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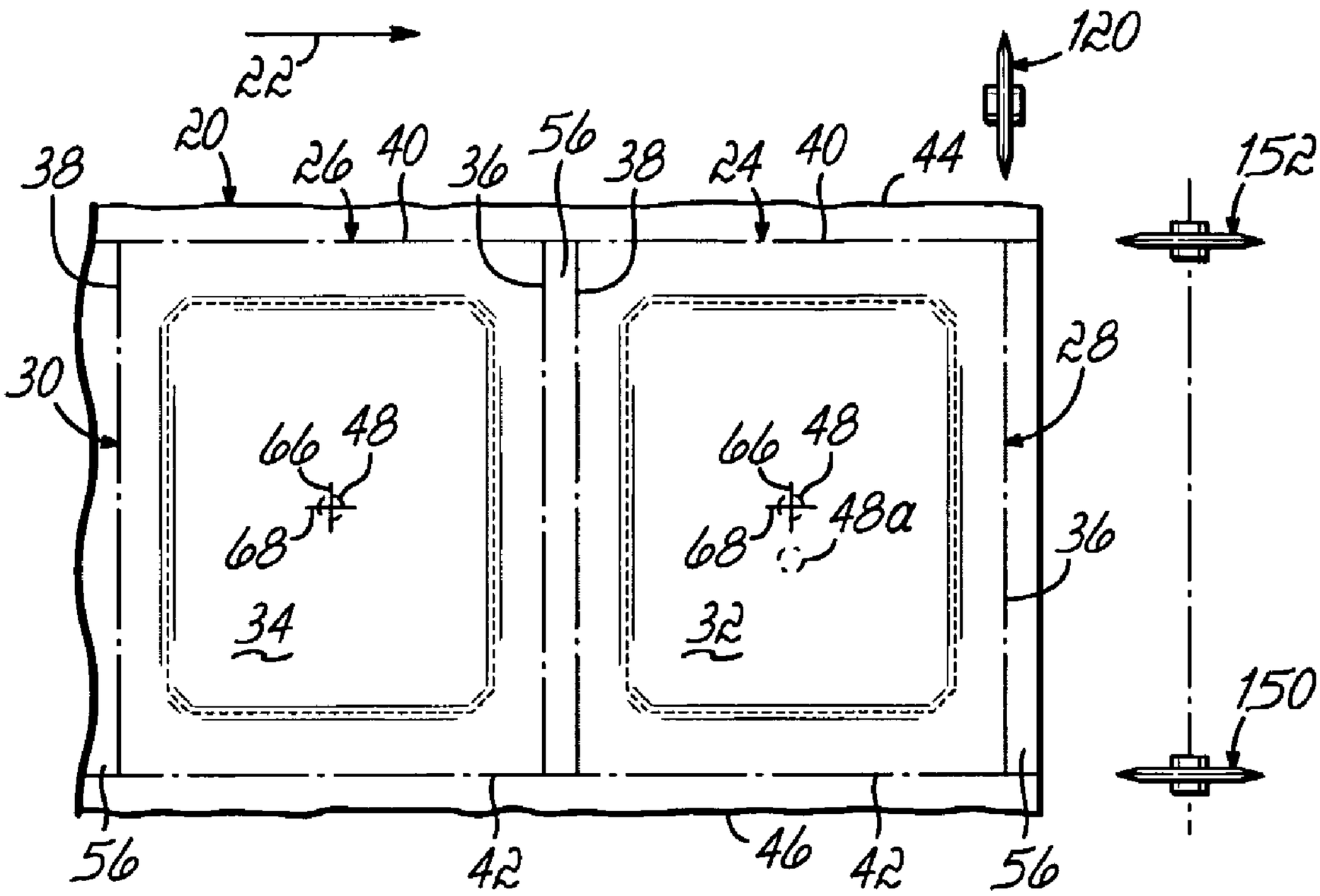
(54) Title: QUILTED FABRIC PANEL CUTTER



(57) Abrégé/Abstract:
An apparatus for cutting a quilted material web (20) having a quilted patterns (32,34) thereon into panels (24,26) having a desired length and width with respective quilted patterns centered therein. A first detector (182) detects a center of a quilted pattern on the quilted material web; and in response thereto, a cutting apparatus (120,150,152) cuts the quilted material web to form edges (36,38,40,42) of a panel equidistant from the quilted pattern center. The cutting apparatus includes a pair of trim blades (150,152) that cut opposite side edges of the panel equidistant from the quilted pattern center and a cross cutting apparatus (120) that cuts end edges of the panel equidistant from the quilted pattern center.

