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(54) **Title:** ROTATING MULTI-CLIPPER PLATFORM SYSTEMS WITH COOPERATING ADHESIVE SEAL MODULES, ADHESIVE SEAL SYSTEMS AND ASSOCIATED DEVICES AND RELATED METHODS

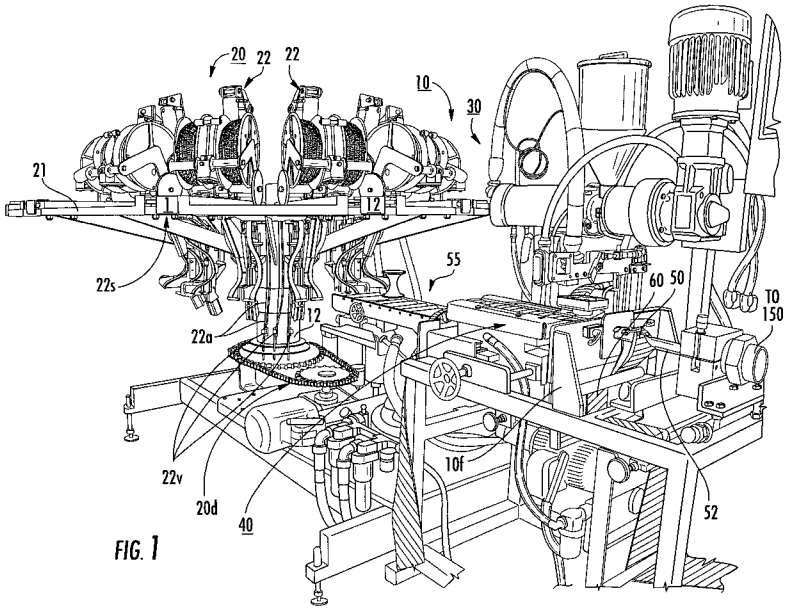


FIG. 1

(57) **Abstract:** Apparatus, systems, devices, methods and computer program products configured to provide one or more of the following: improved rotary table or platform packaging systems, improved adhesive (glue) based film seal systems, and/or easier loading or releasing mounting systems of horns, forming collars and/or sprockets.

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ROTATING MULTI-CLIPPER PLATFORM SYSTEMS WITH COOPERATING ADHESIVE SEAL MODULES, ADHESIVE SEAL SYSTEMS AND ASSOCIATED DEVICES AND RELATED METHODS

Related Application

[0001] This application claims the benefit of priority to U.S. Provisional Application Serial No. 61/015,067, filed December 19, 2007, 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 apparatus, systems, methods and computer program products that stuff or otherwise fill product into casings that enclose products therein.

Background of the Invention

[0003] Conventionally, in the production of consumer goods such as, for example, meat or other food products, the food is fed (typically pumped) or stuffed into a casing in a manner that allows the casing to fill with a desired amount of the product. As is well-known, the casings can be a slug-type natural or artificial casing that unwinds, advances, stretches and/or pulls to form the elongate casing over the desired product. Another type of casing is a heat-sealed tubular casing formed by seaming together a thin sheet of flexible material, typically elastomeric and/or polymeric material. U.S. Patent Nos. 5,085,036 and 5,203,760 describe examples of automated substantially continuous-feed devices suitable for forming sheet material or flat roll stock into tubular film casings. Rotating multi-clipper platform systems, such as the Rota-Clip® high speed packaging systems by Tipper Tie, Apex, N.C., have been used to produce increased quantities of clipped product. *See, e.g.*, U.S. Patent Nos. 4,821,485; 5,020,298; 5,259,168; 5,471,815; and 5,644,896. The contents of the above referenced patents are hereby incorporated by reference as if recited in full herein.

Summary of Embodiments of the Invention

[0004] Some embodiments of the invention are directed to packaging systems. The packaging systems include a rotating platform having a vertical column and a plurality of circumferentially spaced apart clippers mounted to the rotating platform. The platform is configured to concurrently mount a plurality of clippers in respective circumferentially spaced apart clipper stations.

[0005] In some embodiments, the platform is configured to releasably interchangeably mount two different sized clippers in the different clipper stations, one of the different sized clippers being configured to output larger clip sizes than the other clipper.

[0006] In particular embodiments, the different sized clippers include on-board air supply lines that connect to air supply lines at each clip station of the platform such that, in position, the clippers are in fluid communication with a common pressurized air supply for actuation of the different sized clippers.

[0007] The table or platform can be configured to concurrently hold twelve clippers, one in each of twelve clipper stations.

[0008] The system may optionally include a split main drive sprocket residing under the rotating platform surrounding the vertical column and a drive system with a chain in communication with the sprocket that rotates the rotating platform at a desired speed. The system may also optionally include first and second vertically stacked and spaced apart plates, each of the plates being split into a plurality of adjacent pieces with a radially extending split line extending between the adjacent pieces.

[0009] In some embodiments, the system can include a location sensor in communication with the rotating platform and a frame holding the rotating platform. The system can also include a controller that receives data from the location sensor and automatically moves the rotating platform to a desired longitudinal position based on location data from the sensor and user input selecting a product type and/or size for production.

[0010] In some embodiments, the system includes a plurality of circumferentially spaced apart cradles that hold clip spools on the platform. Each cradle holds a respective clip spool with clips in cooperating alignment with a

corresponding clipper. Each cradle is configured to allow a clip spool to be inserted into the cradle while a corresponding proximate clipper remains in position.

[0011] The system may include fine adjustment screws, one in communication with each of cradles, the fine adjustment screws configured to allow an operator to radially move the cradle into a desired position on the platform. Each cradle can releasably hold two spools side-by-side.

[0012] In some particular embodiments, the system can include an automated lubrication system configured to automatically mist or spray lubricant onto the sprocket and/or a chain associated therewith during operation.

[0013] In some embodiments, the system can also include a flat roll stock to a tubular covering forming system with a forming collar residing upstream of the rotating platform and an adhesive seal system in communication with the forming system that seals the flat stock in a tubular configuration. The adhesive seal system can include an automatic lifter that lifts one long edge of the covering to allow a nozzle to apply adhesive proximate the lifted long edge to seal the covering into the tubular configuration.

[0014] The nozzle can be a self-cleaning nozzle with a heater. The nozzle heater is in communication with a controller and the controller is configured to direct the heater to heat to a sufficient temperature to clean adhesive residue from the nozzle.

[0015] The adhesive seal system may include a stationary substantially horizontal extruder that merges into a curvilinear flow path that connects to the nozzle.

[0016] The adhesive seal system can include four temperature zones that can be individually controlled for temperature, including a first zone associated with the extruder, a second zone associated with an exit from the extruder, a third zone associated with the curvilinear flow path, and a fourth zone associated with an exit from the curvilinear flow path proximate the nozzle.

[0017] The lifter can be configured to automatically move between a home position that is laterally and upwardly away from a centerline of the horn and an operative position whereby the lifter travels downwardly to reside above and proximate the horn and inwardly toward the centerline of the horn.

[0018] The adhesive seal system can include a rotating drip tray that resides under the nozzle in a inactive nozzle configuration and that is synchronized to automatically rotate away from under the nozzle when the lifter moves to and/or is in its operative position.

[0019] The system can include a product horn residing upstream of the platform and a film drive system in communication with a supply of flat roll-stock film. The film drive system can include two vacuum drives, each having a belt, in communication with a display and a system controller, whereby the display is configured to accept user input to cause the vacuum drives to automatically translate the vacuum drive belts to an operative position to clamp the film against the horn.

[0020] The system can include a frame. The system can also include a product horn residing upstream of the platform, a film drive system in communication with a supply of flat roll-stock film and a forming collar residing on the horn in communication with the supply of flat-roll stock. The system can include a tool-less forming collar and horn mount assembly having first and second handles that rotate to force a member against a plate that releasably holds the horn and collar in position and a tool-less horn mounting assembly that holds the horn upstream of the forming collar. The tool-less horn mounting assembly can include first and second blocks that define a substantially cylindrical cavity therebetween. The first and second blocks can be configured to releasably attach together via a handle in communication with a rod that extends through the first and second blocks and clamps the blocks against the horn.

[0021] Other embodiments are directed to an adhesive sealing module for a packaging system. The module includes: (a) a stationary-mounted substantially horizontal extruder in communication with a hopper of bulk adhesive; (b) a curvilinear heated conduit having opposing upper and lower end portions, the upper end portion being in fluid communication with an adhesive exit portion of the substantially horizontal extruder; (c) an adhesive dispensing nozzle in fluid communication with and positioned proximate the lower end portion of the heated conduit; (d) a roll of flat sheet stock in communication with a forming collar and a substantially horizontally extending horn configured to form the sheet stock *in situ* into a substantially tubular shape with open overlapping long edges about the horn; and (e) an automated lifter mechanism in communication with the roll of flat sheet

stock downstream of the forming collar. In operation, the lifter mechanism is configured to automatically translate to lift a top one of the overlapping long edges of the sheet stock whereby the adhesive dispensing nozzle automatically dispenses flowable adhesive between the long edges of the formed sheet stock.

[0022] The nozzle can be a self-cleaning nozzle that is in communication with a system controller that electronically directs a heater associated with the nozzle to heat to a sufficiently high temperature to melt and release adhesive residue in the nozzle.

[0023] Still other embodiments are directed to a computer program product for operating a packaging system with a rotating table having a plurality of circumferentially spaced apart clippers thereon in communication with a horn and flat stock to generally tubular film or covering forming system. The computer program product includes a computer readable storage medium having computer readable program code embodied in the medium. The computer-readable program code including: (a) computer readable program code configured to monitor and adjust temperatures in four different temperature zones associated with an adhesive flow path that terminates into an adhesive dispensing nozzle; and (b) computer readable program code configured to increase, then decrease, temperature of the heating zone proximate the dispensing nozzle to cause the dispensing member to perform a self-cleaning or self-clearing operation, thereby inhibiting clogging of the dispensing nozzle.

[0024] Still other embodiments are directed to a computer program product for operating a packaging system with a rotating table having a plurality of circumferentially spaced apart clippers thereon in communication with a horn and flat stock to a generally tubular film or covering forming system. The computer program product includes a computer readable storage medium having computer readable program code embodied in the medium. The computer-readable program code includes computer readable program code configured to programmatically provide recipe-specific position adjustment of the table, the clippers and display of set-up data for operators.

[0025] Additional embodiments are directed to clip spool cradles configured to releasably hold and release at least one, typically two, side-by-side clip spools.

[0026] Still other embodiments are directed to a packaging system with a product horn having a forming collar thereon and a roll of flat sheet stock in communication with the forming collar and the product horn. The system is configured to form the sheet stock *in situ* into a substantially tubular shape with open overlapping long edges about the product horn. The system also includes a hot adhesive supply source in communication with a nozzle and an automated lift mechanism configured to automatically lift a top one of the overlapping long edges to allow the adhesive nozzle to move under the lifted long edge and apply sealant between the overlapping long edges.

[0027] Still other embodiments are directed to a rotating table holding a plurality of circumferentially spaced apart clippers with each respective clipper having a pair of cooperating clip guide bars with an aperture pattern and a guide slot that mount to the rotating table and cooperate with clipper guides that hold and lock the clipper into a desired one of multiple different radial positions.

[0028] Yet other embodiments are directed to a rotating table rotary support table holding a plurality of circumferentially spaced apart clippers with each respective clipper having a radially extendable screw defining a fine radial location/position adjustment member for the clipper.

[0029] Additional embodiments are directed to a packaging system that includes an adhesive seal system with an extruder, a dispensing nozzle and an adhesive fluid flow path comprising at least four discrete automatic temperature controlled heat zones.

[0030] Some embodiments are directed to a packaging system with a rotating table with a vertical column, the table having a plurality of circumferentially spaced apart clippers in fluid communication with a pressurized air supply and air preparation units and a split sprocket surrounding the vertical column in communication with a drive system for rotating the table at a desired speed.

[0031] The table can be configured to releasably mount different sized clippers, one that applies larger clips than the other, and wherein the system air supply and air preparation units allow for rapid actuation of the different clippers at a rate of about 300 pieces per minute or 300 feet/min of film to thereby provide substantially the same operational output irrespective of the clipper used.

[0032] Some embodiments are directed to a packaging system that includes a horn with a forming collar and a tool-less forming collar assembly support shoulder attached to a frame of the packaging system. The tool-less forming collar assembly includes a support plate with a semi-circular cavity and at least one user-accessible handle attached to the support plate, the at least one handle in communication with a laterally translating member that locks the horn in a substantially horizontal orientation.

[0033] Yet other embodiments are directed to a rotating table with a plurality of circumferentially spaced apart clippers. The table is in communication with a sprocket and chain. The table further includes an automated sprocket lubricator sprayer system that is configured to automatically spray or mist lubrication onto the sprocket and/or chain at defined intervals and/or after a predetermined number of rotations of the table.

[0034] Additional embodiments are directed to packaging systems with a plurality of cooperating different drive systems. The system includes: (a) a rotating table holding a plurality of circumferentially spaced apart clippers, the rotating table in communication with a table drive system with a selectable rotation speed; (b) a film drive assembly having a film drive system in communication with a supply of flat roll stock film having a selectable speed, the film drive assembly residing upstream of the rotating table with clippers; (c) an adhesive seal system in communication with the film drive system and residing upstream of the table with the clippers, the adhesive seal system having an extruder with an extruder drive system with a selectable extrusion speed in communication with an adhesive flow path that terminates into an adhesive nozzle; and (d) an automated control system in communication with the table drive system, the film drive system and the extruder drive system, configured to synchronize operation, adjust drive speed of one or more of the drive systems during operation of the packaging system and adjust each drive system to operate at a defined speed to cooperate to produce a desired product.

[0035] The system may include a horn with an exit portion that ejects filling into lengths of sealed casing. The automated control system is configured to adjust a speed of at least one drive system responsive to force exerted against a dancer arm positioned between the rotating table and the exit portion of the horn so as to be in communication with tensioned filled sealed covering.

[0036] Yet other embodiments are directed to a packaging system with a horn that terminates at an end portion proximate a pump interface into a horn collar and pump to horn interface block that releasably holds the horn in sealed fluid communication with the pump.

[0037] The horn collar and horn may be held to the system frame by a tool-less horn mount assembly with the block having an upper and lower block member that hold the horn therebetween and attach and release with a user-accessible handle.

[0038] Additional embodiments are directed to methods of packaging lengths of products using a packaging system with a multi-clipper rotating table, that include at least one of the following steps, typically a plurality of the steps, and may be carried out using all of the following steps:

[0039] (a) accepting user input on a display to select a desired product and/or recipe for production; (b) electronically determining desired operating parameters using based on the user input; (c) electronically determining a longitudinal position of the rotating table; (d) automatically translating the rotating table to a desired longitudinal position based on the selected product or recipe; (e) accepting user input to cause film drives to close against a product horn; (f) electronically monitoring temperatures in an adhesive flow path and adjusting heating zone temperatures to remain within desired operational ranges; (g) electronically directing an adhesive nozzle in communication with the adhesive flow path to carry out a self-cleaning operation; (h) electronically directing a lubricant to mist or spray onto a chain or sprocket associated with a drive system for the rotating table; (i) automatically lifting a top long edge of overlying film layers, then electronically directing the nozzle to advance to dispense adhesive between the overlying film layers; (j) electronically accessing an operating system and/or controller of the system from a remote location using a computer network; (k) electronically synchronizing different drive systems of the system to cooperate at appropriate speeds, including the synchronization of a film drive, an adhesive extruder drive, and the rotating table drive; and (l) replacing one or more spools of clips on the table using a drop in cradle that releasably holds the clip spools.

[0040] Although described above with respect to method aspects of embodiments of the present invention, it will be understood that these features may

also be embodied as systems, sub-systems, modules and/or computer program products.

[0041] 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

[0042] **Figure 1** is a front perspective view of a multi-clipper rotation platform packaging system according to embodiments of the present invention.

[0043] **Figure 2** is an end perspective view of the system shown in **Figure 1**.

[0044] **Figure 3** is a side perspective view of a dancer arm system configured to cooperate with the tensioned product to automatically adjust the speed of the adhesive/glue applicator output according to embodiments of the present invention.

[0045] **Figure 4A** is an end view of an exemplary cradle for releasably holding clip spools according to embodiments of the present invention.

[0046] **Figure 4B** is a side perspective view of another exemplary cradle according to other embodiments of the present invention.

[0047] **Figure 4C** is an end view a rotating table holding the cradles of **Figure 4B** according to embodiments of the present invention.

[0048] **Figure 5** is a partial top perspective view of a portion of the platform shown in **Figure 1** illustrating the clip guides with multi-position settings and fine radial adjustment capability according to embodiments of the present invention.

[0049] **Figure 6** is an enlarged side view of a portion of the platform shown in **Figure 1** (shown looking inward) illustrating the clip guide mounting plate with the fine radial adjustment capability as shown in **Figure 5**.

[0050] **Figure 7** is an end view of the cradle shown in **Figure 4A** illustrating the spool lock lifted to allow easy access to the loaded spools according to embodiments of the present invention.

[0051] **Figure 8** is a side perspective view of the cradle shown in **Figure 4A** illustrating one spool removed from the cradle while the handle is lifted according to embodiments of the present invention.

[0052] **Figure 9** is an enlarged view of the cradle shown in **Figure 8**.

[0053] **Figure 10** is a partial bottom view of the platform shown in **Figure 1** illustrating an automatic oil sprayer for the platform-rotation drive sprocket and/or chain according to embodiments of the present invention.

[0054] **Figure 11** is a partial bottom view taken from the opposing side of that in **Figure 10** illustrating, *inter alia*, the automatic oil sprayer shown in **Figure 10**.

[0055] **Figure 12** is a view from below the platform level of the system shown in **Figure 1**, illustrating the vertical support for the rotating platform held in communication with the split sprocket and stacked split support plates that allows ease of replacement of the sprocket without requiring disassembly of the vertical support according to embodiments of the present invention.

[0056] **Figure 13** illustrates an adhesive module/system with a multi-heat zone adhesive flow path with a horizontal extruder and a curvilinear flexible pipe that supplies hot fluid adhesive to the output port or nozzle according to embodiments of the present invention.

[0057] **Figure 14** is an enlarged partial front view of the system shown in **Figure 13**.

[0058] **Figure 15** is an enlarged view of the discharge end portion of the adhesive flow path shown in **Figure 13** according to embodiments of the present invention.

[0059] **Figure 16** is an enlarged view of a heated end block proximate the discharge end of the extruder according to embodiments of the present invention.

[0060] **Figure 17A** is a partial end perspective view of the forming collar and horn with a tool-less mounting configuration according to embodiments of the present invention.

[0061] **Figure 17B** is an exploded view of the tool-less forming shoulder support assembly according to embodiments of the present invention.

[0062] **Figure 18A** is an end perspective view of a tool-less releasable horn mounting configuration according to embodiments of the present invention.

[0063] **Figure 18B** is an exploded view of the tool-less horn mount assembly according to embodiments of the present invention.

[0064] **Figure 19** is an end perspective view of the opposite side of the horn mount assembly shown in **Figure 18A** according to embodiments of the present invention.

[0065] **Figure 20** is a side view of an automated film/covering lifter according to embodiments of the present invention.

[0066] **Figure 21** is a side perspective view of the lifter shown in **Figure 20** illustrating the lifter translated vertically down and pivoted toward the axial centerline of the horn to travel under the top layer of the film, synchronized with the nozzle to allow the nozzle to travel between the overlying layers in response to the lifting operation according to embodiments of the present invention.

[0067] **Figure 22** is a side perspective view of the lifter shown in **Figure 20** illustrating the lifter in an upwardly extended rest or home configuration and with an adhesive drop tray that can be rotated to reside under an adhesive output nozzle according to embodiments of the present invention.

[0068] **Figure 23A** is an exploded view of a film drive assembly that includes a primary belt that is in communication with front and rear vacuum drives according to embodiments of the present invention.

[0069] **Figure 23B** is a bottom assembled view of the film drive assembly shown in **Figure 23A**.

[0070] **Figure 24** is a block diagram of a data processing system according to embodiments of the present invention.

Detailed Description of Embodiments of the Invention

[0071] 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. Features described with respect to one embodiment may be used alone or with another embodiment although not specifically described with respect to that other embodiment.

[0072] 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.

[0073] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and should not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0074] The term "frame" means a generally skeletal structure used to support one or more assemblies, modules and/or components. The frame can be a floor mount frame. The term "automated" means that operations can be carried out substantially without manual assistance, typically using programmatically directed control systems and electrical and/or mechanical devices. The term semi-automatic means that operator input or assistance may be used but that most operations are carried out automatically using electromechanical devices and programmatically directed control systems.

[0075] In the description of embodiments 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 filler or product travels in a production line to form an encased product; 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.

[0076] The terms "adhesive" or "glue" means a material that when applied to a seam or overlying edge portions of a covering or casing material can adhere the edges to seal the product (typically in a substantially tubular or elongate shape). The seal is typically strong and is able to withstand desired pressures. For food products,

the adhesive can be biocompatible. Examples of suitable adhesives include, but are not limited to, polymers such as melted HDPE (high density polyethylene).

[0077] Embodiments of the present invention are particularly suitable for producing encased products that cooperate with clippers to apply clips to seal products held in the casings. The product may be a linked chain of elongated extruded product held in a casing. The casing or covering can be any suitable material or materials (edible or inedible, natural or synthetic) such as, but not limited to, collagen, cellulose, elastomeric, polymeric and/or plastic casing. The term "film" refers to a thin flexible sheet of covering material. When used with food products, the film, casing or covering should be food-compatible.

