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(54) Title: SYSTEM FOR MANUFACTURING COILED FILM

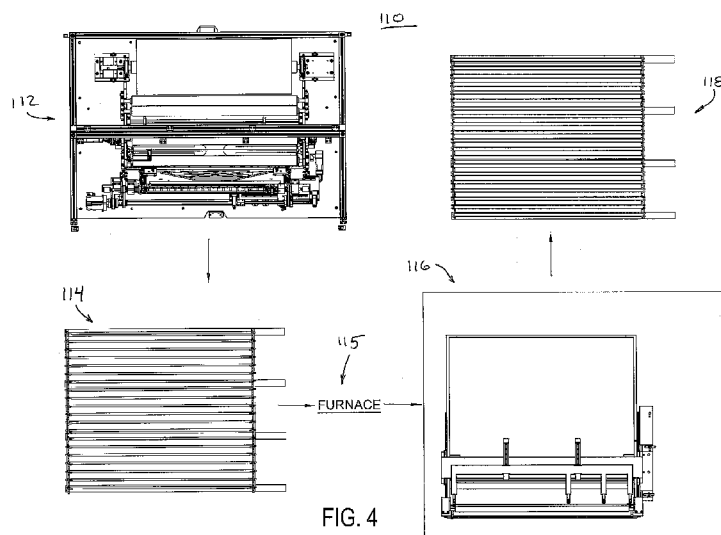


FIG. 4

(57) Abstract: A system for coiling film onto a mandrel includes a film coiling device and a supply roll of film. The film coiling device includes a rotational drive device that is operable to rotate a mandrel to coil film from the supply roll onto the mandrel. The tension device is operable to provide a selected amount of tension on the film between the supply roll and the mandrel. A tension monitoring device is operable to determine a change in tension of the film between the supply roll and the mandrel. A control is operable to adjust a rotational speed of at least one roller to adjust the relative rotational speed of the supply roll and the rotational drive device to adjust the tension in the film. After the film is coiled around the mandrel, the film is cut and the mandrel and coiled film is removed from the film coiling device.

SYSTEM FOR MANUFACTURING COILED FILM
CROSS REFERENCE TO RELATED APPLICATION

[0001] The present application claims the filing benefits of U.S. provisional application Ser. No. 61/847,222 filed Jul. 17, 2013, which is hereby in herein by reference in its entirety.

FIELD OF THE INVENTION

[0002] The present invention relates to film sheets that are coiled around a mandrel, such as a coiled film for use in a window assembly that includes a shade film.

BACKGROUND OF THE INVENTION

[0003] It is known to provide a window assembly (such as for a vehicle) that includes a coiled film or shade that is movable between an open position and a closed or shading position. Examples of such shades are described in International Publication No. WO 2011/133830 and/or U.S. Publication No. US-2008-0106124, and/or U.S. Pat. Nos. 7,645,977; 6,520,239; 7,083,226; 6,899,380; 6,513,864; and 6,520,239, which are hereby incorporated herein by reference in their entirety.

SUMMARY OF THE INVENTION

[0004] The present invention provides a system for coiling a film onto a mandrel or rod, such as a film to be used in manufacturing a window assembly that has a coiled shade disposed in a cavity between a pair of spaced apart window panels. The system provides for fully or substantially automated coiling of the film onto the mandrel and for fully or substantially automated forming of a closed loop at the end of the film, such as for window applications with coiled shades or films.

[0005] According to an aspect of the present invention, a system for coiling film onto a mandrel includes a film coiling device, a supply roll of film, a tension device and tension monitoring device. The film coiling device includes a rotational drive device that is operable to rotate a mandrel to coil film from the supply roll onto the mandrel. The tension device is operable to provide a selected amount of tension on the film between the supply roll and the mandrel. The tension device applies the tension on the film via gravitational forces, and the tension monitoring device is operable to determine a change in tension of the film between the supply roll and the mandrel. A control is responsive to the tension monitoring device, and the control is operable to adjust a rotational speed of at least one

roller to adjust the relative rotational speed of the supply roll and the rotational drive device to adjust the tension in the film. After the film is coiled around the mandrel a sufficient amount, the film is cut and the mandrel and coiled film construction is removed from the film coiling device.

[0006] Optionally, and desirably, the tension device comprises a floating roller that rotatably rests on the film between the supply roll and the mandrel. The tension monitoring device may comprise a sensor (such as a laser sensor or the like) that is operable to determine a degree of depression in the film at or near the floating roller.

[0007] The film coiling device may be operable to affix an end of the film to the mandrel to start the coiling process. For example, the film coiling device may include a support element that has a groove established therealong and, when an end of the film is disposed over the groove, the film coiling device is operable to draw the film onto the support element (such as via a vacuum source and a plurality of vacuum ports established along the support element) and to move the mandrel into engagement with the film and partially into the groove, whereby the end of the film engages an at least partially adhesive portion of the mandrel (such as a moistened portion of the mandrel or a strip or bead of adhesive established along the mandrel or the like). The film coiling device rotates the mandrel to partially coil the film around the mandrel and to align the end of the film with a tuck blade, and, when the end of the film is so aligned, the tuck blade is moved into engagement with the end of the film to press the film against the mandrel to affix the end of the film at the mandrel.

[0008] A pair of clips may be used to grasp the ends of mandrel to remove the mandrel and coiled film construction from the film coiling device, with the clips including a portion that is spaced from the coiled film to limit uncoiling of the film. Optionally, a plurality of the clips and mandrel and coiled film constructions are placed at a rack for heating or curing the coiled film on the mandrels.

[0009] The system may include a scroll forming device that is operable to establish a closed loop at the cut end of the mandrel and coiled film construction. The scroll forming device is operable to (i) position the mandrel and coiled film construction at a platform, (ii) hold the film at the platform, (iii) position a second mandrel at or near an end of the film, and (iv) release the film so that the film end coils around the second mandrel to form a scroll construction. When the film is held at the platform, a bead of adhesive is dispensed

across the film near the cut end of the film, and wherein, when the film is released and coils around the second mandrel, the end of the film contacts the bead of adhesive to form a closed loop around the second mandrel.

[0010] After the scroll construction is formed, a pair of clips may be used to grasp the ends of the mandrels and to hold the mandrels a selected distance apart. Optionally, a plurality of said clips and scroll constructions are placed at a rack, such as for transferring the plurality of scroll constructions to another process, such as another step or process of a window assembly manufacturing process or the like.

[0011] The present invention thus provides a substantially automated process for coiling film onto a mandrel that also provides for substantially uniform tension at the film during the coiling process. The system of the present invention also provides a substantially automated process for establishing a closed loop at the end of a coiled film (so as to provide a scroll type construction such as for window assemblies or the like). The present invention thus provides automated processes to enhance manufacturing of window assemblies and the like with such shades or films, and provides uniform constructions that may be manufactured at a higher rate than current manual, labor intensive processes.

[0012] These and other objects, advantages, purposes and features of the present invention will become apparent upon review of the following specification in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 is a perspective view of a portion of a vehicle having a window assembly manufactured in accordance with the present invention;

[0014] FIG. 2 is a perspective view of the window assembly of FIG. 1;

[0015] FIG. 3 is a perspective and partial sectional view of the window assembly of FIG. 2;

[0016] FIG. 4 is a plan view of the components of the system and process of the present invention, showing a film coiling device, a holding rack, a film fixture and an exit rack;

[0017] FIGS. 5 and 6 are perspective views of the film coiling device of the system and process of the present invention;

[0018] FIG. 6A is an enlarged perspective view of one of the collets that holds an end of the mandrel during the film coiling process;

[0019] FIG. 7 is another perspective view of the film coiling device of the system and process of the present invention;

- [0020] FIG. 7A is an enlarged perspective view of another one of the collets that holds the other end of the mandrel during the film coiling process;
- [0021] FIG. 8 is a side view of the film coiling device of FIG. 5;
- [0022] FIG. 9 is a top plan view of the film coiling device of FIG. 5;
- [0023] FIG. 10 is a front end elevation of the film coiling device of FIG. 5;
- [0024] FIG. 11 is a schematic of the rollers and sensors and film attaching elements of the film coiling device of the present invention;
- [0025] FIGS. 12 and 13 are enlarged views of portions of the schematic of FIG. 11, showing the attachment of the film onto the mandrel and the tensioning of the film via a tension roller in accordance with the present invention;
- [0026] FIG. 14 is a top plan view of a holding rack for holding a coiled film coiled by the film coiling device of the system and process of the present invention;
- [0027] FIG. 14A is a sectional view taken along the line A-A in FIG. 14;
- [0028] FIG. 15 is a side elevation of the holding rack of FIG. 14;
- [0029] FIG. 16 is a perspective view of the holding rack of FIG. 14;
- [0030] FIG. 16A is an enlarged perspective view of the area A in FIG. 16;
- [0031] FIG. 16B is an enlarged perspective view of the area B in FIG. 16;
- [0032] FIG. 17 is a perspective view of the holding rack of FIG. 14, with some portions shown in phantom;
- [0033] FIG. 17A is an enlarged perspective view of the area C in FIG. 17;
- [0034] FIG. 17B is an enlarged perspective view of the area D in FIG. 17;
- [0035] FIG. 18 is a front end elevation of the holding rack of FIG. 14;
- [0036] FIGS. 19 and 20 are perspective views of a film fixturing device of the system and process of the present invention;
- [0037] FIG. 20A is an enlarged perspective view of the area A of FIG. 20, showing an end of the scrolled shade film attached at a clip;
- [0038] FIG. 20B is an enlarged perspective view of the area B of FIG. 20, showing the opposite end of the scrolled shade film attached at another clip;
- [0039] FIG. 21 is a front end elevation of the film fixturing device of FIGS. 19 and 20;
- [0040] FIG. 22 is a side elevation of the film fixturing device of FIGS. 19 and 20;
- [0041] FIG. 23 is a top plan view of the film fixturing device of FIGS. 19 and 20;

- [0042] FIGS. 24-29 are schematics showing operation of the film fixturing device of the present invention;
- [0043] FIG. 30 is a top plan view of an exit rack of the system and process of the present invention;
- [0044] FIG. 30A is a sectional view taken along the line A-A in FIG. 30;
- [0045] FIG. 31 is a side elevation of the exit rack of FIG. 30;
- [0046] FIG. 32 is a perspective view of the exit rack of FIG. 30;
- [0047] FIG. 32A is an enlarged perspective view of the area A in FIG. 32;
- [0048] FIG. 32B is an enlarged perspective view of the area B in FIG. 32;
- [0049] FIG. 33 is a perspective view of the exit rack of FIG. 30, with some of the lines shown in phantom;
- [0050] FIG. 33A is an enlarged perspective view of the area A in FIG. 33;
- [0051] FIG. 33B is an enlarged perspective view of the area B in FIG. 33; and
- [0052] FIG. 34 is a front end elevation of the exit rack of FIG. 30.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

- [0053] Referring now to the drawings and the illustrative embodiments depicted therein, a window assembly or module 10 (such as a sunroof or moonroof of a vehicle 12 or the like or such as a side or rear window of a vehicle 12 or the like or such as for any other suitable window application, such as for a building or the like) includes an outer window panel 14 and an inner window panel 16 with a coiled shade element 18 disposed therebetween (FIGS. 1-3). In the illustrated embodiment, window assembly 10 comprises a roof module or roof window (such as a sunroof or moonroof or glass roof or the like) that is disposed between a front windshield 13a of vehicle 12 and a rear backlite or rear window 13b of vehicle 12 (such as at an opening in the roof of the vehicle or otherwise between the windshield and backlite of the vehicle, such as by utilizing aspects of the glass roof assembly described in U.S. Pat. Publication No. US-2008-0106124, which is hereby incorporated herein by reference in its entirety). The coiled shading element 18 is coiled or retracted to an open or non-shading position, and may uncoil or extend across the window assembly to a closed or shading position, such as in response to a user input or the like. The present invention provides a system and process and device for coiling the shade element or film onto a mandrel and preparing the coiled film for attachment at one of the window panels, as discussed below.

[0054] As shown in FIGS. 1-3, the window module or window assembly 10, when assembled with the film coil 18, has an outer window panel 14 (or upper panel for the roof window application) that has greater cross dimensions than the inner panel 16 (or lower panel for the roof window application), and may provide a uniform or flush outer panel at the exterior surface of the vehicle sheet metal and/or front windshield and rear backlite. The outer and inner window panels 14, 16 of window module or window assembly 10 may have different contours or curvatures (and thus define or establish a non-uniform spacing or cavity therebetween), and thus may provide enhanced matching or correspondence with the contours of the respective surfaces of the vehicle sheet metal and/or front windshield and rear backlite and of the interior or in-cabin roof liner or headliner. The window assembly may utilize aspects of the window assemblies described in PCT Application No. PCT/US2014/027478, filed Mar. 14, 2014, and/or International Publication Nos. WO 2014/011395, WO 2012/177995, and/or WO 2011/133830, and/or U.S. Publication No. US-2008-0106124, which are hereby incorporated herein by reference in their entireties.

[0055] As shown in FIGS. 2 and 3, window panels 14, 16 of the assembled window assembly 10 are spaced apart to define an interpane cavity 20 therebetween, within which the shade element 18 is disposed. Window panels 14, 16 may comprise any suitable materials or panels, such as transparent glass panels, such as tempered glass panels or laminated glass panels or the like, and optionally may comprise glass panels with a low-'E'missivity coating or treatment, such as on a surface of the panel or panels that faces the cavity 20. The window assembly 10 has side perimeter regions 22a and the shade element 18 is configured to be narrow enough or low profile enough to move along the side perimeter regions 22a (such as from the rear perimeter portion 22b towards the front perimeter portion 22c or vice versa) between its open and closed or shading positions.

[0056] The window panels 14, 16 of window assembly are spaced apart and joined together via a sealing element or spacer element or spacing frame 26 that is disposed at and around the perimeter regions of the upper or cavity facing surface of the inner window panel 16. The outer window panel 14 is attached at spacing element 26, with the spacing element 26 engaging the cavity facing surface of the outer window panel 14 inboard of the perimeter edges of the outer window panel. Thus, the spacing element 26 functions to space the window panels 14, 16 apart from one another (to establish the interpane cavity

20) and to secure or join the window panels together to form the double pane window assembly 10.

[0057] Spacing element or frame 26 comprises a perimeter frame having perimeter portions 26a, 26b, 26c that encompass or surround and establish the interpane cavity between the window panels 14, 16. The spacing element or frame 26 is adhered to the lower or inner window panel 16 (which may include an opaque or substantially opaque coating or layer, such as a ceramic frit layer or the like disposed or established about its periphery where the spacing element is attached), such as via an adhesive bead or the like, with the spacing element 26 receiving or retaining the end stop at the lower window panel 16 and along its perimeter portion 26b opposite from its perimeter portion 26a where the roller shade 18 is disposed in its unrolled state. The roller shade 18 is attached at or mounted to a support or anchor element, which in turn is mounted at or received at and along portion 26a of spacing element 26, such that the roller shade is disposed at the inner surface of the lower window panel 16. The upper or outer window panel 14 is adhered or attached at the upper perimeter of the spacing element 26 via an adhesive bead or the like to assemble the window assembly and sandwich the spacing element 26 between the window panels 14, 16, with the roller shade disposed at the inner surface (facing the cavity) of the window panel 16.

[0058] Shade element 18 comprises a conductive shade element, such as an electro-polymeric or metalized polymeric shade element or film or the like, that has a thin rolled up or coiled conductive film, such as a metalized polymeric film or the like, that is responsive to electrostatic action, and that unrolls when a voltage is applied thereto, such as by utilizing aspects of the insulated glazing units described in U.S. Pat. No. 7,645,977 and/or PCT Application No. PCT/US2014/027478, filed Mar. 14, 2014, and/or International Publication Nos. WO 2014/011395, WO 2012/177995, and/or WO 2011/133830, and/or U.S. Publication No. US-2008-0106124, which are hereby incorporated herein by reference in their entireties. The coiled film is coiled or retracted to an open or non-shading position in the absence of a voltage applied thereto, and may at least partially uncoil or extend across the window assembly to a closed or shading position or partially shading position responsive to a voltage applied thereto.

[0059] Optionally, and for any suitable film construction, it is desirable to have the film coiled as tightly as possible to provide the desired performance of the film. It is also

desirable to have the film be as thin as possible while still providing the desired or appropriate performance characteristics (voltage and force to unroll, dissipation and the like).

[0060] From testing, it has been found that the polymeric layer appears to have the most effect of all of the layers on the eventual coil diameter of the film. For example, the thinner the polymer layer, the tighter the roll that can be achieved, with the coil being processed by wrapping the film around a small mandrel (or not using a mandrel at all) and the film coiling onto itself when placed into the furnace. Smaller coils provide for smaller packaging, which is desirable when applying the shade and window assembly into a vehicle.

[0061] A mandrel is used and the film or shade is tightly wrapped or coiled onto the mandrel before the film is placed in a furnace (or otherwise shaped or cured). After the heating process, the coiled film is uncoiled and the end of the coil that has the mandrel (such as a ceramic mandrel or the like) disposed thereat is attached at the anchor stop or element to affix the fixed end of the film at the window panel. The mandrel may be removed after the heating process, or may be attached at the end of the shade film. Optionally, the mandrel may comprise a carbon fiber tubing or mandrel, or may comprise other suitable materials. The carbon fiber tubing or mandrel or the like may be attached at the end of the shade film and, after the film has been heated and uncoiled, the tubing or mandrel may be attached at the window panel to attach or affix the fixed end of the shade at the window panel without use or need of a separate anchor stop element or bar (such that the carbon fiber tubing or mandrel acts as the anchor stop element at the window panel).

[0062] When forming the tight coil of the shade film for heating, the mandrel is disposed at and/or attached at an end of the shade film, and before or after the shade film is heated to form or retain its tightly coiled form, the outer or free end of the heated coil is formed to have the fixed loop or coil thereat. After the coiled shade film has been heated, the film is uncoiled from the mandrel and coiled tightly around the fixed loop. Optionally, a second mandrel (such as a carbon fiber tubing or mandrel or the like) may be disposed at the fixed loop at the end of the shade film (the end that is disposed at or near the stop element when uncoiled) to assist in tightly coiling the film about the mandrel and fixed loop.

[0063] The present invention provides a system or process of coiling the film onto a mandrel in a controlled and automated manner, and of forming a scrolled film that is

configured for attachment at an anchor stop of a window panel of a window assembly of the types described above. For example, and with reference to FIG. 4, the system 110 of the present invention includes a film coiling device 112, a coiled film holding rack 114, a film fixturing device 116 and an exit rack 118. The film coiling device 112 is operable to coil the film material around a mandrel while maintaining proper tension on the film so that the coiled film is a tightly wound coil, as discussed in detail below. The holding rack 114 provides a support for multiple coiled films and mandrels so that the coiled films can be moved together as a batch or unit into an oven or furnace or heating and/or curing device 115, as also discussed in detail below. The film fixturing device 116 is operable to form an end coil at the free end of the coiled film, as discussed in detail below. After the end coil is formed, the exit rack 118 provides a support for holding multiple coiled films having the end portions of the film coiled about respective mandrels, so that multiple coiled film "scrolls" can be moved to another station as a batch or unit for attachment of the film at the window panel and/or anchor stop of a window assembly, as also discussed in detail below. The film coiling and heating and scrolling processes are preferably all conducted in a clean room environment.

[0064] Referring now to FIGS. 5-13, the film coiling device 112 includes a controller 119, a supply roll 120 of film 122, which is rotatably mounted at a frame 124 and a rotational drive device 126 that receives the ends of the mandrel 128 thereat and rotates the mandrel to coil the film onto the mandrel and uncoil the film from the supply roller 120. The supply roll 120 comprises a roll of film material at a selected width, whereby the film may be unrolled from the supply roll as it is coiled around the mandrel. The supply roll may initially have several yards or meters of film for providing many (such as, for example, hundreds) of coiled film units (with the film coiled around the mandrel via the drive device and cut to the appropriate length after the coiling) with a single supply roll.

[0065] The film coiling device includes a plurality of guide rollers 121, which guide the film along its path between the supply roll 120 and the drive device 126 and mandrel 128. In the illustrated embodiment, and as best shown in FIG. 11, the guide rollers 121 include a pair of tensioning rollers 121a, 121b that guide the film 122 from the supply roller 120 to nip rollers 121c, which may tension the film pull the film from the supply roller to feed the film to the drive device. The film is fed from the nip rollers 121c over another guide roller

121d to the mandrel 128 at the drive device, which rotates the mandrel to wind or coil the film onto and around the mandrel.

[0066] The drive device 126 includes a drive motor 126a that rotatably drives a rotatable shaft 126b that extends along and is rotatably mounted at the frame 124. The shaft 126b is coupled (such as via a pair of drive belts 126c) to a pair of collets 126d that receive and clamp onto the respective ends of the mandrel 128 when the mandrel is positioned at the collets. The two collets are thus simultaneously driven or rotated via a single common drive motor so that the two collets rotate together to simultaneously and synchronously rotate the ends of the mandrel together so as to limit or avoid twisting of the mandrel during the film coiling process. The drive motor 126a thus rotates the mandrel, which, after an end of the film is attached to the mandrel (as discussed below), coils the film around the mandrel and draws the film from the supply roller 120.

[0067] While the drive device 126 is rotatably driven to increase or decrease the drawing of the film from the supply roller and coiling of the film onto the mandrel, one or both of the nip rollers 121c (and/or optionally the supply roller 120) may be rotatably driven to increase or decrease the payout or uncoiling of the film from the supply roller. In order to provide the proper tension of the film that is wound or coiled around the mandrel, the film coiling device 112 includes a tension control device or system or element 130 that functions to maintain the desired or appropriate or selected tension on the film as the film is coiled onto the mandrel, with the rotational speed of the drive motor 126a and/or the nip rollers 121c and/or the supply roller 120 being adjusted responsive to the detected or determined tension in the film.

[0068] In the illustrated embodiment, the tension control device 130 comprises a floating resistance roller or tensioning roller, which rotatably rests on the film material 122 between the supply roller 120 and the mandrel 128 and is freely movable in the vertical direction so that the floating or tensioning roller 130 generally "floats" on the film and forms a depression or curve in the film path. For example, the floating roller 130 may have its ends movably received along generally vertically oriented slots of a mounting bracket, whereby gravitational forces provide the downward pressure of the floating roller 130 onto the film 122. The size and weight and material of the roller is selected to provide the desired or appropriate down pressure at the film, thereby causing the appropriate depression in the film as the drive device 126 coils the film onto the mandrel, and the speed of the supply

roller is adjusted to maintain the desired degree of depression of the film (and thus the desired tension in the film as the film is coiled onto the mandrel).

[0069] In order to determine or monitor the amount of depression of the film, a detecting device or sensor 132 (such as a laser sensor or motion sensor or the like) may be used to monitor and measure the depression of the film. In the illustrated embodiment, the sensor 132 (such as a laser sensor or the like) is disposed at or above the film path (such as at a generally central location over the film path) and directed at the film or floating roller to determine the degree of depression in the film or height or change in elevation of the floating roller. Optionally, other suitable sensors or the like may monitor the ends or end regions of the floating roller to determine the height of the floating roller along the vertical slots, or other sensing means may be provided to determine the height of the floating roller and/or the depression in the film. The controller 119 of the film coiling device 112, responsive to an output of the sensor or sensors, controls the rotational speed of the nip rollers and/or the supply roller and/or the drive device and mandrel, in order to maintain the film tension at the appropriate or selected level.

[0070] For example, as the depression increases, the speed of the nip roller may be decreased to increase the tension (as the film continues to be drawn by the rotational driving of the mandrel by the drive device) and thus decrease the depression towards its appropriate level. Likewise, as the depression decreases, the speed of the nip roller may be increased to decrease the tension and thus increase the depression towards its appropriate level. Thus, while the drive device 126 is rotating the mandrel at a set speed, the rotational payout speed of the supply roller and/or nip rollers is adjusted responsive to the sensor to maintain the desired or appropriate tension in the film throughout the coiling process. Thus, the coiling device of the present invention provides a controlled, rapid and automated means for coiling the film onto the mandrel.

[0071] Optionally, the tension in the film may be monitored and controlled via other means. For example, other ways of applying a constant gravitational force or weight on the film or supply roller may be implemented. Optionally, for example, the tension in the roller may be monitored via a force transducer or sensor at the supply roller that determines the tension of the film as it leaves the roller via the rotational force or pull of the film at the supply roller. The controller of the film coiling device then adjusts the speed of the drive device and/or the supply roller in response to a detected or determined increase or

decrease in film tension to maintain the film at the desired or appropriate or selected tension during the process of coiling the film onto the mandrel.

[0072] The film coiling device 112 also provides for a controlled and automated means for attaching the free end of the film (as fed from the supply roller 120 and through rollers 121) to the mandrel in a consistent manner. In the illustrated embodiment, the film coiling device 112 includes a film attaching system 134 that attaches (such as via an adhesive strip or tape disposed along the mandrel or such as via moistening the end of the film or a strip along the mandrel) the end of the film to the mandrel in a controlled and automated manner. In the illustrated embodiment, the film attaching system 134 comprises a V-shaped groove 134a and a film holding element 134b (such as a platform with a plurality of apertures or ports and a vacuum source that draws air through the plurality of apertures or ports disposed along and near the V-shaped groove to draw the film down onto the holding element or platform) and a film pressing element or tuck blade device 136.

[0073] As best shown in FIGS. 11-13, when a mandrel has the film coiled around it (and after the film is fully coiled around the mandrel and ready to be cut to the appropriate length), the vacuum source may be actuated to hold the film in place at the film holding element 134b (with the mandrel and collets moved away from the platform or holding element 134b such as shown in FIG. 11) and the film may be cut (such as via a manual cutting process or an automated or robotic process that cuts the film at or near the holding element while the film is held in place along the holding element or platform via the vacuum) so that the fully coiled film and mandrel (now a film coil and mandrel construction 137) can be removed from the film coiling device and moved to the next process or step, as discussed below. After the coiled and cut film and mandrel construction is removed from the collets, a new mandrel is provided and secured at the collets (this may be done via a manual process where an operator manually removes the mandrel and film construction and installs a new mandrel and applies the adhesive on the new mandrel, or this may be done robotically where one or more robotic devices removes the completed mandrel/film construction and/or installs a new mandrel, depending on the particular application or system). The new mandrel has an adhesive strip or tape established longitudinally along a portion of its outer cylindrical surface. The mandrel is secured at the collets with the adhesive strip positioned at a particular location or orientation relative to the collets and the film holding element and V-shaped groove. The initial positioning or

orientation of the mandrel and its adhesive strip at the collets is important and may be assisted by markings at the mandrel and collets or the ends of the mandrel and the receiving portions of the collets may be keyed to ensure that the mandrel (and its adhesive strip) is properly oriented at the collets before the film attaching process begins, so that the adhesive strip, when the mandrel is moved into the groove, properly aligns with and contacts the end of the film. The adhesive strip or tape may be applied along the mandrel via any suitable means, and may be applied before or after the mandrel is secured at the collets (and optionally may be robotically applied at the mandrel when the mandrel is at the collets to ensure that the adhesive strip is at the correct orientation relative to the collets before the film attaching process begins).