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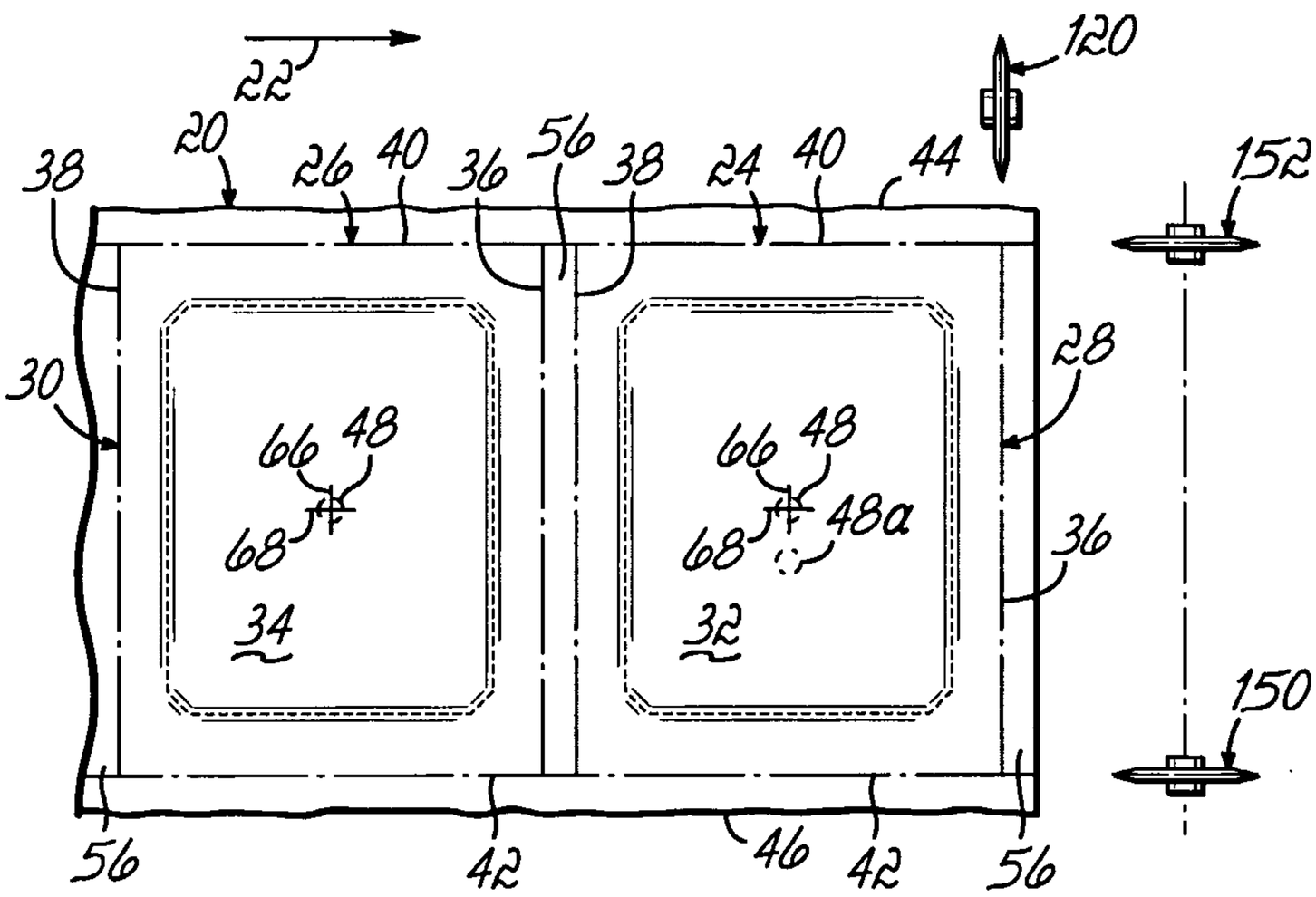
(54) Title: QUILTED FABRIC PANEL CUTTER