[0078] Referring now to the figures, the system **10 (Figure 1)** includes a rotating platform **20** with a table top **21** with circumferentially spaced apart clippers **22** (typically double clippers). The system may also include a flowable adhesive fluid delivery path **30**, a horn **52** and a forming collar **50**. As is well known to those of skill in the art, the forming collar **50** is configured to form sealed (seamed) substantially tubular casings from an elastomeric and/or polymeric sheet and/or planar roll stock that is then stuffed or filled with flowable product. More typically, the roll stock is an elastomeric and/or polymeric sheet that is relatively thin. The roll stock can be flat sheet stock of a flexible film that can be formed *in situ* into a continuous length of heat-sealed and/or otherwise joined or seamed tubular casing. The forming can be carried out substantially automatically and continuously over a desired interval (typically between at least about 45-60 minutes, depending on the size of the length of the roll stock). The seaming can be performed using a hot-melt flowable material, such as a polymer, as the adhesive that seals two layers together. The seaming can use additional and/or other suitable sealing means, including, for example, ultrasonic, light (ultraviolet or other desired wavelength), chemical, and/or other sealing means. The seam can be a flat seam, a fin seam, or other overlapping and/or abutting joint configuration, but is typically formed with one long edge **62** of the casing **60** overlapping the other as shown, for example, in **Figure 21**.

[0079] The encased elongated or tubular product can be an elongated food product, such as 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, hotdogs, and the like. Other embodiments of the present invention may be directed to seal other types of food (such as cheese) or other product in casing materials. Examples of other products include powders such as granular materials including grain, sugar, sand, explosives and the like or other flowable materials including wet pet food (similar to that held conventionally in cans) or other powder, granular, solid, semi-solid or gelatinous materials. The product may be a packaged in any suitable industry including food, aquaculture, agriculture, environment, chemical, explosives, or other applications.

[0080] Turning to **Figures 1** and **2**, an exemplary rotating platform multi-clipper system **10** is shown. Although shown as including (typically dual) clippers **22**, not all need be operational during a packaging operation (*e.g.*, alternating ones can be deactivated), or the table **20** may include other numbers of clippers **22**, typically between 10-14. Conventional Rota-Clip® systems are available from Tipper Tie, Apex, N.C. The number of clippers **22** used in combination with the circumference of the table **20**, and/or the radially adjusted position of the clippers **22** on the table **20** can allow for different lengths of end product to be produced. For example, for the same clipper radial positions, one operation using all 12 clippers **22** can produce a six-inch product and if every other clipper **22** is deactivated, up to a 36 inch product can be used. Larger sizes can be achieved using alternate configurations. As shown in **Figures 1** and **2**, the system **10** can include miniature ball valves **22v**, typically one for each clipper **22** in communication with a pneumatic control that automatically controls the activation and deactivation of the respective clipper **22** based on the system (HMI/PLC) controller **10c**. As with conventional rotating platform clippers, in operation, the sealed filled tubular covering is clipped under the platform table surface.

[0081] As shown in **Figures 1** and **2**, there are two air lines **22a** that run down the center column **12** for each clipper station **22s**. One line is the main air line for the trigger valve underneath the sprocket **83** (**Figure 10**). The second air line allows the clipper gate of the respective clipper **22** to close. It also has an inline shut off valve **22v** installed in the tubing. If this is used, it shuts off the air to the gate cylinder on that individual clipper. If the gate does not close the clipper will not "fire" (send down the punch or fire the knife). The reason behind turning off a clipper is to run a longer product than the normal length of product (e.g., chub) each clipper can

handle. For example, if clipper #1 is on, clipper #2 is off, and clipper #3 is on, the product length becomes the distance from the #1 clipper to the #3 clipper.

[0082] This activation/deactivation status can be based on the "recipe" selected by a user during set-up. The term "recipe" means that the system **10** can be preloaded, programmed and/or configured with a plurality of different operating conditions and/or configurations based on the desired output. The system **10** can accept user input to select the desired product and the system can automatically electronically implement different parameters such as different drive speeds, table position, extruder speed, desired clipper activation pattern such as, for example, clipper nos. 1, 3, 5...11, clipper nos. 2, 4, 6, 8, 10, 12, or clipper nos. 1-12, and the like used based on a pre-defined "recipe" that can generate the desired output.

[0083] The user input can be a list or blocks on a display with visual indicia of product types, names and/or desired product length. The system can define the related operational parameters to achieve this output based on the recipe. The recipe may be size- and/or product-specific. For example, a user can select the desired pre-defined product and/or a product size, and the system can be configured to select or identify proper longitudinal position of the platform **20** with respect to the output feed support surface **55** (shown as comprising rollers) and/or select the drive speed of certain components, the temperature of the heat zones (*e.g.*, **A-D**), correct radial pin hole position to use for mounting the clippers **22** to the platform **20**, and the like, based on a defined "recipe". Thus, for example, the recipe can be programmed and configured to include an electronic library and/or look-up table of clipper position (*e.g.*, which pin aperture number to use on the clip mounting slide bar and clip guides), which can be visually displayed for an operator and can also automatically activate the desired clippers **22** and select the platform **20** rotation speed, the covering draw speed (*e.g.*, film or casing), temperatures for one or more of the zones A-D, and the adhesive extruder speed.

[0084] The rotating platform or table **20** can be in communication with an improved air supply and air preparation system **20a** (**Figure 2**) for actuation of the clippers so that the systems **10** can operate with interchangeable size clippers **22** and associated clips to provide improved speed, manufacturing adaptation, and/or provide the same operational output (*e.g.*, 300 pieces per minute) irrespective of the size of the clipper **22** used.

[0085] In some embodiments, the table **20** can accept different sized clippers **22**, such as a "100" series clipper available from Tipper Tie, Inc., Apex, NC and a "200" series clipper available from Tipper Tie, Inc., Apex, NC. The 100 series can have a 100T clip size and the 200 series clipper can operate with a Z200 clip size. The 100 series clip sizes (smaller clipper) is normally used for products having about a 0.75 inch diameter to about a 1-1/2 inch diameter. The 200 series (larger clipper) is normally used for product sizes up to about 3-1/2 inch in diameter. The clip size for a particular product can be selected based upon film material thickness. In the past, two different machines were required, one for each clipper size. The larger old model clipper (200 series) required more air to run it at its maximum speed. The machine could run 300 feet of film per minute, but because of the air consumption of the large valves on the 200 series clippers, it slowed down the maximum number of pieces to 140 pieces per minute. Embodiments of the present invention employ a larger air supply system and allow for interchangeable use of the different size clippers in a manner that does not require that the machine maximum output be slowed to accommodate the larger clipper. Embodiments of the system **10** can run either set of clippers on the one machine at a speed of about 300 feet of film per minute.

[0086] The system **10** can have an air system that can run the larger clippers (200 series) at the same rate as the old systems could run the smaller clippers (100 series). That is, the system **10** can operate at a rate that is either about 300 pieces/minute or a maximum of about 300 feet of film/minute, "whichever comes first". To further explain the term "whichever comes first": the speed of the overall machine can be determined in feet of film/minute produced. The smaller length and smaller diameter products can sometimes pump faster than large ones. For example, an 8 inch long x 1 inch diameter piece or "chub" of product can be pumped and produced faster than a 18 inch long chub x 3 inch in diameter. Embodiments of the present invention can produce 300 pieces/minute as long as they are 12 inch and under. Pump speeds can vary for each client's facility. The system can produce about 300 feet of film/minute irrespective of the clipper size in use.

[0087] The rotating platform **20** has a vertical support **12** (also described as a column or leg) which is in communication with the main drive system **20d** that rotates the platform and clippers at the desired speed (and can automatically vary the speed depending on production requirements/inputs). The air supply lines that

connect to the various clippers can travel down the column **12** to an air supply. The system **10** can include a single common main air supply that can be diverted to feed all of the clippers. Alternatively, each or groups of the clippers may have a dedicated discrete air supply. Each clipper **22** can include on-board air supply conduits/lines with valves that releasably connect to the air supply lines on the column **12**. The large clippers may have larger valves relative to the smaller clippers but can mount to the platform **20** using the same mounting hardware and/or mounting configuration as the smaller clippers, including allowing for the same fine and gross position adjustment as will be discussed further below. The air supply can be provided at any desired operating pressure sufficient to run the clippers at a desired speed, typically at a pressure between about 80-125 psi. The large and small clippers can interchangeably attach to the air supply lines at each clipper station on the platform **20** and the clip air supply lines on the platform can have standardized fittings that interconnect to each type of clipper.

[0088] **Figure 2** illustrates that the system **10** can also include a position or location sensor **27** that may optionally longitudinally translate **12d** with the vertical table support **12** on a sliding platform **12p.** The sensor **27** is configured to detect and provide data regarding the position of the forward edge of the frame **10e** relative to the position of the table **20** and/or table support **12** and communicate the position data to the system controller **10c,** which directs the longitudinal (motorized) drive to cause the vertical table support **12** to be longitudinally translated to automatically adjust for spacing relative to the discharge feed support **55** and/or exit end of the horn **50**. The location sensor **27** can be an optical sensor(s) that can be configured to optically project substantially horizontally from a location upstream of the frame edge **10e** as illustrated by the arrows in **Figure 2**. The location of the platform **20** relative to the horn **50** can be automatically carried out based on a selected "recipe" that is selected for manufacture to help automatically set-up the system for operation. Previous systems employed a hand-crank wheel for movement, which required operator labor and unreliable precision in placement.

[0089] **Figure 3** illustrates that the discharge feed support surface **55** includes tension feedback members **70, 72** that communicate with the filled tensioned casing/product (not shown). Member **72** is configured to translate outwardly from pivot **71** in response to excess tension, which exerts force against the member **72,**

causing the film speed, the adhesive extrusion speed, and/or adhesion delivery to increase. In operation, the downstream member **72** is configured to communicate with a position sensor **73** to provide the feedback to the controller to allow the controller to adjust the operational parameters.

[0090] **Figure 4A** illustrates a clip guide **23** defined by a pair of spaced apart plates **23p**$_1$, **23p**$_2$, each having a slot **23s** formed therein and mounted to the table **20** across a radially extending gap **21g** therebetween. Each of the clip guide plates **23p** includes aligned radially spaced apart apertures **23a** that releasably receive a locking pin **23l** (**Figure 5**) to hold the clipper **22** in a desired radial position on the table **20**. **Figure 4A** also illustrates a cradle **25** that releasably holds spools of clips **28** on the table **20**. **Figures 4B** and **4C** show an alternate embodiment of the cradle **25'** as will be discussed further below. As shown in **Figure 5**, the clippers **22** each include a clip mount **24** that extends across the gap **21g** and slides in the slots **23s**. The clip mount **24** also includes apertures **24a** that receive the locking pin **23l**. An operator can select different apertures **24a**, **23a** to define the desired radial position and lock the clipper **22** into place. The clipper mount **24** can have fewer apertures **24a** than the clip guides **23**, such as between about 2-3 apertures **24a,** while the clip guides **23** can have between 5-10, typically about 6, apertures **23a**.

[0091] In some embodiments, as also shown in **Figures 5** and **6**, the system **10** can include a "fine" radial adjustment screw **26**. The "fine" radial adjustment screw can allow an operator to adjust the position after a clipper **22** is locked into a "gross" position using the selected apertures **23a**, **24a.** The "fine" adjustment screw **26** can move the clipper **22** for even more precise radial position. The fine adjustment screw **26** can provide for between 0.1 inch to about 1 inch or radial adjustment, but is typically less than the gross adjustment that is obtained using only the gross adjustment mounting positions. The gross adjustment can be provided using a selected pair of cooperating apertures **23a**, **24a** (typically allowing for about 1/8 inch radial position changes), while the fine adjustment may be used to "tweak" such a position, typically radially moving the locked-position clipper **22** less than the gross adjustments, typically by less than 1/8 inch. This fine adjustment can help set substantially exact distances between clippers **22** and can produce more accurate or reliable product lengths. The system controller **10c** can reside in the HMI unit with a display **10d** for touchscreen input. Other user-interface and/or inputs can be used.

[0092] **Figures 7-9** illustrate easy-release and mount spool cradles **25** according to embodiments of the present invention. This configuration allows for rapid clip reload as the clipper can remain in position while the clip spool with the clips can be dropped into the cradle **25**. The cradle **25** is configured to snugly hold two side-by-side clip spools $\mathbf{28_1}$, $\mathbf{28_2}$. As shown in **Figure 8**, the cradle **25** is aligned with and can be mounted to the clipper **22** and also reside on the surface of the table **21**. One side of the cradle may span the gap **21g**. The cradle **25** can include an upwardly extendable spring **126** configured to bias the handle **125** to a retracted configuration that can be lifted upward to allow a clip spool to be easily withdrawn and a different spool dropped straight in as desired. The spring **126** can be provided as a coil spring or another resiliently configured device that can provide the desired retention force and/or bias. The cradle **25** can be configured to define two spool holding cavities **25c** that snugly receive the respective spool $\mathbf{28_1}$, $\mathbf{28_2}$, and that extend radially between an upper and lower (rigid elastomeric) tubular bar, **25u 25l** as shown in **Figure 8**. The cradle **25** can include a handle **125** that can pivot between open and closed positions via pivot **125p**. The handle **125** can comprise two lateral top portion extensions (*e.g.*, a "T" shape) to snugly reside against adjacent spool walls of the different clip spools (**Figure 2**) to inhibit the spools from "free wheeling". The cradle **25** can be configured to hold different size clips (such as the "100" and "200" size clips and associated clippers are available from Tipper Tie, Inc., Apex, N.C.). The spool width for each different clip size can be substantially the same. The cradle **25** can be configured to radially slide as the clipper mount **24** slides into the desired clipper mounting location on the platform or table **20**. As shown the cradle **25** can include inner wheels **25w** on the outside of the lower bars **25l** that reside on the support surface of the table **20**.

[0093] **Figures 4B** and **4C** illustrate another embodiment of the cradle **25'**. In this embodiment, instead of the wheel **25w** discussed above, the cradle **25'** mounts to the table **20** using a block **25b** and an inner mount **25m** that hold the front and back members **25i, 25o** above the table **20** and in alignment with adjacent corresponding clippers **22**. The cradle **25'** can translate with the adjustment of the clipper **22** as discussed herein. The block **25b** can engage the slots **23s** and the front mount **25m** can engage a clipper **22**. As for the embodiment shown in **Figure 4A**, the cradle **25'** has inner and outer members **25i, 25*0* that** can be radially spaced apart and cooperate

to hold a respective clip spool **28**. The members **25i, 25o** can be rollers that can mount on an internal rod that extends between and attaches to outer mounts **127**. The members **25i, 25o** can reside at substantially the same level (rather than one residing above the other).

[0094] **Figures 10** and **11** illustrate a sprocket **83** and chain drive **84** in fluid communication with an automated lubrication spray system **80** that extends from an oil supply **85** to a nozzle **80n** that is directed to spray the teeth of the sprocket **83** and/or the chain **84** as the chain contacts the sprocket **83**. The system **10** can be configured to automatically activate the sprayer nozzle **80n** periodically (*e.g.*, every 10 minutes or every certain number of revolutions of the table **20)** and to have the sprayer **80n** spray or mist the entire perimeter of the sprocket **83** at least once per activation. The activation is typically programmatically directed based on communication from the system controller. The lubricant spray can be in a fine mist to inhibit pooling of fluid under the system **10**. A catch tray may be placed between the sprocket and the floor (not shown).

[0095] **Figure 12** shows that the sprocket **83** can be a split sprocket. The split sprocket **83** is typically in two equal pieces **83a, 83b**, but may be in more than two pieces and may not be symmetrically split. The sprocket **83** can also include spaced apart holes apertures **83h** that direct the airlines **22a** from each clip station **22** beneath the sprocket **83**. The table (vertical) support stand or leg **12** rotates in response to rotation of the sprocket **83**, driven by the chain drive **84** and drive system (*e.g.*, motor). The stacked vertically spaced apart (support) plates **86, 87** can reside proximate the sprocket **83** and may also be split plates **87a, 87b, 86a, 86b**, respectively, to allow for ease of repair without requiring disassembly of the vertical stand **12** to remove the sprocket **83**. The split line of the support plates **86, 87** can be aligned, as shown, or offset. The split line of the support plates **86, 87** may be offset with the split line of the sprocket **83** as shown or may be aligned (not shown). A suitable split sprocket is available from Martin Sprocket and Gears, Inc., located in Mansfield, TX.

[0096] **Figure 13** illustrates the fluid adhesive system **30** with an associated adhesive flow path **30f**. The flow path **30f** has a substantially horizontal first portion associated with the (horizontal) extruder **33**, which merges into a curvilinear portion associated with a conduit, pipe or hose **36** that travels up, then

down to a delivery head or nozzle **39** (**Figure 15**). The extruder **33** can be stationary and horizontally oriented which may improve resin feeding from the hopper **31** into the extruder **33** relative to a conventionally used vertical extruder. The conduit, pipe or hose **36** has a lower end proximate the nozzle **39** that is able to move substantially vertically between about 3-6 inches, typically between about 4-5 inches (down for application or dispensing of the adhesive from the nozzle **39** and up in a rest configuration).

[0097] The heat seal module or system with the fluid adhesive delivery system **30** can include at least four separately controllable heat zones, shown as "**A, B, C, D**" in **Figure 13**. Individual control allows the system **10** to electronically monitor and to set different (or the same) temperatures at each zone **A-D**. Zone **A** is associated with the barrel **33b** of the extruder, which includes at least one internal heater, typically two internal heaters. Zone **B** is associated with the end fitting or exit block **34** proximate the discharge end of the extruder **33**. Zone **C** is associated with the curvilinear conduit **36** (the conduit can be a hose and/or pipe). Zone **D** is associated with the end fitting **38** proximate the lower portion of the conduit **36**. The end fittings **34, 38** can include heat blocks **34b, 38b** with a respective heat element attached thereto. The heat blocks can heat conductively based on the heat input through the thermal elements **34e, 38e**, respectively. The heat blocks **34b, 38b** can be metallic such as SST or brass. As also shown, ropes or other fastening or insulating members can be wrapped around the end portions of the conduit **36** proximate the heater blocks/end fittings for further structural and/or insulation reinforcement. As shown, rope is looped around the end fittings.

[0098] The conduit **36** can comprise a blanket heater **36h** that is configured to provide the desired wattage and is overwrapped with at least one insulation layer, typically comprising Nomex® -fiberglass fibers, but other insulation materials may be used. As shown, the conduit **36** can include an outer elastomeric sleeve. The conduit **36** can also include an internal steel or SST tube or other material that defines the inner wall that contacts the flowable adhesive, which may be surrounded with a SST mesh for improving burst pressure (the SST mesh can reside under the insulation layer(s)). Examples of suitable flexible heated hoses include those available from Diebolt and Company, located in Old Lyme, CT or Conrad Company, located in Columbus, OH. The conduit **36** can have a length between

about 10-80 inches. In the embodiment shown, the conduit **36** has a length of about 48 inches.

[0099] Each of the heaters can be configured to heat the adhesive to or above the melt point, typically between about 200-300 degrees Celsius. All the zones can be heated to the same temperature (typically between about 200-300 degrees Celsius) or each zone can be heated to a different temperature to promote the flow of the adhesive. In some embodiments, the blocks **34b, 38b** may have a higher target temperature than the extruder **33**.

[0100] The heater **38e** proximate the nozzle **39** can be configured to operate at a higher temperature, particularly at start-up (and/or shut down) to provide a self-clearing or self-cleaning nozzle. This is in contrast to conventional systems where operators were required to use a blow-torch or other cleaning method after removing the nozzle from the device to re-configure the nozzle to be ready for subsequent use. The cleaning or clearing temperature can be set to about 225-300 degrees Celsius. The cleaning or clearing operation can be automatically initiated upon start-up of the system **10**, upon activation of the extruder **33** and/or by an operator selectable input on the controller or other suitable switch. The temperature of the lower heater zone **D** can be reduced from the cleaning or clearing temperature once the adhesive flows suitably from the nozzle **39.** The temperature reduction can be automatic after a defined time or self-cleaning period.

[0101] As shown, the system **10** includes a vertically oriented hopper **31** that holds bulk adhesive material, typically in solid pellet, crystal or granule form. The adhesive pellets can comprise a polymer such as, for example, HDPE. The hopper **31** feeds the raw material to a horizontally extending screw extruder **33** that includes a barrel **33b** in communication with a screw auger. As shown, the extruder **33** is stationary and fixed in position. As discussed above, the barrel **33b** includes at least one heater, typically two internal heaters, to melt the pellets or other source adhesive material into a flowable form.

[0102] The fluid flow system can comprise a pressure sensor that senses the pressure in the extruder barrel **33b**. The pressure limit can be configured to ensure that the downstream pipe or hose is not over-pressured; typically the pressure limit is set to about 1500 psi and the system **10** and/or the adhesive system **30** can be automatically shut down if this pressure is exceeded. A suitable commercially

available extruder is a ¾ inch screw extruder from Killion Extruders, located in Cedar Grove, N.J. A keyway or groove can be bored or formed into the inner diameter of the extruder feed section (at about "6:00 o'clock" opposite the infeed of the hopper) to promote flowability of the pellets into the extruder **33** without over driving the motor.

[0103] The nozzle **39** can be configured to emit a plurality of strips of adhesive onto the surface of the film/covering (**60, Figure 21**), typically three strips.

[0104] **Figures 17A** and **17B** illustrate that the system **10** can include a tool-less/tool-free mounting configuration **153** for releasably attaching the forming collar **50** and horn **52** to the frame **10f**. As shown, two rotating handles **53** can be used to both lock and release a substantially planar vertically oriented mounting plate **54** in axial position on a forming shoulder plate **111** attached to the system frame **10f** and holding two web guide idler rollers **125**. Once the horn **52** is in position in the cavity of the shoulder plate **111c**, the horn **52** and collar **50** can be easily locked into position by turning the handles **53** to force the compression members **56** toward each other and against the plate **54.** To release, the handles **53** can be turned the other way to release the holding force of the members **56**, allowing a user to be able to remove the horn/collar **52/50** without requiring any tools. The compression members **56** can be configured so that one resides on each side of the cavity **111c**. The compression members **56** can comprise a forming collar clamp block that cooperates with a respective handle **53**.

[0105] As discussed above, the system **10** includes a horn **52** which cooperates with forming and sealing mechanisms to convert flat roll stock material **60** into substantially tubular seamed covering/casing as the material travels over the forming collar **50**. The horn **52** includes an internal flow channel that extends through the horn **52**. In operation, the flow channel directs product to flow therethrough (sealed from the environment). As the product exits the discharge end of the horn **52**, it is stuffed into or fills the sealed casing material **60** that is held around the outer surface of the horn **52**. The horn **52** can be positioned in the apparatus **10** on support structures **10f** so that it is substantially horizontal with the centerline aligned with upstream and downstream components during operation.