[0074] After the mandrel is secured at the collets with the adhesive strip at the correct or proper initial orientation or position, the vacuum device may be turned off and the collets and mandrel may be lowered or moved so that the mandrel contacts the film (which extends at least partially over the groove) and pushes the film partially into the groove (with the adhesive strip being at a location where the cut or free end of the film contacts the mandrel as the film and mandrel at least partially enter the groove so that the film is initially and temporarily adhesively attached at the mandrel). The mandrel is then rotated (via drive device 126) to move the adhered end of the film to where the tuck blade 136 is located, whereby the tuck blade 136 moves into engagement with the film and mandrel at the adhesive strip to press the film against the tape to attach the film end to the mandrel (see FIG. 12).

[0075] In the illustrated embodiment, the tuck blade 136 is attached at or disposed at a rigid plate or member 136a that is mounted at or relative to the frame 124 via an actuator 136b disposed at each end of the rigid plate or member 136a. Actuation of the actuators 136b (which actuate in tandem to move the opposite ends of the rigid member and tuck blade together) moves the tuck blade towards or away from the V-shaped groove 134a and towards and away from engagement with the film and mandrel. The rigid structure of the member 136a limits or substantially precludes any flexing of the tuck blade during use so that the tuck blade uniformly engages the film and mandrel. The tuck blade 136 may have a soft engaging end (such as a low durometer rubber engaging end or the like) to provide a compression force at the film end without damaging or marring the film or mandrel. Once the end of the film is firmly attached at the mandrel, the collets and

mandrel may be moved away from the groove and the device may begin coiling the film onto the mandrel, as discussed above.

[0076] After the film is coiled onto the mandrel and the film is cut so that the coiled film is the desired length, the coiled film and mandrel construction 137 may be removed from the collets. With reference to FIGS. 14-18, the system of the present invention provides clips 138 that are attached at the mandrel when the mandrel is at the collets and that hold the ends of the mandrel. The clips are configured to hold the mandrel and to be received at or supported at a rack or support structure 140, which can be moved into a furnace or oven or the like to cure or heat the coiled film and mandrel constructions supported thereat. As shown in FIGS. 14-18, a plurality of clips 138 may be received at respective notches 140a established along opposite side portions 140b of the support structure 140, such that the film coil and mandrel constructions are supported by the clips and do not contact one another or the support structure during transport and heating of the coiled film and mandrel constructions.

[0077] Thus, for example, before removing the mandrel (with film coiled thereon) from the collets, and at the time of cutting the film, the clips 138 may be provided to clip onto or attach at the end regions of the mandrel (outboard of where the film is coiled and between the coiled film and the collets when the mandrel is disposed at the collets) to hold the mandrel for transporting the mandrel from the film coiling device to the furnace or oven. Each clip 138 preferably includes a grasping portion 138a that clamps onto or receives the end regions of the mandrel and further includes an elongated element or rod 138b (such as a cylindrical rod, such as a metallic or steel rod or the like) that is spaced from the mandrel by a small gap (such as, for example, about 2 mm or less between the rod and the outermost coil of the film). The clips may include respective torsional springs 138e that bias the clips towards their clamping state where they clamp or grasp onto the end region of the mandrel.

[0078] As best shown in FIG. 14A, when the coiled film is fully coiled and cut from the supply roll of film, the film may have a tail or free end 122a that extends from the mandrel and coiled portion of the film. The rod 138b is spaced from the coiled film and functions to limit or substantially preclude uncoiling of the film that is tightly coiled or wound around the mandrel. Thus, the clips 138 function to hold the mandrel and to limit or substantially preclude uncoiling of the coiled film, while avoiding contact with the film so that the film

may be more uniformly heated during the heating or curing process. The clips may be grasped by an operator to manually move them from the film coiling device to the rack or the clips may be robotically grasped and moved via an automated robot or the like. As can be seen with reference to FIGS. 15-16B, the notches 140a of the rack 140 receive the grasping portion of the clips therein and limit or substantially preclude opening of the clips so that the clips and mandrels are secured relative to the support structure (with the clips and mandrel/film constructions supported so that the tail 122a of the film hangs down from the coiled film portion and does not contact the base of the rack), which can then be moved as a unit into a furnace or oven or the like to cure or heat the coiled film and mandrel constructions supported thereat.

[0079] In the illustrated embodiment, the clips 138 include holding portions or tabs 138c that are hooked or grasped to move the clips and mandrel from the coiling device 112 to the rack 140 and from the rack 140 to the fixturing device 116 and for holding the clips and mandrel at the fixturing device 116, as discussed below. The tabs 138c may include a locating element or hole 138d to provide a locating function for properly locating or positioning the tabs and clips and mandrels relative to a support structure of a robotic arm or the like, as discussed below. After the coiled film and mandrel constructions are heated or cured, they are moved to the fixturing device 116 where the end loop or coil is established at the free end of the coiled film (the end opposite the end of the coiled film that is attached at the mandrel).

[0080] The fixturing device 116 is operable to cut or trim the film end and establish a fixed coil at the free or tail end of the coiled film in an automated and controlled manner. In the illustrated embodiment, fixturing device 116 includes a mandrel moving device 142 that supports a mandrel and coiled film construction via the clips 138 and moves the construction onto a platform 144 so that the tail or free end 122a of the coiled film lies flat on the platform. The mandrel moving device or carriage 142 includes arms 142a that are formed to support and hold the tabs 138c of the clips 138 when the mandrel and clip construction is disposed at the fixturing device 116. As can be seen with reference to FIGS. 20-23, the clips 138 may be held or supported at respective arms 142a and the mandrel moving device may include multiple arms or supports that are set at selected distances apart so that the fixturing device may receive and support different sized mandrels, such as mandrels (and coiled film) for window assemblies of different widths.

Optionally, one or more of the arms 142a may be adjustably attached at the mandrel moving device 142 and may be adjustable to set their spacing or gap to the appropriate dimension for a particular shade application.

[0081] The platform 144 of the fixturing device 116 comprises a planar surface, such as a planar glass surface or the like, and has a portion 144a that is operable to hold the film in place at the surface of that platform portion (for example, the platform portion may have a vacuum port or ports at that region so that a vacuum source may draw air through the ports to draw the film onto the platform surface, or the platform portion may have a conductive coating that is able to be powered so that the film is held at a powered portion of the platform). Thus, when the mandrel and coiled film is located at the appropriate location on the platform portion (via movement of the arms 142a and carriage) the mandrel may be secured and the platform portion may be powered (such as via a vacuum source or electrical power or the like) to hold the film in place. When the film is held in place at the platform, the film may be cut or trimmed to an appropriate length and a bead of adhesive may be disposed along the film a predetermined distance from the cut end of the film, whereby another mandrel or rod may be placed at or near the end of the film. When the platform portion is then unpowered, the film will coil around the rod or mandrel and coil until the coiled film at the free end contacts the adhesive strip, thereby forming a fixed loop or coil at the free end of the film. The coiled film and mandrel construction thus is formed into a "pirate scroll" configuration, with the film coiled at each end about a respective mandrel or rod (but with the film not attached at the newly formed free end of the film).

[0082] In the illustrated embodiment (see, for example, FIG. 24 and "A" in FIGS. 20A and 20B), the mandrels and clips 138 are set on the arms 142a (this may be done via a manual process where an operator manually places the clips at the arms, or this may be done robotically, depending on the particular application or system) and the arms are automatically moved in a controlled manner downward towards the platform and also in a direction along the platform surface (such as by having the arms 142a move downward along the ramped portion 142b), so that as the free end or tail of the film is moved towards the platform and into engagement with the platform surface, the film will flex in the coiling direction (such as in the counter-clockwise direction in FIGS. 24 and 25) so that the film end or tail will lay flat on the platform and extend from the mandrel as shown in FIGS. 25 and 26 and at "B" in FIGS. 20A and 20B. To lower the mandrel and coiled film

construction 137 downward in this manner, the arms 142a may be moved downward and at an angle or may move in an arcuate manner to limit bending of the film and/or flexing of the film in the wrong direction as the film is moved onto the platform surface. In the illustrated embodiment, and as best shown in FIG. 22, the arms 142a move downward along a ramped element or wedge 142b as the ramped element 142b moves along the platform 140 (such as via a roller or bearing mechanism 142c) to provide a controlled downward and translational movement of the arms 142a and mandrel/film construction supported thereat.

[0083] Thus, and as best seen with reference to FIGS. 24-29, the clip is initially placed at the arm 142a, with the tail 122a of the film hanging down from the mandrel 128 (FIG. 24). The arm 142a (and clip 138 and mandrel/film construction 137) is then lowered and moved along the platform to move the clip and mandrel/film construction 137 onto the platform (see FIG. 25), with the film tail 122a laying on the platform 144. When the film and mandrel is positioned at the appropriate location relative to the platform, the mandrel may engage a locking or securing element 146, which rotatably holds the mandrel at the carriage or moving device 142 to secure or retain the mandrel at the moving device. When the mandrel is held in place, a vacuum source is powered to draw the end region of the film onto the surface of the platform. Once so retained, the clip 138 is removed (FIG. 26) from the mandrel/film construction 137. The carriage or moving device 142 then moves the mandrel (allowing the film to uncoil while the end of the tail 122a is held via the vacuum) along the platform (such as via sliding or roller bearing mechanism 142c) to uncoil a portion of the coiled film (see FIG. 27), such as a few inches or more of film, with the film lying flat on the platform and held in place via the vacuum. As shown in FIGS. 27 and 28, the film may be moved partially onto the powered portion 144a and held in place, allowing for the film to be cut at the unpowered portion 144b at or near the junction of the two platform portions. The film may then be cut (such as via an automated cutting device) so as to have a straight cut across the film at the desired length from the mandrel. An adhesive dispenser may then dispense a small adhesive bead (or strip of tape) along the upper exposed surface of the film at a predetermined distance from the cut end of the film.

[0084] As can be seen with reference to FIGS. 27 and 28, a second mandrel 148 is pivotally mounted at the platform 144 via a mandrel holding device or keeper 150. After the film has been partially uncoiled and cut and after the adhesive bead has been

dispensed on the film, the mandrel keeper 150 is operable to pivot the second mandrel 148 onto the film and at a location between the cut end and the adhesive bead. The mandrel keeper is then moved away from the film (leaving the second mandrel 148 at the film) and the vacuum or power is turned off, thereby allowing the free or cut end of the film to coil up around the second mandrel and onto the adhesive bead so that the end of the film is adhered to the film itself to form a fixed coil or loop at the end of the film (with the second mandrel disposed within the fixed loop, but not adhered to the film). The film and mandrels now are formed as a scroll construction 152. The fixture device may be entirely automated and may perform the above moving and affixing and adhering processes in an automated and controlled manner responsive to receiving the clips at the arms and the second mandrel at the mandrel keeper, or an operator may assist in the cutting or adhering processes or the like, depending on the particular application or process.

[0085] As shown in FIG. 29, the mandrels may be rolled relative to one another to the right or selected spacing, and a pair of exit clips 154 are used to grasp the ends of the mandrels so that the scroll construction 152 so that the scroll construction 152 can be moved to the exit rack 118 (this may be done via a manual process where an operator manually removes the scroll construction or this may be done robotically, depending on the particular application or system). As shown in FIG. 29, exit clips 154 comprise a spacer portion 154a and a pair of pivotable arms 154b that pivot relative to a center portion 154c to clamp or grasp the mandrel ends between the arms and the spacer portion 154a. As shown in FIGS. 30-34, the exit rack 118 is configured receive and support a plurality of clips 154 and scroll constructions 152. In the illustrated embodiment, a plurality of clips 154 may be received at respective notches 156a established along opposite side portions 156b of a support structure 156 of exit rack 118, such that the scroll constructions are supported by the clips and do not contact one another or the support structure during transport of the scroll constructions. As can be seen with reference to FIGS. 32-33B, the notches 156a of the support structure 156 receive the grasping portions of the clips therein and limit or substantially preclude opening of the clips so that the clips and mandrels are secured relative to the support structure, which can then be moved as a unit to the next manufacturing stage, such as where the film scroll construction is mounted at a glass panel of a window assembly. An outer side portion 156c of the support structure 156 may have notches for receiving the ends of the mandrels therein.

[0086] Preferably, the above film coiling processes and the window assembly processes are conducted in a clean room environment to limit or substantially preclude particles, such as dust or dirt particles, from being drawn to the sheet or film material during the cutting and coiling and forming processes. For example, the inner and outer window panels may be provided or supplied at a clean room along with the other components (the anchor bar and end stop and the like). The components may be pre-cleaned before being moved into the clean room (such as via a detergent scrub or the like to the glass surfaces of the window panels). When in the clean room, the inner or lower glass panel (which may already be coated on its inner or upper surface with a transparent conductive layer or ITO layer) may be ground cleaned with isopropyl alcohol (with the panel being connected to ground during the cleaning process). For example, a wiping element or sponge or the like may be saturated with isopropyl alcohol and connected to a ground wire and wiped over the inner glass surface of the inner or lower glass panel to clean the inner or lower glass panel and to remove all stored pockets or charge that may be present on the glass surface.

[0087] The process of cleaning the lower glass panel with isopropyl alcohol helps to reduce or keep the charge off of the dielectric surface. Preferably, the cleaning process takes place on the glass before the dielectric layer is applied, and then may be repeated on top of the dielectric layer after the components (such as the anchor bar, roll stop bar, and shade coil) are placed, and then may be repeated again on top of the dielectric layer before the cover glass and perimeter frame are placed at the lower glass panel. The cleaning process may use a primer tip made of any suitable material, such as a felt material wrapped with a clean wipe or the like. Fluid may be dispensed through the felt tip, which may control the flow of the isopropyl alcohol. The clean wipe may limit or substantially preclude felt contaminants from getting onto the glass surface during the cleaning process. Optionally, and desirably, the glass panel and components may be robotically cleaned. For example, the felt tip may be disposed at the end of a robot arm or the like. Such robot arms may typically be used to dispense primer, but in this case the robot arm would dispense isopropyl alcohol or MEK, and would be wrapped with a cleanroom wipe to prevent felt particles from getting onto the lower glass and dielectric layer during the cleaning process.

[0088] The coiled film or scroll construction may be fixtured and bonded along an inboard portion of the spacing element or frame of the window panel. During operation of the roller shade, a voltage may be selectively applied (such as in response to a user input or control signal or the like) between the conductive roller shade and the conductive coating or layer at the glass surface during operation of the roller shade. For example, an electrical wire or lead may be connected to the conductive coating at the glass surface and another electrical wire may be connected to the roller shade (such as to the anchor element or bar at which the roller shade is attached), such that, when power is applied (and a voltage difference is generated between the roller shade and the conductive coating), the roller shade may unroll towards its closed or uncoiled state, and when power is stopped or no longer applied, the roller shade may be coiled or rolled up to its open or coiled state along the perimeter portion of the spacing element or frame.

[0089] The window assembly, when fully assembled, may be disposed at an opening in a vehicle and secured or mounted thereat or therein via any suitable mounting or attaching means. For example, the outer perimeter of the outer or upper window panel may be bonded or adhered to a metal frame or the like at the vehicle, or the window assembly may be attached to and/or supported by a separate frame that is attached to the vehicle. Optionally, the window assembly may include mounting hardware or the like that is attached to corresponding mounting structure or hardware at the vehicle to mount the window assembly at the vehicle.

[0090] Although shown and described as comprising a sunroof or moonroof for a vehicle, it is envisioned that the shaded window assembly of the present invention may be suitable for a variety of vehicular applications, such as side window applications and/or rear window or backlite applications and/or windshield applications. For example, an upper portion of a windshield may comprise the spaced apart window panels with a spacer element and roller shade as described above, with a perimeter trim panel or trim strip extending along the lower edge of the dual panel construction. Thus, the driver may selectively darken or shade the upper portion of the windshield (or optionally, the windshield portion may automatically darken responsive to one or more ambient light sensors or glare sensors at the vehicle) to limit glare or sunlight passing through the upper portion of the windshield, such as when driving towards the sunrise or sunset. Optionally, aspects of the window assembly of the present invention may also or otherwise be applied

to a rear backlite of a vehicle (either shading the entire rear backlite or a portion of the rear backlite) or a side window of a vehicle or the like. For applications where the shade element unrolls to shade only a portion of the window or windshield, the dual pane construction may only be at that portion of the window or windshield, or the dual pane and spacing element construction may apply to the entire window or windshield, with the roller shade being controlled or limited or sized to unroll only to cover or shade or darken a selected portion of the window or windshield (such that the roller shade only partially unrolls over part of the window or windshield or such that the roller shade is cut or formed so that, when fully unrolled, it extends over or encompasses only a portion of the window or windshield). Other window configurations and roller shade constructions (such as by utilizing aspects of U.S. Publication No. US-2006-0082192, which is hereby incorporated herein by reference in its entirety) may be implemented while remaining within the spirit and scope of the present invention.

[0091] Optionally, for example, the window assembly of the present invention may be configured for use in other applications, such as non-vehicular applications, such as residential windows (such as house windows, including exterior and interior windows, and/or storm doors and the like), commercial windows (such as general building windows, skyscraper windows, and/or the like), aerospace windows (such as airplane windows and/or the like), appliance windows (such as for refrigerator doors, washing machine lids, clothes dryer doors, wine cooler doors, and/or the like), interior windows (such as for office partitions, room dividing panels, bathroom glass, light lenses and/or the like) and/or any other transportation vehicle windows (such as, for example, windows for trains, buses, RVs, tractors, heavy equipment and/or the like), while remaining within the spirit and scope of the present invention. The present invention thus provides a shaded window that may be suitable for use in a variety of applications that are suitable for or that require some type of dimming or blackout or shading. Also, the film coiling process of the present invention may be suitable for coiling any film type material or flexible sheet material onto a mandrel or rod or axle, and may provide the desired and substantially uniform or constant tension in the film or flexible sheet as it is coiled onto the mandrel or rod or axle.

[0092] When uncoiled, the film provides a desired degree of shading at the window assembly, and may provide shading in any suitable color, depending on the particular application of the window assembly. For example, the film or films may be painted or

inked or screen printed or coated with a dark or black coating to provide a dark or black colored shading of the window assembly, or the film or films may be painted or inked or screen printed or coated with any other colored coating or layer or the like to provide the desired appearance of the shaded window assembly. Optionally, for example, the film or films may be colored or tinted or patterned (such as with a vehicle manufacturer logo or any desirable or suitable pattern or icon or image or the like) to match the interior or exterior color scheme or trim scheme of the particular vehicle or vehicle manufacturer, or the film or films may be colored or tinted to match a selected color scheme as selected by the vehicle manufacturer or the vehicle owner or the like, such as by utilizing aspects of the mirror assemblies described in U.S. Pat. Nos. 7,289,037; 7,626,749 and/or 7,255,451, which are hereby incorporated herein by reference in their entireties.

[0093] Optionally, the film may have a reflective layer or reflective property, so as to reflect light and/or UV radiation away from the window and away from the interior cabin of the vehicle. Optionally, the film may comprise polarization properties and may darken when it encounters UV radiation (or the film may automatically extend or close or cover the window panel when a threshold degree of UV radiation is detected or sensed at the window assembly, such as via a controller that, responsive to a detection of a threshold level of UV radiation, energizes the shade to extend or deploy or uncoil the film).

[0094] Optionally, the film may be formed without an ink layer. For example, the film material or substrate may be already colored or darkened, such as by having a pigmentation additive added to the film substrate so the film substrate itself is formed at the desired or selected color and opaqueness. Such an additive may obviate the need for the inking process and may provide a more durable film (because, with the pigmentation additive as part of the film material itself, there is a reduced chance of scratching or marring an inked surface at the surface of the shade film). Optionally, an ultraviolet (UV) or infrared (IR) pigmentation may be added to the film substrate or may be disposed at the surface of the film to provide a desired UV/IR protection or filter at the shade film.

[0095] The film or films may provide any desired or appropriate degree of shading and thus may function to block or attenuate a desired or appropriate percentage of light incident at the window assembly. For example, the film may block or attenuate at least about forty percent of the visible light incident at the window assembly, and preferably may block or attenuate at least about sixty percent of the visible light incident at the window assembly,

more preferably at least about eighty percent of the visible light incident at the window assembly (or the film may block or attenuate less than about forty percent of the visible light incident at the window assembly), and it is envisioned that the film may block up to about one hundred percent of the visible light incident at the window assembly (so as to provide a generally or substantially opaque or non-light-transmissive window or sunroof), depending on the particular application of the window assembly and desired shading of the window when the shading element is deployed. The degree of light transmissivity or light attenuation of the film or shade element may be varied by varying the thickness of the ink layer or coating on the polymeric film roll or by including a metallic coating or light absorbing layer or light reflecting layer at the polymeric film roll or the like.

[0096] Changes and modifications to the specifically described embodiments may be carried out without departing from the principles of the present invention, which is intended to be limited only by the scope of the appended claims, as interpreted according to the principles of patent law.

CLAIMS:

1. A system for coiling film onto a mandrel comprising:
 - a film coiling device;
 - a supply roll of film;
 - wherein said film coiling device includes a rotational drive device that is operable to rotate a mandrel to coil film from said supply roll onto said mandrel;
 - a tension device operable to provide a selected amount of tension on the film between said supply roll and the mandrel;
 - wherein said tension device applies the tension on said film via gravitational forces;
 - a tension monitoring device operable to determine a change in tension of the film between said supply roll and the mandrel;
 - a control responsive to said tension monitoring device, and wherein said control is operable to adjust a rotational speed of at least one roller to adjust the relative rotational speed of said supply roll and said rotational drive device to adjust the tension in the film;
 - and
 - wherein, after the film is coiled around the mandrel a sufficient amount, the film is cut and the mandrel and coiled film construction is removed from said film coiling device.
2. The system of claim 1, wherein said tension device comprises a floating roller that rotatably rests on the film between said supply roll and the mandrel.
3. The system of claim 2, wherein said tension monitoring device comprises a sensor that is operable to determine a degree of depression in the film at or near said floating roller.
4. The system of claim 2, wherein said floating roller is movably disposed along generally vertical slots of a roller support.
5. The system of any preceding claim, wherein said film coiling device is operable to affix an end of the film to a mandrel to start the coiling process.

6. The system of claim 5, wherein said film coiling device includes a support element that has a groove established therealong and wherein, when an end of the film is disposed over the groove, said film coiling device is operable to draw the film onto the support element and to move the mandrel into engagement with the film and partially into the groove, whereby the end of the film engages an at least partially adhesive portion of the mandrel.

7. The system of claim 6, wherein said film coiling device rotates the mandrel to partially coil the film around the mandrel and to align the end of the film with a tuck blade, and wherein, when the end of the film is so aligned, the tuck blade is moved into engagement with the end of the film to press the film against the mandrel to affix the end of the film at the mandrel.

8. The system of any preceding claim, wherein said rotational drive device includes a pair of collets that receive and clamp onto respective ends of the mandrel, and wherein said collets are rotatably driven via a common drive motor so that the two collets rotate together to synchronously rotate the ends of the mandrel together.

9. The system of any preceding claim, wherein a pair of clips are used to grasp the ends of mandrel to remove the mandrel and coiled film construction from said film coiling device, wherein said clips include a portion that is spaced from the coiled film to limit uncoiling of the film.

10. The system of claim 9, wherein a plurality of said clips and mandrel and coiled film constructions are placed at a rack for heating or curing the coiled film on the mandrels.

11. The system of any preceding claim, comprising a scroll forming device that is operable to establish a closed loop at the cut end of the mandrel and coiled film construction.

12. The system of claim 11, wherein said scroll forming device is operable to (i) position the mandrel and coiled film construction at a platform, (ii) hold the film at the platform, (iii)

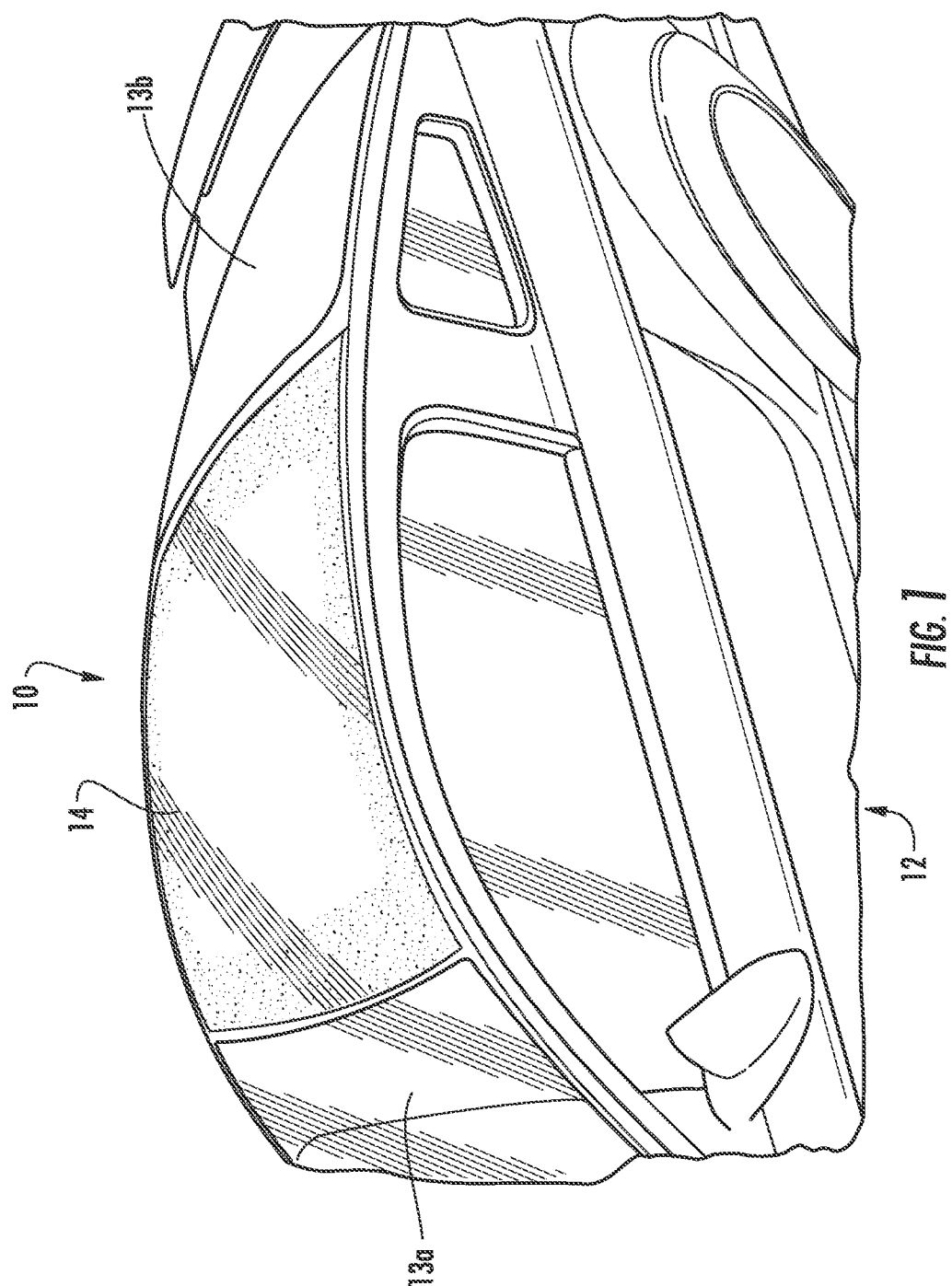
position a second mandrel at or near an end of the film, and (iv) release the film so that the film end coils around the second mandrel to form a scroll construction.