(57) Abstract: An apparatus for cutting a quilted material web (20) having a quilted patterns (32,34) thereon into panels (24,26) having a desired length and width with respective quilted patterns centered therein. A first detector (182) detects a center of a quilted pattern on the quilted material web; and in response thereto, a cutting apparatus (120,150,152) cuts the quilted material web to form edges (36,38,40,42) of a panel equidistant from the quilted pattern center. The cutting apparatus includes a pair of trim blades (150,152) that cut opposite side edges of the panel equidistant from the quilted pattern center and a cross cutting apparatus (120) that cuts end edges of the panel equidistant from the quilted pattern center.

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QUILTED FABRIC PANEL CUTTER

Field of the Invention

[0002] This invention relates generally to cutting flat stock and, more particularly, to cutting quilted fabric goods.

Background of the Invention

[0003] Quilting is a sewing process by which layers of textile material and other fabric are joined to produce compressible panels that are both decorative and functional. Stitch patterns are used to decorate the panels with sewn designs while the stitches themselves join the various layers of material that make up the quilts. Large scale quilting processes usually use high-speed multi-needle quilting machines to form a series of panels along webs of the multiple-layered materials. These large scale quilting processes typically use chain-stitch sewing heads which produce resilient stitch chains that can be supplied by large spools of thread.

[0004] After the pattern has been stitched in a panel, the panel must be cut to length and trimmed to a width such that the stitched pattern is centered on the cut panel. If a panel is automatically cut from a quilted material web without locating the quilted pattern, the quilted pattern may be shifted to one side of the panel or, in some circumstances, may be partially cut off when the panel was cut from the web. Thus, the panel must be cut from the web using manual or semiautomatic processes in which an operator is used to align cutting devices so that the quilted pattern is approximately centered in the panel. Further, proper centering of the pattern on the panel facilitates a more automated and less labor intensive panel assembly or sewing process. Therefore, there is a need to provide a panel cutter of a relatively simple design that accurately and quickly automatically centers the pattern on the panel in the cutting process.

Summary of the Invention

[0005] The present invention provides a panel cutter and process that quickly positions cutters with respect to a quilted pattern in a panel. Further, the panel cutter and process of the present invention automatically cuts the panel to the proper length and width with the quilted pattern centered in the panel. In addition, the panel cutter of the present invention uses known, commercially available components and cutting devices and provides a relatively low cost solution to a difficult problem in the quilting industry. Thus, the panel cutter of the present invention is especially useful in cutting panels with quilted patterns from a quilted material web.

[0006] In accordance with the principles of the present invention and in accordance with the described embodiments, the present invention provides an apparatus for cutting a quilted material web having a quilted patterns thereon into panels having a desired length and width with respective quilted patterns centered therein. A first detector detects a center of a quilted pattern on the quilted material web; and in response thereto, a cutting apparatus cuts the quilted material web to form edges of a panel equidistant from the center of the quilted pattern.

[0007] In one aspect of the invention, the cutting apparatus is a trimming apparatus movable to a position displaced from the center of the quilted pattern a first distance in a transverse direction substantially perpendicular to a length of the quilted material web. The first distance being substantially equal to one-half the width of the panel, and the trimming apparatus being operable to cut the quilted material web to form a first side edge of the panel in a longitudinal direction in response to the first detector detecting the center of the quilted pattern.

[0008] In another aspect of the invention, the cutting apparatus is a pair of trim blades, wherein each of the trim blades is movable on an opposite side of the center of the quilted pattern. The pair of trim blades is operable to cut the quilted material web to form opposite side edges of the panel extending in the longitudinal direction equidistant from the center of the quilted pattern.

[0009] In a further aspect of the invention, the cutting apparatus includes a cross cutting apparatus movable in the transverse direction for cutting the quilted web material to form end edges of the panel extending in the transverse direction. A second detector is

movable to a position displaced from the cross cutting apparatus by a second distance in the longitudinal direction, wherein the second distance is equal to the length of the panel. The second detector detects an end edge of the quilted material web, and the cross cutting apparatus is operable to cut the quilted material web and form end edges of the panel equidistant from the center of the quilted pattern.

[0010] These and other objects and advantages of the present invention will become more readily apparent during the following detailed description taken in conjunction with the drawings herein.