[0106] Referring to **Figures 18A, 18B** and **19**, the horn **52** is in fluid communication with a filler/product pump and supply **150** located upstream thereof as shown schematically in **Figure 19**. The horn **52** can terminate into a metal mounting

collar **57** that engages a tool-less mounting assembly **154** located upstream of the forming collar proximate the pump outlet block **54** configured to seal the collar **57** to the pump interface **58i** of the pump pipe **58**. The tool-less/tool-free horn mount assembly **154** can include a handle **59** on a top portion of the block **54** can be easily turned to lock or release the horn **52** from the system frame. The block **54** can be in two cooperating pieces, a top block **54t** and a bottom block **54b** which form a cylindrical cavity **54c** that engages the horn **52**. The top and bottom blocks **54t, 54b** can include a vertical slot **54s** that hold a clamp screw **159** that is attached to the handle **59**. The assembly may also include a flat washer **118** and a thrust washer **115** that reside in or proximate a recess **54r** in the top block **54t**. The tool-less horn mount assembly **154** may include two dowel pins **116**, one on each side of the block **54**, typically residing at a top portion of the lower block **54b**. The assembly **154** may also include a fill horn key **117.**

[0107] **Figures 20-22** illustrate an automated lifting mechanism for lifting one long edge portion of the covering (*e.g.*, film) to allow the adhesive delivery nozzle **39** (**Figure 15**) to advance between the upper and lower layers of overlying covering **60**, particularly to flip or lift the top layer **62** up proximate in time to when the conduit **36** and nozzle **39** are lowered to an active dispensing position and the adhesive catch tray **99** (**Figure 17A**) is also automatically rotated out from under the nozzle **39** in concert with the lowering of the lifting mechanism and/or lowering of the conduit **36** into a dispensing mode. As shown, the lifting mechanism **90** includes a pivoting finger **90f** that is pivotably attached to a laterally extending mounting member **92** via pivot **90p** and is attached to a linear actuator **90a**. The mounting member **92** can be configured to slide on a vertical support member (*e.g.*, tube) **93** between extended and retracted configurations. As shown, the mounting member **92** is also attached to a vertically extending actuator **96** that causes the member to slide up to the rest or home position and down to the operative position on a member **93**.

[0108] In operation, the mounting member **92** slides down the vertical support member **93** as the actuator **96** retracts and the actuator **90a** extends, causing the finger **90f** to rotate down and inward toward the covering **60**, then lift the covering and retract during a short cycle time. Typically, the finger **90f** rotates forward and lifts and/or flips the top covering **62**, then rotates back within less than about 5 seconds, typically in less than about 1-2 seconds. When the actuator **90a** retracts, the

finger rotates away from the covering **60**. The member **92** can remain lowered during dispensing but the finger **90f** is retracted. **Figures 20** and **22** show the lifting mechanism **90** in a rest position while **Figure 21** illustrates the lifting mechanism **90** lowered and the tray **99** rotated, but with the finger **90f** already actuated and retracted with the nozzle **39** between the layers **60, 62**. The system **10** can include a user input button (*e.g.*, touchscreen on an operator control display or button or switch) to allow an operator to "refire" or extend the finger **90f** as needed.

[0109] The system **10** can include a Siemens variable frequency drive and integral safety system, including, for example, a Siemens Step7 300 Processor with Integral Safety Systems, including a Siemens touch screen, motor drives and safety modules. The touch screen can include a series of iconic and/or pictorial image display of user-activated or status indicating features for various components, *e.g.*, adhesive nozzle down, pump "on or off" and the like. The electric motors can be explosion-proof TECO motors that can be mounted outside the electrical box to reduce or eliminate cooling issues. The system can include automatic positioning of vacuum belt drives. The system **10** can be Ethernet ready for remote access via VPN and may also be PROFIBUS ready, foreign language supported.

[0110] In some embodiments, the system **10** can be configured to operate with an automated synchronized drive control system that may use a single virtual axis for ramp-up to maximum operational speed that synchronizes the covering (*e.g.*, film) drive, the adhesive extruder drive and the rotating table drive (using the Siemens or a similar variable frequency drive system). Each drive system can operate at a selected (variable or constant) speed. The film and extrusion drive can operate to provide sealed tubular covering at any desired speed, including between about 10-300 feet per minute, typically between about 150-300 feet/min; more typically, the machine can operate at an operating speed of about 300 feet/minute.

[0111] **Figures 23A** and **23B** illustrate an example of a film drive assembly **200** which drives the film **60** (or other covering) that forms the tubular casing or covering. As shown, there is a belt **210** that is driven by an electric motor **215** which drives both vacuum belt drives **221, 222**.

[0112] In a typical sequence of events, the forming collar **50** is placed into position on the horn **52** by sliding the product horn **52** through the forming collar **50**. The forming collar **50** and product horn **52** are then placed into position into the tool-

less forming shoulder support assembly **153** (**Figures 17A, 17B**). Once the forming collar **50** is in place, the product horn **52** can be clamped into position using the tool-less horn mount assembly **154** (**Figures 18A, 18B**). The horn **52** is clamped, aligning it into position via the vertical pin **159** in the assembly **154** (**Figure18B**).

[0113] Referring again to **Figures 23A** and **23B**, the film drive assembly **200** has an adjustment wheel **225** which moves both sets of the vacuum belt drives **221, 222** (together) toward the front or back of the machine. This action allows the front and back vacuum belt drives to be aligned substantially equidistant to the horn **52**. Once they are equal in distance from the horn **52**, an input on the touchscreen **10d** (**Figure 2**) can be used to electronically open or close the vacuum drives **221, 222**. The opening and closing are typically simultaneous.

[0114] At this point the operator is ready to load film **60**. Flat roll stock film **60** is pulled through the forming collar **50** (which forms a tube around the product horn **52**). It is pulled past the open vacuum belts **221, 222** down the length of the horn **52**.

[0115] The system **10** can be configured with an automatic positioning using a touchscreen input on the HMI (human/machine interface) display **10d**. This user-selectable input tells the vacuum belt drives rear and front **221, 222** of the film drive assembly **200**, to open or close. After the film **60** is in position, the machine/system **10** is ready for operational position whereby the vacuum drives **221, 222** should be closed so that the vacuum belts **221b, 222b** abut up against the film **60**, clamping the film **60** between the horn **52** and the belts **221b, 222b**. This can be done pneumatically with air cylinders which are associated with the vacuum belt drive assemblies **221, 222**.

[0116] **Figure 24** is a block diagram of exemplary embodiments of data processing systems that illustrates 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. 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. 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.

[0117] As shown in **Figure 24**, 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 Automated Control and Drive Module **450** and/or Recipe Module **449**; and the data **456**.

[0118] The data **456** may include a look-up chart of different "recipes" as well as the associated drive speeds, clipper and table position set-up information, and the like, corresponding to particular or target products for one or more producers. The data **456** may include temperature zone monitoring data to automatically control the temperature in each zone and a synchronized drive module for synchronizing the drive speeds of the different cooperating systems, *e.g.*, film drive system, the table rotation drive system, the extruding speed, pump speed, and the like. The speed of the film/covering **60** or rotation speed of the table **20** and the like can be adjusted based on real-time feedback of the operative status of the machine such as from the tension/force feedback from the dancer arm discussed above with respect to **Figure 3**. Selection of all, groups and/or individual clippers **22** can be automated based on the "recipe" to activate or deactivate certain clippers at different (typically alternating) clipper stations, *e.g.*, stations 1-12.

[0119] 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, NY, Windows CE, Windows NT, Windows95, Windows98 or Windows2000 from Microsoft Corporation, Redmond, WA, 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 and/or the dispensing system **420**. 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

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

[0120] While the present invention is illustrated, for example, with reference to the Modules **449**, **450** being an application program in **Figure 24**, 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 **449**, **450** 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 **Figure 24**, which is intended to encompass any configuration capable of carrying out the operations described herein.

[0121] The I/O data port can be used to transfer information between the data processing system **405** and the downstream clippers or another computer system or a network (*e.g.*, the Internet or Ethernet) 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.

[0122] 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 configuration of **Figure 24** but is intended to encompass any configuration capable of carrying out the operations described herein.

[0123] The operation and sequence of events and can be controlled by a programmable logic controller (PLC). The operational mode and certain input parameters or machine controls can be selected or controlled by an operator input using a Human Machine Interface (HMI) to communicate with the controller as is well known to those of skill in the art.

[0124] The block diagram illustrates the architecture, functionality, and operation of possible implementations of embodiments of 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.

[0125] In summary, embodiments of the present invention provide apparatus, systems, devices, methods and computer program products configured to provide one or more of the following features or components: rotating tables with at multiple clippers, typically at least 10, and more typically about 12, circumferentially spaced apart (providing conformance with industry-standard product lengths with minimal or reduced waste); improved flowable adhesive seal systems; clip spool cradles with easy load and release systems; horizontal (typically stationary) extruders in cooperation with curvilinear flow paths and horizontal fill configurations; automated casing (*e.g.*, film) lift members for nozzle insertion between overlapping layers of the casing; an automated table longitude position adjustor extender and retractor; rotary support tables with fine radial clipper location/position adjustments; self-cleaning or self-clearing systems for adhesive delivery nozzles; automated parameter (recipe-specific) position adjustment and displayed set-up data for operators; cooperating clip guide bars with aperture patterns and guide slots that mount to the rotating table and cooperate with clipper guides that hold dual clippers to lock and position the clipper in multiple different radial positions; at least four discrete temperature controlled heat zones in the adhesive fluid flow path; a rotating table with improved air supply and air preparation units for actuation that can operate with interchangeable size clippers and associated clips to provide improved speed or the same operational output (*e.g.*, 300 pieces per minute) irrespective of the clipper used; tool-free releasable mounting of the horn and forming collar; an automated sprocket lubricator sprayer system; automated controls to synchronize the different drive systems of the overall system to cooperate at appropriate speeds, including the synchronization of the film drive, adhesive extruder, and the rotating table drive; an automated drive system speed adjustment based on force exerted against a dancer arm positioned between the table or platform and downstream of the horn and in communication with the tensioned filled film; a split sprocket and split overlying supports positioned about the vertical table mount leg for easier replacement of the sprocket without requiring disassembly of the table/platform; a tool-less releasable

horn collar and block that defines a pump interface mounting configuration, and automatic positioning of the vacuum belt drives.

[0126] 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.

THAT WHICH IS CLAIMED IS:

1. A packaging system comprising:

a rotating platform having a vertical column; and

a plurality of circumferentially spaced apart clippers mounted to the rotating platform;

wherein the platform is configured to concurrently mount the plurality of clippers in respective circumferentially spaced apart clipper stations, and wherein the platform is configured to releasably interchangeably mount two different sized clippers in respective clipper stations, one of the different size clippers being configured to output larger clip sizes than the other clipper.

2. A system according to Claim 1, wherein the different sized clippers include on-board air supply lines that connect to air supply lines at each clipper station of the platform, and wherein, in position, the clippers are in fluid communication with a common pressurized air supply for actuation of the different sized clippers.

3. A system according to Claim 1, wherein the platform can concurrently hold twelve clippers, one at each of twelve circumferentially spaced apart clipper stations.

4. A system according to Claim 1, further comprising:

a split main drive sprocket residing under the rotating platform surrounding the vertical column; and

a drive system with a chain in communication with the sprocket that rotates the rotating platform at a desired speed.

5. A system according to Claim 4, further comprising first and second vertically stacked and spaced apart plates residing above the sprocket, each of the plates being split into a plurality of adjacent pieces with a radially extending split line extending between the adjacent pieces.

6. A system according to Claim 1, further comprising a location sensor in communication with the rotating platform and a frame holding the rotating platform, wherein the system comprises a controller that receives data from the location sensor

and automatically moves the rotating platform to a desired longitudinal position based on location data from the sensor and user input selecting a product type and/or size for production.

7. A system according to Claim 1, further comprising a plurality of circumferentially spaced apart cradles that hold clip spools on the platform, each cradle holding a respective clip spool with clips in cooperating alignment with a corresponding clipper, wherein each cradle is configured to allow a clip spool to be inserted into the cradle while a corresponding proximate clipper remains in position.

8. A system according to Claim 7, further comprising fine adjustment screws, one in communication with each of cradles, the fine adjustment screws configured to allow an operator to radially move the cradle into a desired position on the platform.

9. A system according to Claim 7, wherein each cradle releasably holds two spools side-by-side.

10. A system according to Claim 4, further comprising an automated lubrication system configured to automatically mist or spray lubricant onto the sprocket and/or a chain associated therewith during operation.

11. A system according to Claim 1, further comprising:

a flat roll stock to tubular covering forming system with a forming collar residing upstream of the rotating platform; and

an adhesive seal system in communication with the forming system that seals the flat stock in a tubular configuration, wherein the adhesive seal system comprises an automatic lifter that lifts one long edge of the covering to allow a nozzle to apply adhesive proximate the lifted long edge to seal the covering into the tubular configuration.

12. A system according to Claim 11, wherein the nozzle is a self-cleaning nozzle with a heater, the nozzle heater being in communication with a controller,

wherein the controller is configured to direct the heater to heat to a sufficient temperature to clean adhesive residue from the nozzle.

13. A system according to Claim 11, wherein the adhesive seal system comprises a stationary substantially horizontal extruder that merges into a curvilinear flow path that connects to the nozzle.

14. A system according to Claim 11, wherein the adhesive seal system comprises four temperature zones that can be individually controlled for temperature, including a first zone associated with the extruder, a second zone associated with an exit from the extruder, a third zone associated with the curvilinear flow path, and a fourth zone associated with an exit from the curvilinear flow path proximate the nozzle.

15. A system according to Claim 11, wherein the lifter is configured to automatically move between a home position that is laterally and upwardly away from a centerline of the horn and an operative position whereby the lifter travels downwardly to reside above and proximate the horn and inwardly toward the centerline of the horn.

16. A system according to Claim 11, further comprising a rotating drip tray that resides under the nozzle in a non-active nozzle configuration and that is synchronized to automatically rotate away from under the nozzle when the lifter moves to and/or is in its operative position.

17. A system according to Claim 1, wherein the system further comprises:

a product horn residing upstream of the platform; and

a film drive system in communication with a supply of flat roll-stock film, the film drive system including two vacuum drives, each having a belt, in communication with a display and a system controller, whereby the display is configured to accept user input to cause the vacuum drives to automatically translate the vacuum drive belts to an operative position to clamp the film against the horn.

18. A system according to Claim 1, wherein the system further comprises:

a product horn residing upstream of the platform releasably attached to a system frame;

a film drive system in communication with a supply of flat roll-stock film;

a forming collar residing on the horn in communication with the supply of flat-roll stock;

a tool-less forming collar and horn mount assembly having first and second handles that rotate to force a member against a plate that releasably holds the horn and collar in position; and

a tool-less horn mounting assembly that holds the horn upstream of the forming collar, wherein the tool-less horn mounting assembly comprises first and second blocks that define a substantially cylindrical cavity therebetween, the first and second blocks configured to releasably attach together via a handle in communication with a rod that extends through the first and second blocks and clamps the blocks against the horn.

19. An adhesive sealing module for a packaging system, comprising:

a stationary-mounted substantially horizontal extruder in communication with a hopper of bulk adhesive;

a curvilinear heated conduit having opposing upper and lower end portions, the upper end portion being in fluid communication with an adhesive exit portion of the substantially horizontal extruder;

an adhesive dispensing nozzle in fluid communication with and positioned proximate the lower end portion of the heated conduit;

a roll of flat sheet stock in communication with a forming collar and a substantially horizontally extending horn configured to form the sheet stock *in situ* into a substantially tubular shape with open overlapping long edges about the horn; and

an automated lifter mechanism in communication with the roll of flat sheet stock downstream of the forming collar;

wherein, in operation, the lifter mechanism is configured to automatically translate to lift a top one of the overlapping long edges of the sheet stock whereby the

adhesive dispensing nozzle automatically dispenses flowable adhesive between the long edges of the formed sheet stock.

20. A sealing module according to Claim 19, wherein the nozzle is a self-cleaning nozzle that is in communication with a system controller that electronically directs a heater associated with the nozzle to heat to a sufficiently high temperature to melt and release adhesive residue in the nozzle.

21. A computer program product for operating a packaging system with a rotating table having a plurality of circumferentially spaced apart clippers thereon in communication with a horn and flat stock to generally tubular film or covering forming system, 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 configured to monitor and adjust temperatures in four different temperature zones associated with an adhesive flow path that terminates into an adhesive dispensing nozzle; and

computer readable program code configured to increase, then decrease, temperature of the heating zone proximate the dispensing nozzle to cause the dispensing member to perform a self-cleaning or self-clearing operation, thereby inhibiting clogging of the dispensing nozzle.

22. A computer program product for operating a packaging system with a rotating table having a plurality of circumferentially spaced apart clippers thereon in communication with a horn and flat stock to generally tubular film or covering forming system, 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 configured to programmatically provide recipe-specific position adjustment of the table, the clippers and display of set-up data for operators.

23. A clip spool cradle adapted to mount to a table, the cradle having radially spaced apart inner and outer members that cooperate to releasably hold a clip spool.

24. A clip spool according to Claim 23, wherein the clip spool cradle is configured to releasably hold two clip spools side-by-side.

25. A packaging system comprising:

a product horn having a forming collar thereon;

a roll of flat sheet stock in communication with the forming collar and the product horn, the system configured to form the sheet stock *in situ* into a substantially tubular shape with open overlapping long edges about the product horn;

a hot adhesive supply source in communication with an adhesive nozzle; and

an automated lift mechanism configured to automatically lift a top one of the overlapping long edges to allow the adhesive nozzle to move under the lifted long edge and apply sealant between the overlapping long edges.

26. A rotating table holding a plurality of circumferentially spaced apart clippers, with each respective clipper having a pair of cooperating clip guide bars with an aperture pattern and a guide slot that mount to the rotating table and cooperate with clipper guides that hold and lock the clipper into a desired one of multiple different radial positions.

27. A rotating table rotary support table holding a plurality of circumferentially spaced apart clippers, with each respective clipper having a radially extendable screw defining a fine radial location/position adjustment member for the clipper.

28. A packaging system comprising:

an adhesive seal system with an extruder and a dispensing nozzle, and

an adhesive fluid flow path comprising at least four discrete automatic temperature controlled heat zones.

29. A packaging system, comprising:

a rotating table with a vertical column, the table having a plurality of circumferentially spaced apart clippers in fluid communication with a pressurized air supply and air preparation units; and

a split sprocket surrounding the vertical column in communication with a drive system for rotating the table at a desired speed.

30. A packaging system according to Claim 29, wherein the table is configured to releasably mount different sized clippers, one of which applies larger clips than the other, and wherein the air supply and air preparation units allow for rapid actuation of the different clippers at a rate of about 300 pieces per minute or 300 feet/min of film to thereby provide substantially the same operational output irrespective of the clipper used.

31. A packaging system comprising:

a horn with a forming collar;

a tool-less forming collar assembly support shoulder attached to a frame of the packaging system, the tool-less forming collar assembly comprising a support plate with a semi-circular cavity and at least one user-accessible handle attached to the support plate, the at least one handle in communication with a laterally translating member that locks the horn in a substantially horizontal orientation.

32. A rotating table with a plurality of circumferentially spaced apart clippers, the table in communication with a sprocket and chain, the table further comprising an automated sprocket lubricator sprayer system that is configured to automatically spray or mist lubrication onto the sprocket and/or chain at defined intervals and/or after a predetermined number of rotations of the table.

33. A packaging system with a plurality of cooperating different drive systems, comprising:

a rotating table holding a plurality of circumferentially spaced apart clippers, the rotating table in communication with a table drive system with a selectable rotation speed;

a film drive assembly having a film drive system in communication with a supply of flat roll stock film having a selectable speed, the film drive assembly residing upstream of the rotating table;

an adhesive seal system in communication with the film drive system and residing upstream of the table with the clippers, the adhesive seal system having an extruder with an extruder drive system with a selectable extrusion speed in communication with an adhesive flow path that terminates into an adhesive nozzle; and

an automated control system in communication with the table drive system, the film drive system and the extruder drive system, and configured to synchronize operation, adjust drive speed of one or more of the drive systems during operation of the packaging system and adjust each drive system to operate at a defined speed to cooperate to produce a desired product.

34. A packaging system according to Claim 33, further comprising a horn with an exit portion that ejects filling into lengths of sealed casing, and wherein the automated control system is configured to adjust a speed of the film drive system and/or the extruder drive system at least one drive system responsive to force exerted against a dancer arm positioned between the rotating table and the exit portion of the horn so as to be in communication with tensioned filled sealed covering.

35. A packaging system comprising a horn that terminates at an end portion proximate a pump interface into a horn collar and pump to horn interface block that releasably holds the horn in sealed fluid communication with the pump.

36. A packaging system according to Claim 35, wherein the horn collar and horn are held by a tool-less horn mount assembly with the block having an upper and lower block member that hold the horn therebetween and attach and release with a user-accessible handle.

37. A method of packaging lengths of products using a packaging system with a multi-clipper rotating table, comprising:

accepting user input on a display to select a desired product and/or recipe for production;

electronically determining desired operating parameters using based on the user input;

electronically determining a longitudinal position of the rotating table;

automatically translating the rotating table to a desired longitudinal position based on the selected product and/or recipe;

accepting user input to cause film drives to automatically close against a product horn;

electronically monitoring temperatures in an adhesive flow path and adjusting heating zone temperatures to remain within desired operational ranges;

electronically directing an adhesive nozzle in communication with the adhesive flow path to carry out a self-cleaning operation;

electronically directing a lubricant to mist or spray onto a chain or sprocket associated with a drive system for the rotating table;

automatically lifting a top long edge of overlying film layers using a lifting mechanism, then electronically directing the nozzle to advance to dispense adhesive between the overlying film layers;

electronically accessing an operating system and/or controller of the system from a remote location using a computer network;

electronically synchronizing different drive systems of the system to cooperate at appropriate speeds, including the synchronization of a film drive, an adhesive extruder drive, and the rotating table drive; and

replacing one or more spools of clips on the rotating table using a drop-in cradle that releasably holds clip spools so that respective spools are in cooperating alignment with a corresponding clipper on the rotating table.

