unitary body polymer and metallic clips having about the same width, the clip rail configured to define a portion of a clip travel path that merges into a punch path; and

a punch and corresponding die anvil configured to communicate with a clip in the clip path to serially attach the clips to a target package during operation.

47-49. (canceled)

50. A computer program product for operating an automated and/or semi-automated clipping apparatus having a punch and die configured to attach generally U-shaped unitary body non-metallic clips to target packaging material, the computer program product comprising:

a computer readable storage medium having computer readable program code embodied in said medium, said computer-readable program code comprising:

computer readable program code that delays actuation of a cutting actuator after an elastomeric clip is clipped about a target product, the delay being sufficient to allow the punch to forcibly hold the attached clip against the die for a holding period so that the attached clip retains a clipped deformed shape after the punch is retracted and the knife member severs the target package.

51. A computer program product for operating an automated and/or semi-automated clipping apparatus having an automated cooperating punch and die and knife member configured to selectively apply generally U-shaped unitary body elastomeric clips or metallic clips, the computer program product comprising:

a computer readable storage medium having computer readable program code embodied in said medium, said computer-readable program code comprising:

a control module that directs the actuation of the punch and/or knife member in a respective different deployment mode responsive to whether elastomeric clips or metallic clips are being applied from the clipping apparatus.

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