Brief Description of the Drawings

[0011] Fig. 1 is a schematic top view of a web of quilted material containing quilted panels to be cut therefrom.

[0012] Fig. 2 is a schematic side view of one embodiment of a panel cutting machine that may be used to cut a panel from a quilted material web in accordance with the principles of the present invention.

[0013] Fig. 3 is a schematic end view of the panel cutting machine of Fig. 2 looking upstream from the downstream end of the panel cutting machine.

[0014] Fig. 4 is a schematic block diagram of a control system that may be used with the panel machine of Fig. 2 in accordance with the principles of the present invention.

[0015] Fig. 5 is as flowchart indicating the process of cutting a panel from the quilted material web using the panel cutting machine of Figs. 2 and 3.

[0016] Fig. 6 is a schematic side view of the web of the quilted material of Fig. 1 illustrating a first cutting operation of another embodiment of a panel cutter in accordance with the principles of the present invention.

[0017] Fig. 7 is a schematic side view of the web of the quilted material of Fig. 1 illustrating a second cutting operation using components of the embodiment of Fig. 6.

[0018] Fig. 8 is a schematic side view of the web of the quilted material of Fig. 1 illustrating a further embodiment of a panel cutter in accordance with the principles of the present invention.

Detailed Description of the Invention

[0019] Referring to Fig. 1, a web of quilted material 20 is conveyed along an output portion of a quilting machine (not shown) in a direction indicated by the flow arrow 22. Such quilting machines are of the type shown and described in U.S. Patent No. 5,154,130 and U.S. Patent No. 7,073,453, filed March 19, 2004. The quilted material 20 is to be cut to form quilted panels 24, 26 with respective perimeters 28, 30 within which quilted patterns 32, 34 are located. Thus, to cut the panel 24 to a desired length, the quilted material web 20 must be cut along cut lines 36, 38. Further, to cut the panel 24 to a desired width, the quilted material web 20 is cut along trim lines 40, 42, thereby removing selvage pieces 44, 46.

[0020] As will be appreciated, due to the nature of the quilting process, the positions of successive quilted patterns 32, 34 often vary slightly, which substantially complicates the panel cutting process. For example, if the panels 24, 26 are cut to length after moving the quilted material web through an incremental feed equal to a panel length, the quilted patterns in some panels will not be centered. Panels with noncentered quilted patterns are more difficult to properly assemble and/or sew together with other panels; and if the quilted pattern is so far off-center that it can't be used, the panel has to be scrapped.

[0021] Thus, to facilitate an automatic, fast and efficient cutting of the panels 24, 26, a center or reference mark 48 is used and accurately centered with respect to the quilting patterns 32, 34 in the respective panels 24, 26. The center mark 48 can be automatically applied to the web 20 as part of the quilting process using a variety of mediums and processes, for example, a stick-on element, painting, detectable stitching, etc. Further, the center mark 48 can be of any useful shape, for example, a circle, a dot, crosshairs, etc. Alternatively, the center mark 48 can be printed on the web 20 using apparatus and methods shown and described in U.S. Patent Nos. 6,435,117; 6,263,816; 6,158,366; 6,012,403 and 5,873,315. The center mark is often located on a backside of the panel, that is, the side opposite a side presenting the quilted pattern to a user.

[0022] Referring to Fig. 2, a panel cutter 100 has an upstream portion 102, a cutting portion 104 and a downstream portion 106. As used herein, "upstream" refers to a position, motion or direction to the left of a cross cut blade 123; and "downstream" refers to a position, motion or direction to the right of the cross cut blade 123. A quilted material web 20 is fed over rollers 108, 110 across an upstream table 112 and through a pair of transversely

extending, opposed pinch rollers 114. The pinch rollers are engaged and disengaged by means of actuators 116, for example, pneumatic cylinders. After the pinch rollers 114 are engaged with the quilted material web 20 pinched there between, actuator 117 (Fig. 3), for example, an electric motor, is turned On to feed the quilted material web between the pinch rollers 114 in a longitudinal direction 118 generally parallel to a length of the web.