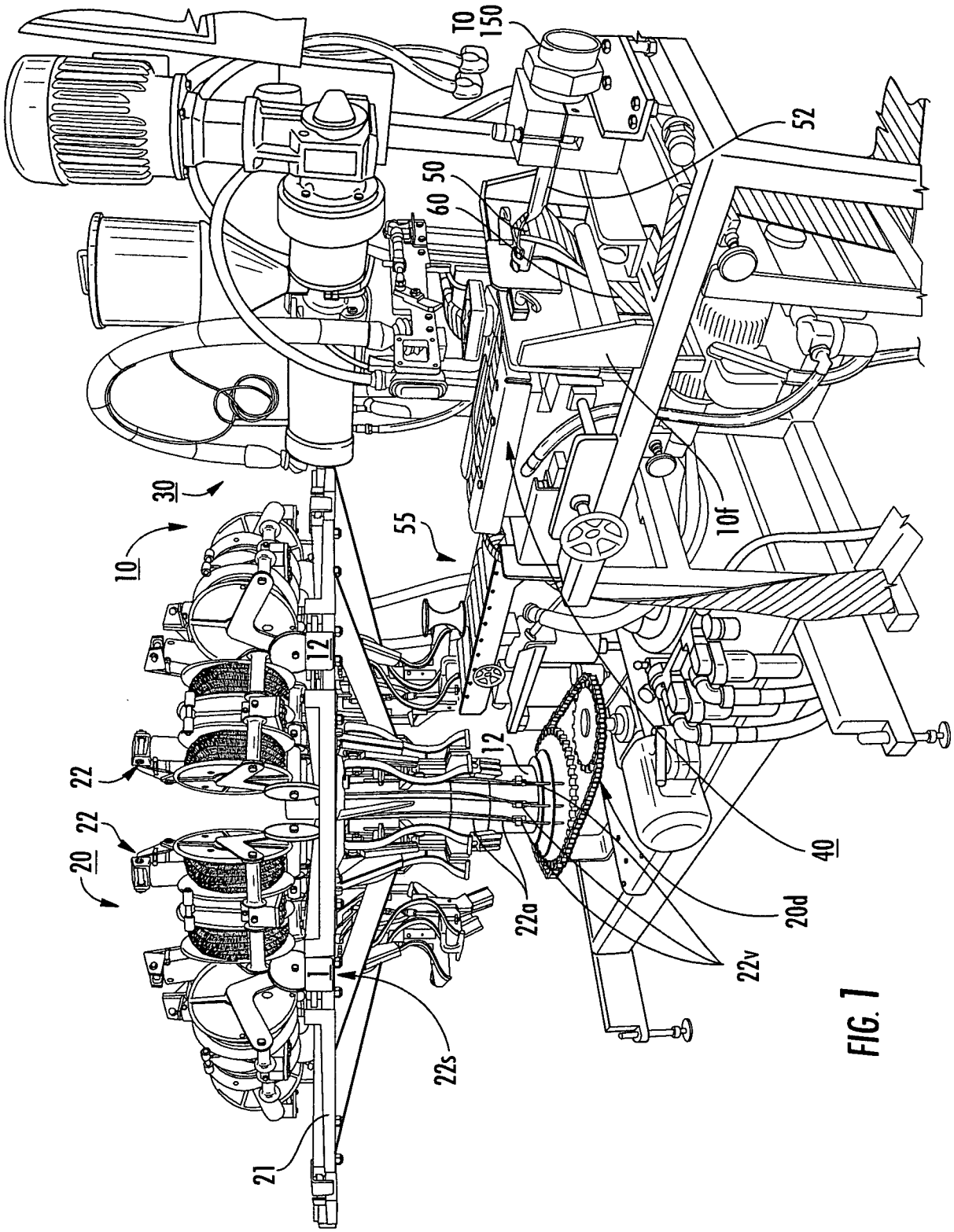


FIG. 1

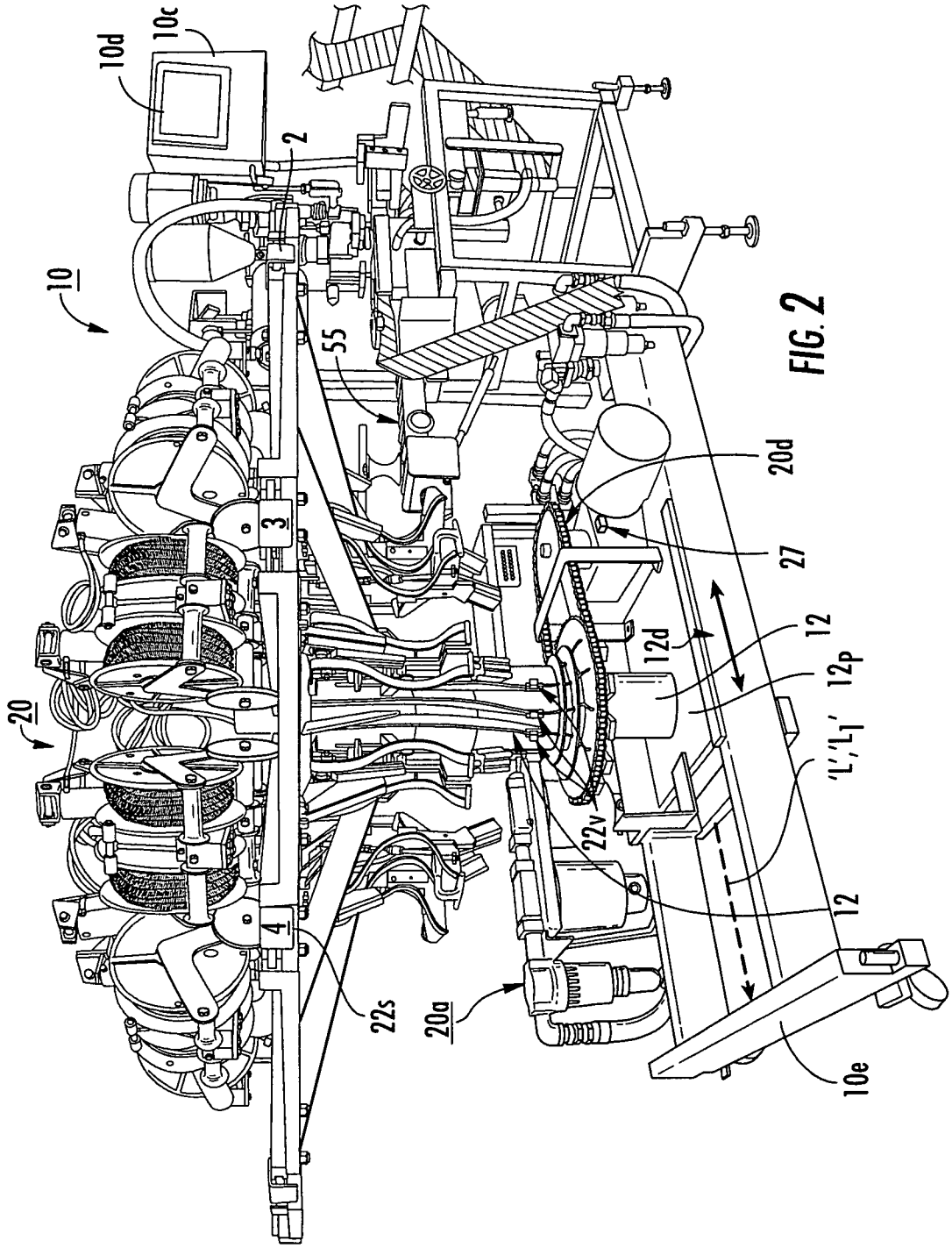


FIG. 2

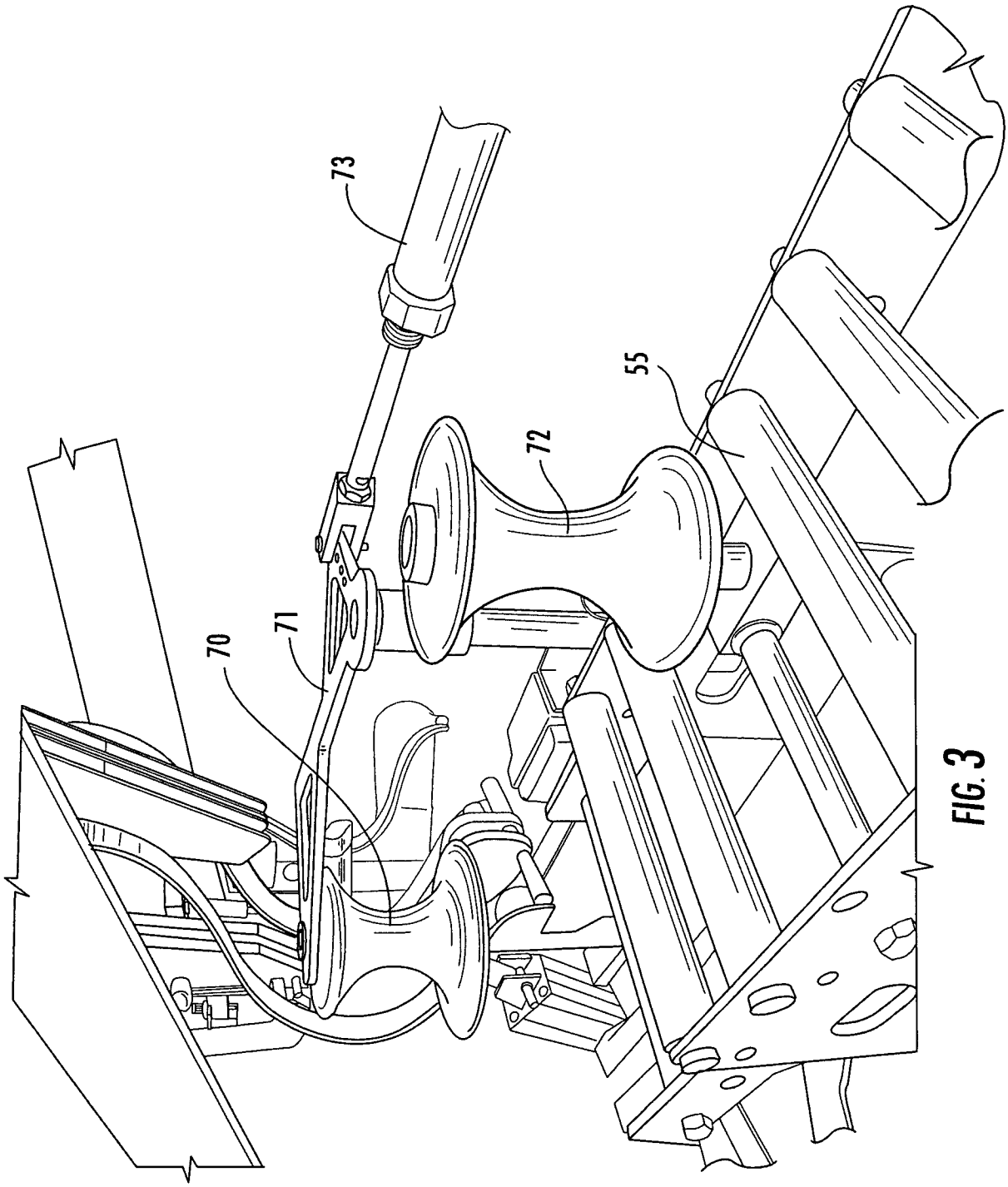


FIG. 3

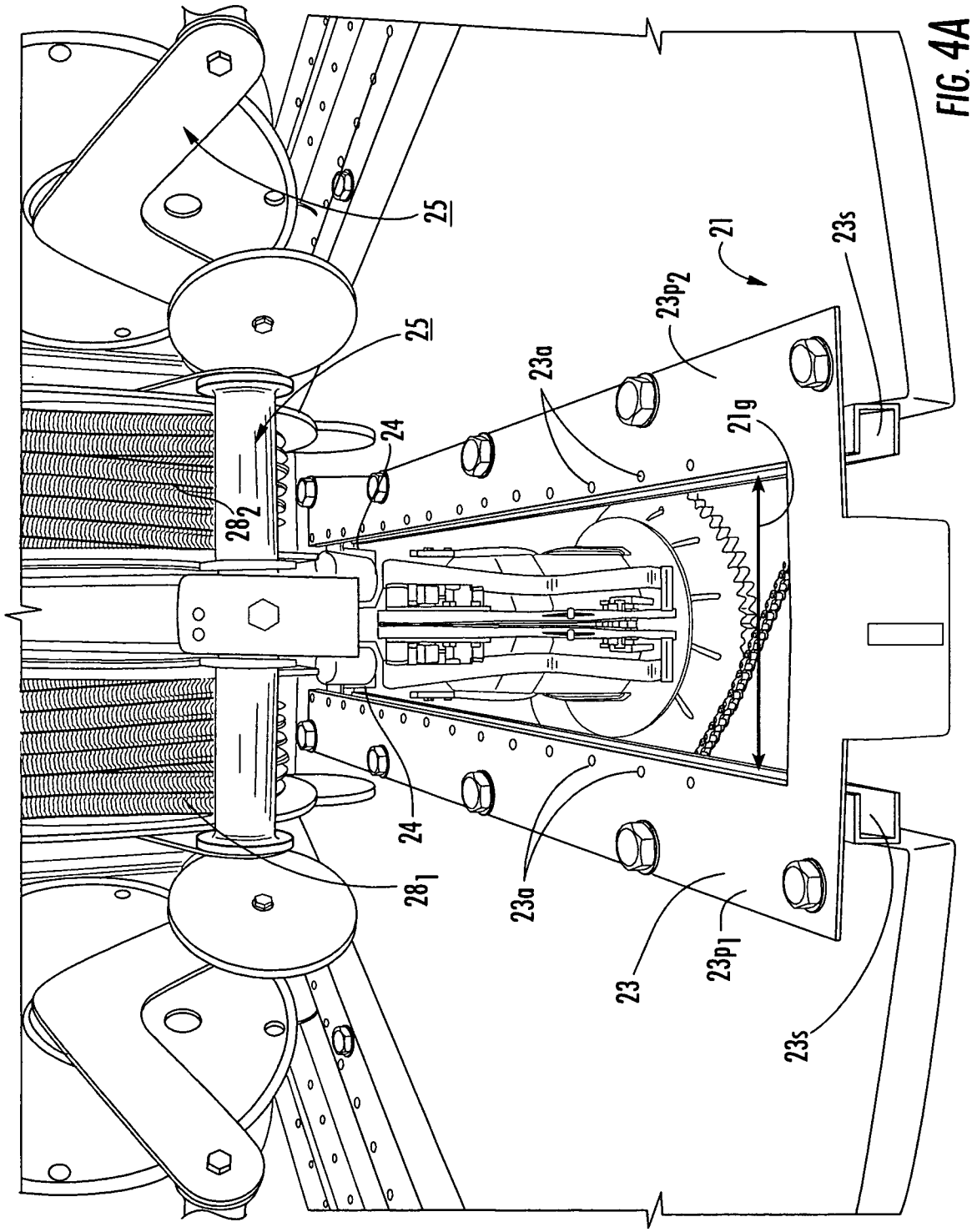


FIG. 4A

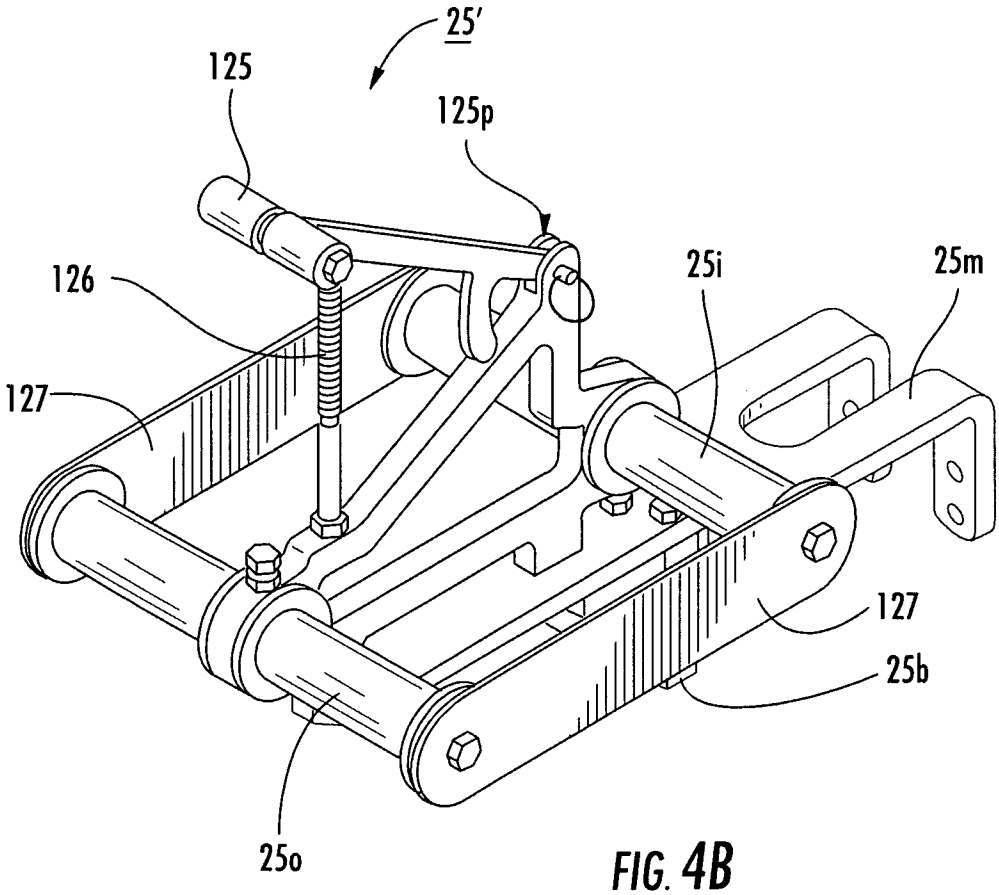


FIG. 4B

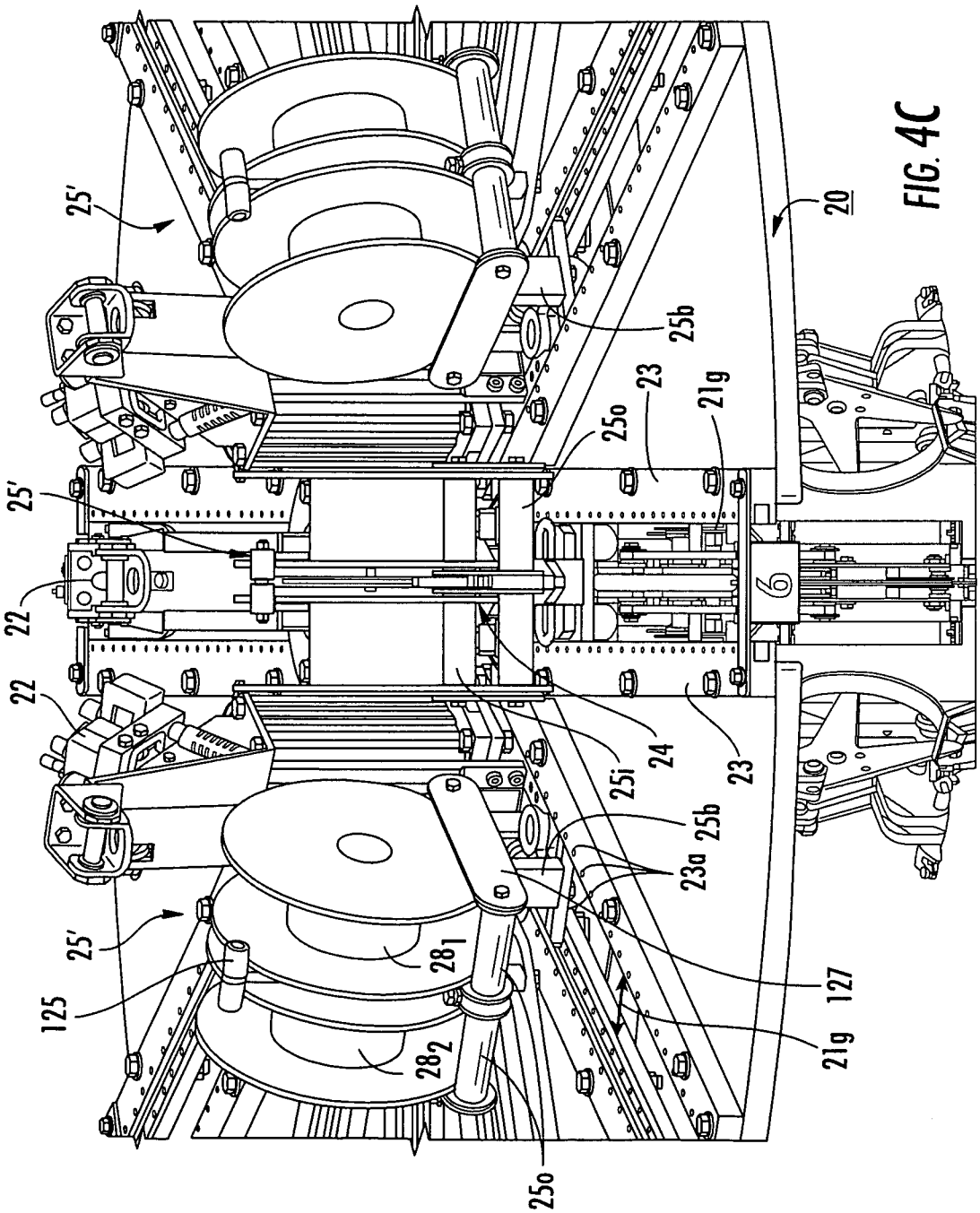

25'
20
25b
23
21g
25o
25'
22
22
24
25i
23
25b
23a
25'
125
28₁
127
21g
28₂