13. The system of claim 12, wherein said scroll forming device positions the mandrel and coiled film construction at the platform by moving said mandrel and coiled film construction towards and along the platform so that the end of the film contacts the platform and is disposed partially along the platform as said mandrel and coiled film construction is positioned at the platform.

14. The system of claim 12, wherein, when the film is held at the platform, a bead of adhesive is dispensed across the film near the cut end of the film, and wherein, when the film is released and coils around the second mandrel, the end of the film contacts the bead of adhesive to form a closed loop around the second mandrel.

15. The system of claim 14, wherein, after the scroll construction is formed, a pair of clips are used to grasp the ends of the mandrels and to hold the mandrels a selected distance apart.

16. The system of claim 15, wherein a plurality of said clips and scroll constructions are placed at a rack.



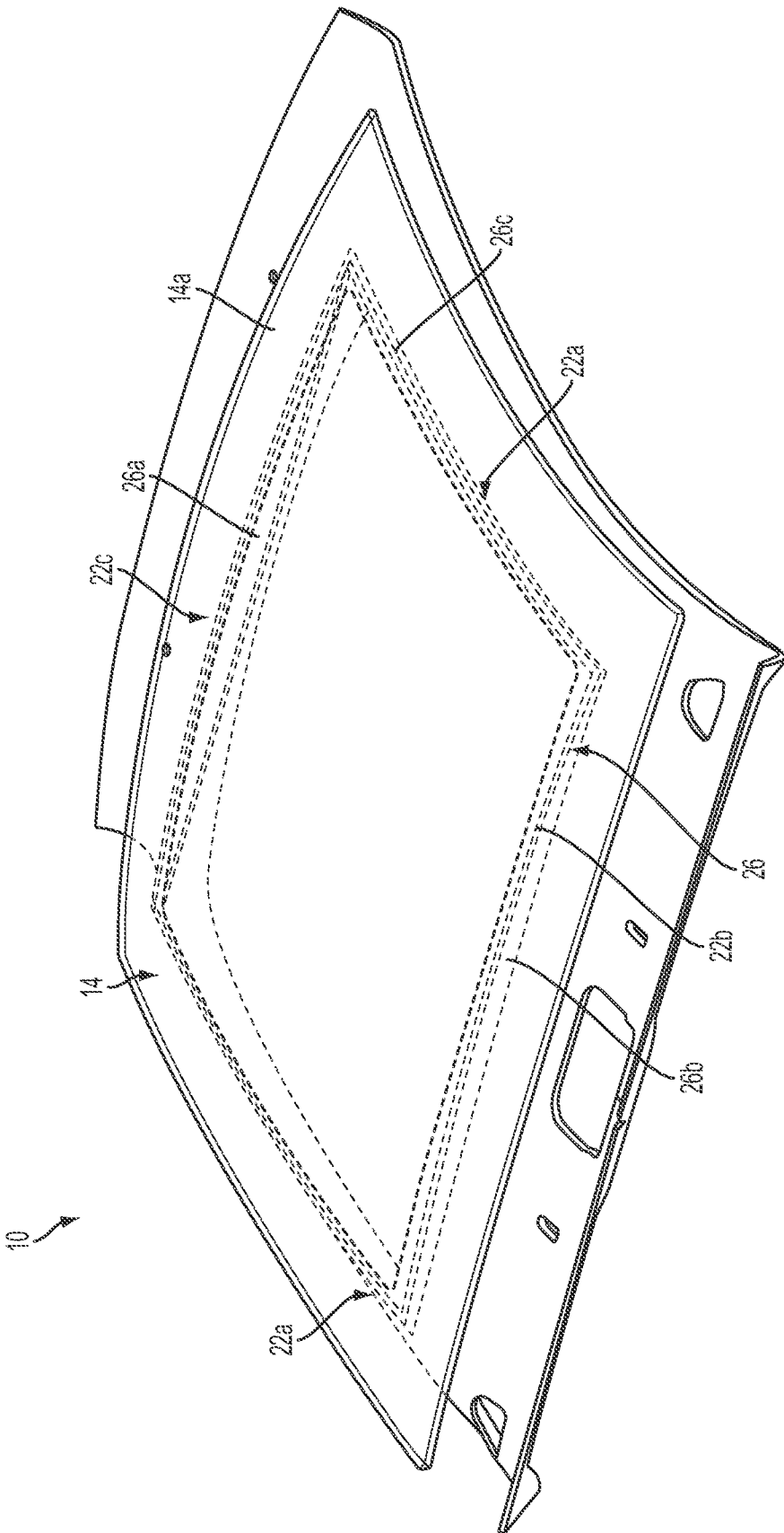


FIG. 2

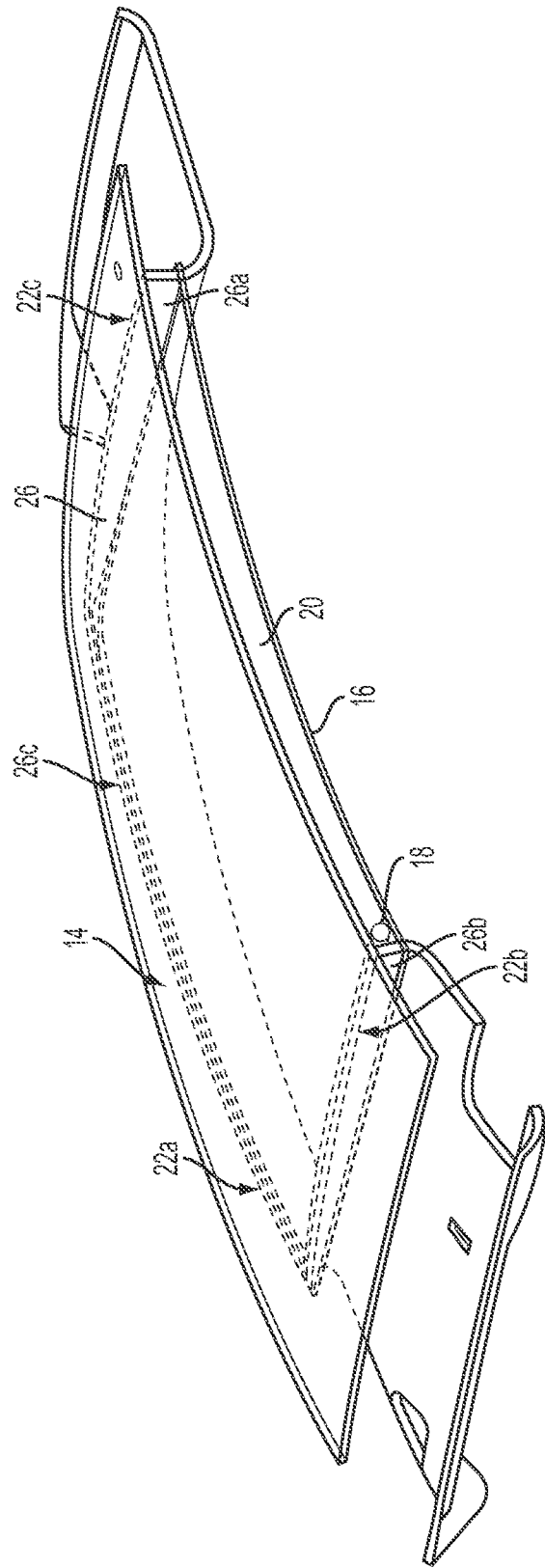
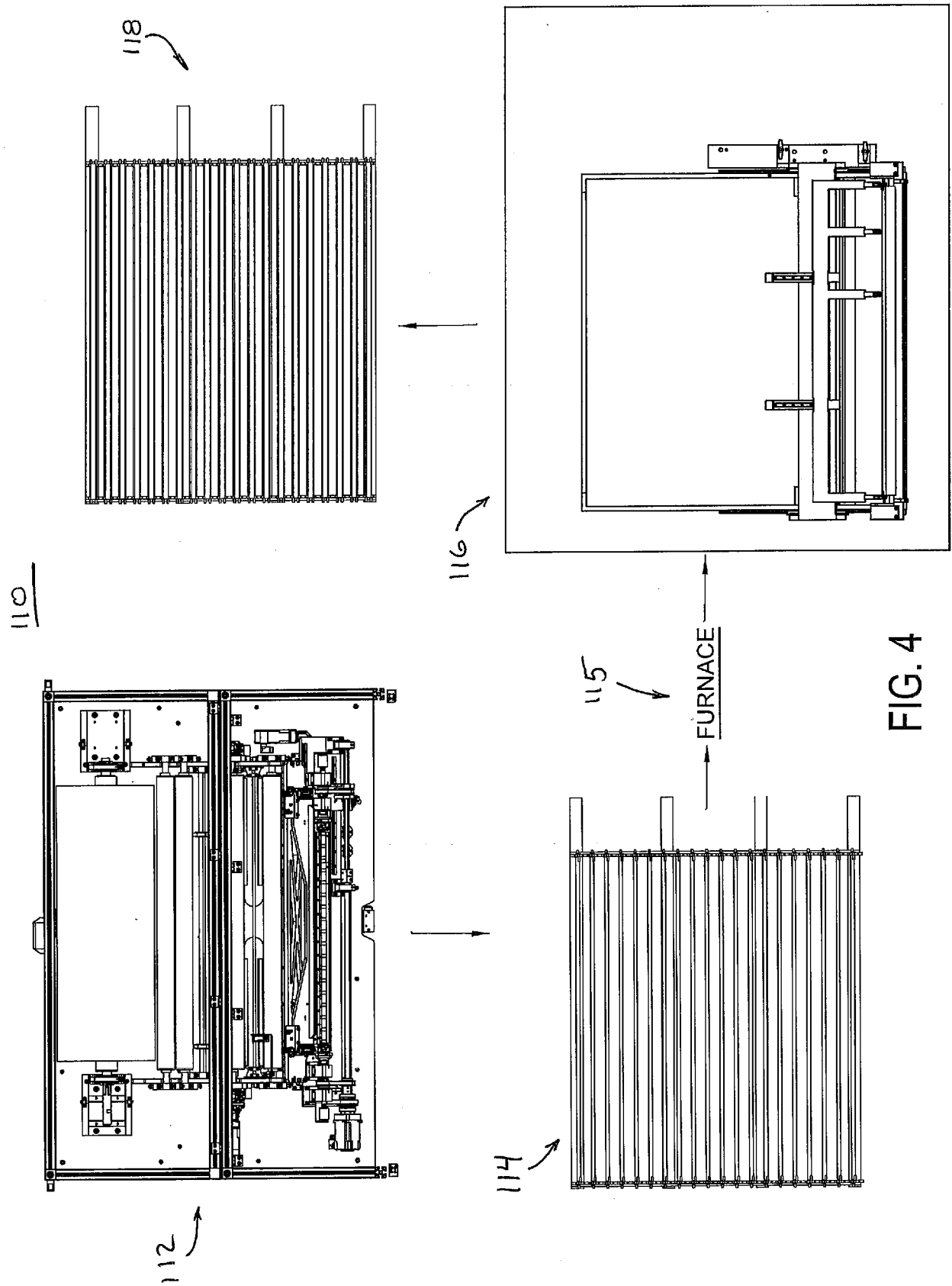


FIG. 3



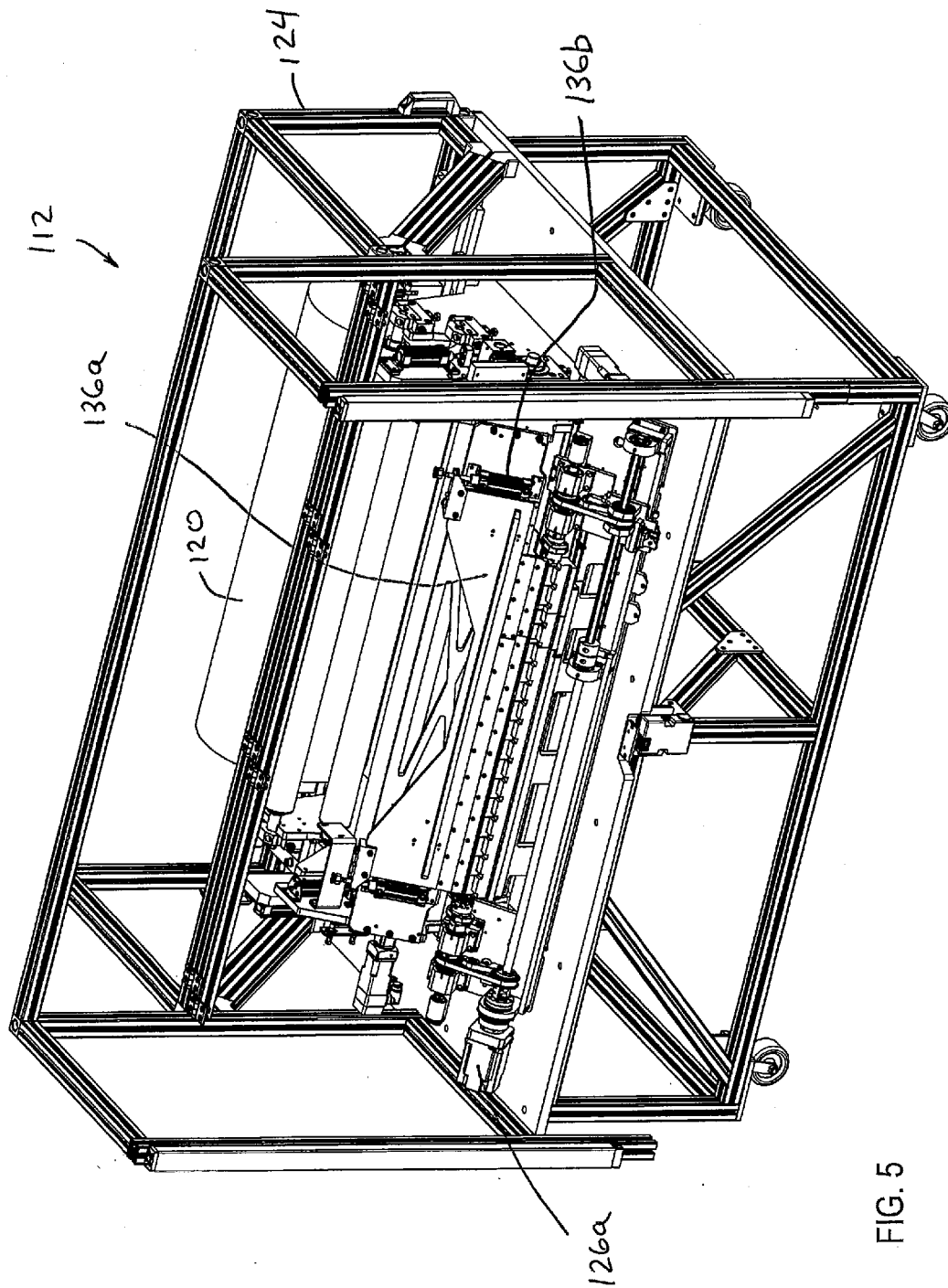


FIG. 5

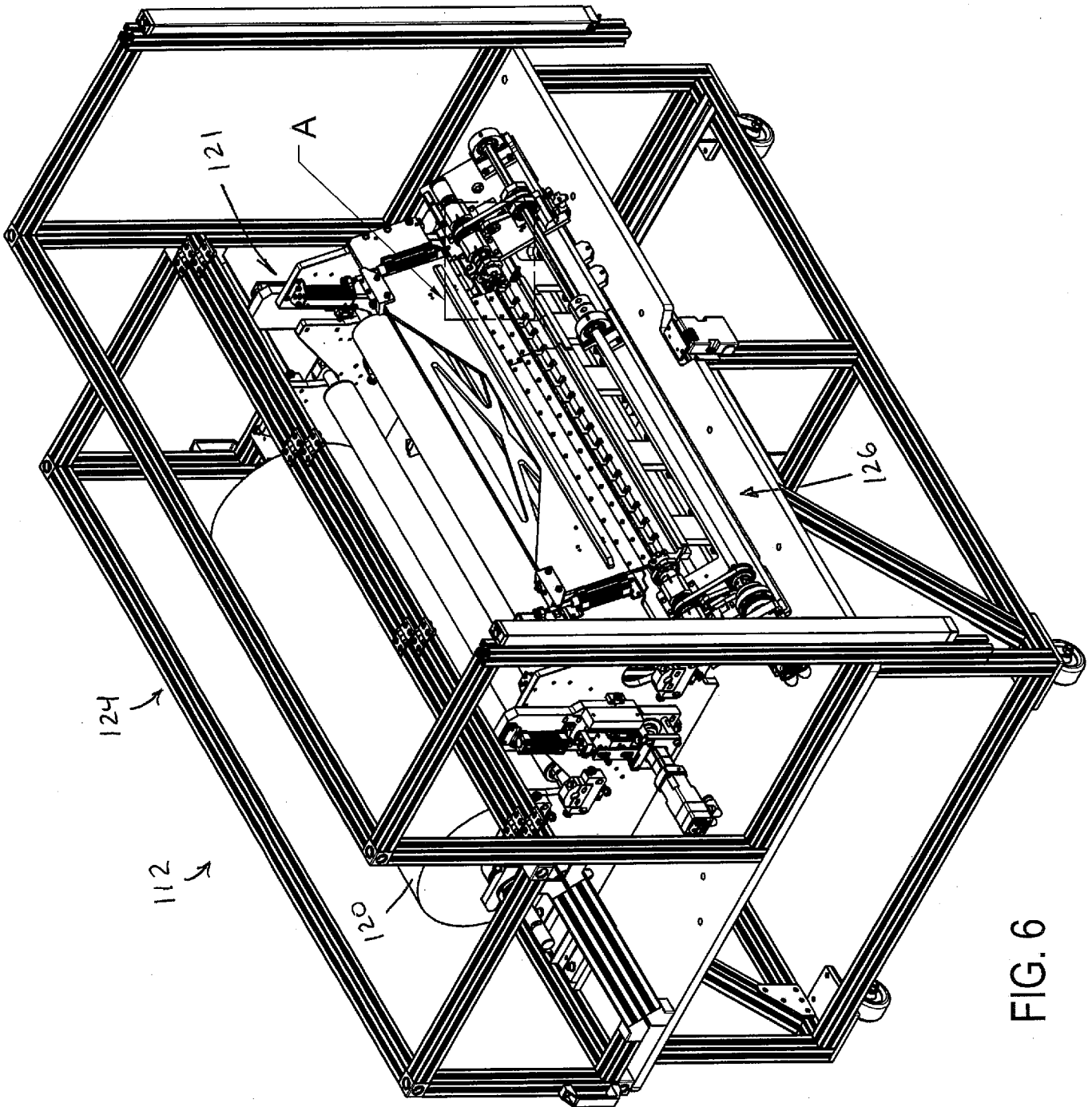
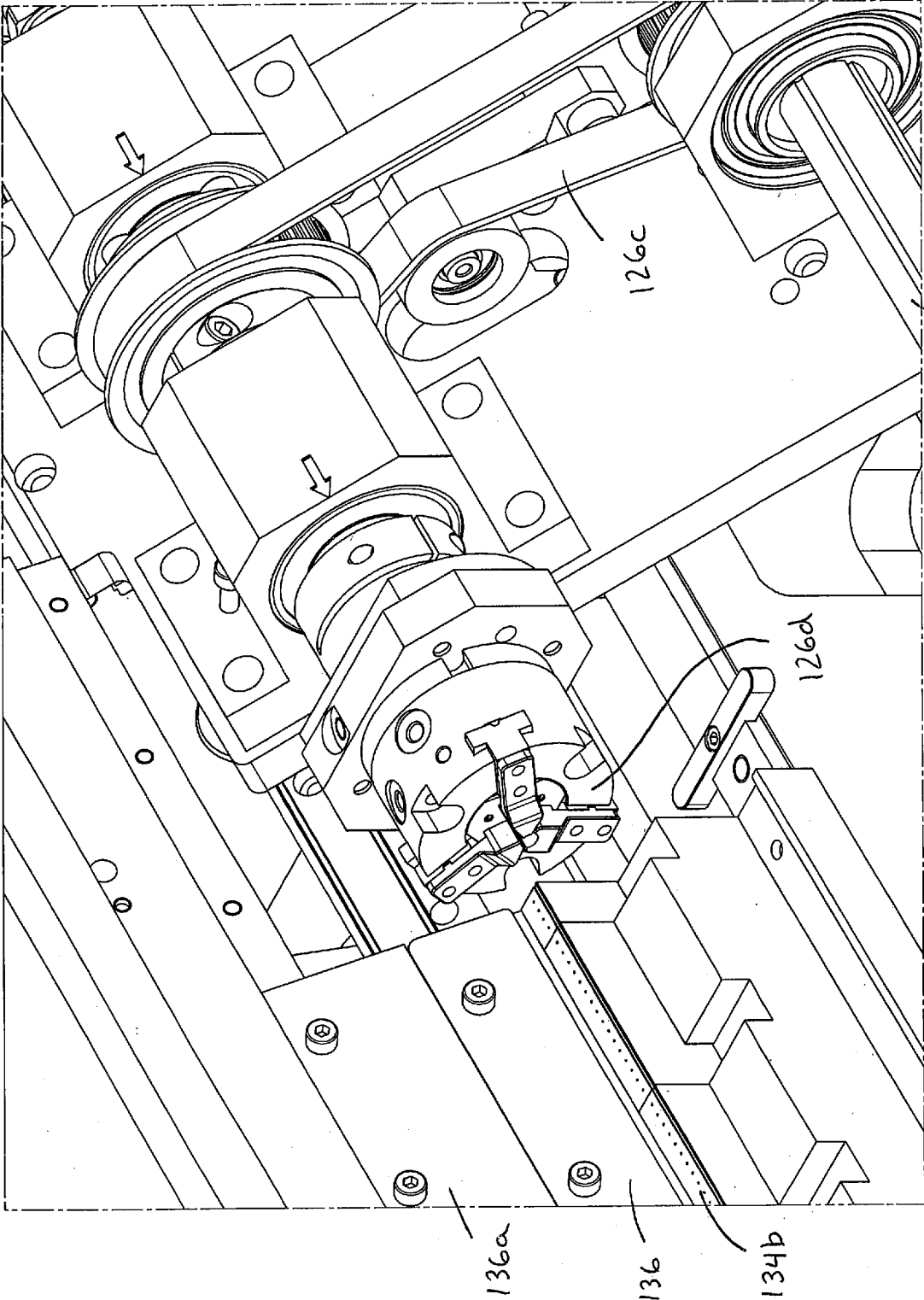