[0023] The cutting portion 104 (Fig. 2) includes a cross cutting apparatus 120 and a trimming apparatus 122. The cross cutting apparatus 120 has a cutting blade 123 operatively connected to a motor 124 that is mounted on a carriage 126. A linear guide 128 extends in the transverse direction 130 (Fig. 3), that is, perpendicular to the longitudinal direction 118. The carriage 126 has a plurality of rollers 132 that ride on opposed longitudinal edges of the guide rail 128. The ends of a drive belt 136 are connected to the carriage 126 and are looped over an idler pulley 138 and a drive pulley 140 that is rotated by a motor 142. Thus, operating the motor 142 is effective to translate the carriage 126 and cross cutting blade 123 in the transverse direction 130 to cut the quilted material web 20.

[0024] A clamp bar 144 extends transversely over substantially a full width of the panel cutter 100 and is supported at its ends by cylinders 146. Motion of the clamp bar 144 in the vertical direction is guided by wheels 147 riding on opposite sides of linear guides 148. The actuators 146 move the clamp bar 144 toward a plate 149 to secure the quilted material web therebetween.

[0025] The trimming apparatus 122 includes left and right slitter and feed mechanisms 150, 152, respectively, that are located on opposite sides of the panel cutter 100 adjacent the ends of the pinch rollers 114. The slitter and feed mechanisms 150, 152 are described in detail in U.S. Patent No. 6,736,078. Each of the slitter and feed mechanisms 150, 152 is operated by a motor 154 that rotates upper and lower slitting wheels 156, 158, respectively, as well as upper and lower conveyors 160, 162, respectively. Each of the slitter and feed mechanisms 152, 154 has a carriage 164 that supports the motor 154, slitting wheels 156, 158 and conveyors 160, 162 and is mounted via wheels 166 onto a guide rail 168. Each of the carriages 164 is mounted on a nut (not shown) that is threaded onto a screw 170 rotated by an actuator 172. Thus, the slitter and feed mechanisms 150, 152 are movable to desired positions on the rail 168 by operating respective actuators 172.

[0026] An upstream, center mark detector 180 has a sensor 182 mounted on a carriage 184 that is supported by linear guide rods 186 beneath the upstream table 112. The center mark detector 180 can be any device that is able to provide output signals representing a detected position of the center mark 48 on the quilted material web 20, for example, a vision camera. The vision camera has a charge coupled device (CCD) providing an output that is converted to digital form and processed to determine the location a center mark on the quilted material web 20. The carriage 184 is also connected to a drive belt 188 extending around an idler pulley 190 and a drive pulley 192 that is rotated by a motor 194. Thus, operation of the motor 194 is effective to move the sensor 182 in the longitudinal direction 118.

[0027] A downstream portion 106 has a downstream conveyor 174 operated by a drive pulley 176 that is rotated by a motor 178. A downstream length detector 196 has a sensor 198 mounted to a carriage 200 that is supported by linear guide rods 201. The sensor 198 can be any device capable of providing an output signal in response to detecting an edge of the quilted material web 20, for example, a photoeye. The carriage 200 is connected to a drive belt 202 looped over an idler pulley 204 and a drive pulley 206. A motor 208 rotates the drive pulley 206 to provide linear motion of the detector 198 in the longitudinal direction 118.

[0028] As shown in Fig. 4, a programmable controller 210 is used to coordinate the operation of the various actuators and motors on the panel cutter 100 to execute a panel cutting operation as shown in Fig. 5. A quilted material web 20 is first loaded onto the panel cutter 100 and located between the pinch rollers 114, and the operator is then able to initiate a panel cutting cycle of operation. The controller 210 first determines, at 250, the size of the next panel 24 (Fig. 1). In this embodiment, the panel cutter 100 has the capability of cutting panels up to 80 inches wide and 60 inches long. However, substantially smaller panels may also be cut; and further, successive panels on the quilted panel web 20 may be of different sizes.

[0029] Assuming the first panel to be cut is 60 inches long and 80 inches wide, the controller 210 first commands the detector positioning motor 194, at 252, to move the detector carriage 184 and center mark sensor 182 to a location that is 30 inches upstream of the cross cut blade 123. Thus, as the web is moved downstream, the center mark sensor 182

is now in a position (transverse center line 66) for the sensor 182 to locate the next center mark on the quilted material web 20 with respect to the cross cut blade 123 (Fig. 2). In addition, the controller 210 commands the length sensor positioning motor 209 to move the length sensor carriage 200 and length sensor 198 to a position that is 60 inches downstream of the cross cut blade 123. In this position, the length sensor 198 is able to control the length of the panel to be cut from the quilted material web 20.