25o

FIG. 4C

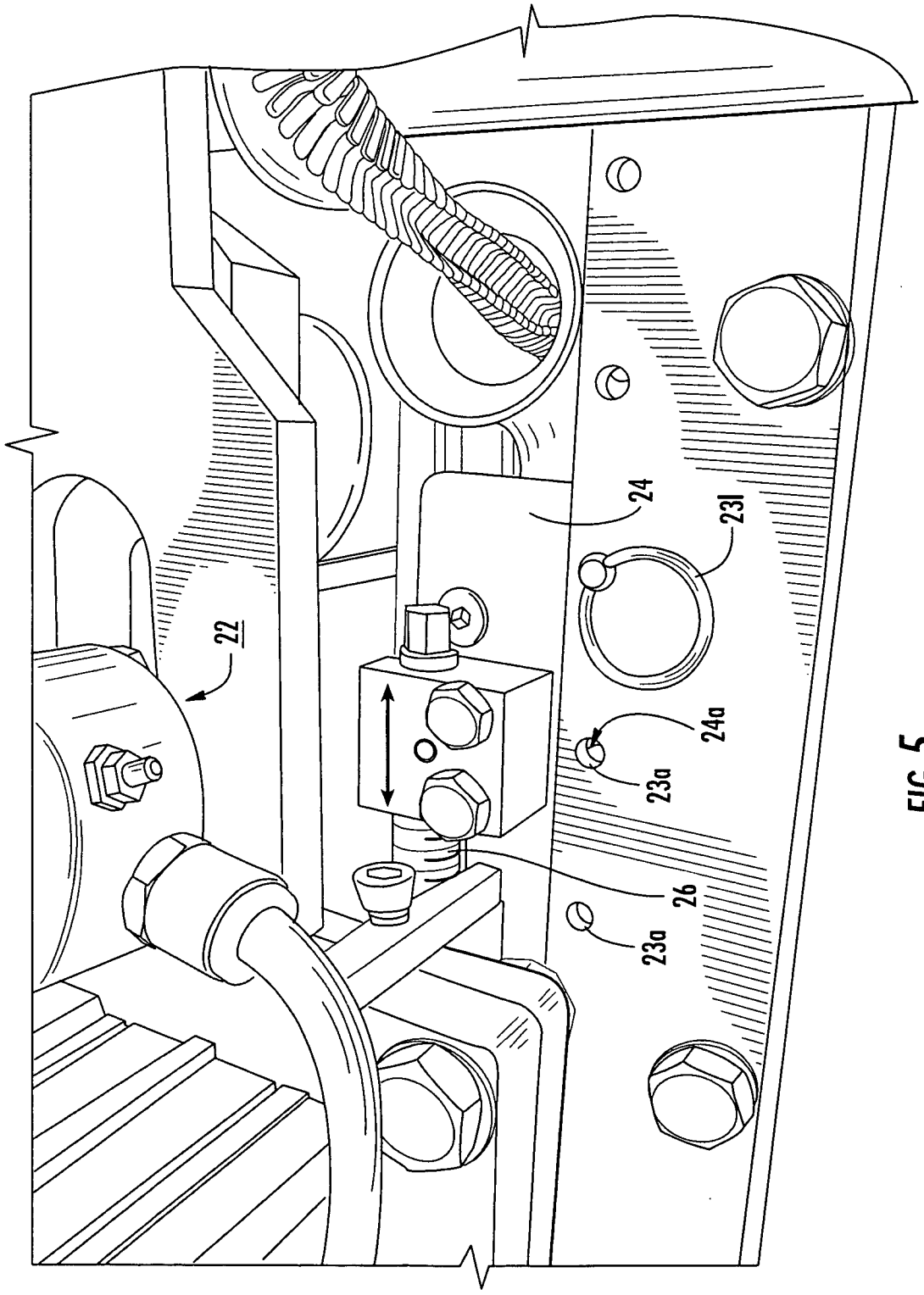


FIG. 5

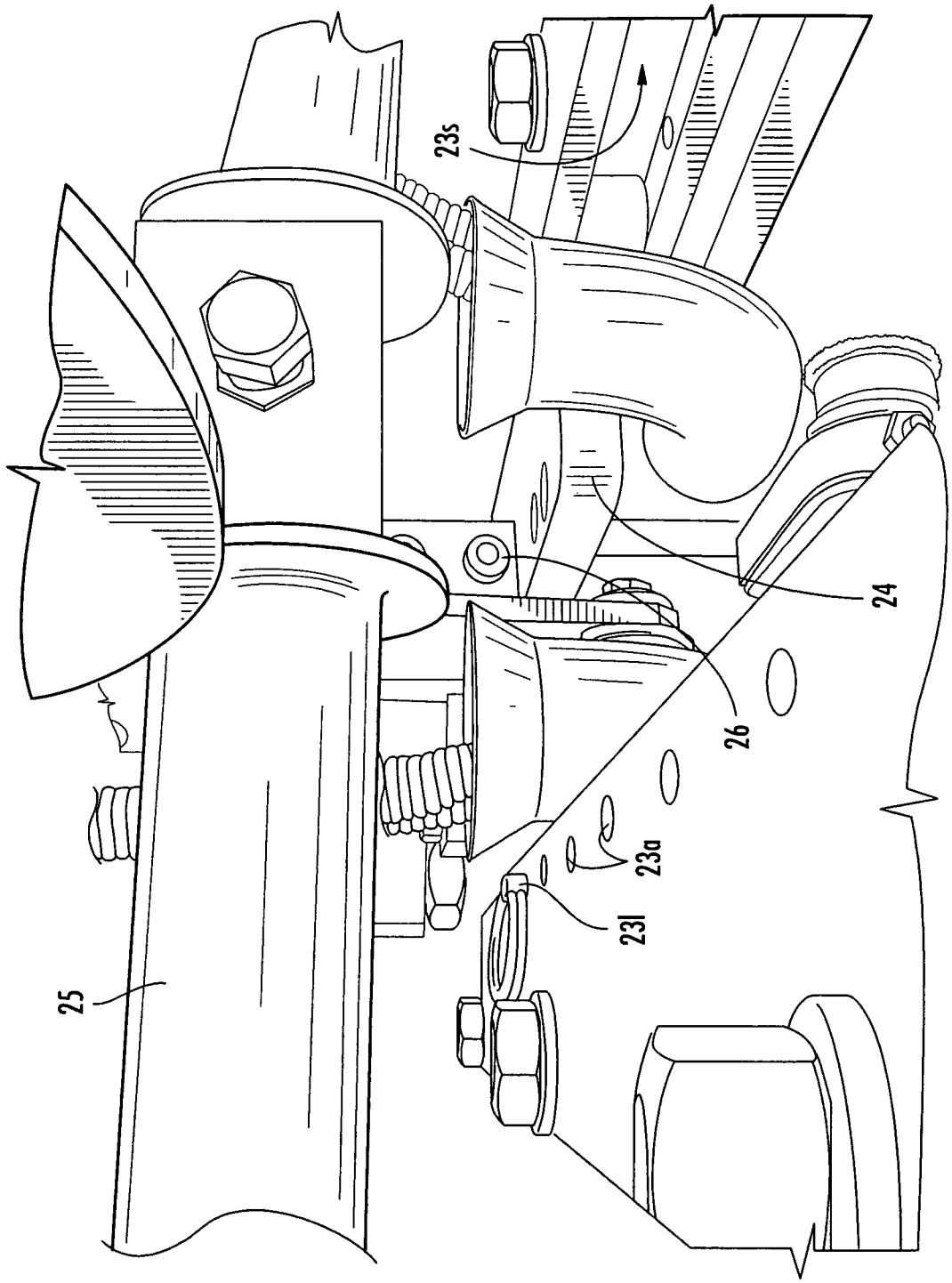


FIG. 6

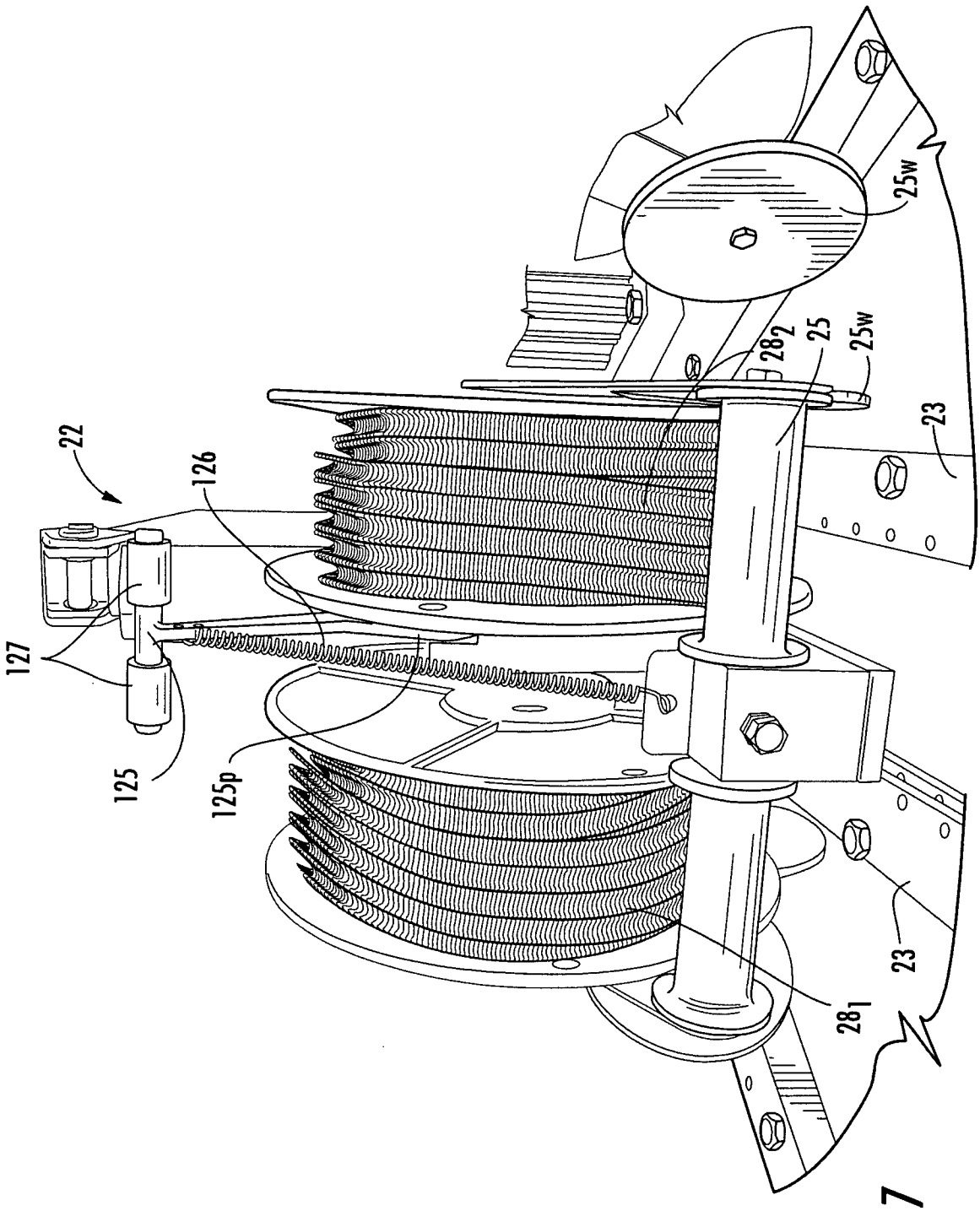


FIG. 7

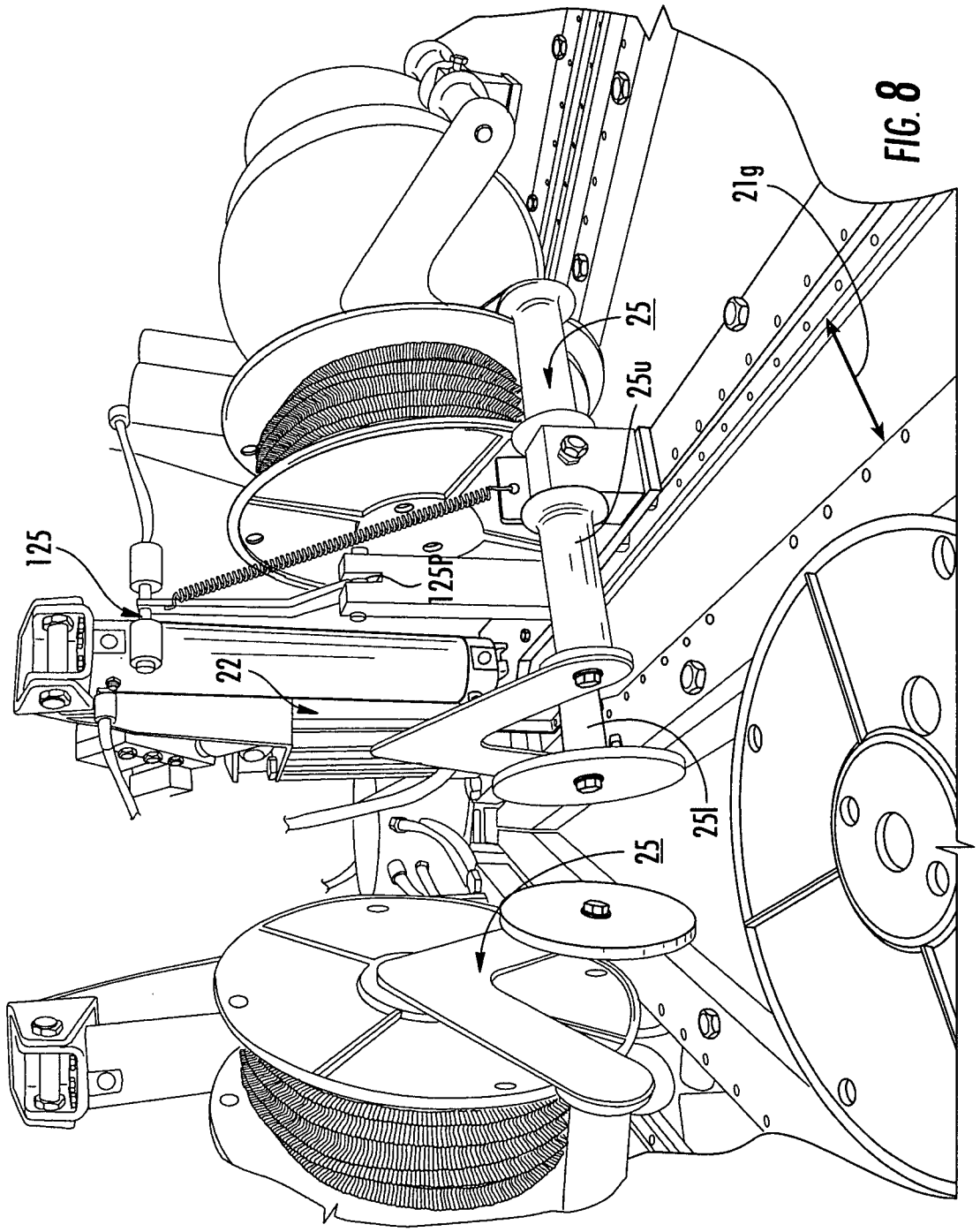


FIG. 8

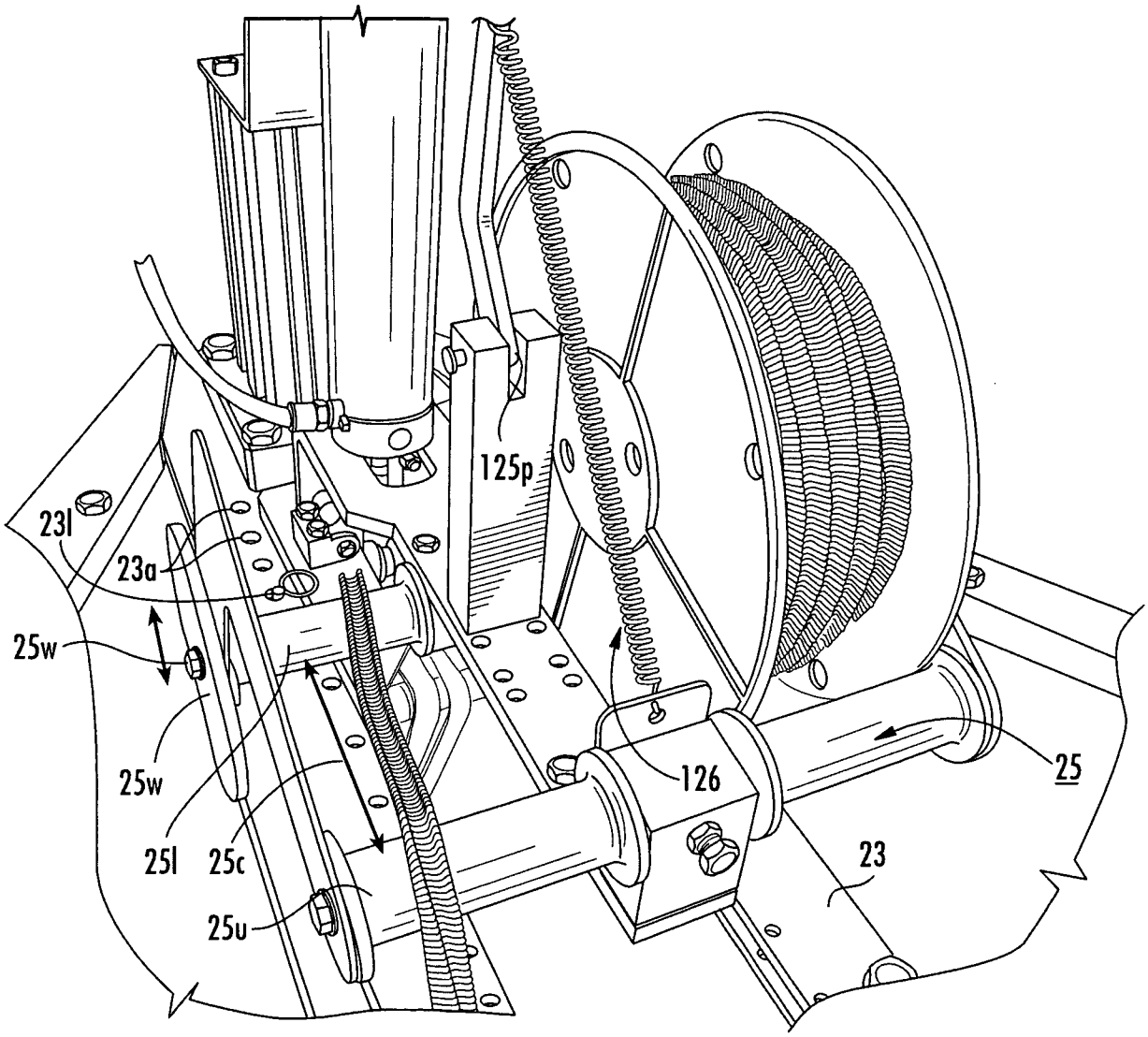


FIG. 9

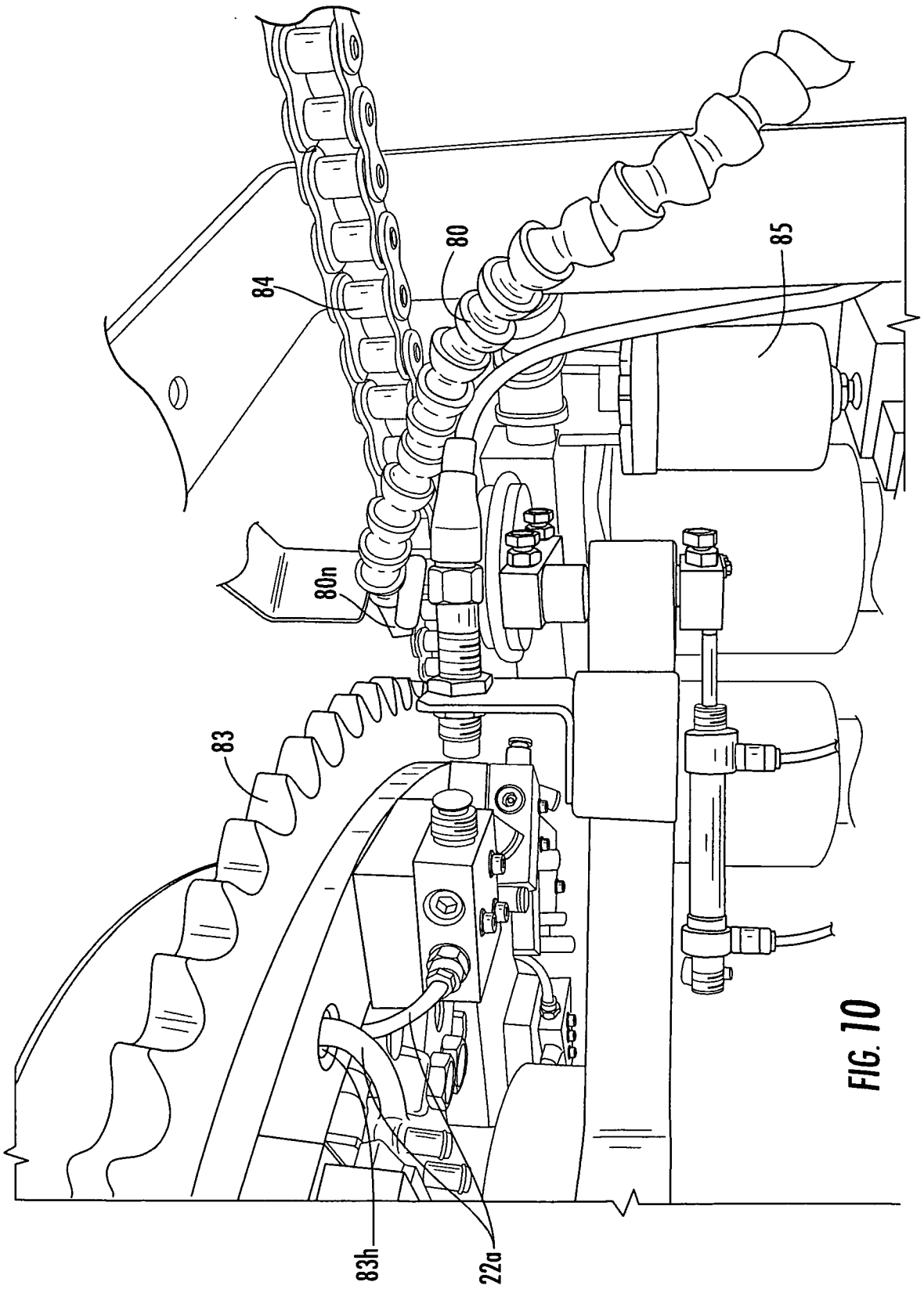


FIG. 10

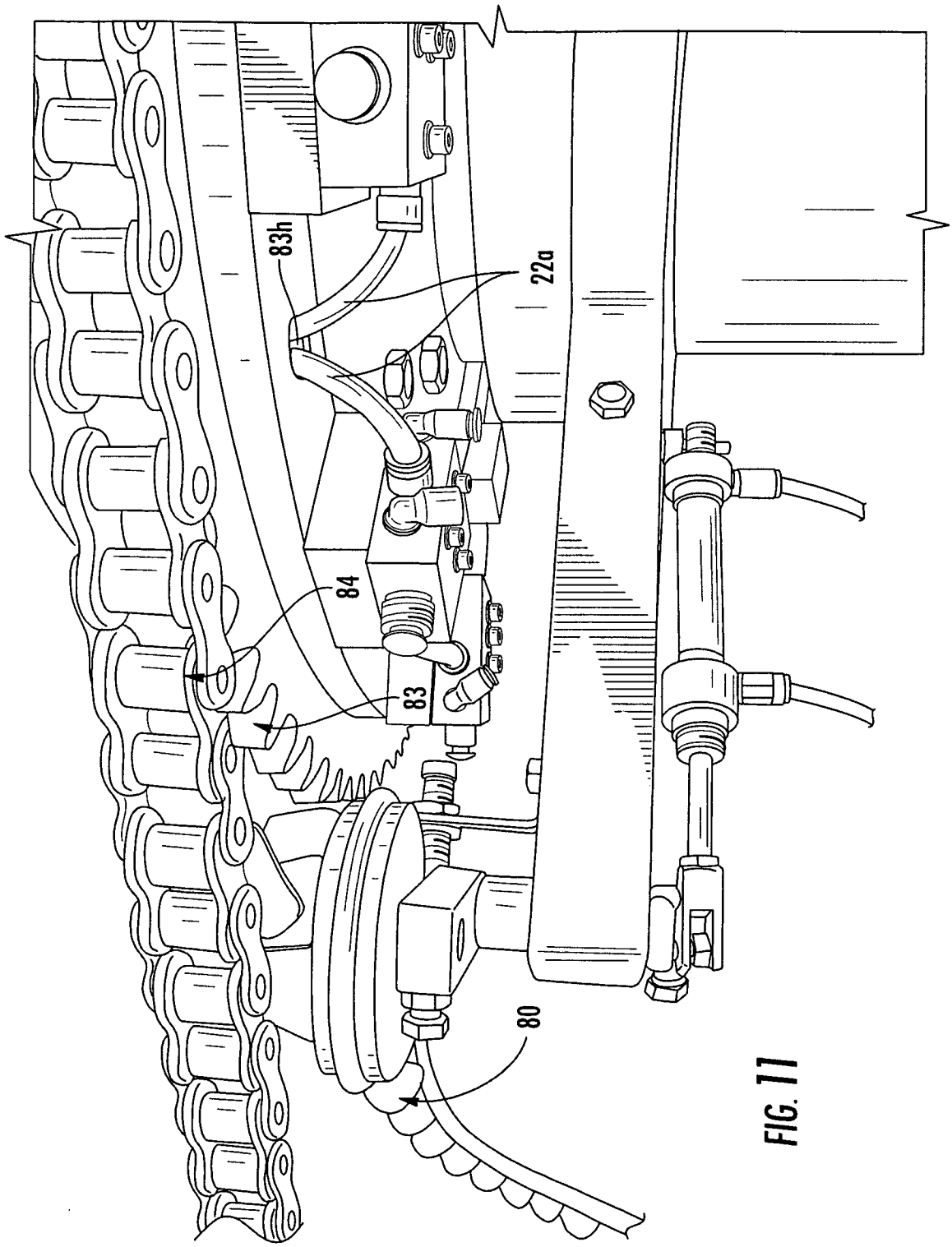


FIG. 11