FIG. 6



126b

126c

126d

FIG. 6A

136a

136

134b

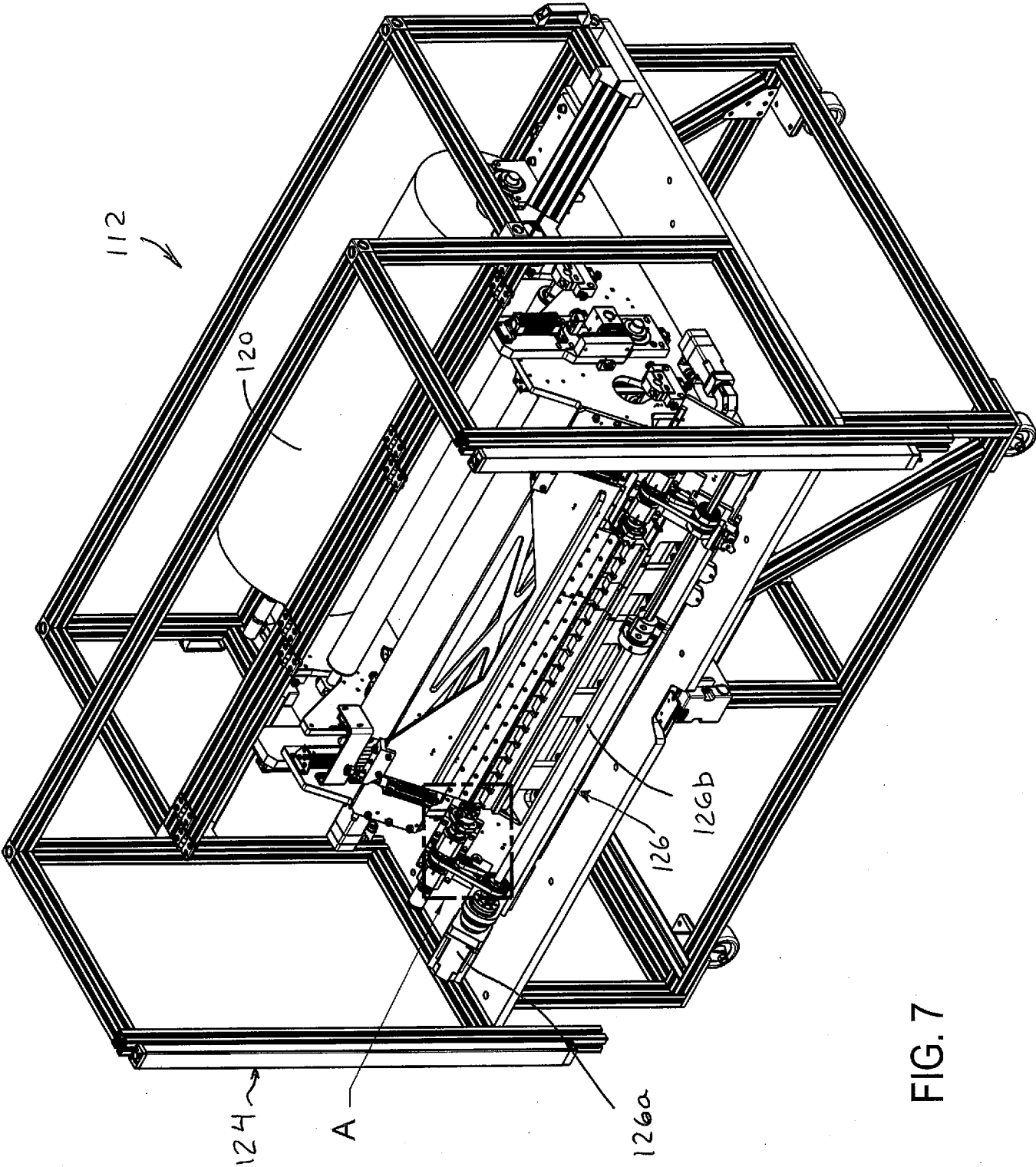


FIG. 7

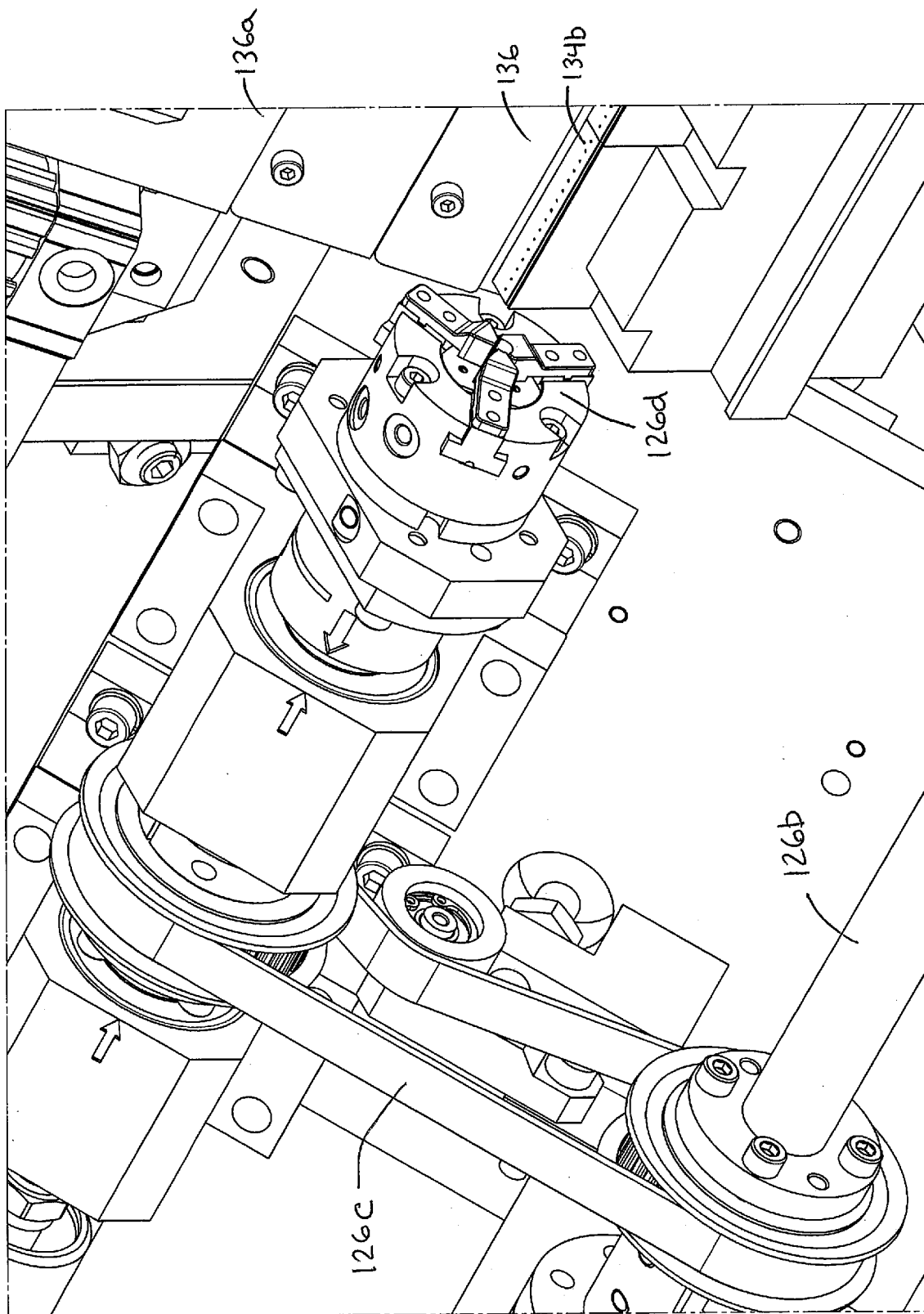


FIG. 7A

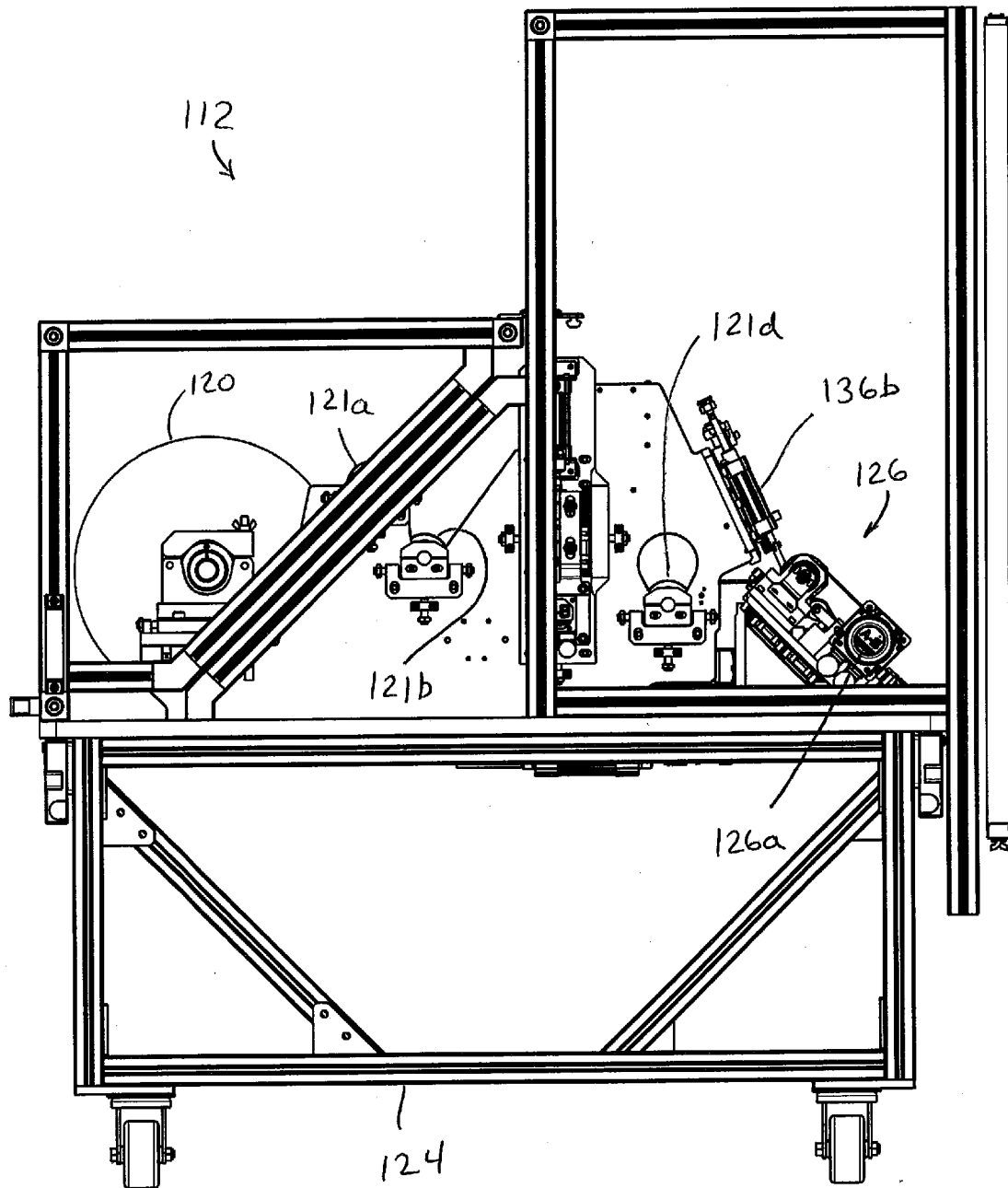


FIG. 8

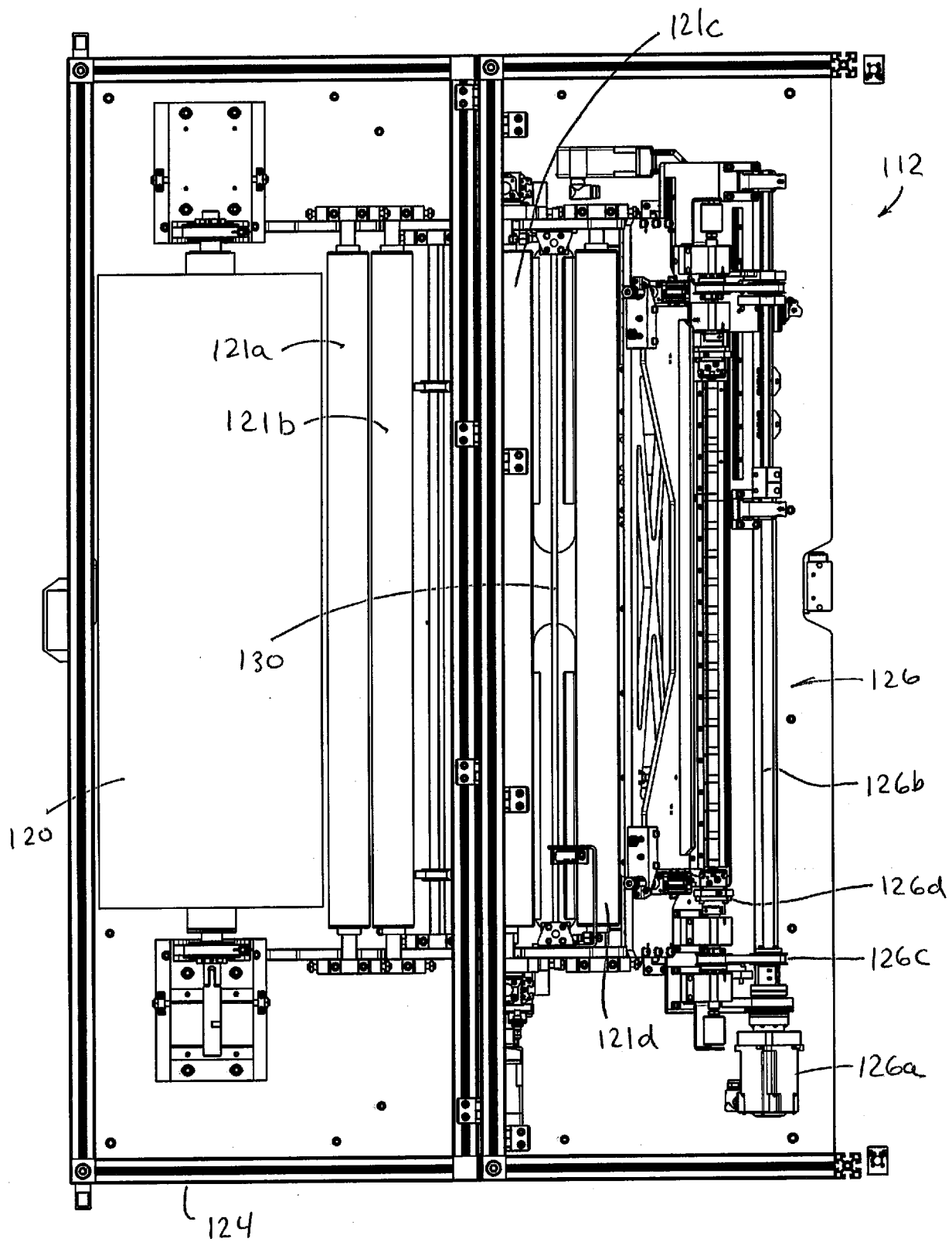


FIG. 9

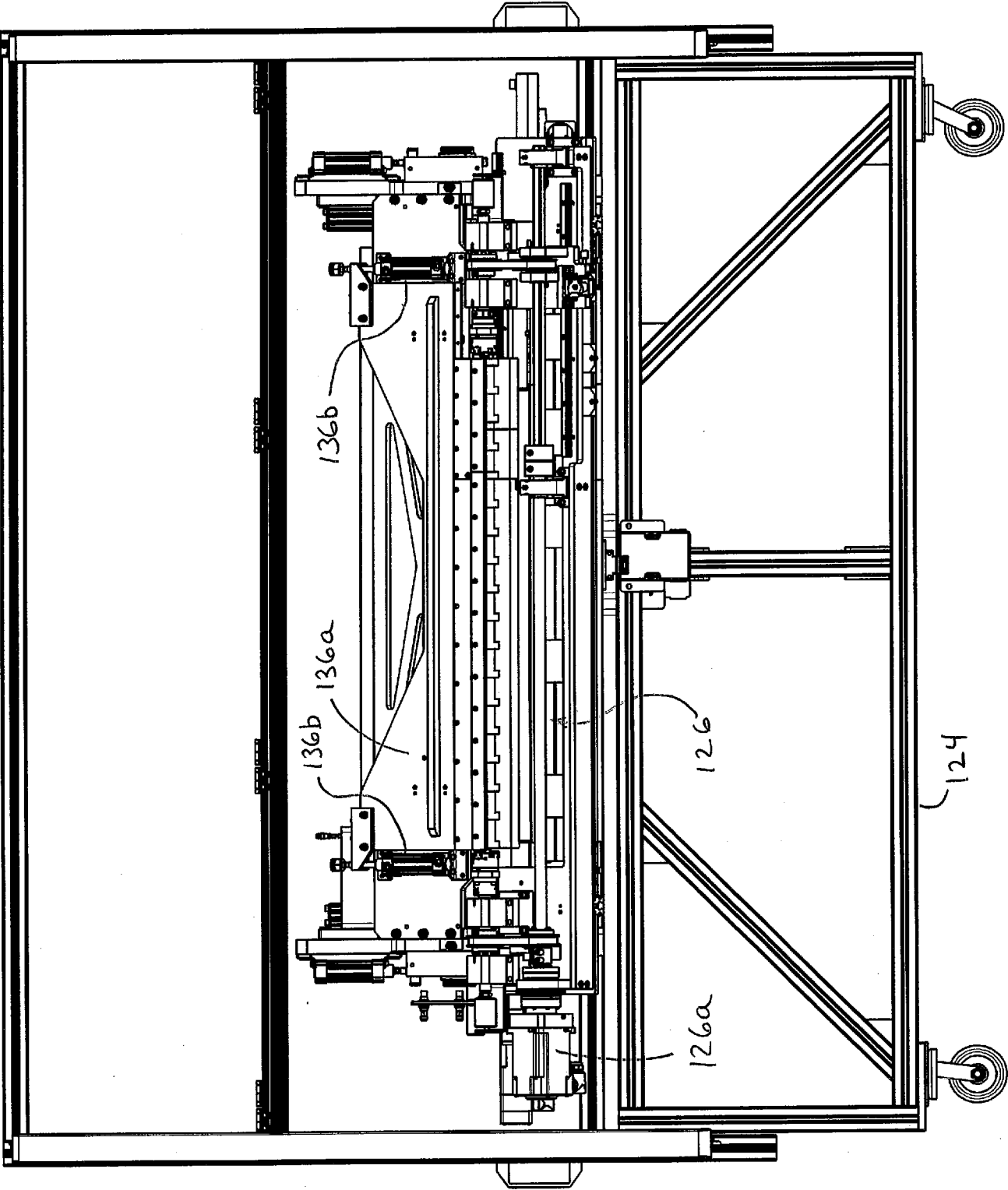
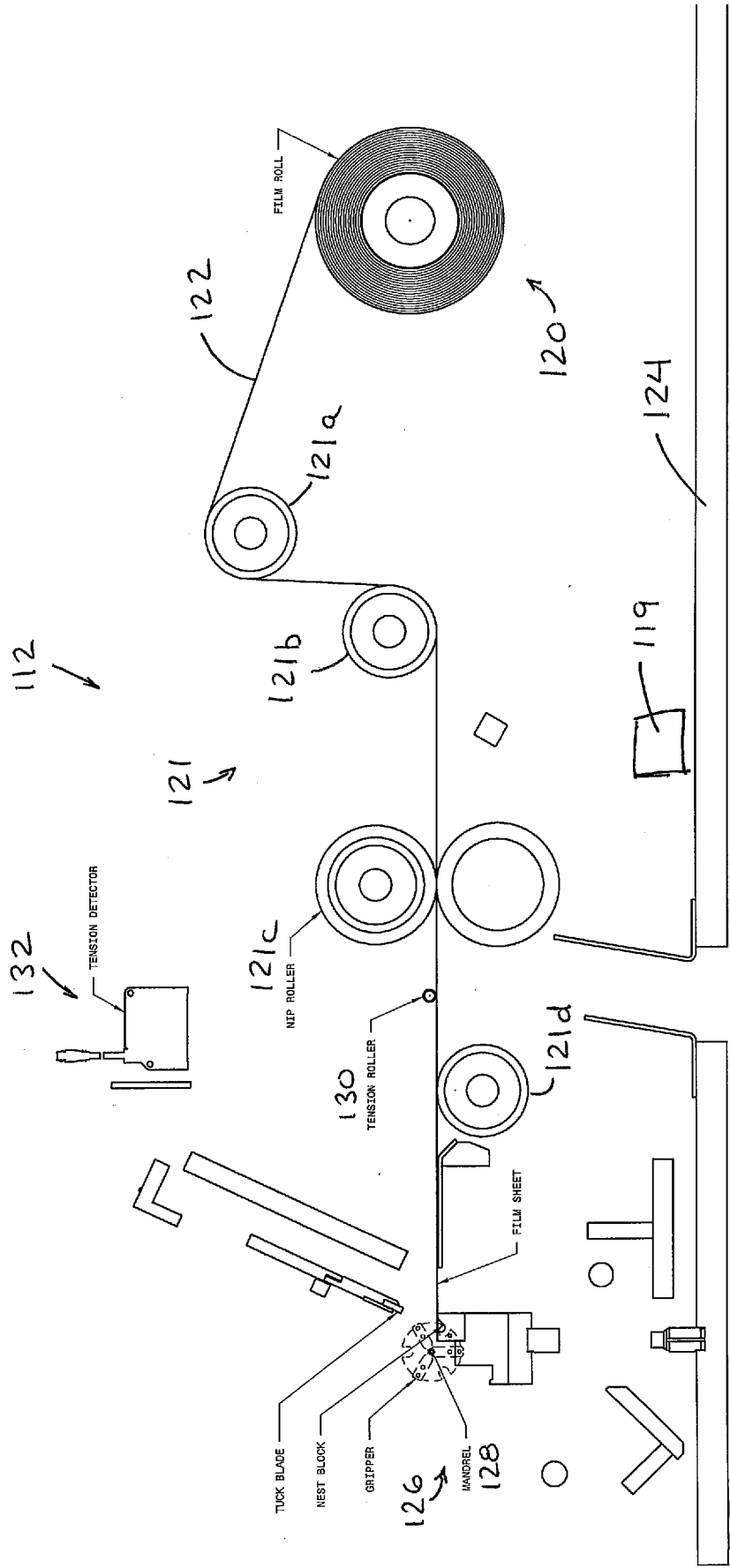


FIG. 10



FILM ROLL Machine
INITIAL SETTING

FIG. 11

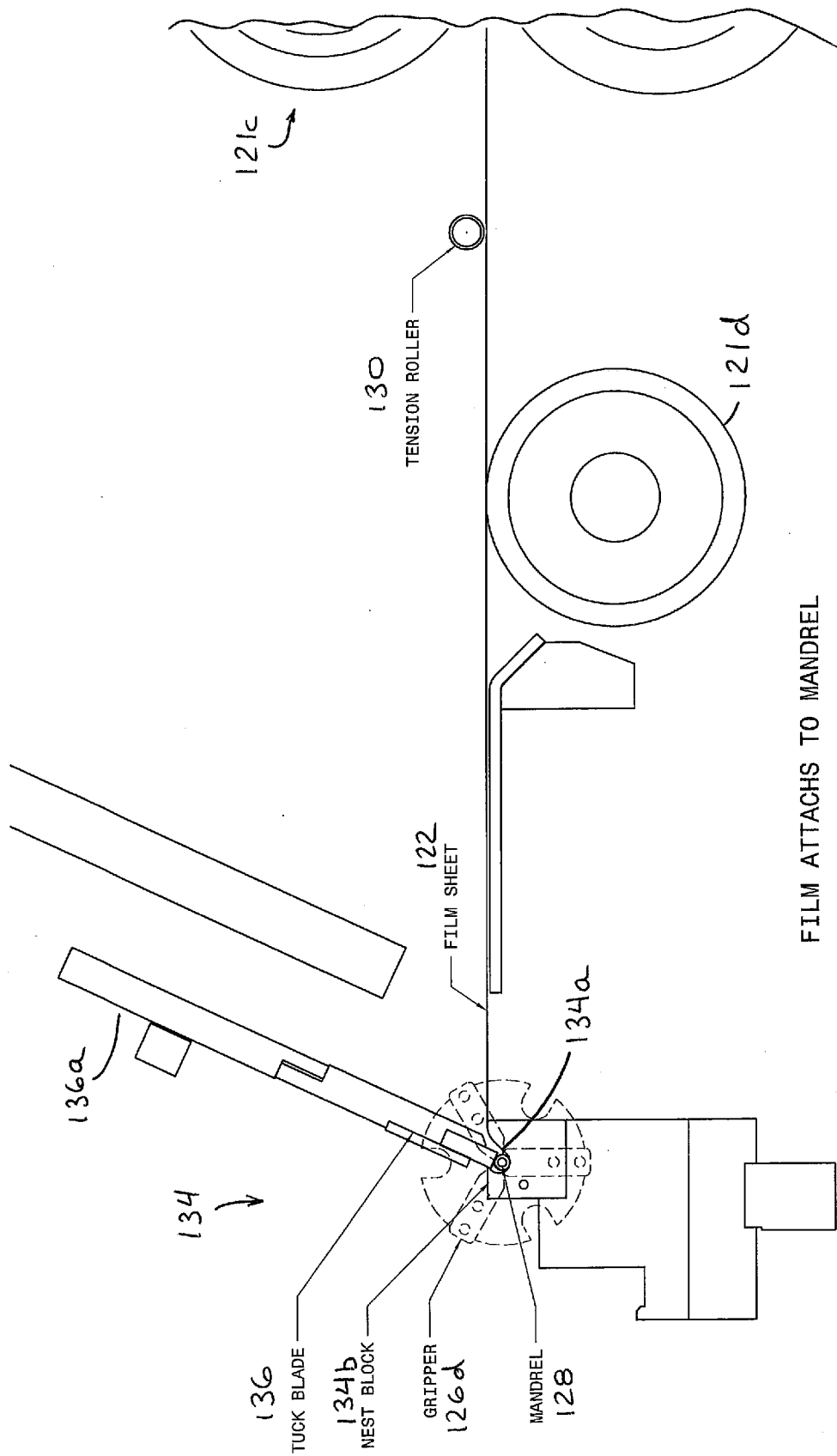


FIG. 12

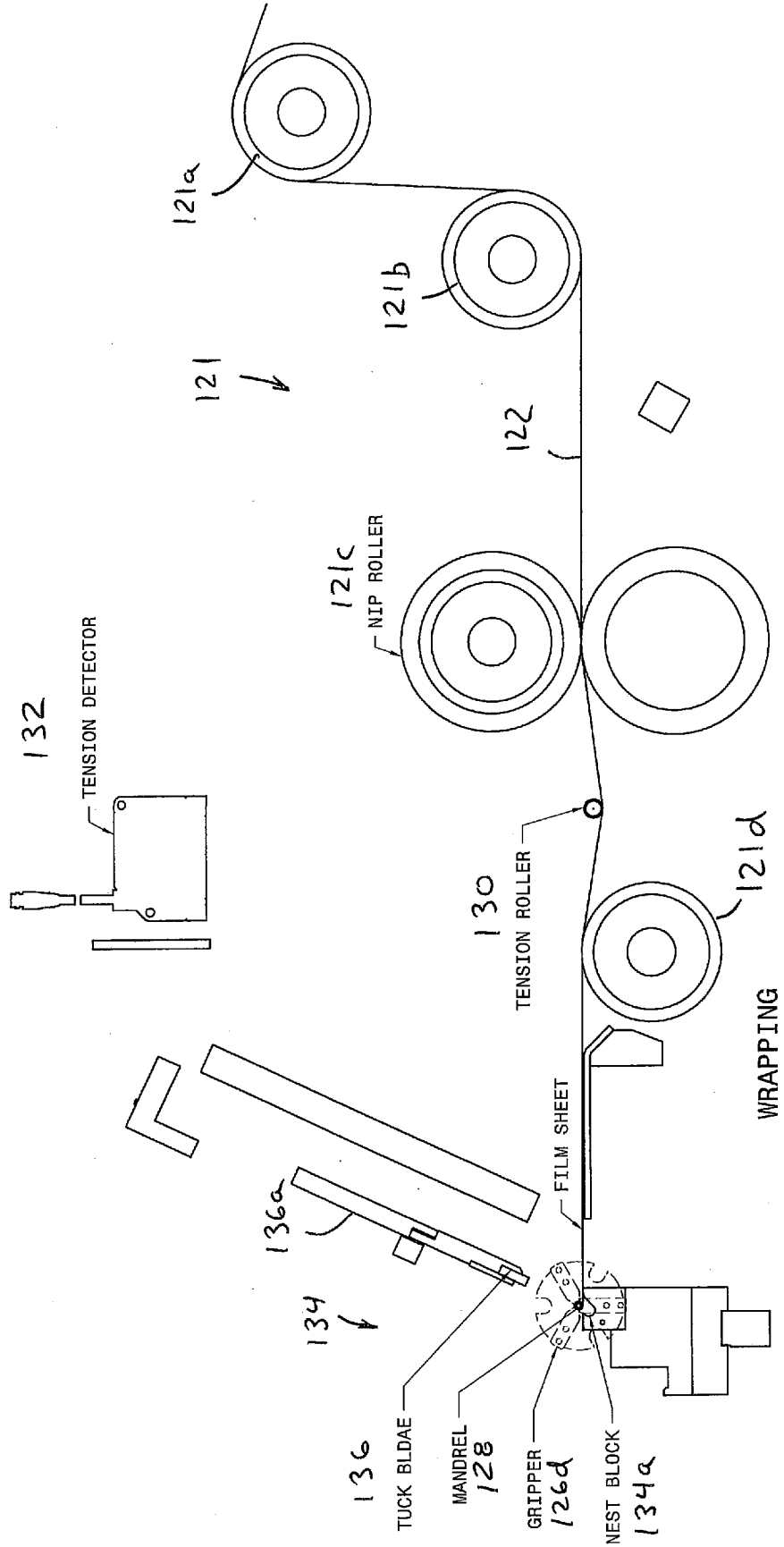
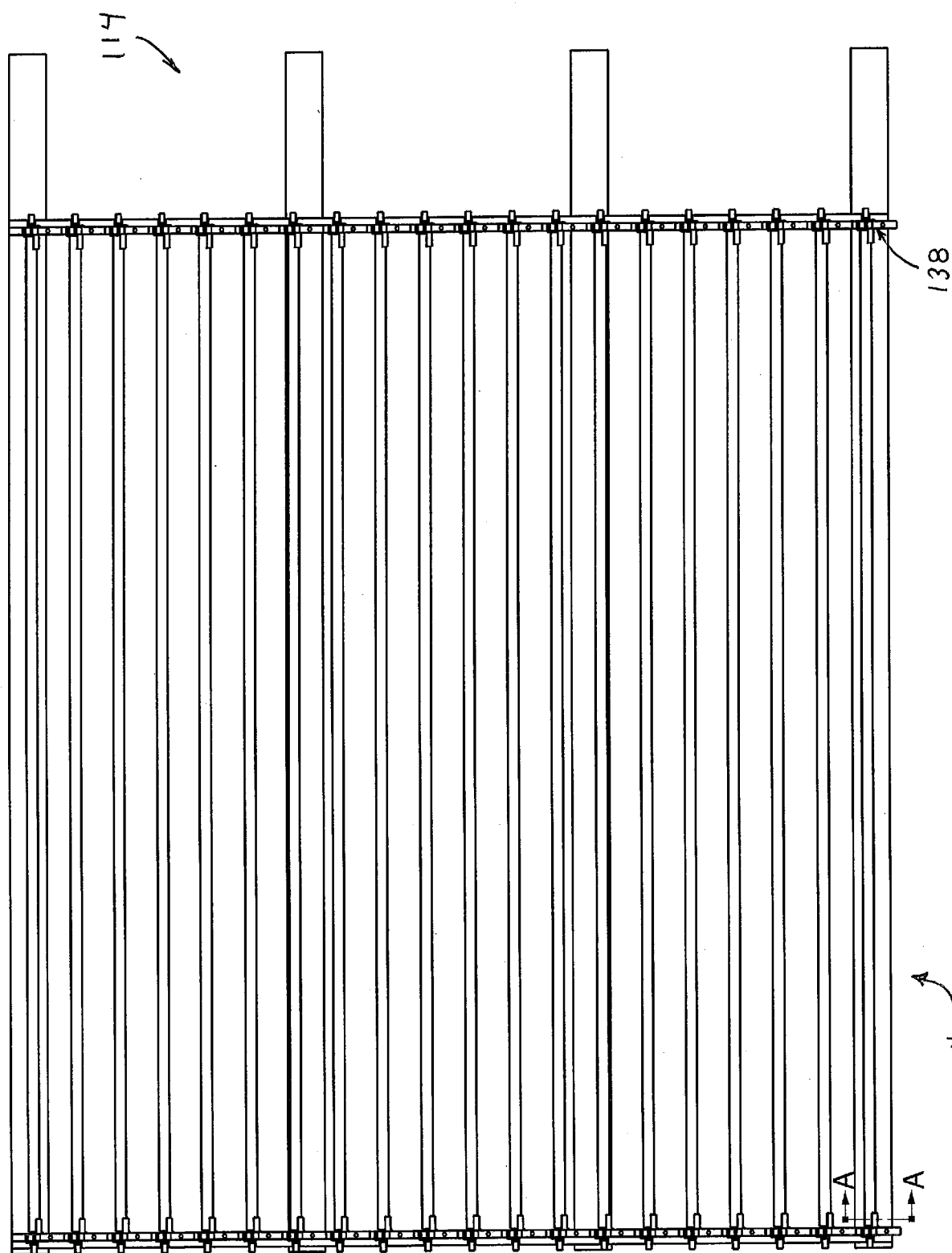
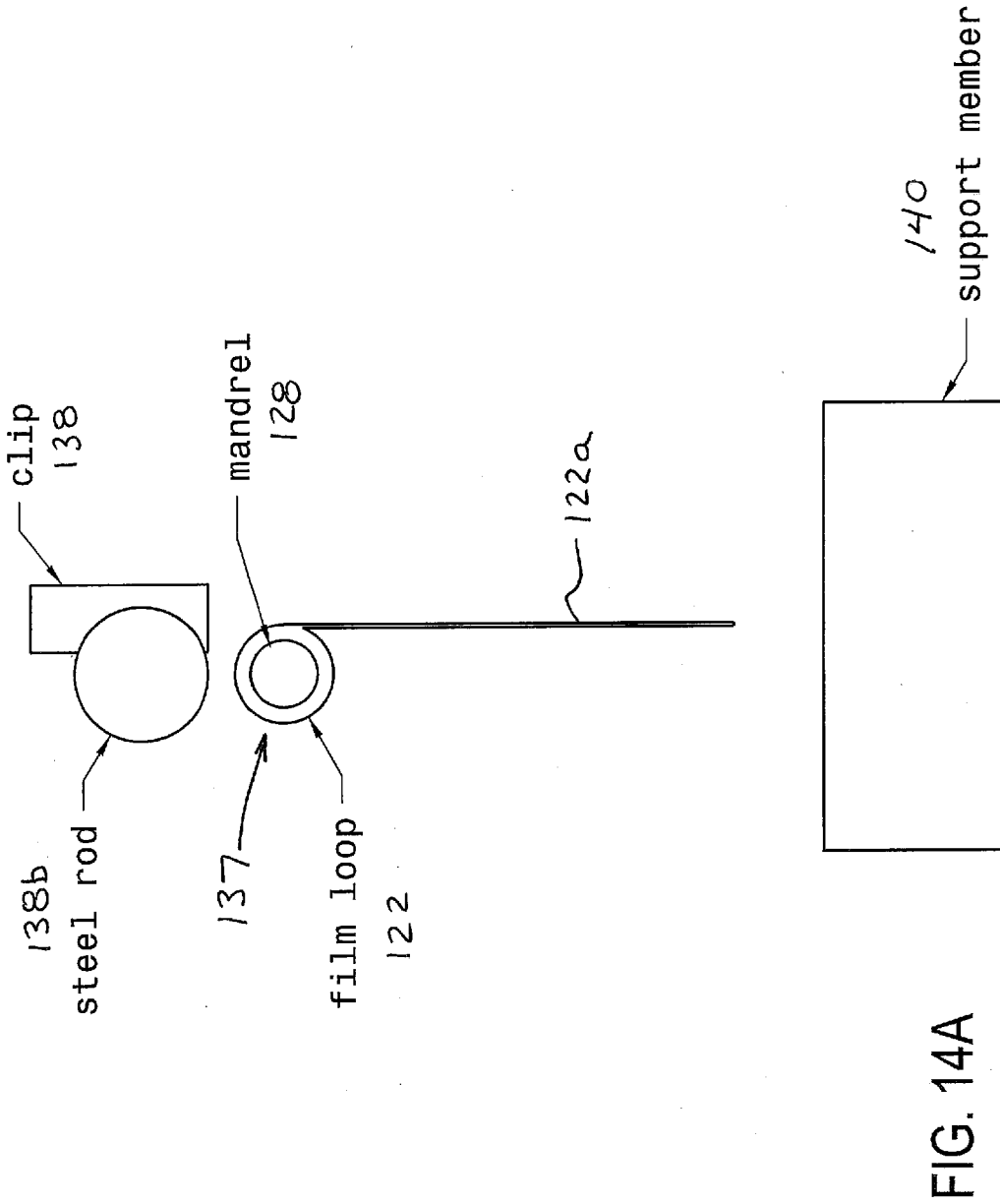