[0030] Thereafter, the controller 210, at 256, initiates a feed of the quilted material web 104. The web feed is initiated by the controller 210 commanding the pinch roller motor 117 (Fig. 3) to rotate the pinch rollers 114 in directions causing the web 20 to move downstream. The quilted material web 20 has a quilted pattern 32 on a top side facing upward above the upstream table 112 and a center mark 48 on an opposite, bottom side facing downward beneath the upstream table 112. Being below the upstream table 112, the center mark sensor 182 is viewing the bottom side of the web 20. When the center mark crosses a transverse centerline 66 (Fig. 1) in a field of vision of the sensor 182, the sensor 182 provides an output signal to the controller 210; and the controller commands the pinch roller motor 117 to stop. As will be appreciated, the process of stopping the operation of the pinch rollers 114 may involve successive decelerations of the pinch roller motor 117, such that the quilted material web 20 can be stopped with the center mark 48 precisely located on the centerline 66 of the field of vision of the sensor 182. If the center mark 48 is offset from a longitudinal centerline 68 (Fig. 1) of the field of vision of the sensor 182, as indicated by the center mark 48a shown in phantom in Fig. 1, sensor 182 and controller 210 are able, at 260, to determine the magnitude of the offset. The controller 210 then commands the side trim positioning motors 172 to position the slitter and feed mechanisms 150, 152, so that the side trim blades 156, 158 are equidistant from the detected center mark 48a.

[0031] Thereafter, at 262, the controller 210 commands the clamp actuators 146 to lower the clamp bar 144, thereby clamping the quilted material web 20 between the clamp bar 144 and stationary plate 149. Next, the controller 210 provides command signals to the cross cut blade motor 124 to initiate rotation of the cross cut blade 123. In addition, the controller 210 commands the cross cut blade positioning motor 142 to move the carriage 126 supporting the rotating cross cut blade 123 transversely across the panel cutter 100 along cut line 36 (Fig. 1). That motion is effective to cut off a crop-out piece 56 to form a leading edge

of the panel 24. Upon the cross cut blade 123 finishing its transverse motion, the controller 210 terminates operation of the cross cut blade positioning motor 142 and initiates, at 264, operation of the downstream conveyor motor 178. Thus, the crop-out piece that has been cut off of the end of the quilted material web 20 is fed from the panel cutter 100.

[0032] The controller 210 then, at 266, commands the clamp actuators 146 to lift the clamp bar 144 from the plate 149, thereby unclamping the quilted material web. The controller 210 then turns on the side trim motors 154 of the left and right slitter and feed mechanisms 150, 152. Operating the side trim motors 154 initiates rotation of the upper and lower slitting wheels 156, 158, respectively, and the upper and lower conveyors 160, 162 of the slitter and feed mechanisms 150, 152. Thus, as the quilted material web 20 is pushed downstream by the pinch rollers 114, it is captured between the upper and lower conveyors 160, 162 (Fig. 3) on both sides of the panel cutter 100. The two sets of upper and lower conveyors 160, 162 are operative to pull the quilted material web 20 past respective sets of upper and lower slitting wheels 156, 158. The controller 210 also commands the operation of the down feed conveyor motor 178 to allow the down feed conveyor 174 to facilitate the conveyance of the quilted material web 20 along the panel cutter 100. Thus, the left and right sets of slitting wheels 156, 158 move along respective cut lines 40, 42 to form side edges of the panel 24 that are equidistant from the detected center mark.

[0033] That operation continues until, at 268, the length sensor 198 detects the leading edge 36 (Fig. 1) of the panel 24 and simultaneously provides a leading edge feedback signal to the controller 210. The controller 210 immediately turns Off the pinch roller feed motor 117, the two slitter and feed mechanism motors 154 and the downstream conveyor motor 178. Thereafter, the controller 210 commands the clamp actuators 146 to lower the clamp bar 144 onto the quilted material web 20 and against the fixed plate 149. In addition, the controller 210 commands the cross cut positioning motor 142 to move the carriage 126 and rotating cross cut blade 123 transversely across the panel cuter 100 along cutline 38 to form a trailing edge of the panel 24. Then, at 272, the controller 210 commands the clamp actuators 146 to raise the clamp bar and unclamp the quilted material web 20. The controller 210 then initiates a panel feed by activating the slitter and feed mechanism motors 154 and the downstream conveyor motor 178. The two sets of upper and lower slitter wheels

continue to trim the side edges 40, 42 of the panel 32 to be equidistant from the center mark 48.