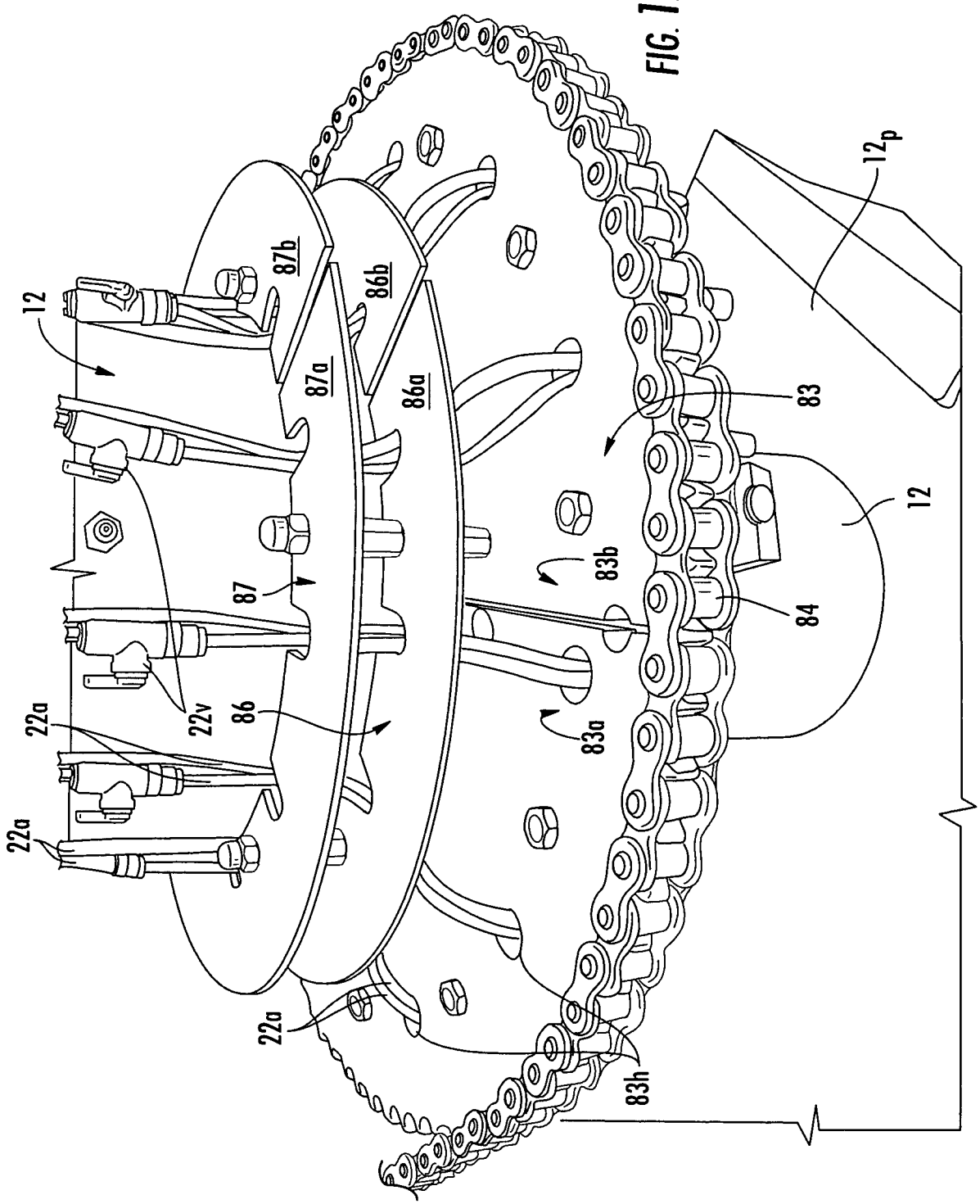


FIG. 12

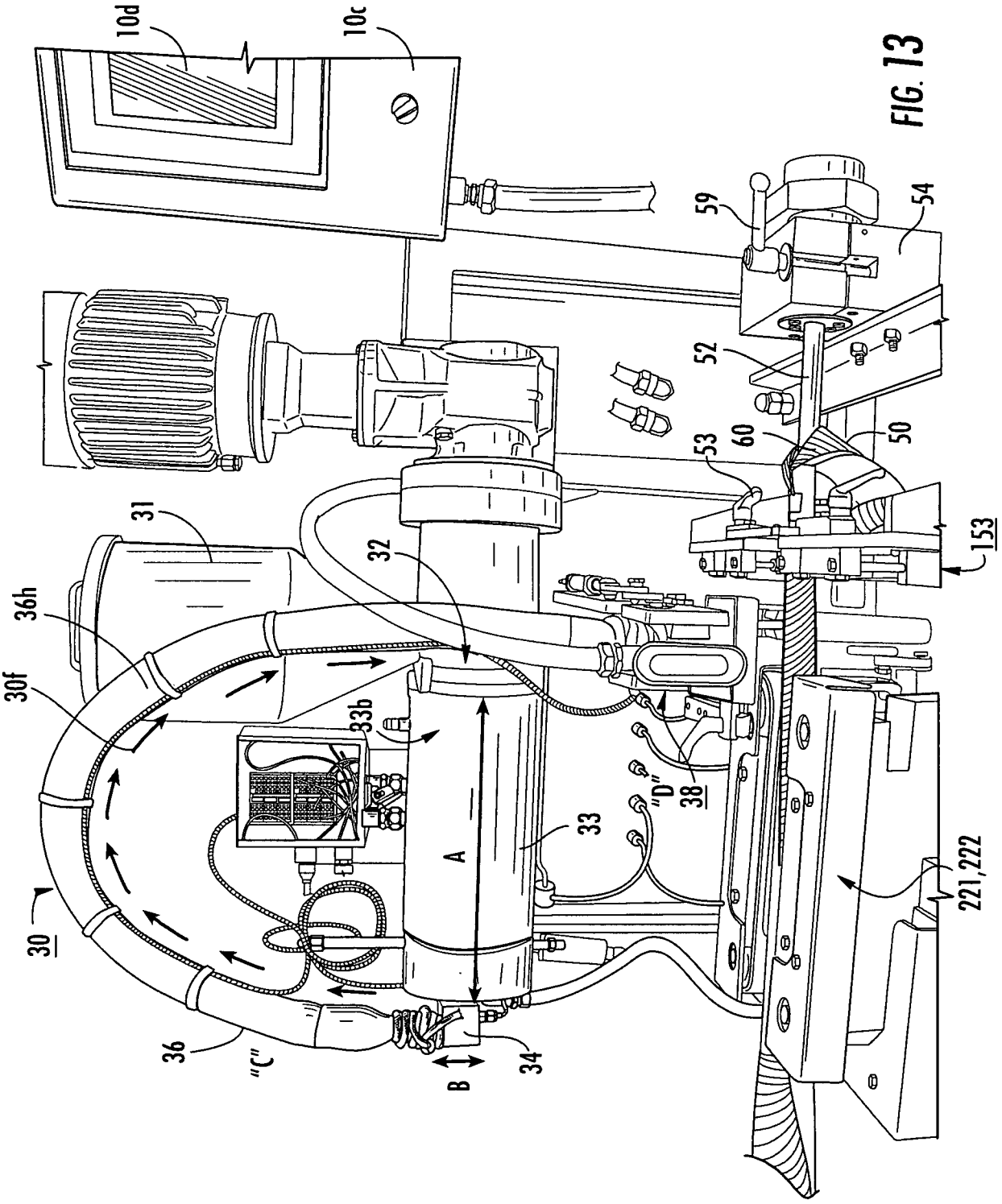

10d
10c
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53
60
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153
31
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36h
30f
33b
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33
A
221,222
30
36
"C"
B
34