FIG. 13





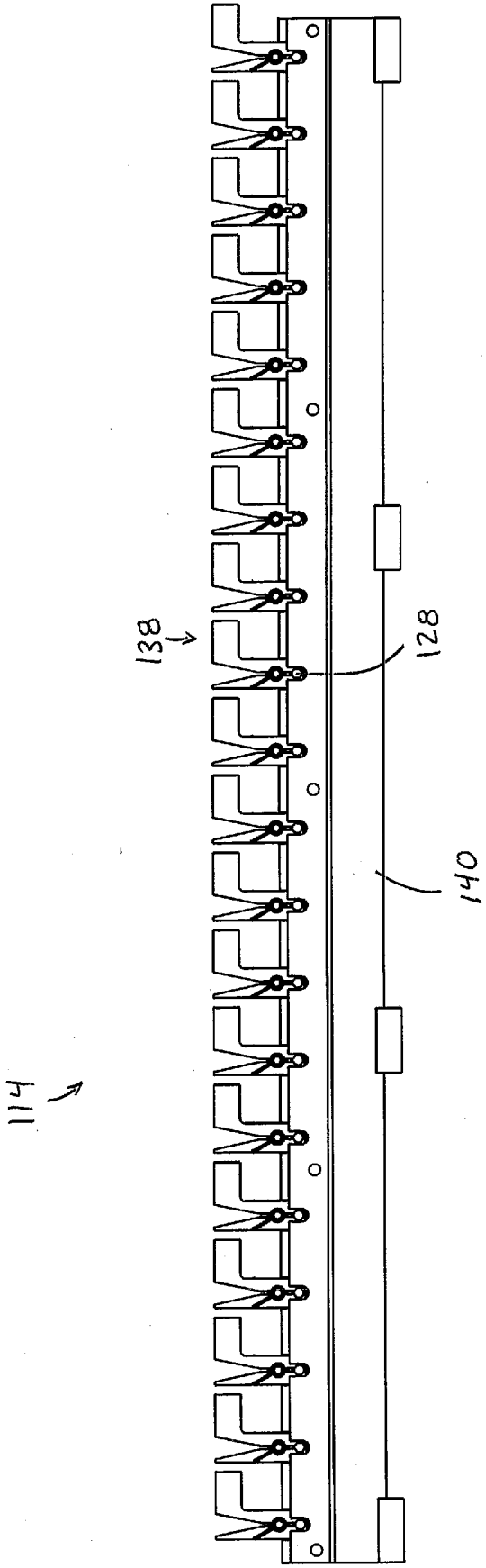
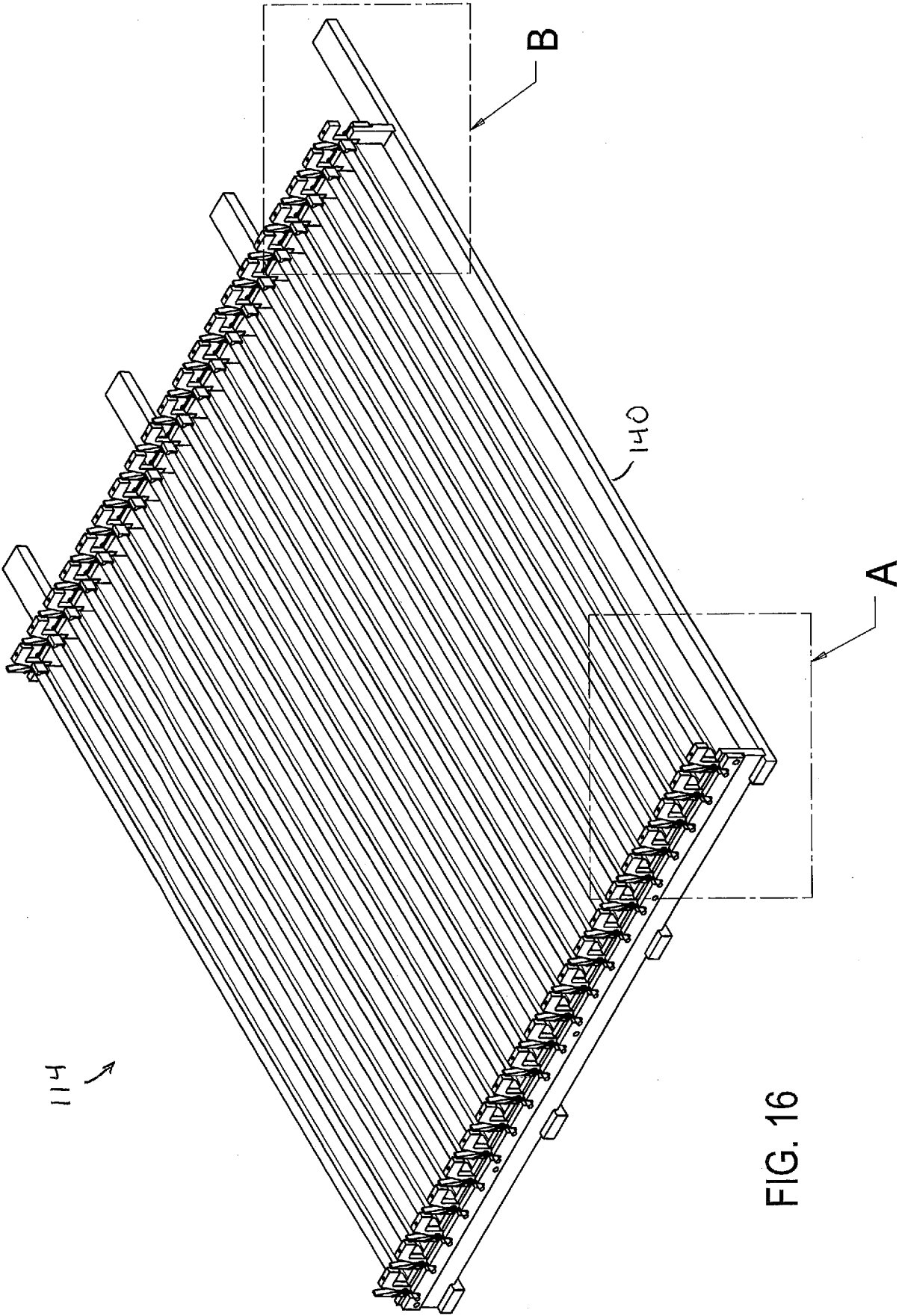
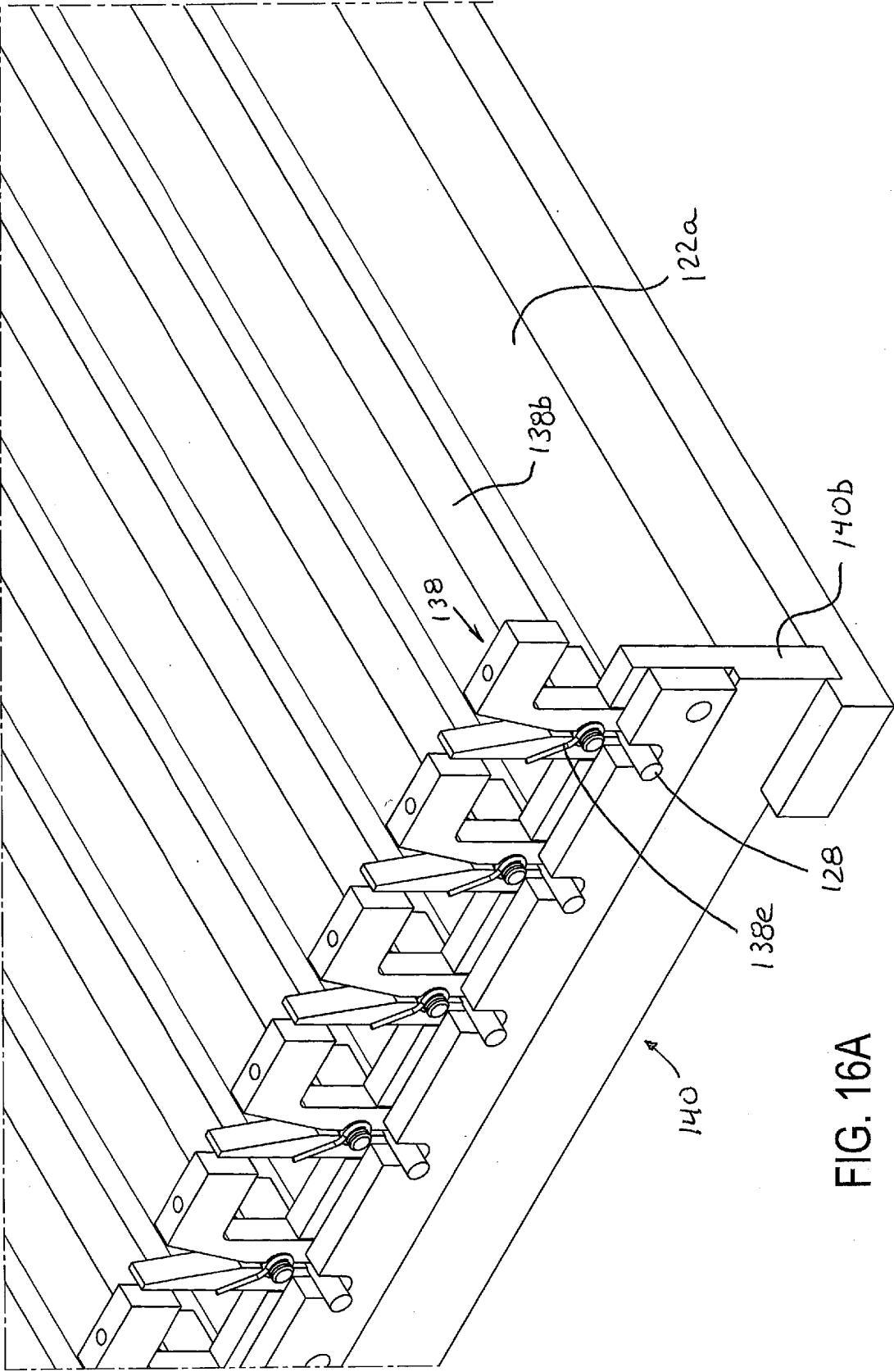


FIG. 15





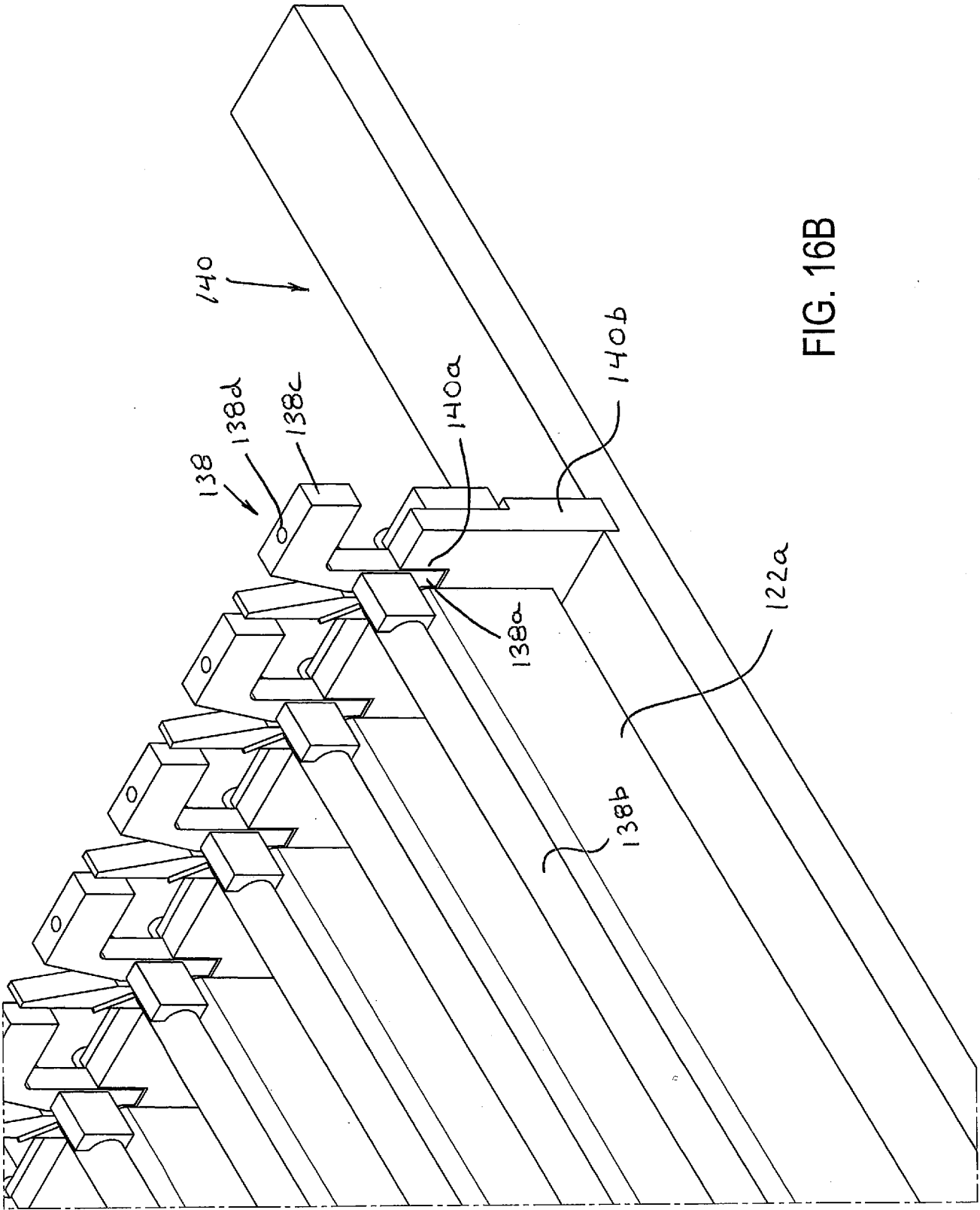
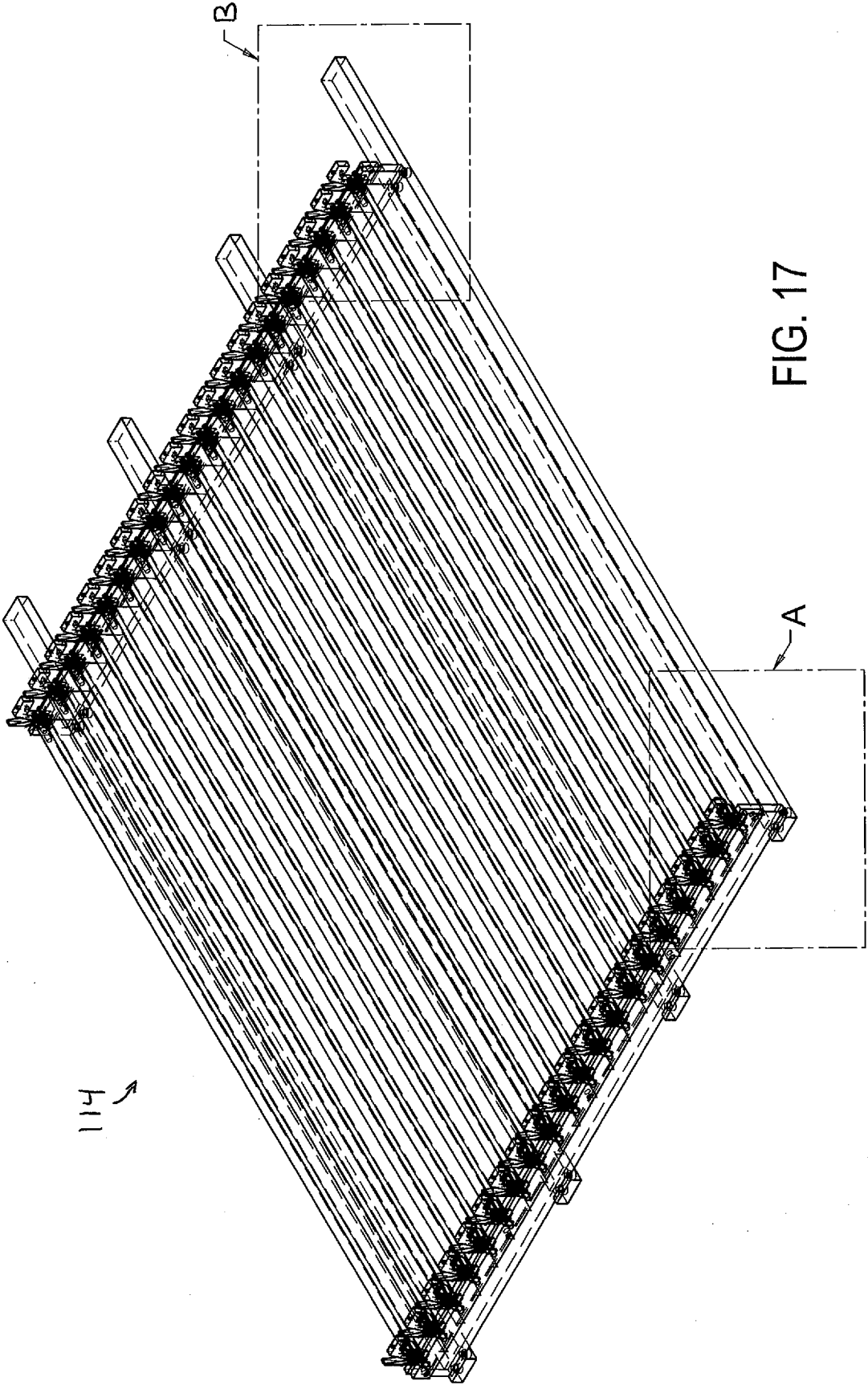