FIG. 13

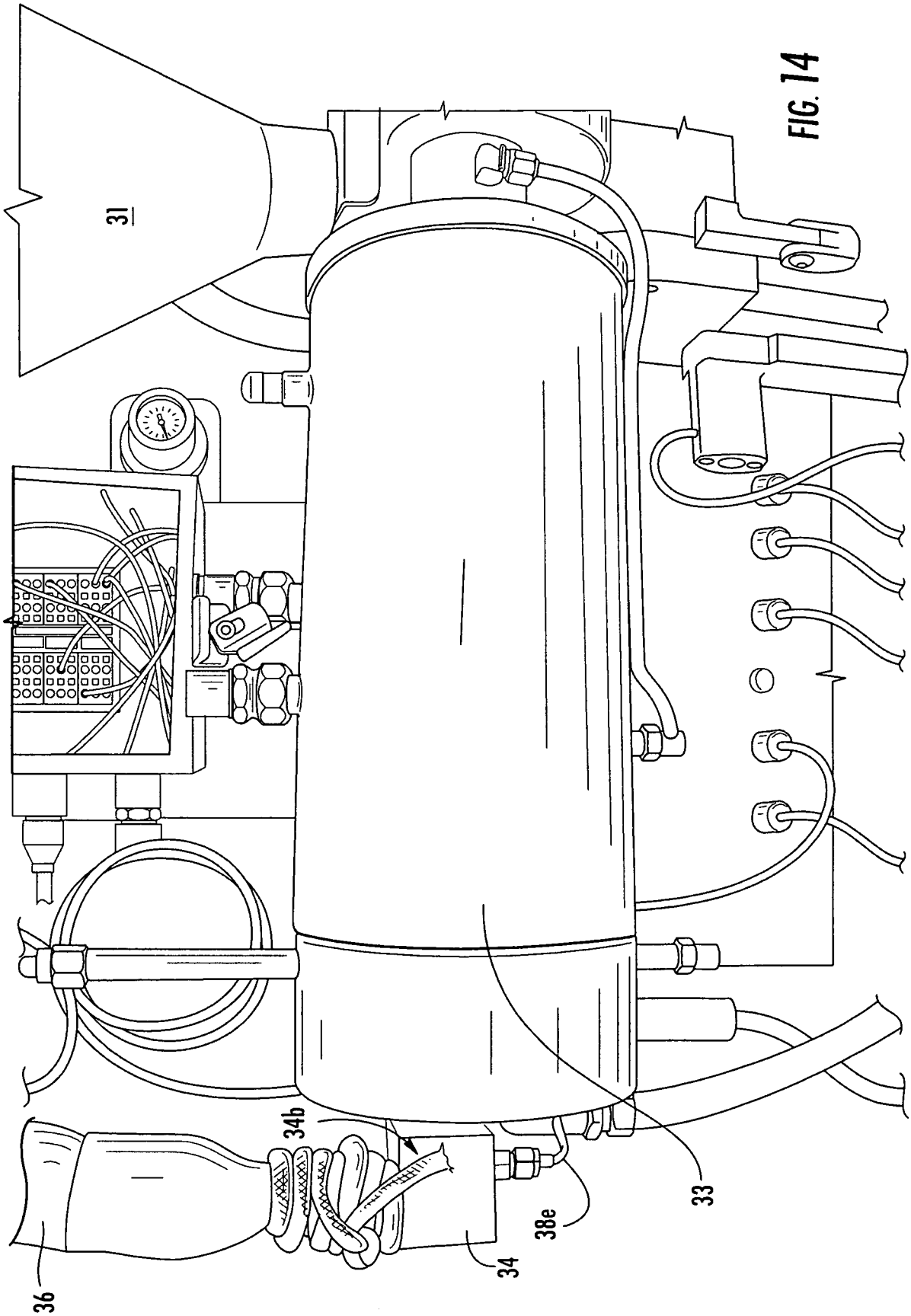


FIG. 14

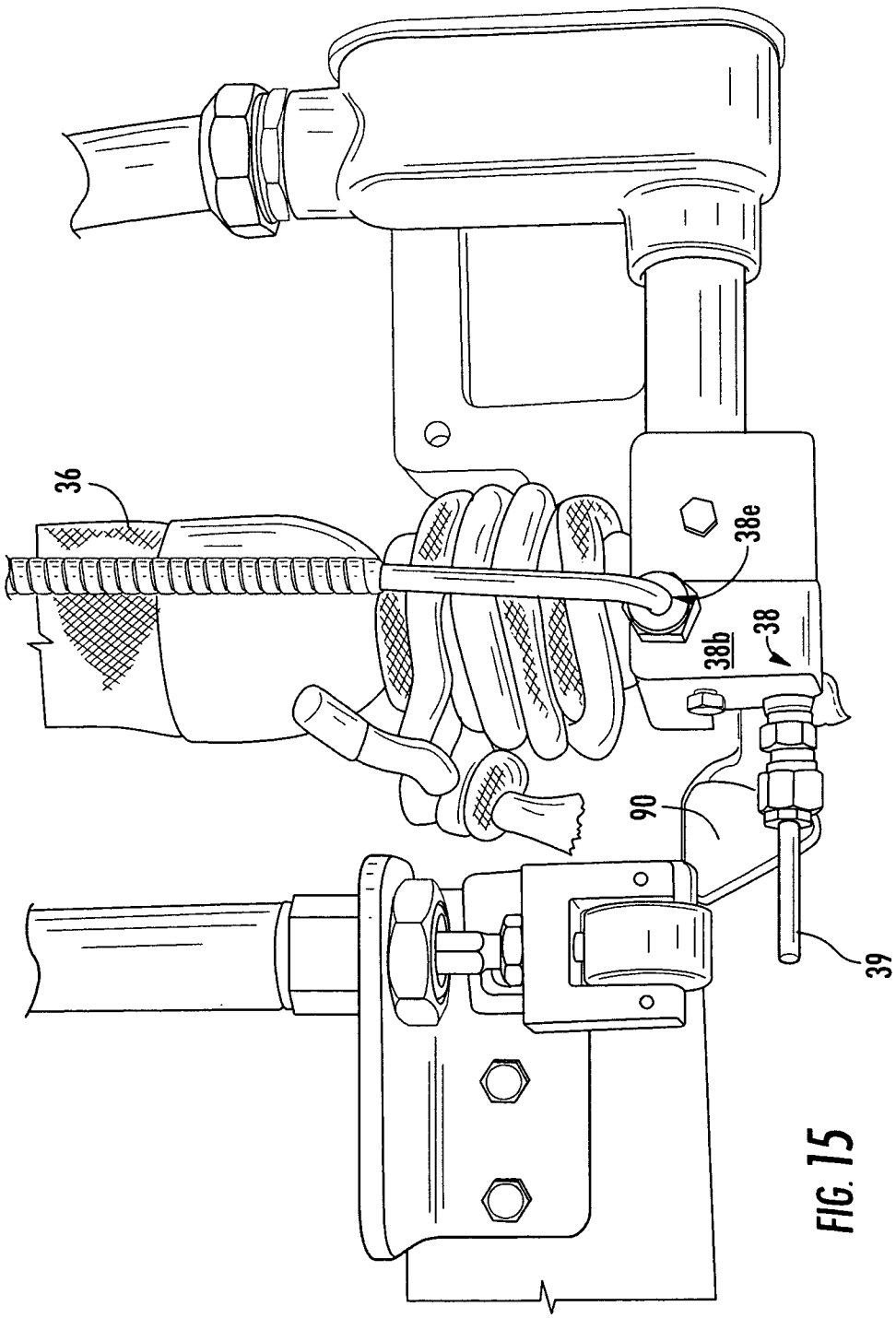


FIG. 15

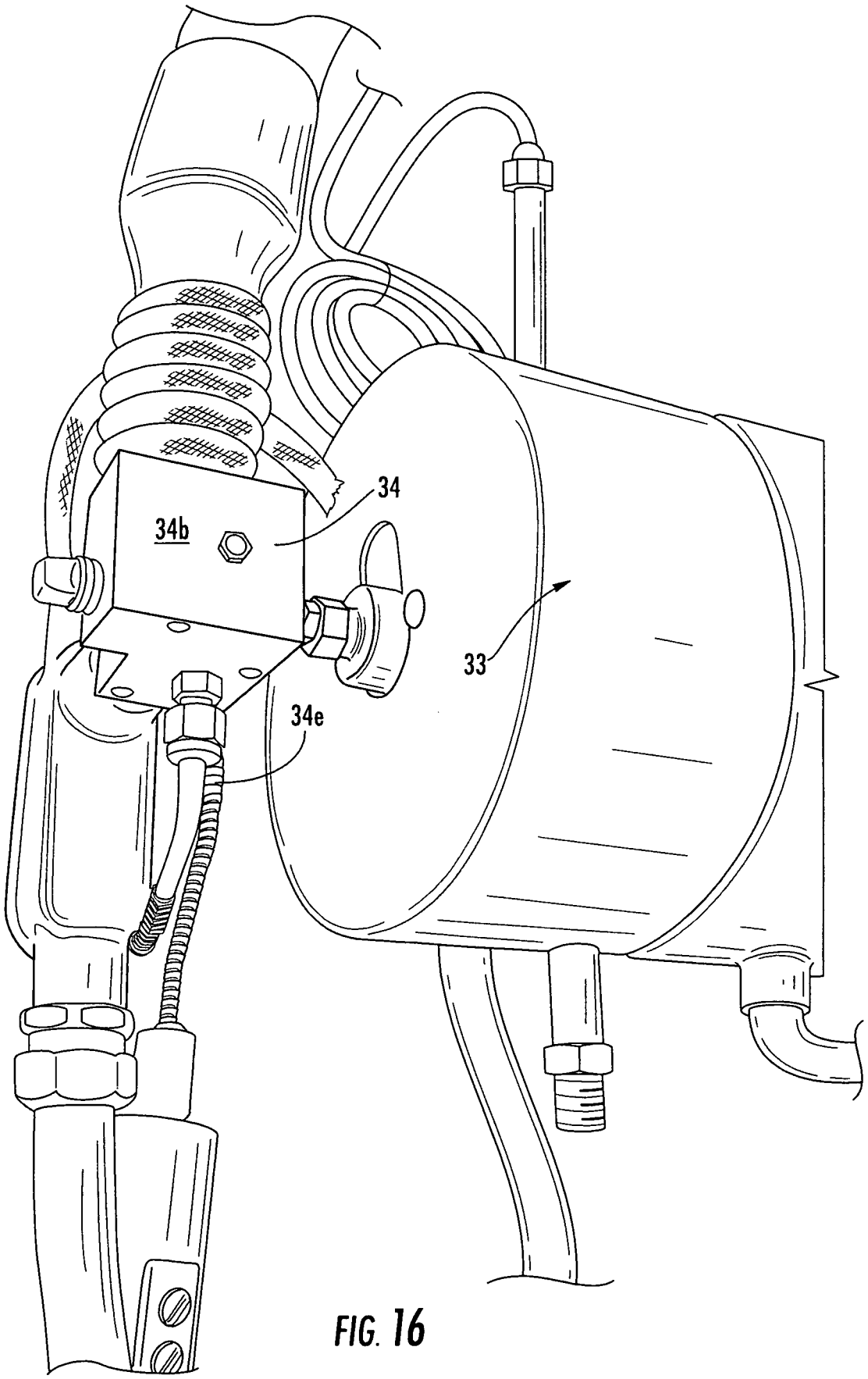


FIG. 16

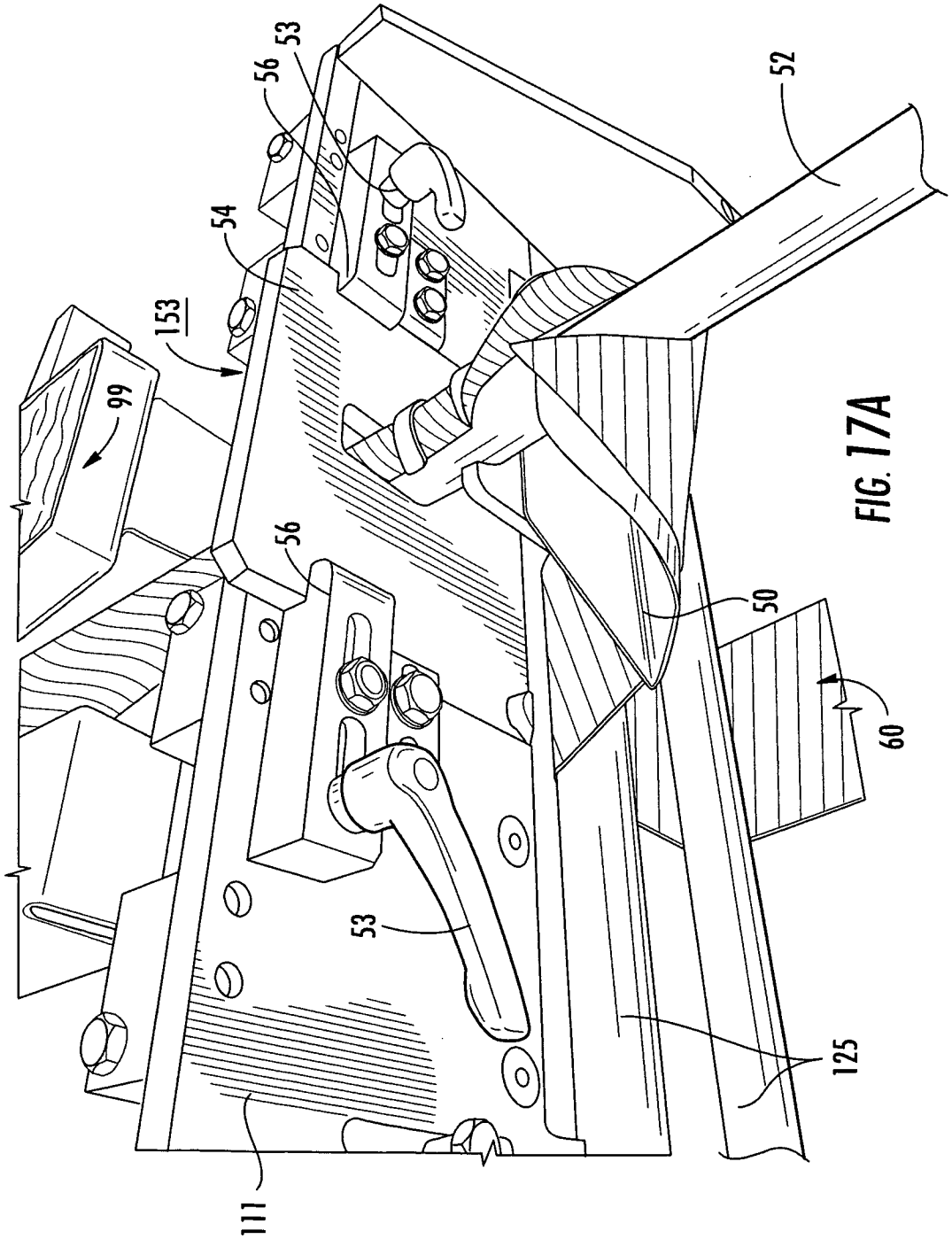


FIG. 17A

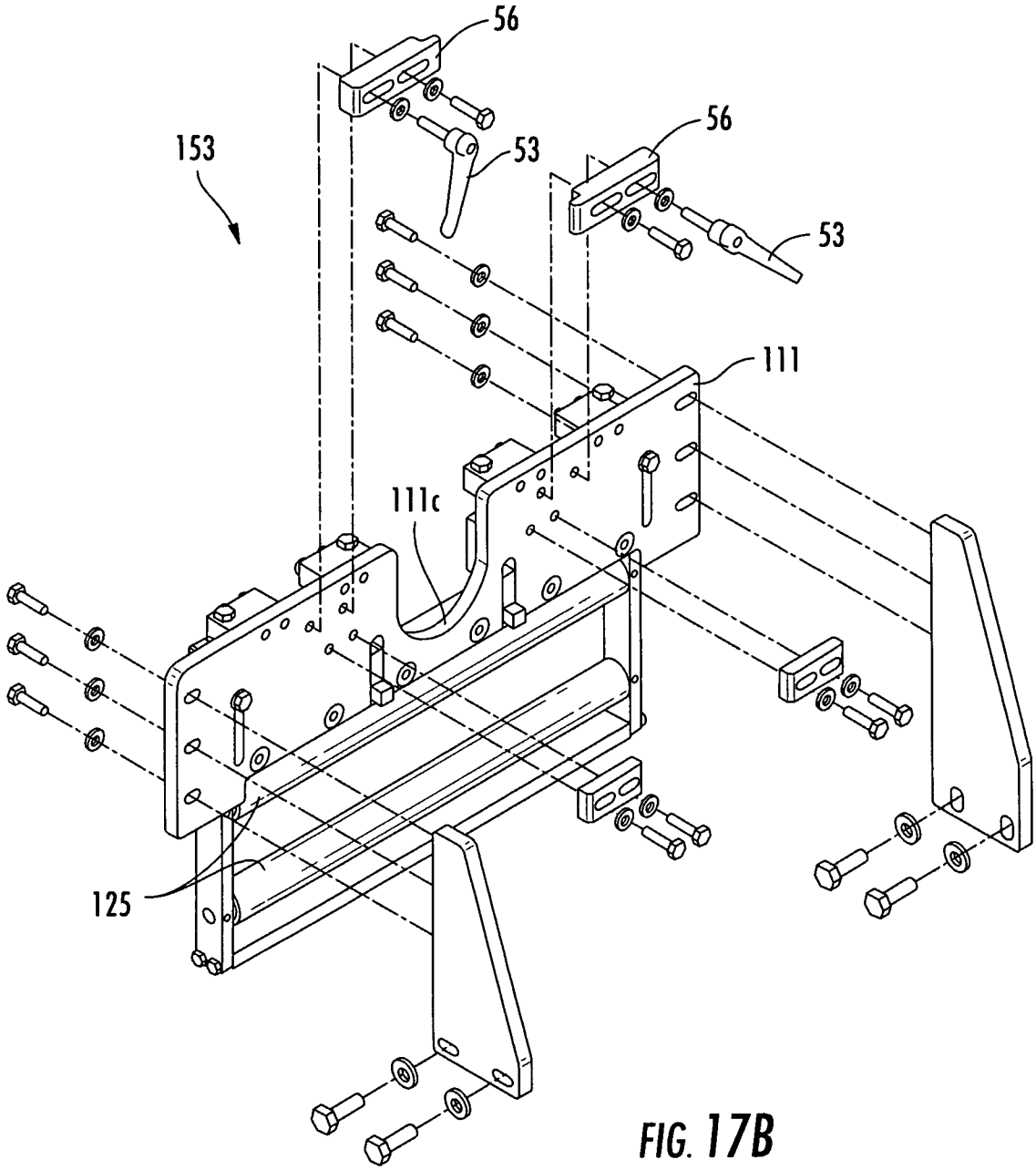


FIG. 17B

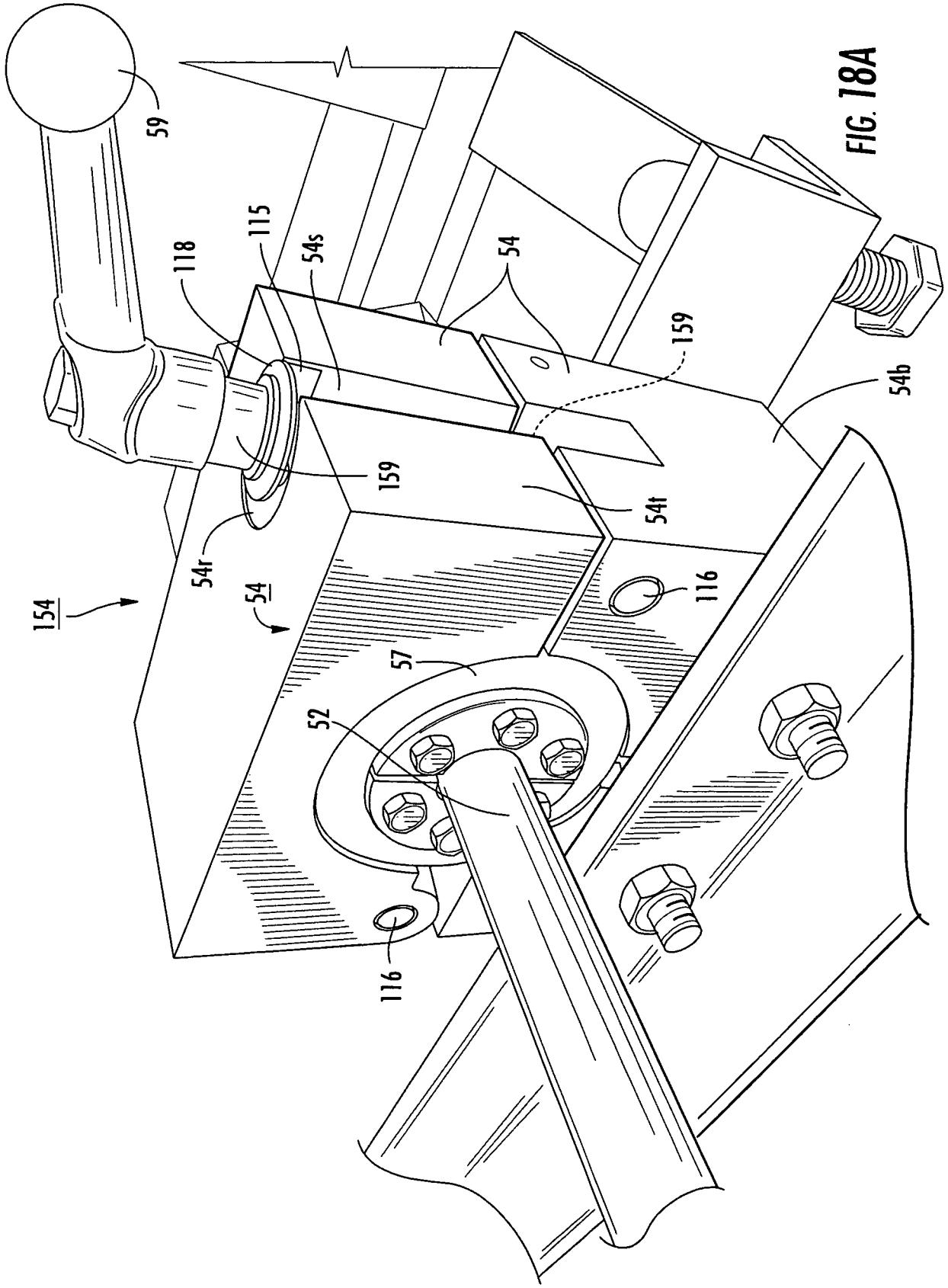


FIG. 18A

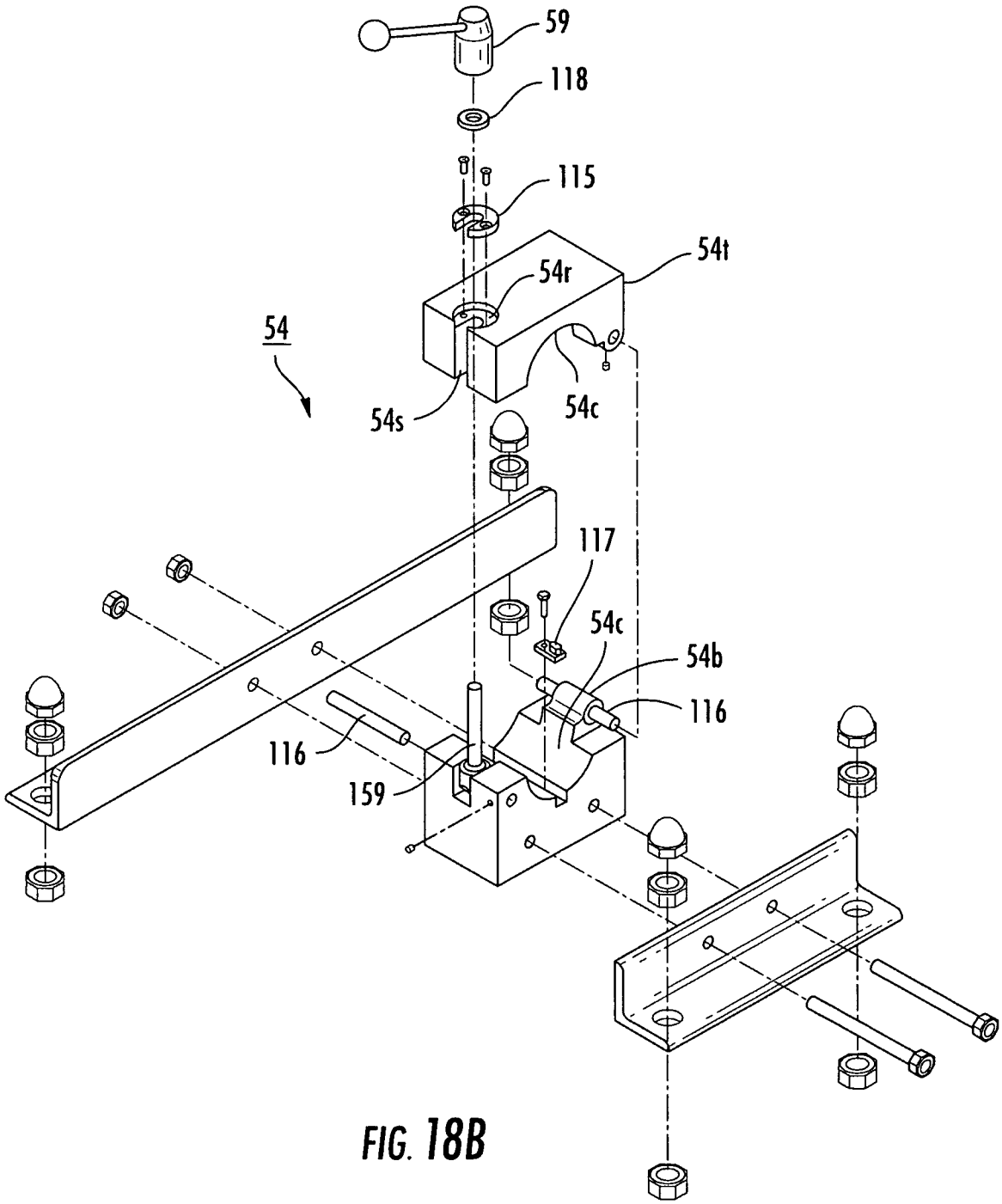


FIG. 18B

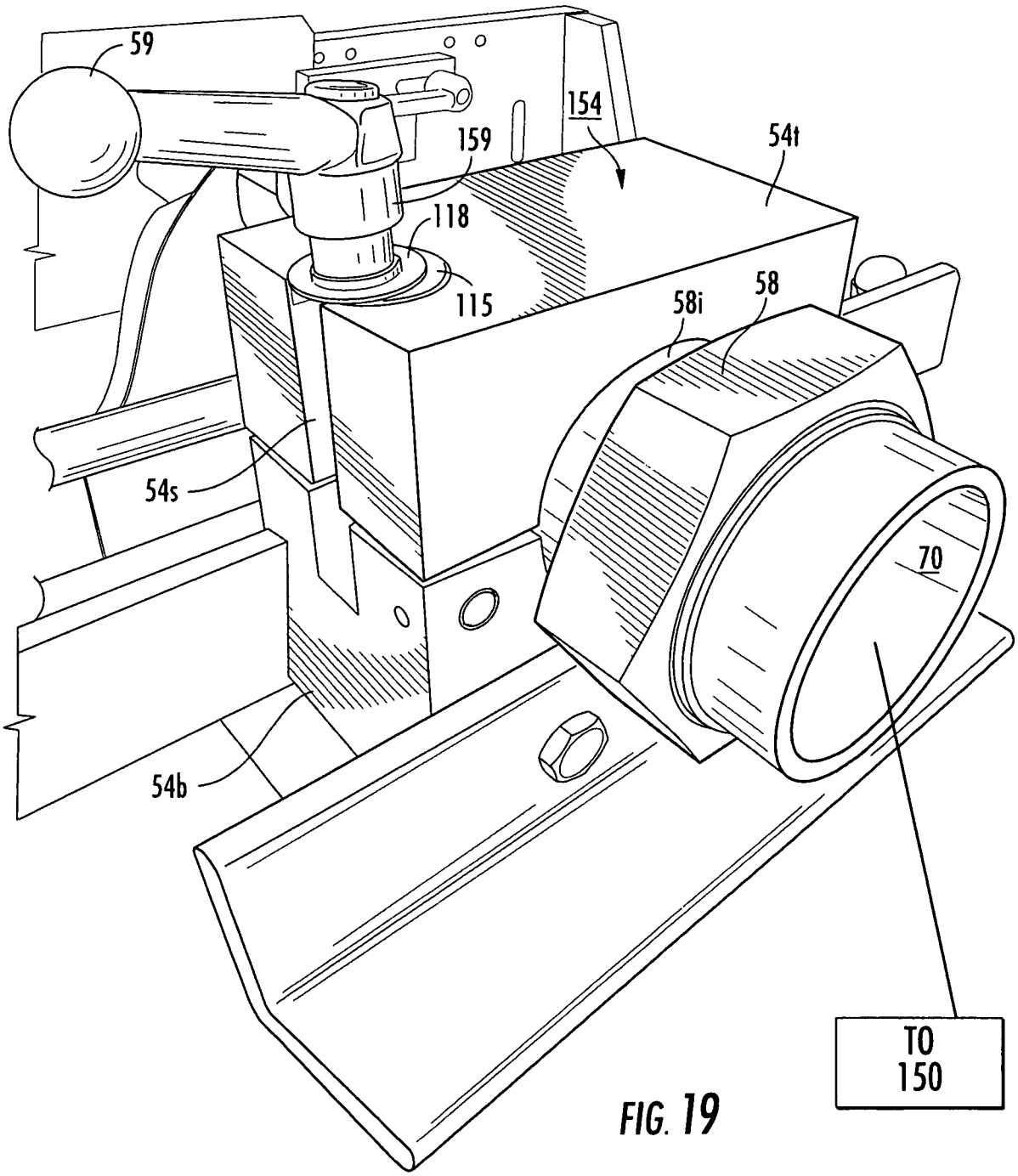


FIG. 19

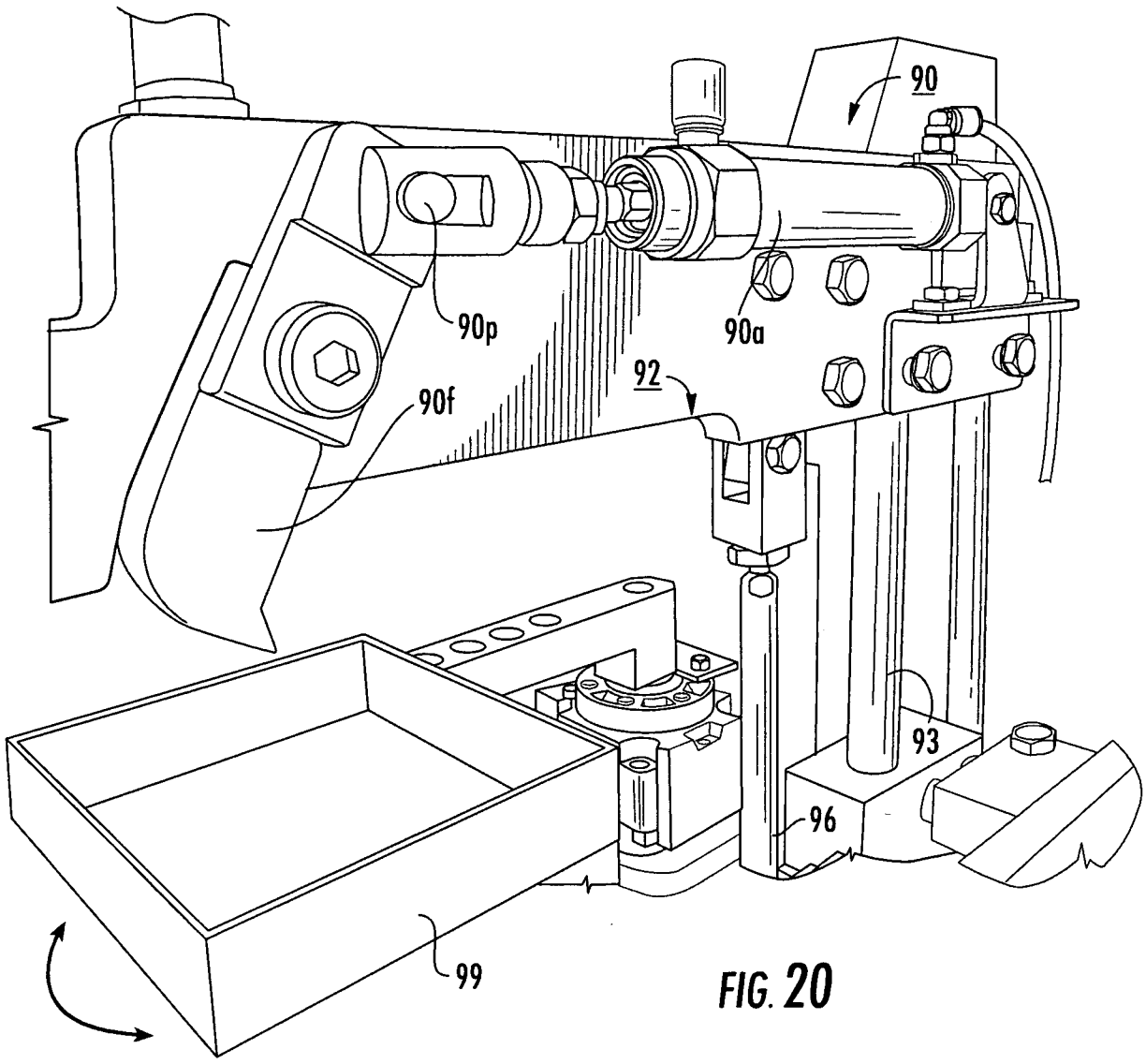


FIG. 20

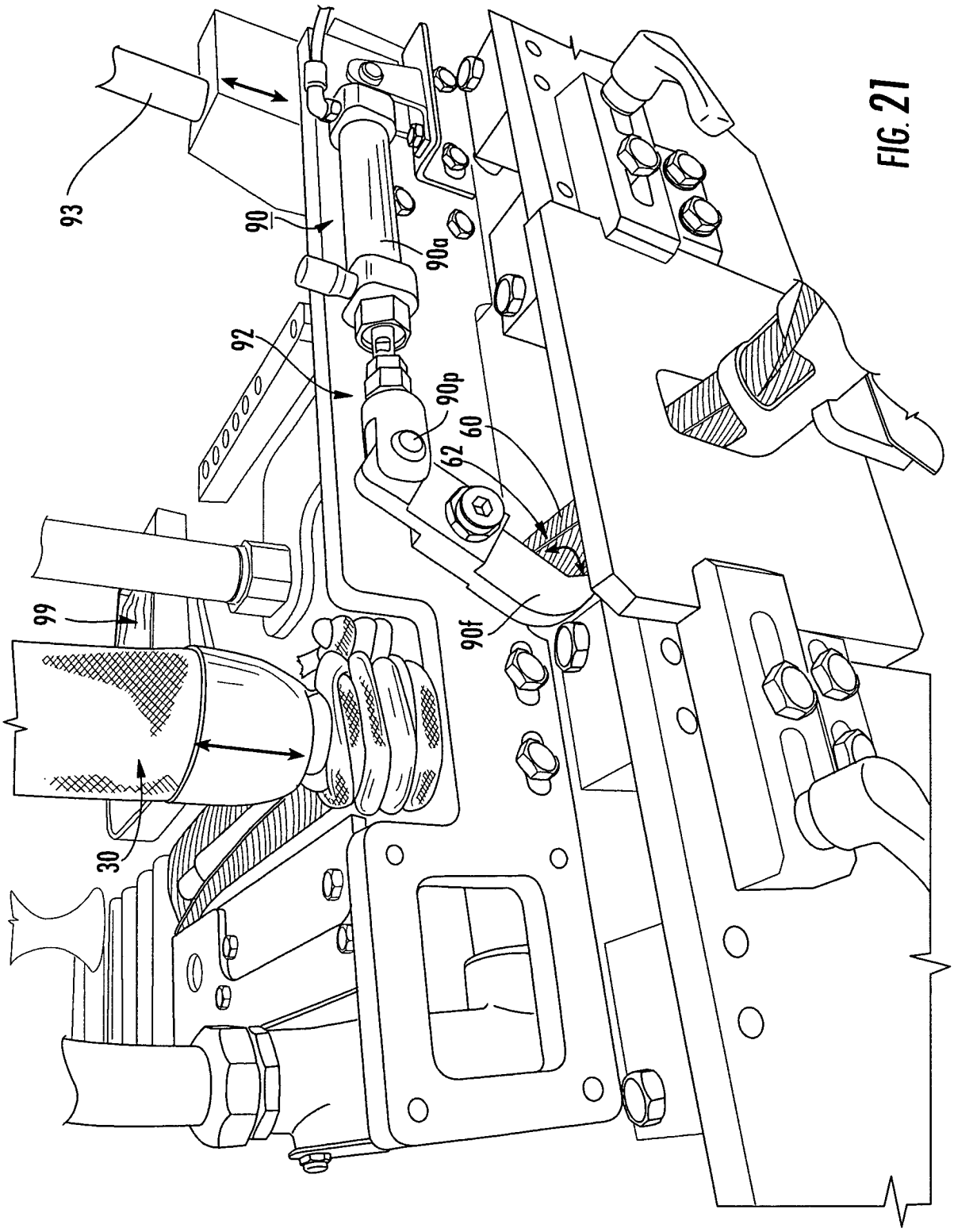


FIG. 21

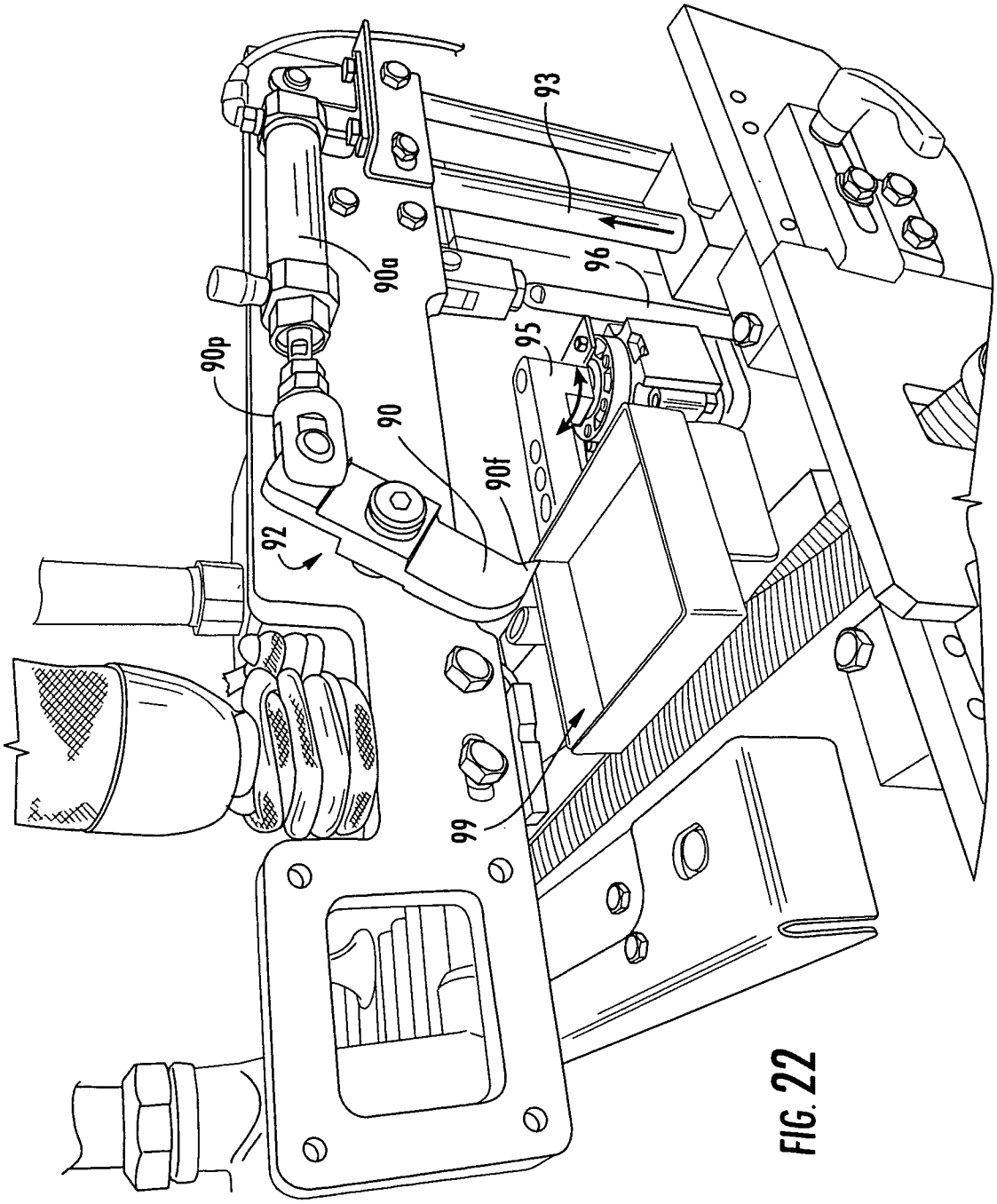


FIG. 22

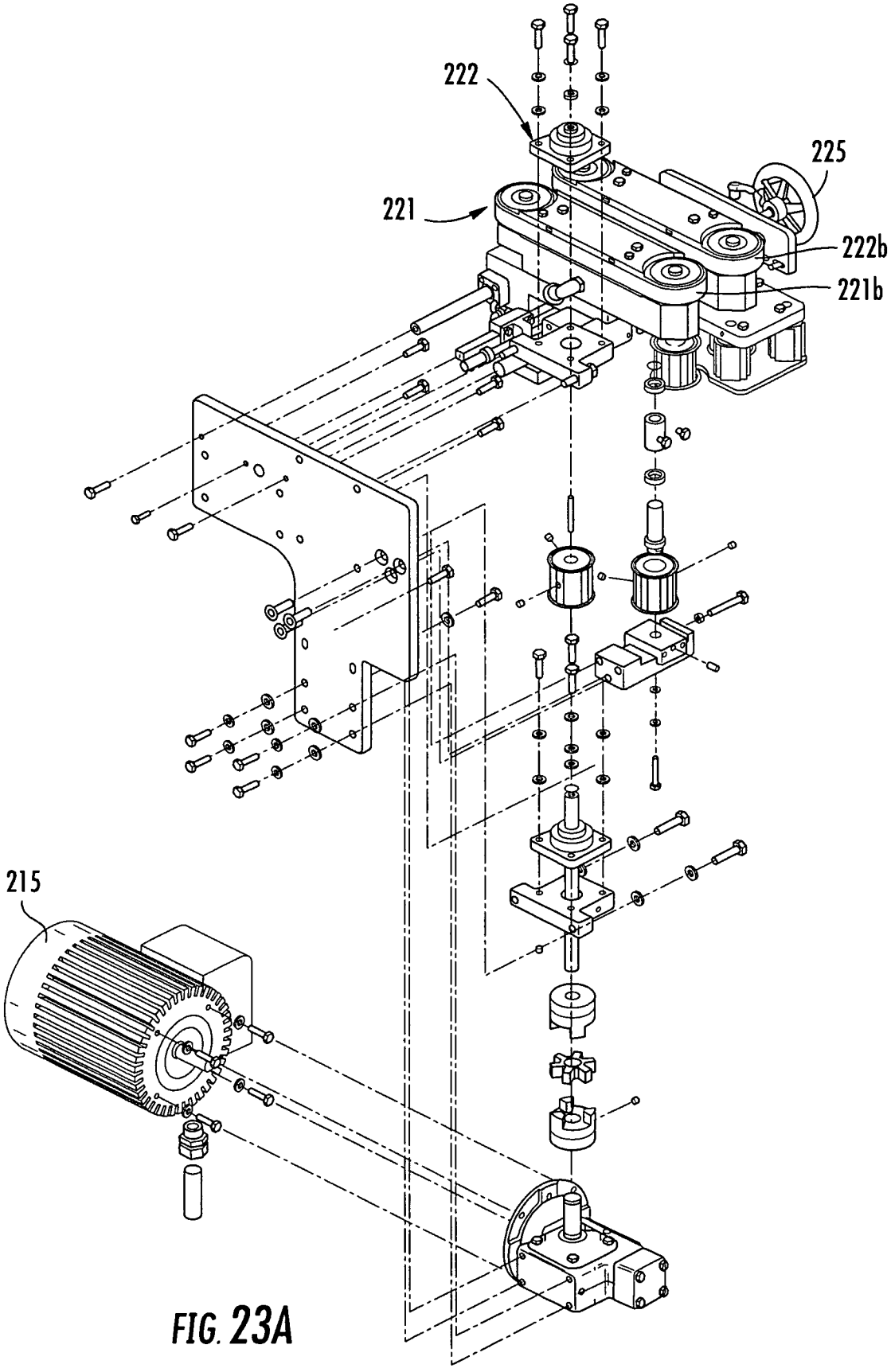


FIG. 23A

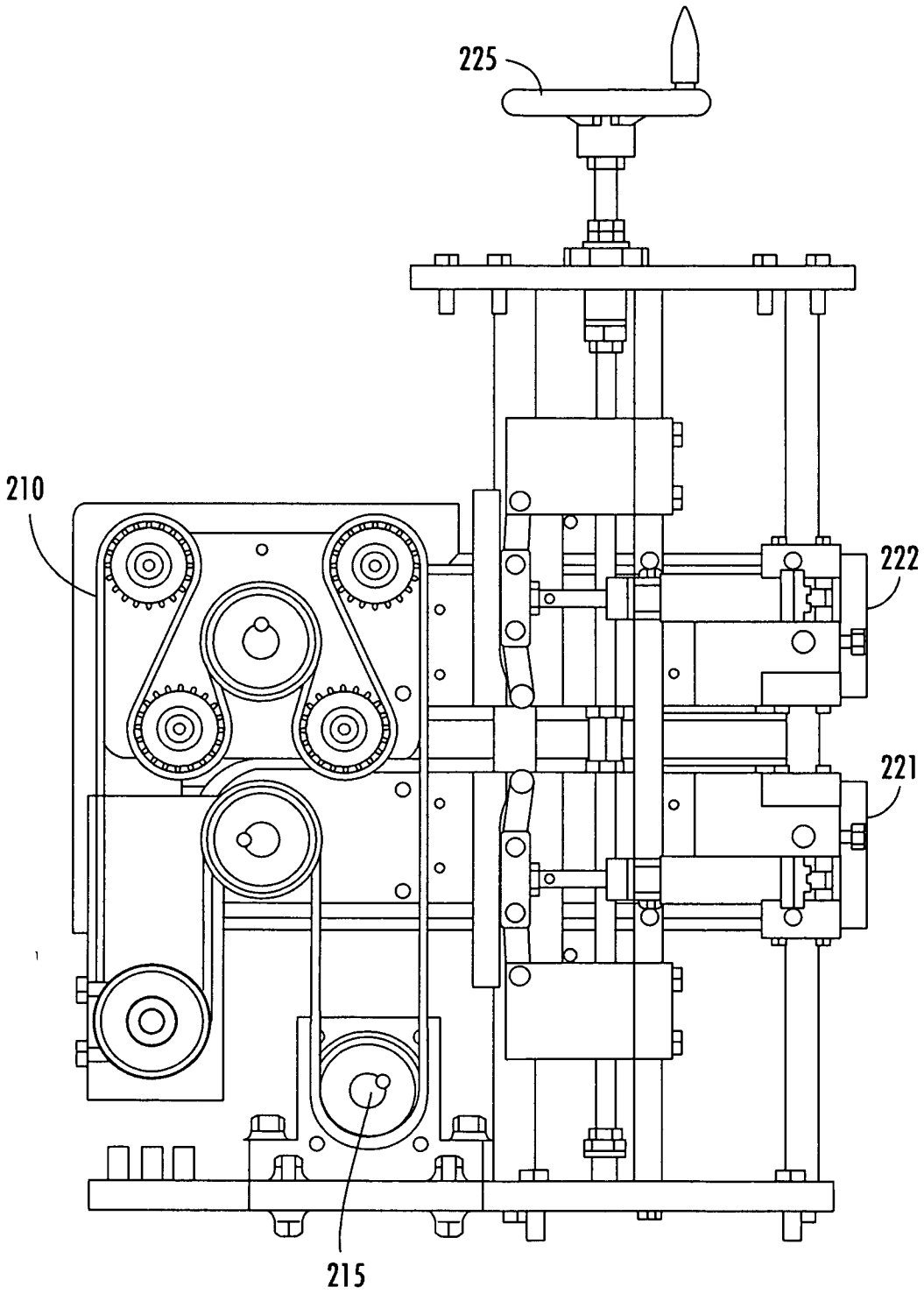


FIG. 23B

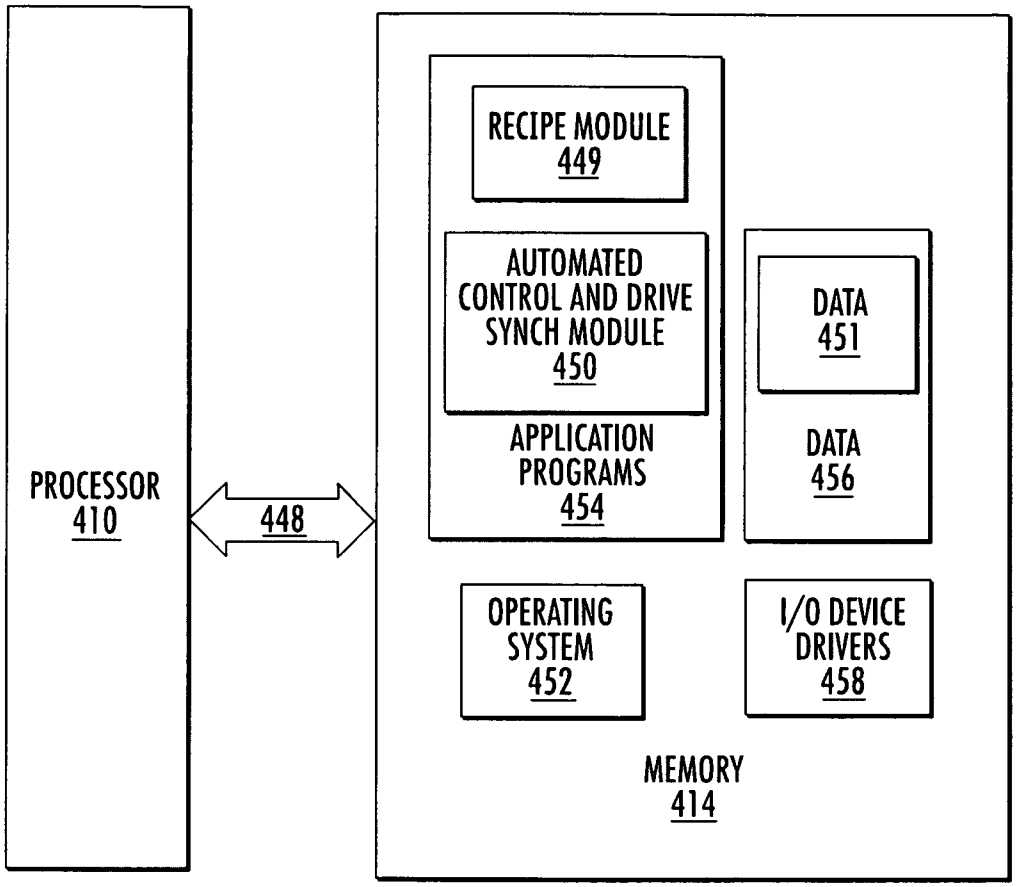

PROCESSOR
410
448
RECIPE MODULE
449
AUTOMATED CONTROL AND DRIVE SYNCH MODULE
450
APPLICATION PROGRAMS
454
DATA
451
DATA
456
OPERATING SYSTEM
452
I/O DEVICE DRIVERS
458
MEMORY
414

FIG. 24

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/013855

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B65B 9/10 (2009.01)
USPC - 493/308
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - A22C 11/00, 11/10; B65B 9/10 (2009.01)