FIG. 16B



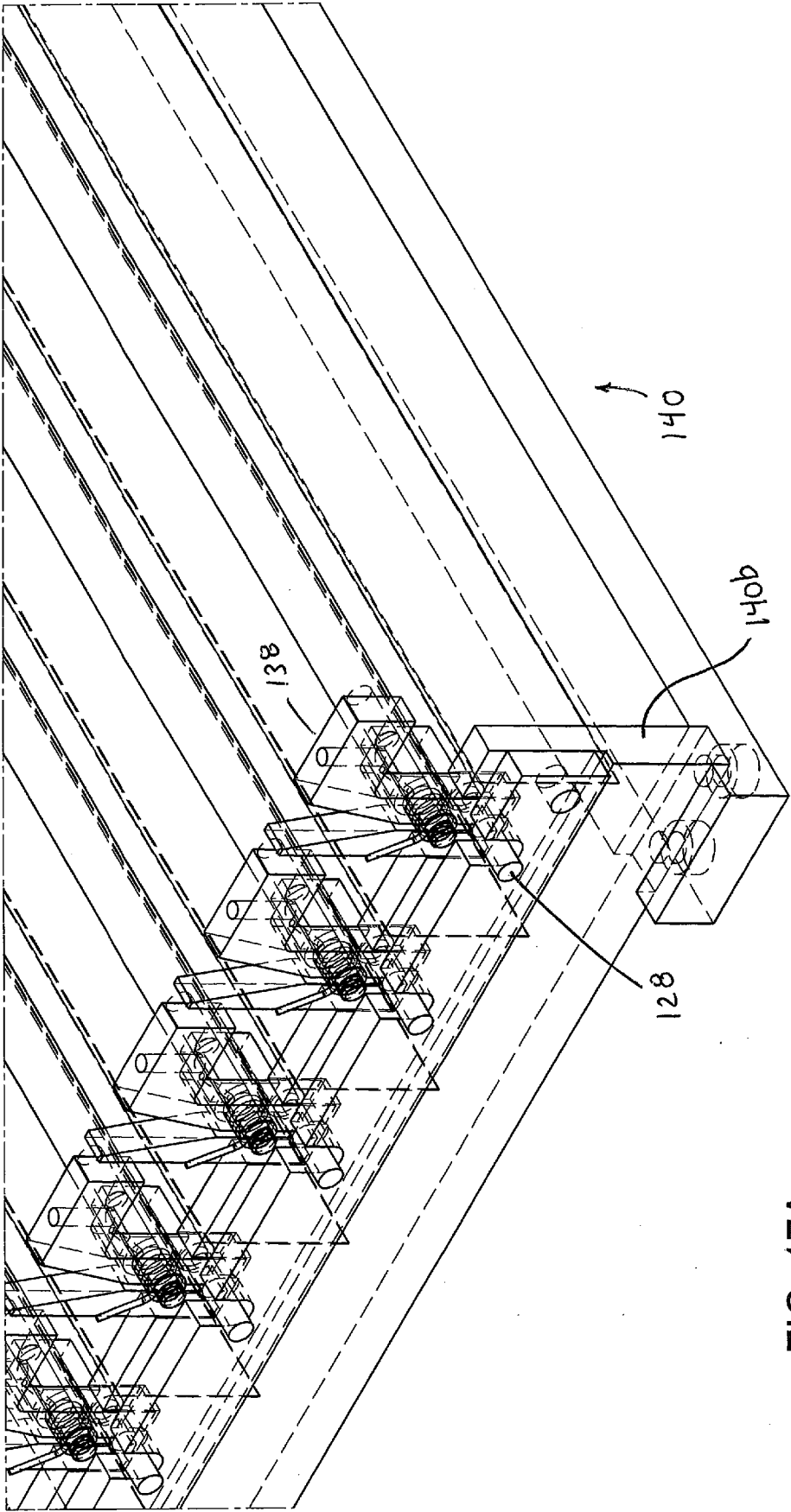


FIG. 17A

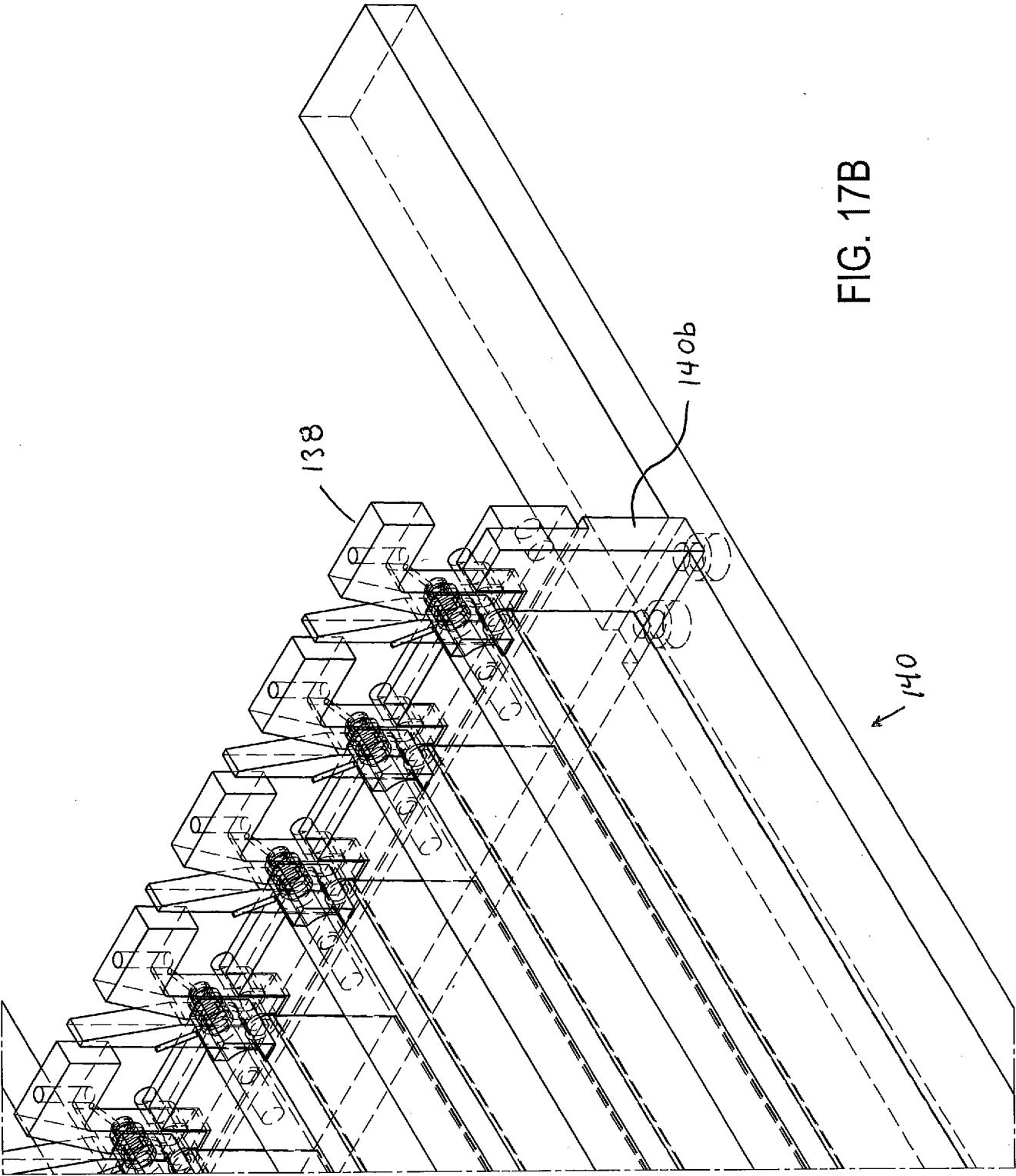


FIG. 17B

114
↓

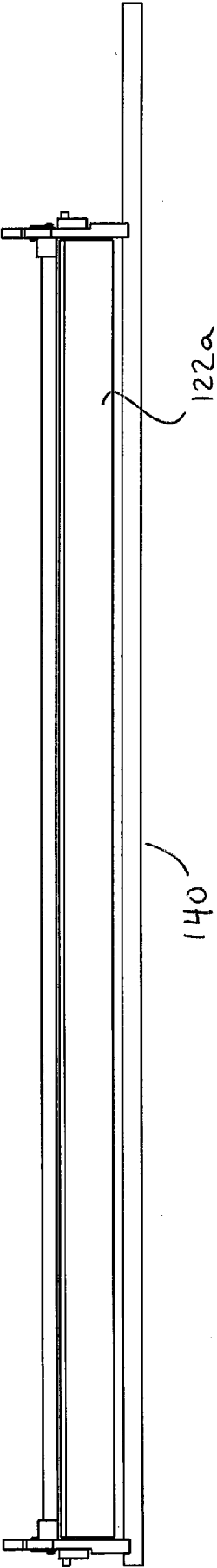


FIG. 18

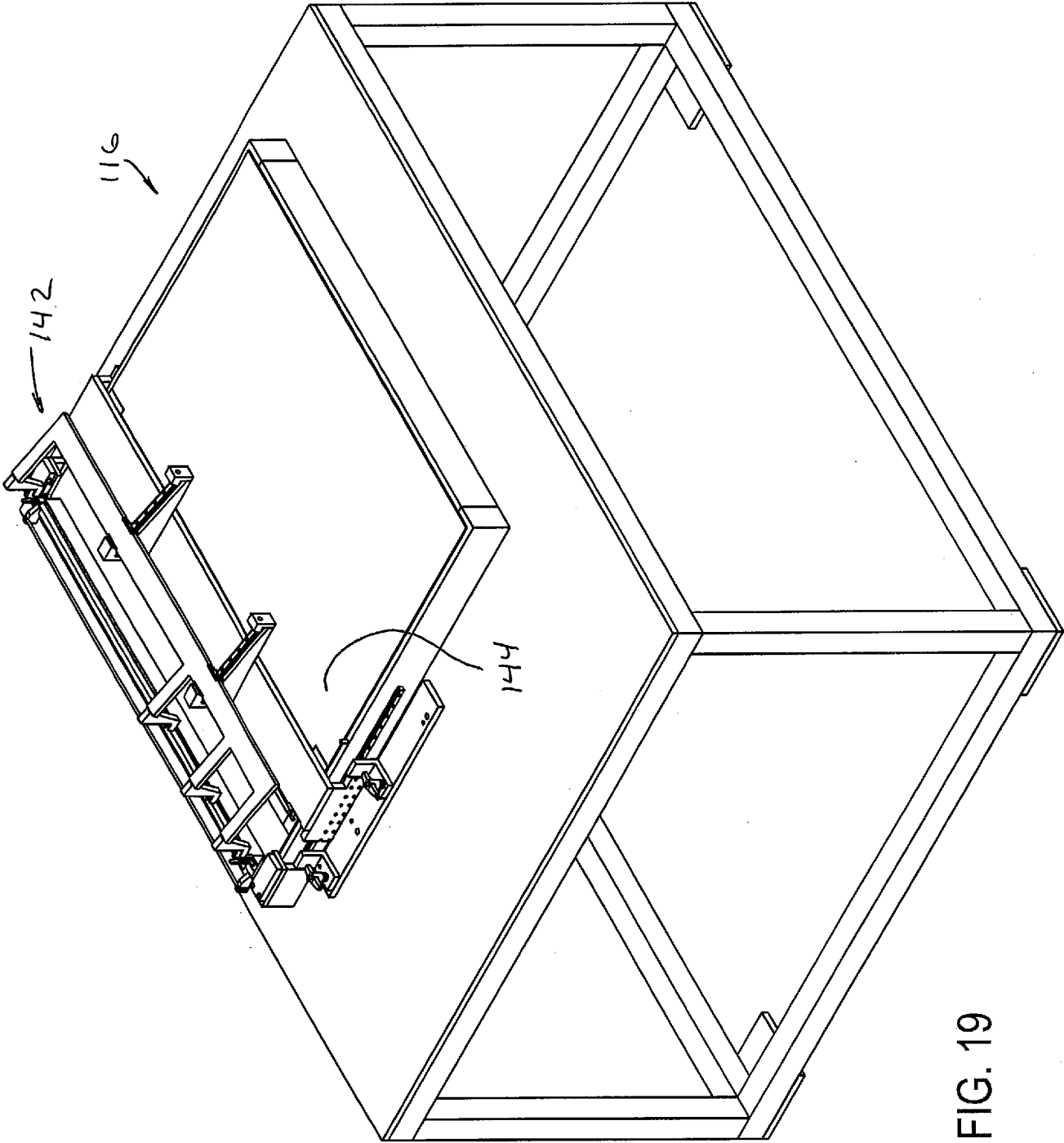
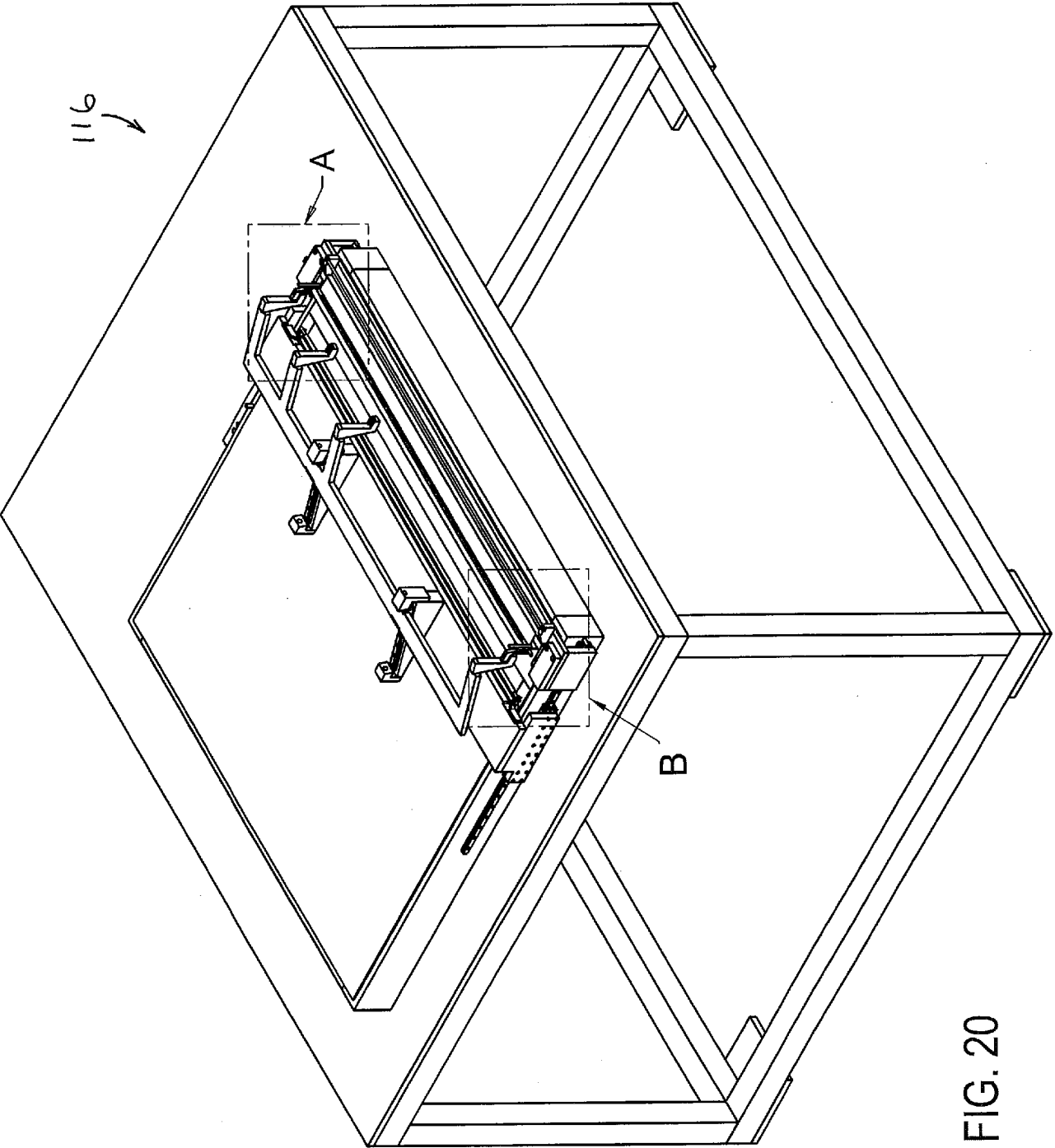