USPC - 29/243.56; 452/30, 48; 493/302, 308

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,020,298 A (EVANS et al) 04 June 1991 (04.06.1991) entire document	23, 24, 26, 29 --- 1-14, 21, 22, 27, 30, 32, 33
X --- Y	US 5,085,036 A (EVANS et al) 04 February 1992 (04.02.1992) entire document	31 --- 33
Y	US 3,818,574 A (REID et al) 25 June 1974 (24.06.1974) entire document	1-14, 30
Y	US 2005/0053699 A1 (WHITTLESEY et al) 10 March 2005 (10.03.2005) entire document	1, 6, 11-14, 21, 22
Y	GB 631,128 A (DAVIES) 27 October 1949 (27.10.1949) entire document	8, 27
Y	GB 2 039 793 A (LISTER) 20 August 1980 (20.08.1980) entire document	10, 32
Y	US 2006/0068113 A1 (AOYAMA et al) 30 March 2006 (30.03.2006) entire document	11-14, 21
Y	US 2004/0043121 A1 (SHEFET) 04 March 2004 (04.03.2004) entire document	12, 14, 21, 28
Y	US 6,153,860 A (WENG) 28 November 2000 (28.11.2000) entire document	21, 22
Y	US 5,605,720 A (ALLEN et al) 25 February 1997 (25.02.1997) entire document	28, 33

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 February 2009	24 FEB 2009

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (April 2005)