FIG. 19



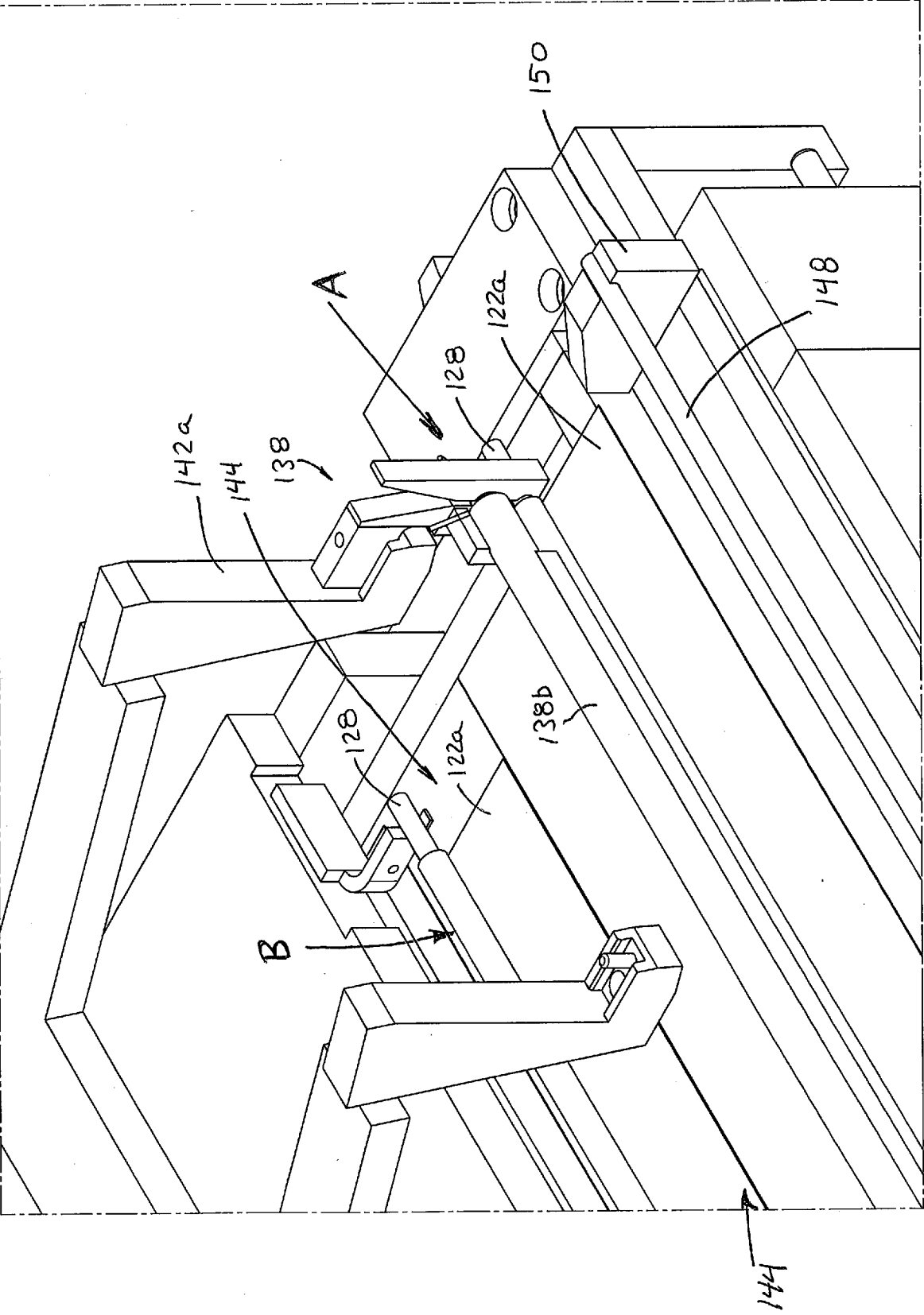


FIG. 20A

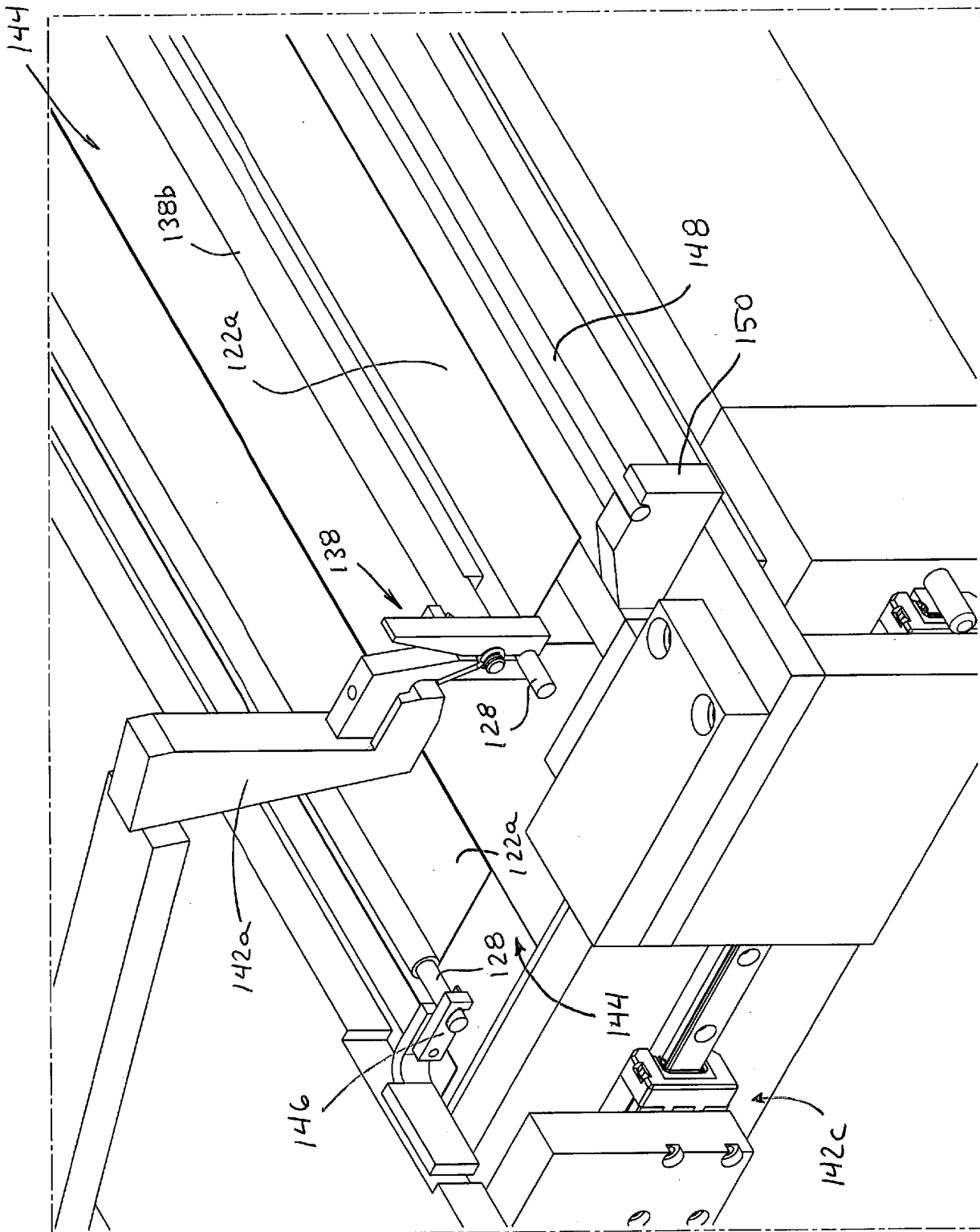


FIG. 20B

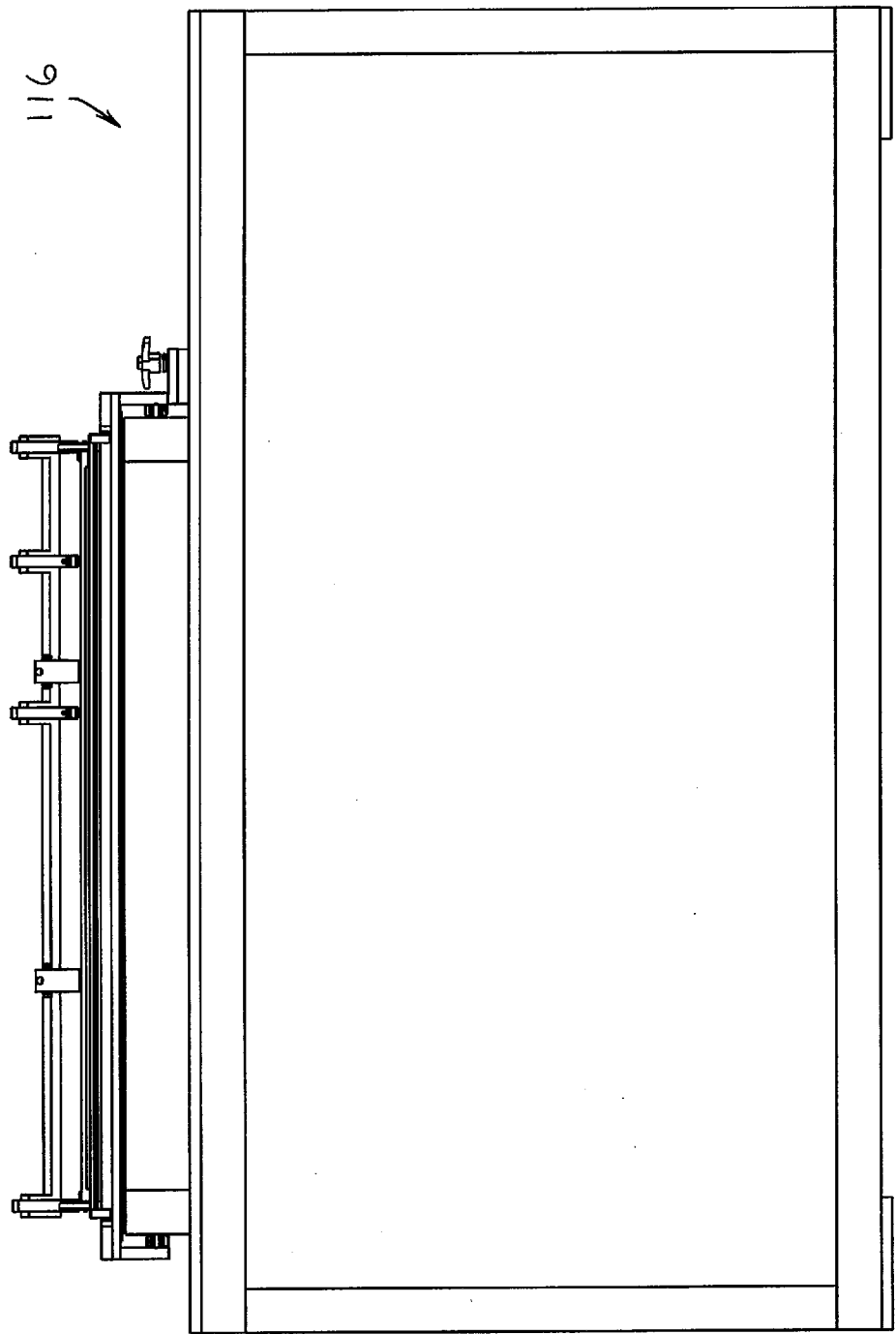


FIG. 21

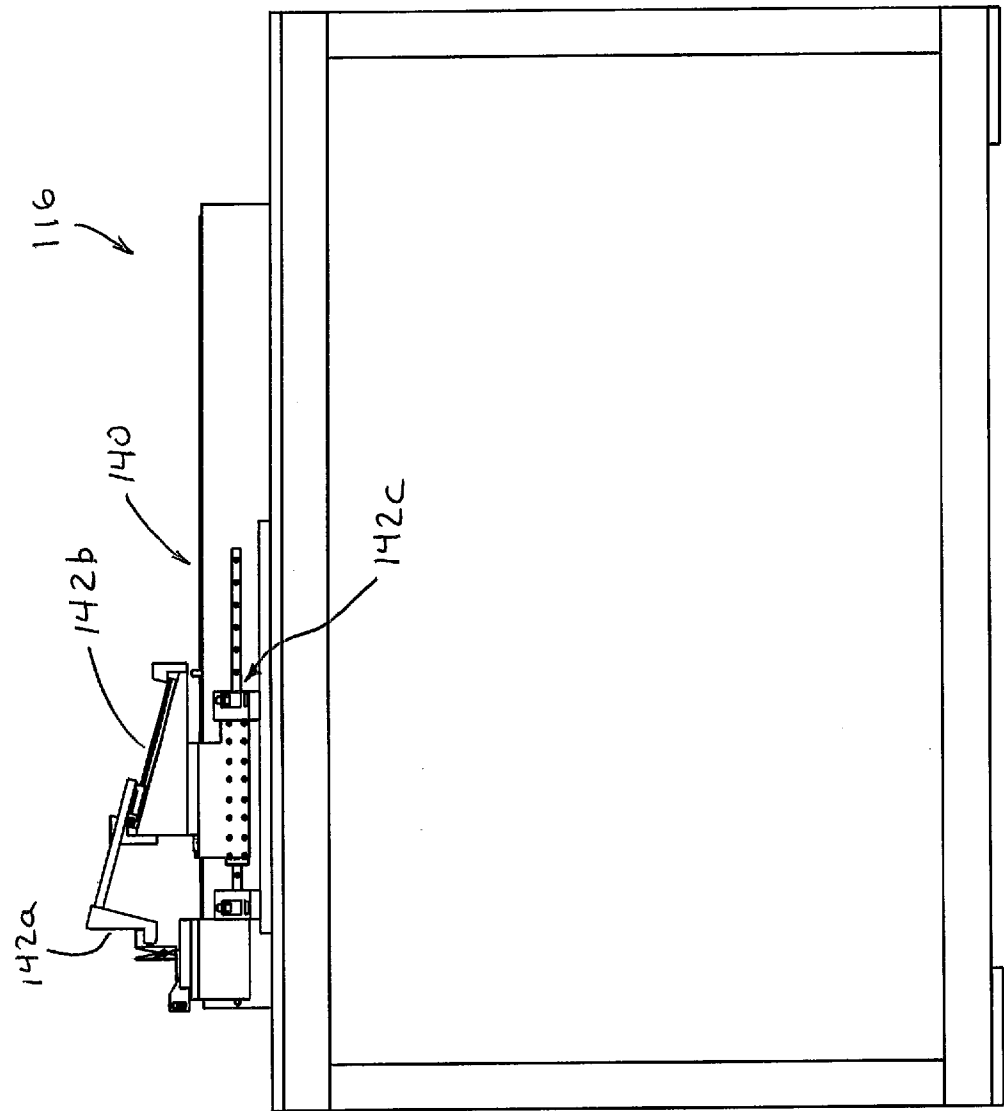


FIG. 22

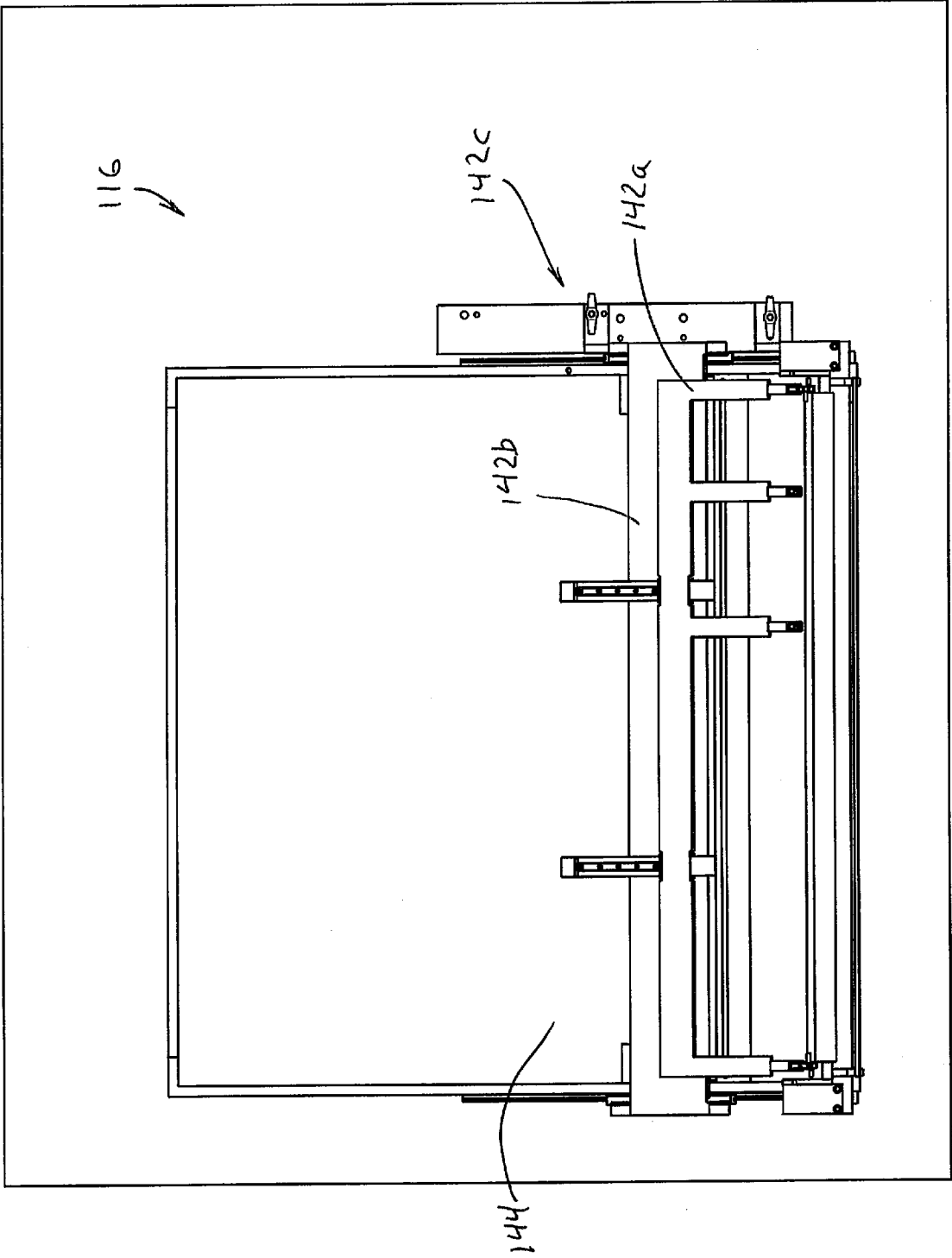


FIG. 23

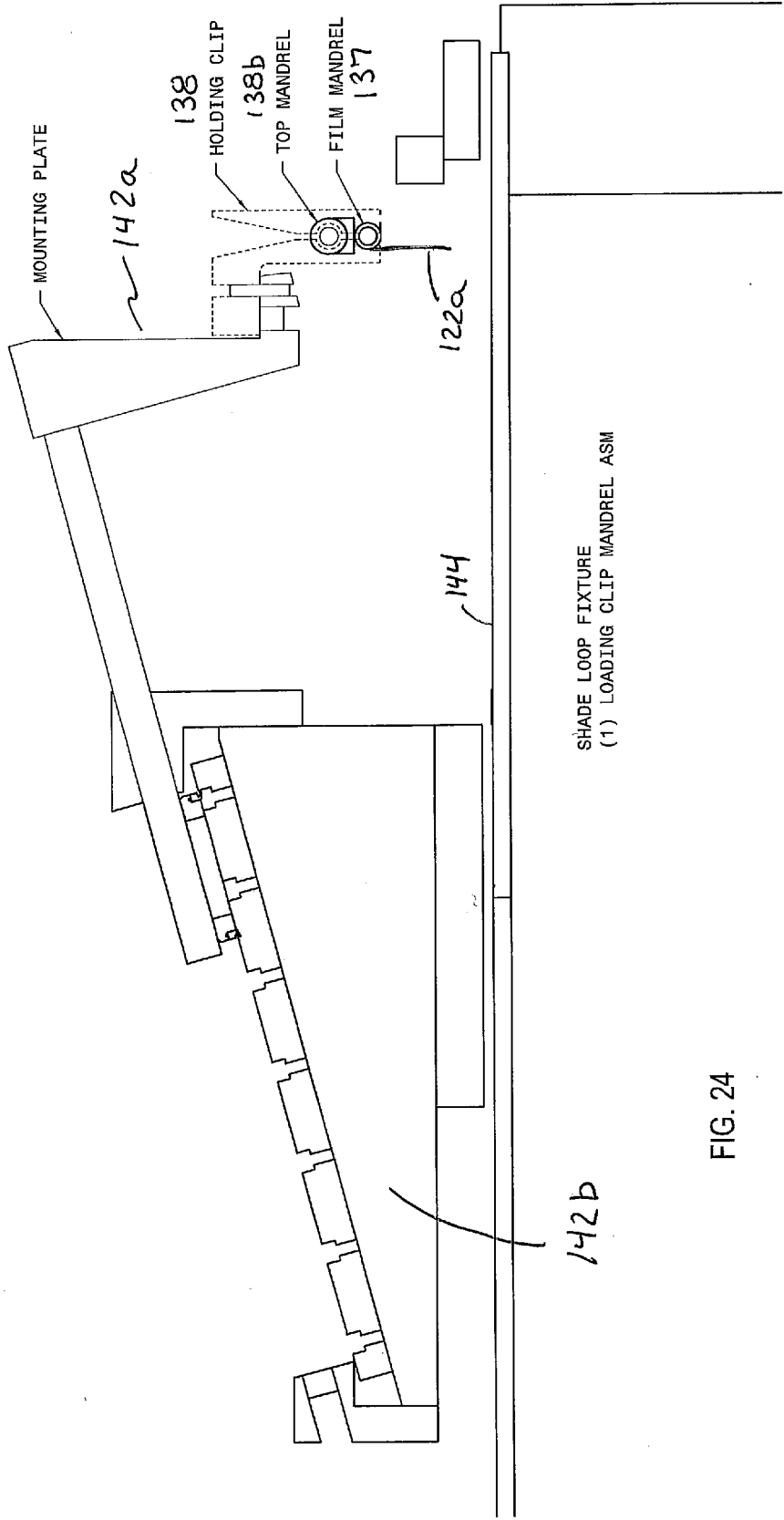


FIG. 24

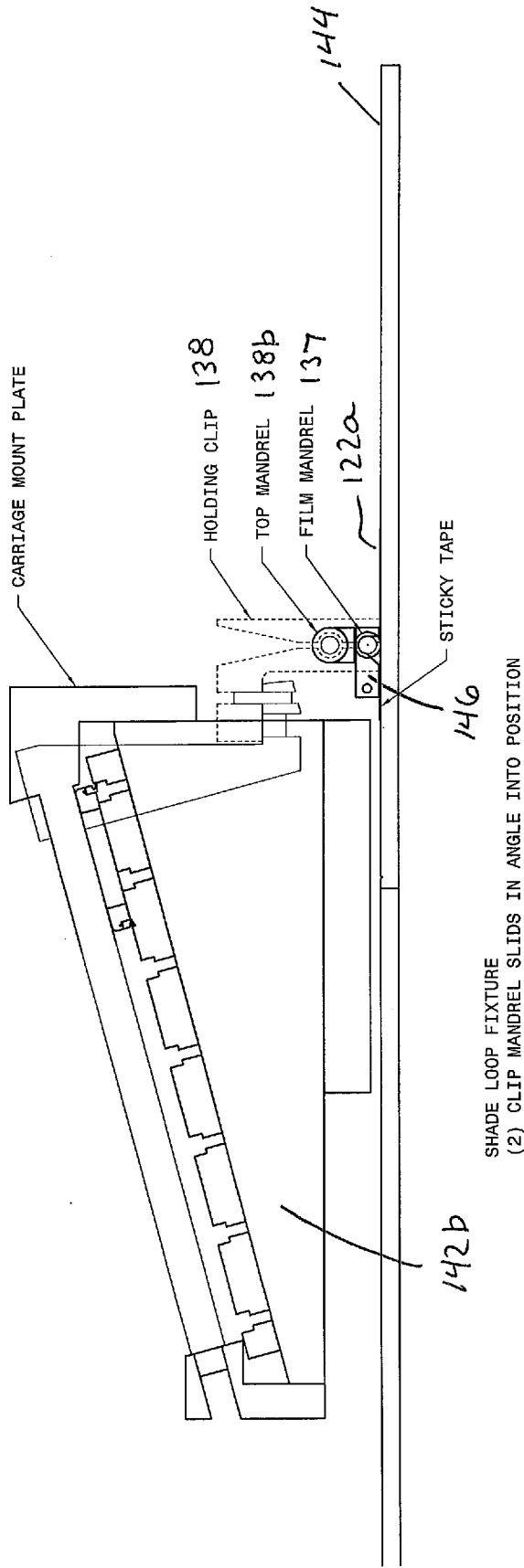
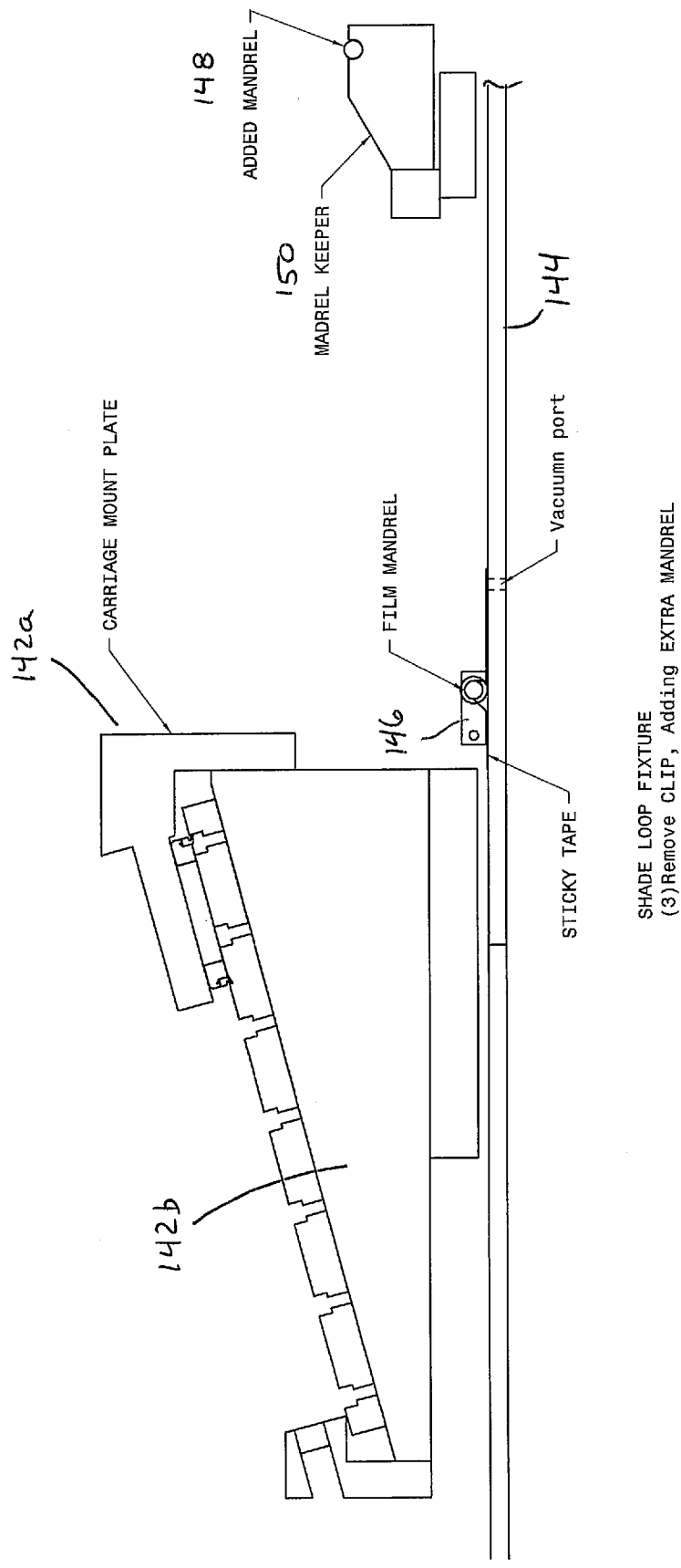
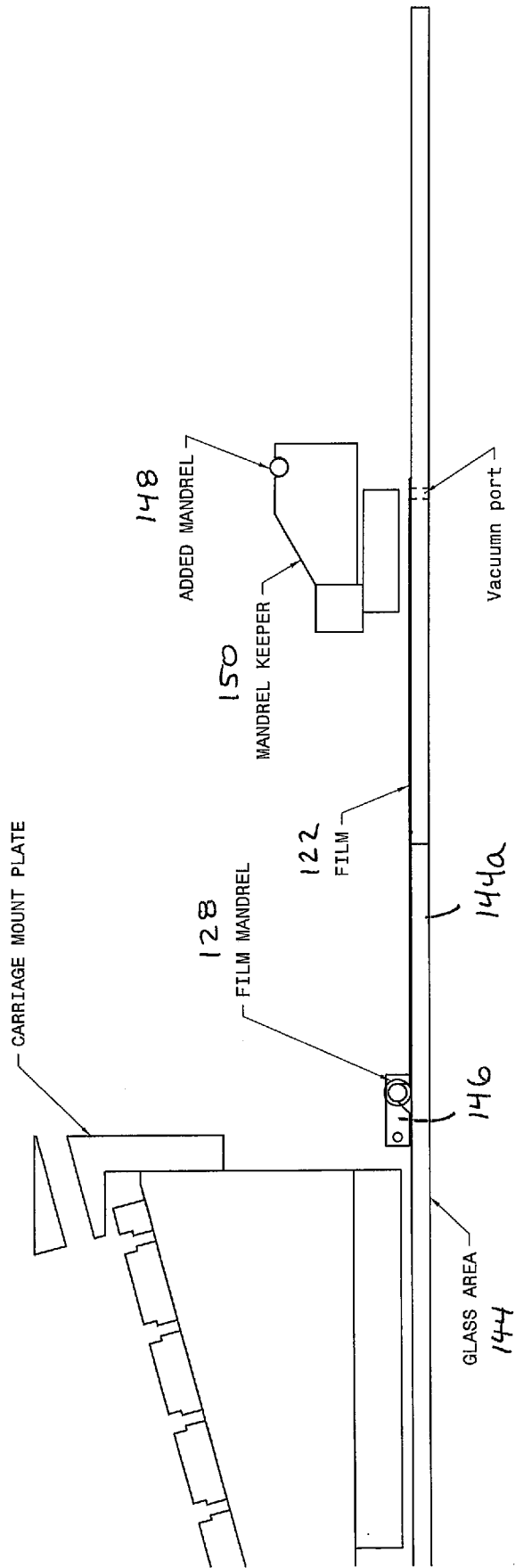


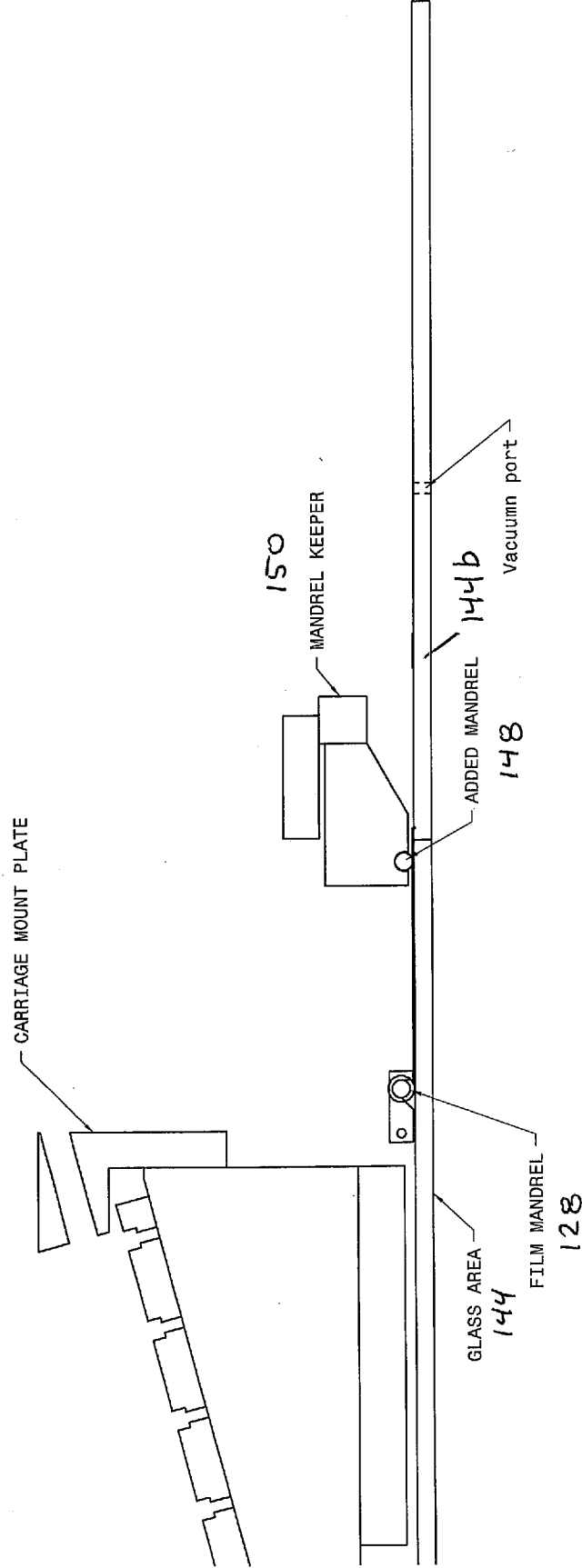
FIG. 25





SHADE LOOP FIXTURE
(4) Rolling FILM MANDREL and MANDREL KEEPER Forward

FIG. 27



SHADE LOOP FIXTURE
(4) Add glue to FILM, Trim FILM to length, Pivot MANDREL KEEPER into FILM

FIG. 28

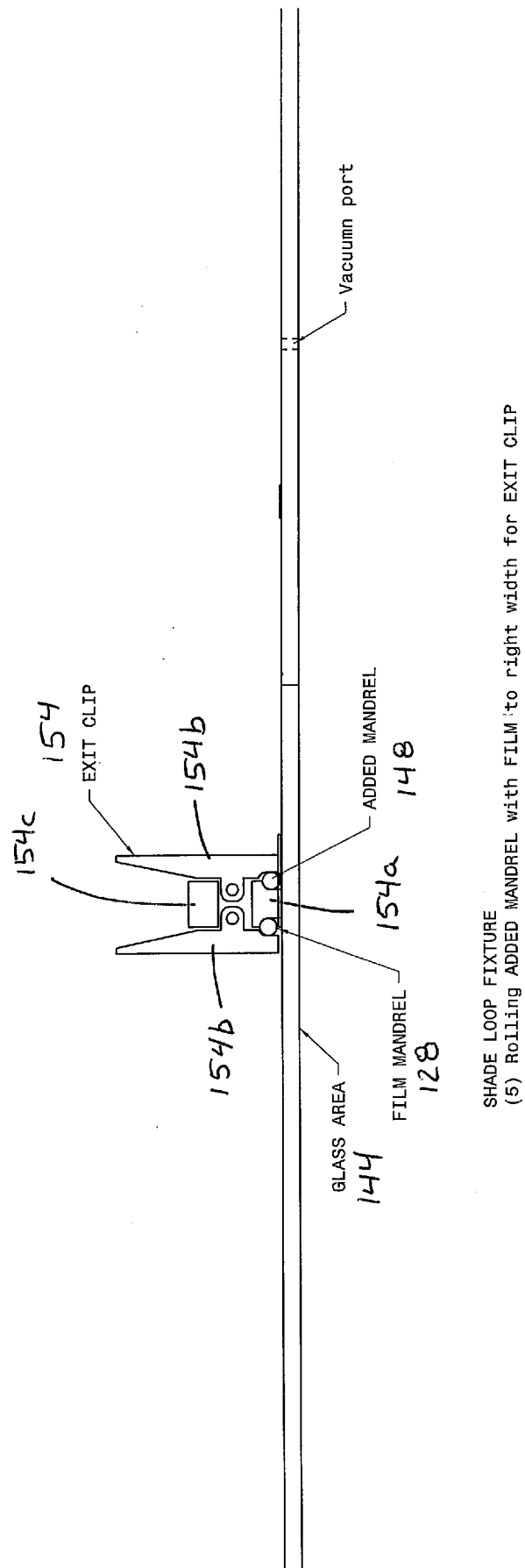


FIG. 29

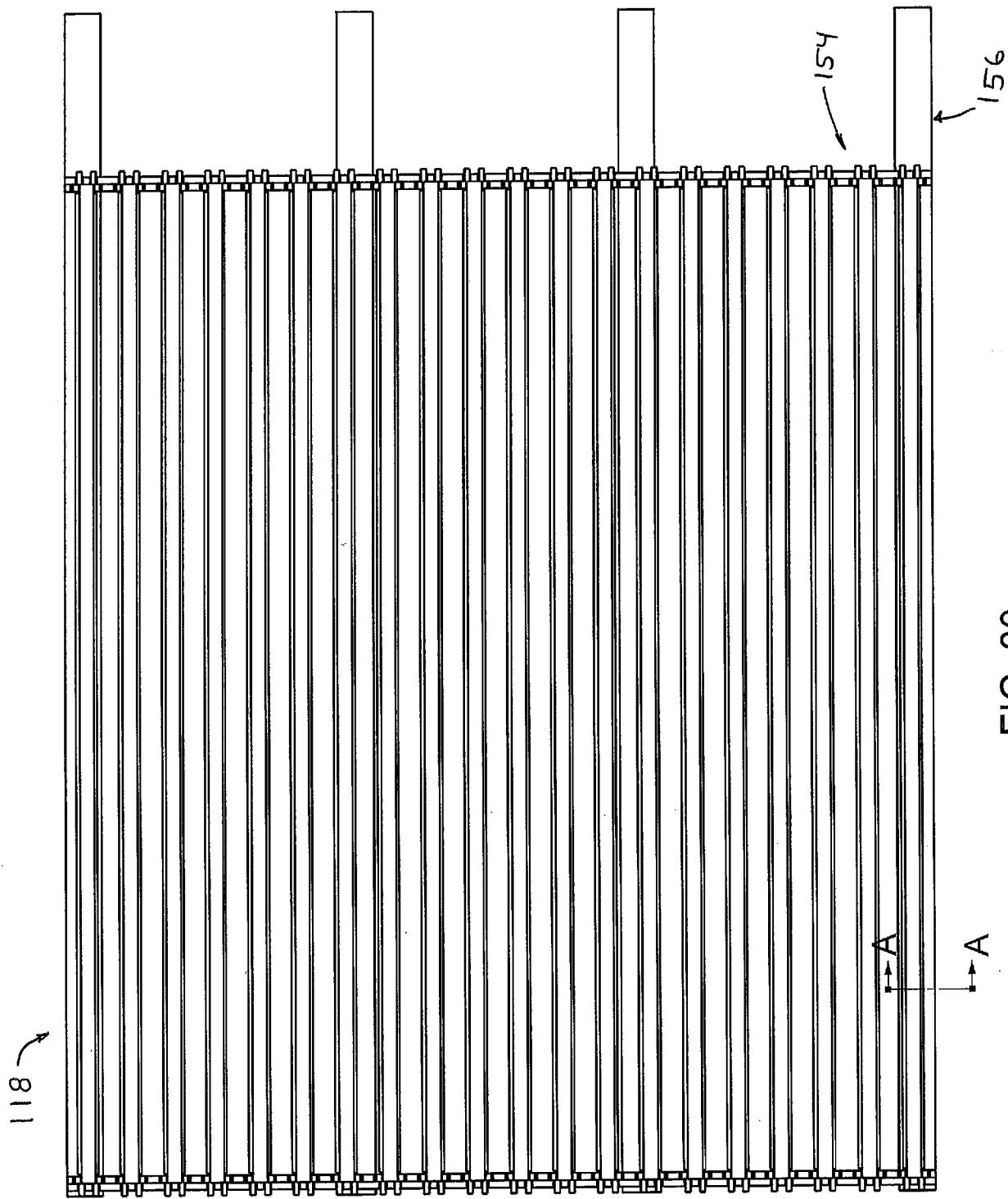


FIG. 30

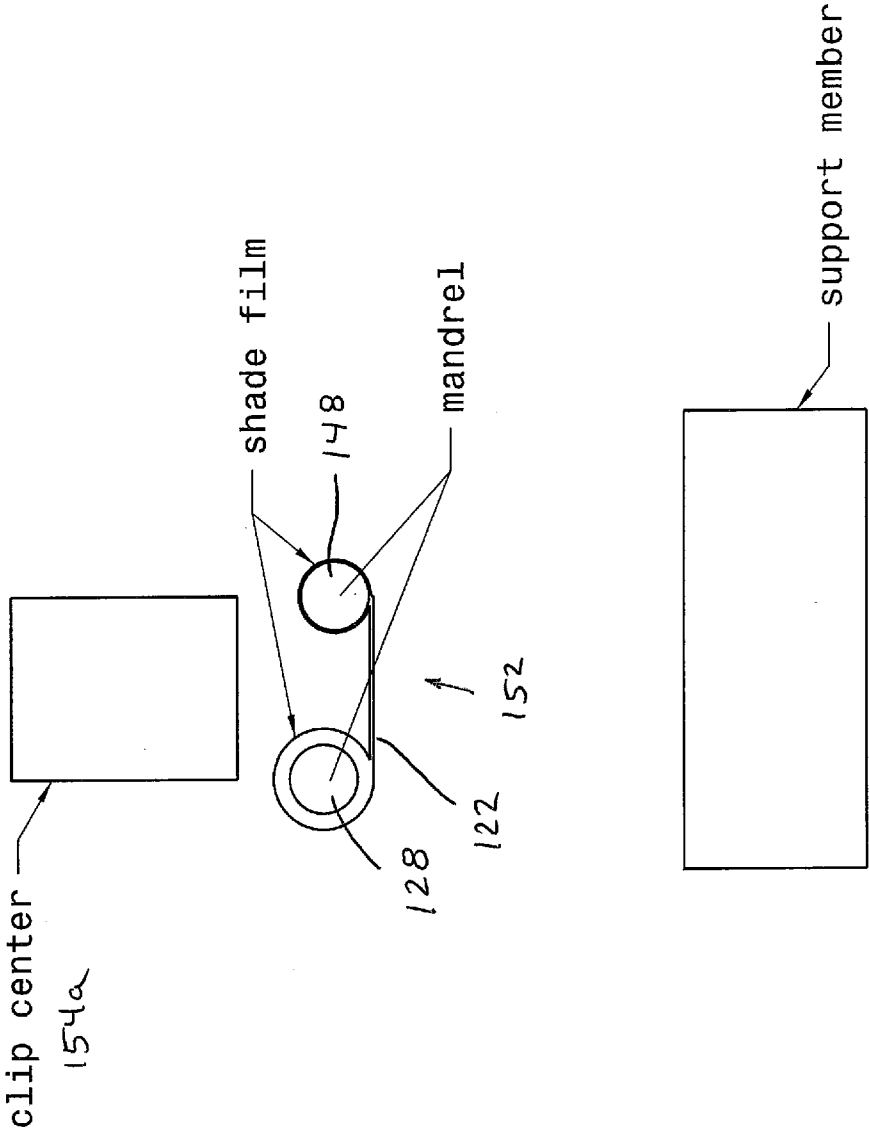


FIG. 30A

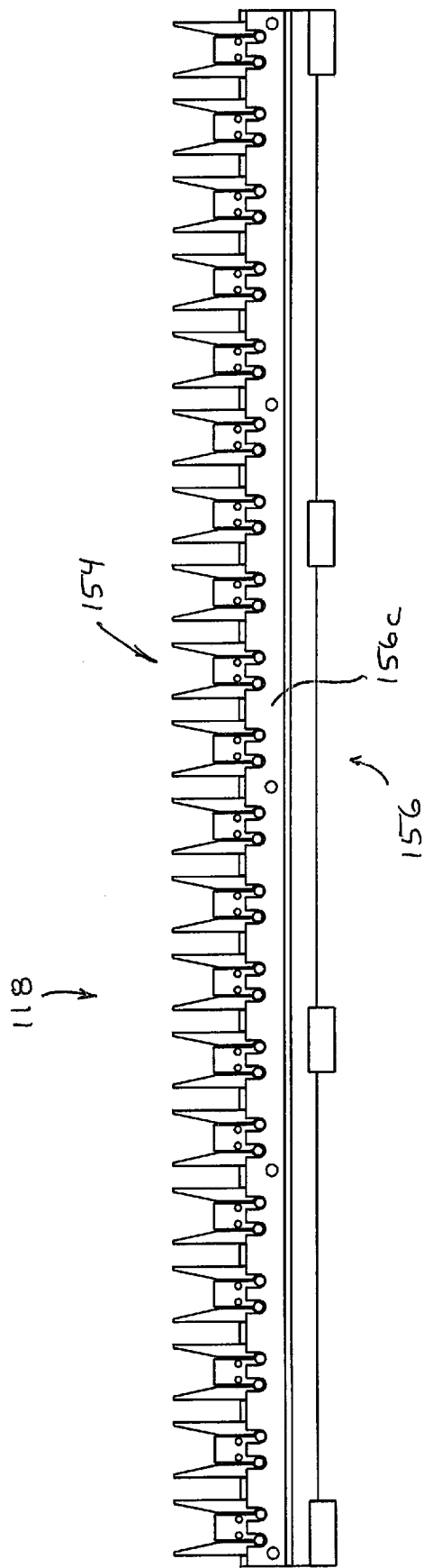


FIG. 31

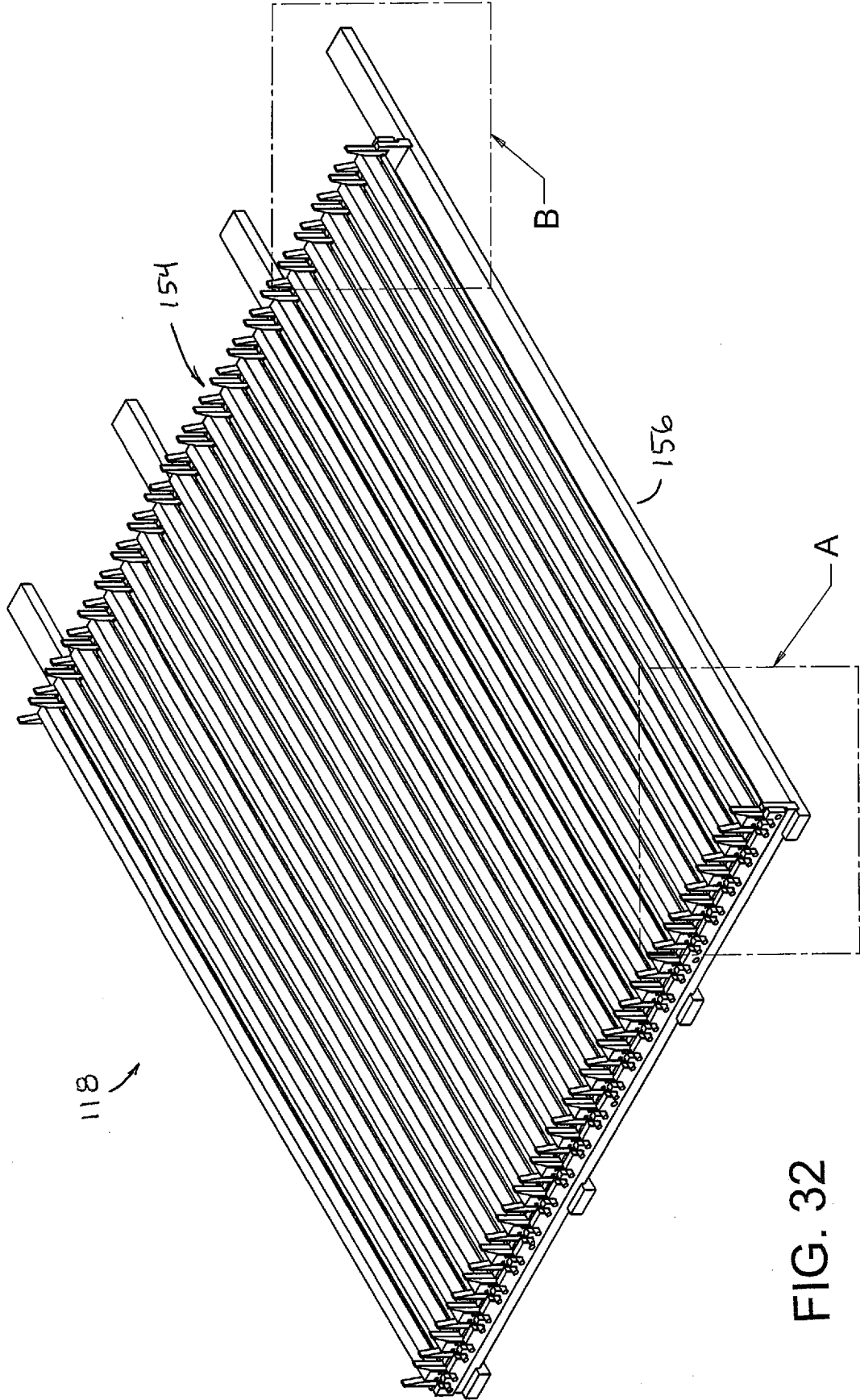


FIG. 32

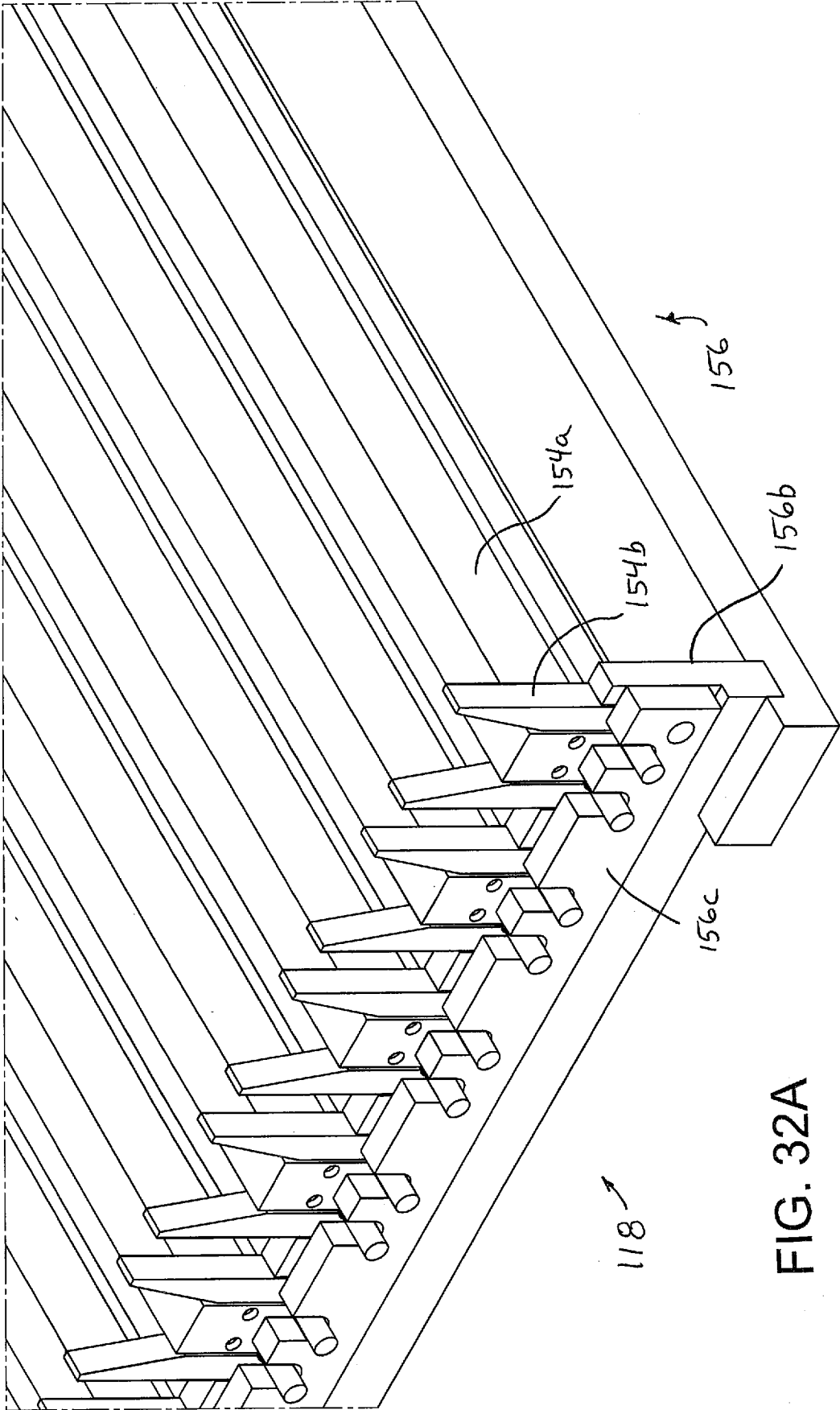


FIG. 32A

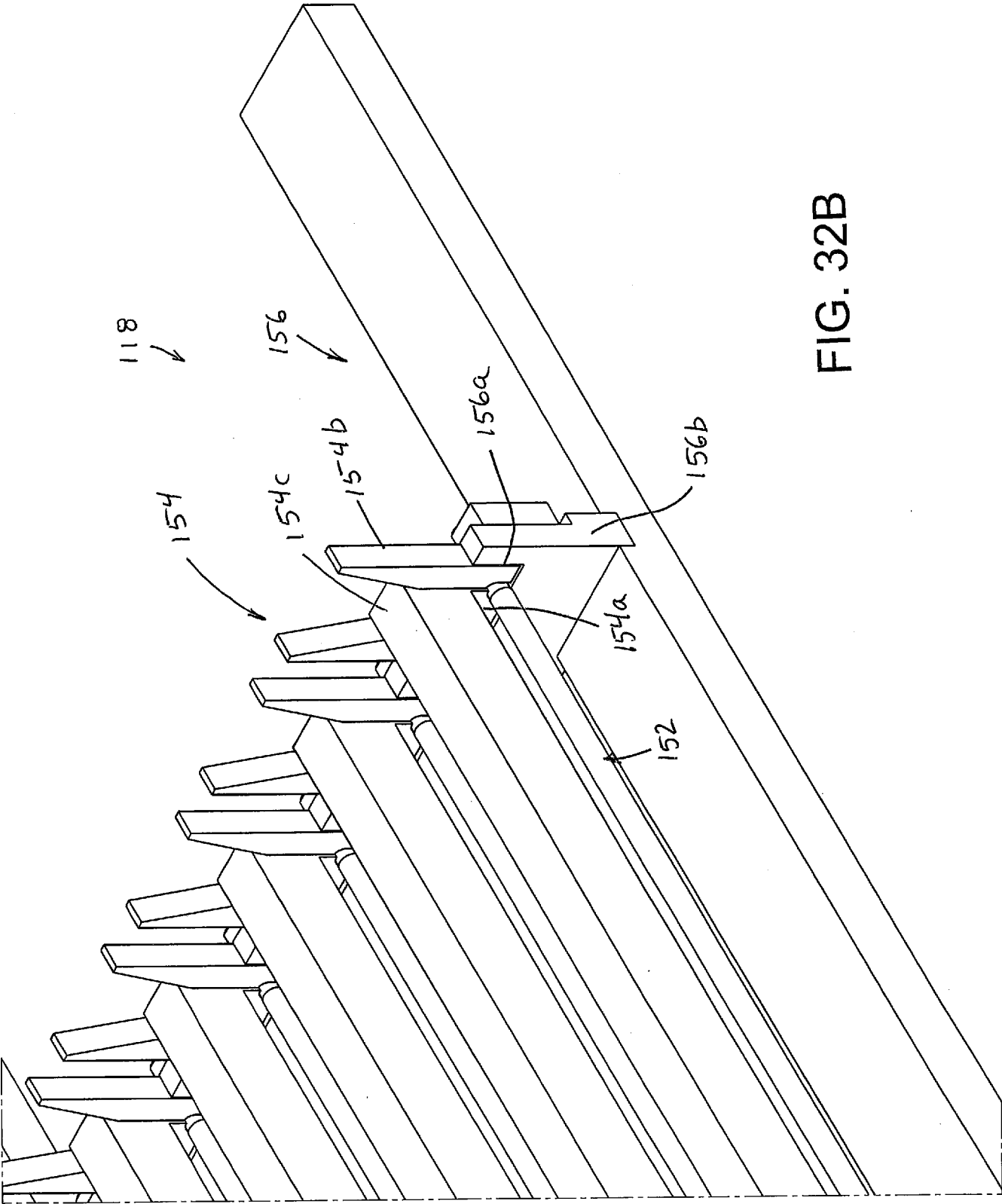


FIG. 32B

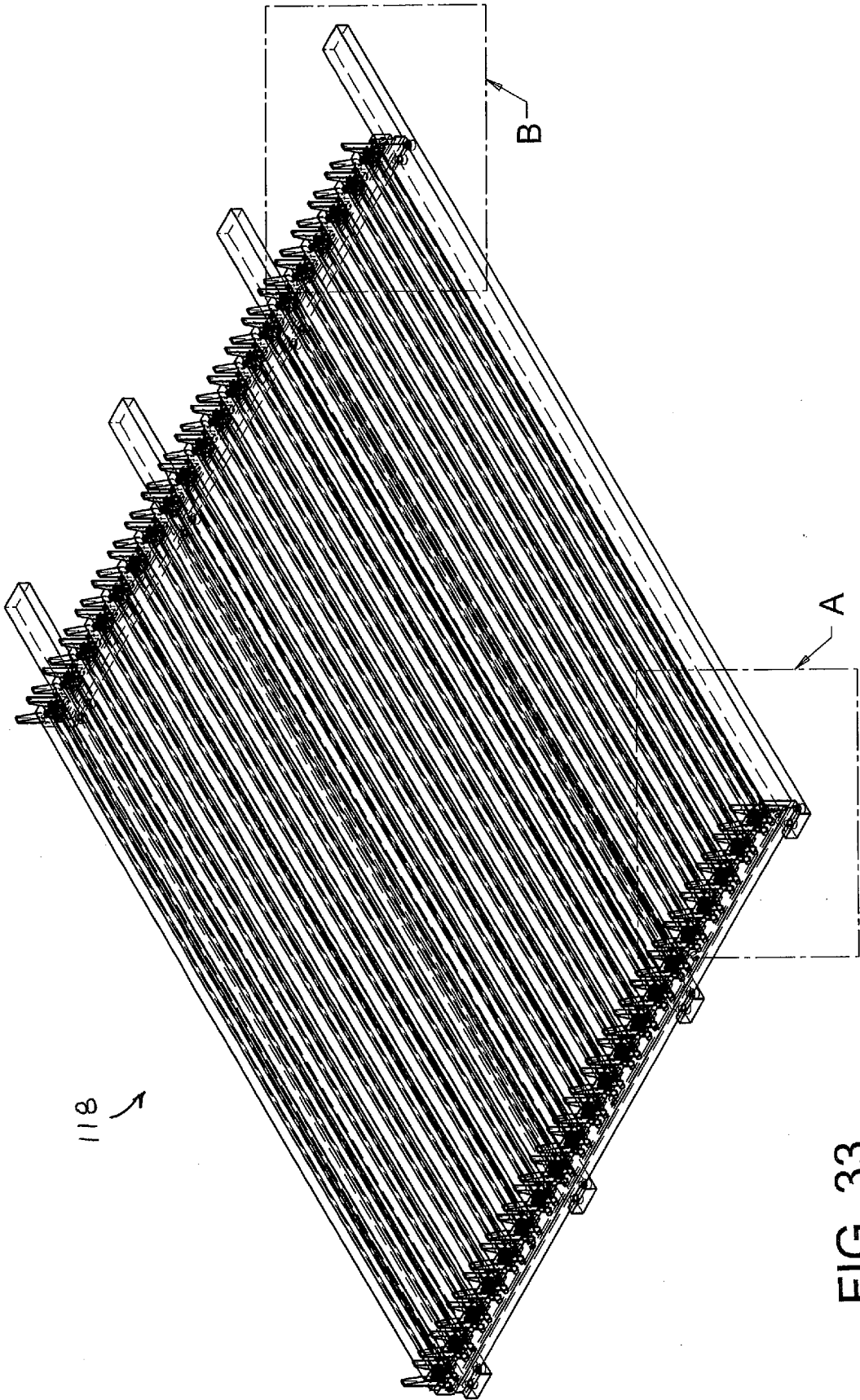


FIG. 33

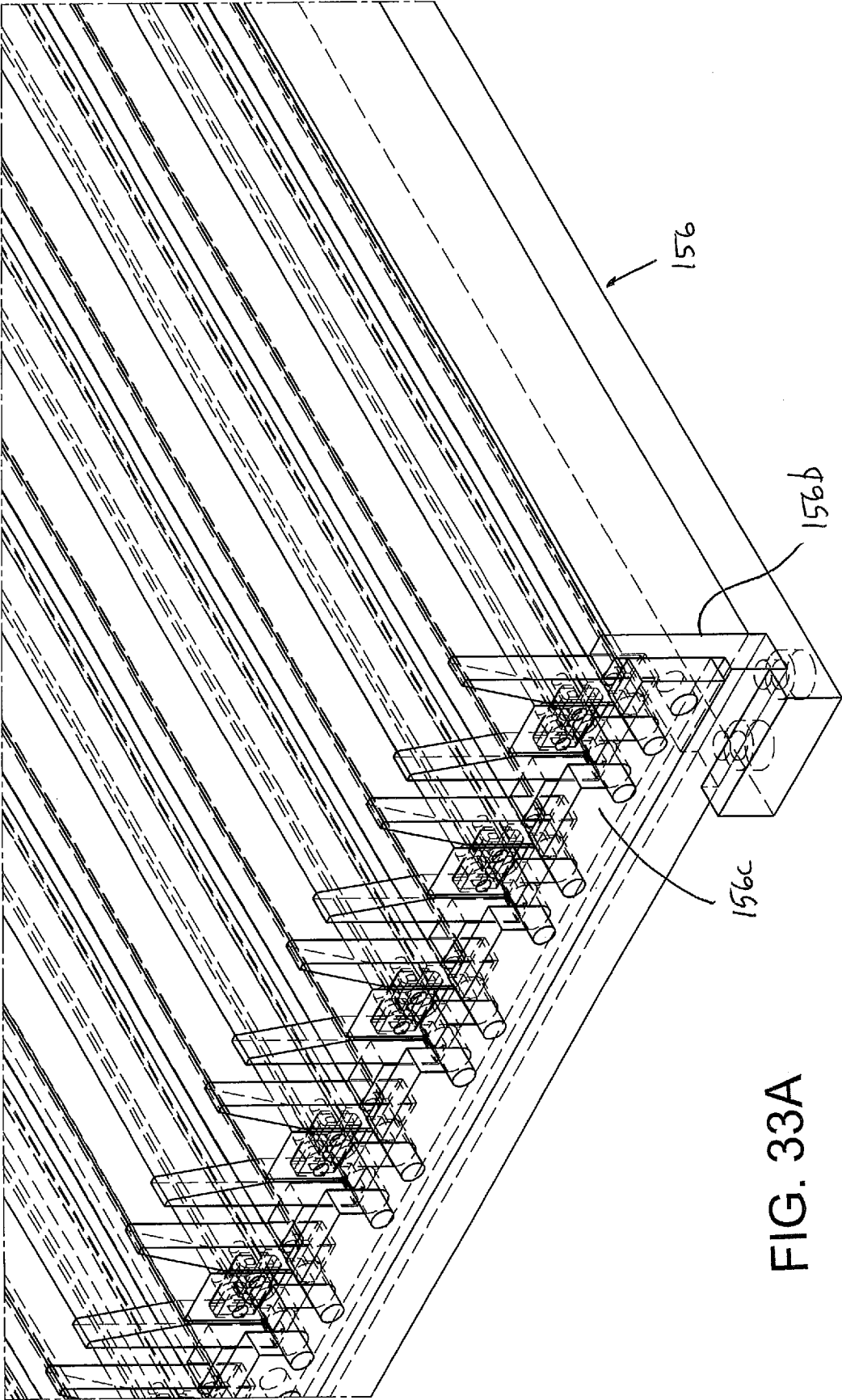
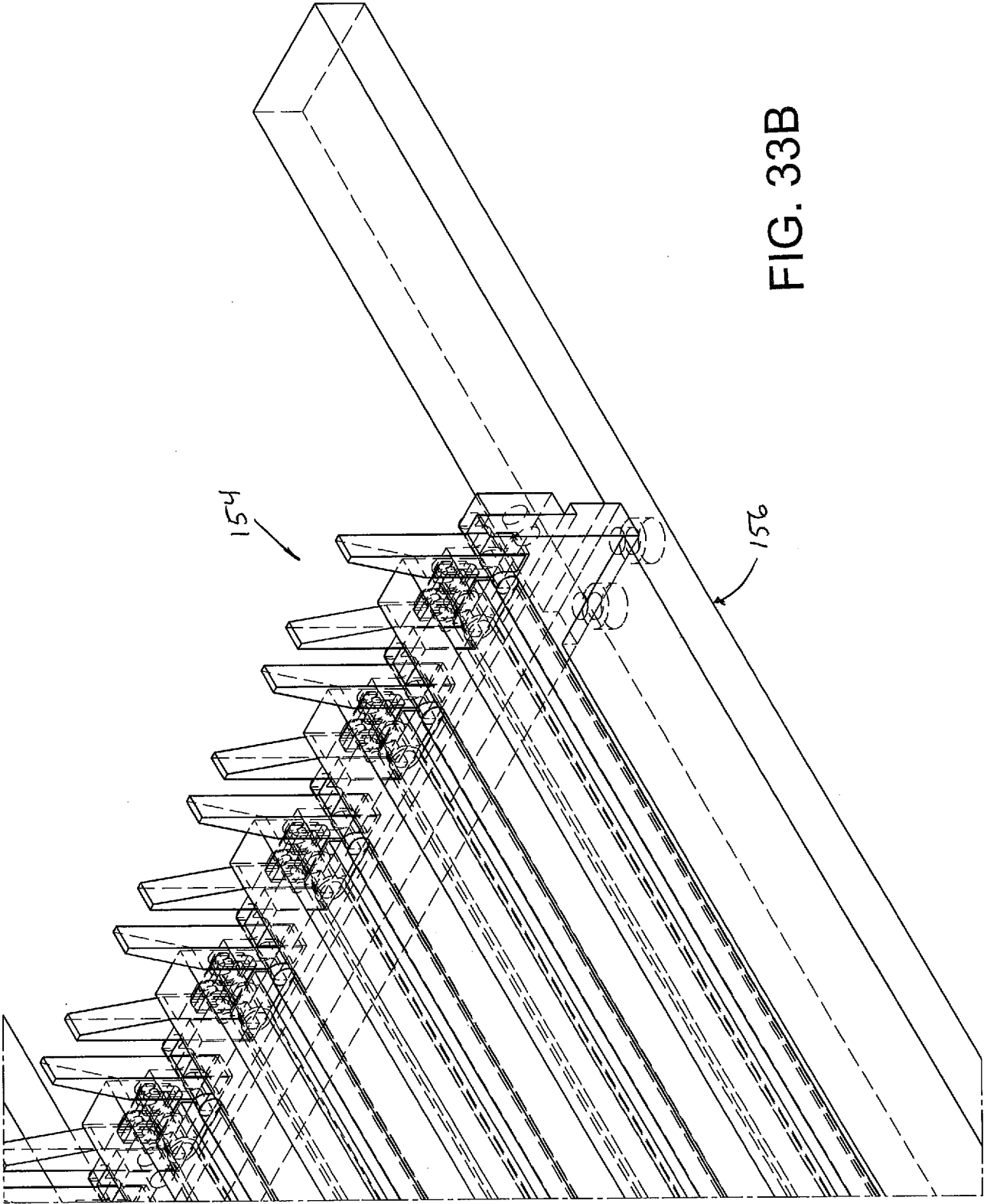


FIG. 33A



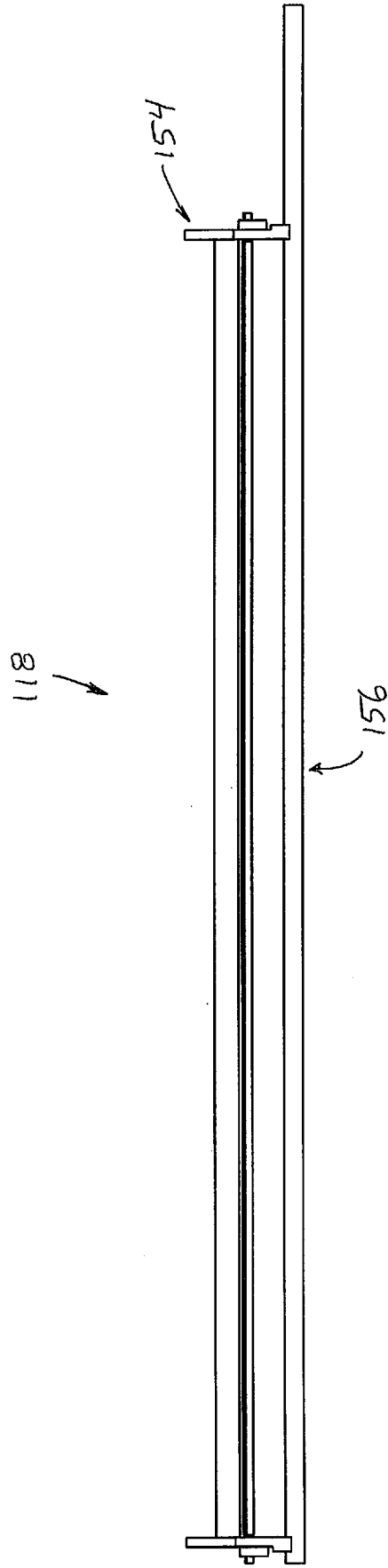


FIG. 34