[0034] Thus, the panel cutter 100 has the advantage of cutting panels from a quilted material web in which quilted patterns are consistently and accurately centered on the panel. Further, with the panel cutter 100, successive quilted patterns can be of different sizes, and the panels can be accurately and quickly cut to different lengths and widths with the quilted panels centered thereon.

[0035] While the invention has been illustrated by the description of one embodiment and while the embodiment has been described in considerable detail, there is no intention to restrict nor in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those who are skilled in the art. As will be appreciated, there are many variations relating to the structure and operation of the sensors 182, 198, the cross cutting apparatus 120 and the trimming apparatus 150, 152. For, example, Fig. 6 illustrates an alternative embodiment of the panel cutter 100 that uses a cross cutting apparatus 120 and a single center mark sensor or camera 182. The cross cutting apparatus 120 is mounted on a second cross cut blade carriage 214 that provides motion of the cross cutting apparatus 120 in the longitudinal direction 118. Thus, the cross cutting blade 123 is movable to the left and right as viewed in Fig. 6. In a process similar to that previously described, the controller 210 is operative to move the quilted material web 20 to the right as viewed in Fig. 6 and to cause the cross cutting apparatus 120 to cut the web 20 along the cut line 36. Thereafter, the controller 210 provides command signals to move the cross cutting apparatus 120 to the left as viewed in Fig. 6 to the position shown in Fig. 7. The cross cutting apparatus 120 is moved through a distance equal to a length of the quilted panel 24, that is, the distance between the cross cut paths 36, 38. As described earlier, the controller 210 is operative to cause the cross cutting apparatus 120 to move across the quilted material web 20 along the cut line 38, thereby cutting the panel 24 to the desired length. Thereafter, the controller 210 initiates motion of the quilted web material 20 and causes the slitter and feed apparatus 150, 152 to cut along the trim lines 40, 42 to form the side edges of the panel.

[0036] Fig. 8 illustrates a further embodiment of the panel cutter 100 using a single center mark sensor 182 and two cross cutting apparatus 120a, 120b. Each of the cross

cutting apparatus 120a, 120b is supported on a separate cross cut carriage 214a, 214b that is movable in the longitudinal direction 118. In a manner as earlier described, the controller 210 is operative to feed the quilted web 20 to the right as viewed in Fig. 8 until the center mark 48 is detected crossing the centerline 66 (Fig. 1) of the sensor 182. The controller 210 then stops the feed of the quilted material web 20. Thereafter, the controller 210 causes the cross cutting apparatus 120a, 120b to move along the cut lines 36, 38, thereby cutting the panel 24 to its desired length. As will be appreciated, alternatively, the controller 210 can operate the cross cutting apparatus 120a, 120b sequentially or simultaneously. As will be appreciated, in a still further embodiment, both of the two cross cut blades and motors can be mounted on the respective longitudinal carriages 214a, 214b instead of the transverse carriage of Fig. 2. Then the longitudinal carriages 214a, 214b can be mounted on separate or a common transverse carriage.

[0037] Therefore, the invention in its broadest aspects is not limited to the specific details shown and described. Consequently, departures may be made from the details described herein without departing from the spirit and scope of the claims that follow.

What is Claimed is:

1. An apparatus for cutting, from a quilted material web, a quilted panel having a transverse width extending between longitudinal side edges and a length extending between transverse leading and trailing edges with a quilted pattern disposed therein, the quilted material web being movable in a longitudinal direction substantially parallel to a length of the quilted material web, the apparatus comprising:

a table for supporting the quilted material web for longitudinal movement over a surface thereof;

a first detector positioned with respect to the table to detect a position of a mark located on a backside of the moving quilted material web within the width and the length of the panel;

a programmable control responsive to the first detector detecting the position of the mark and operable to locate the width and the length of the panel with respect to the position of the mark so that the quilted pattern is substantially centered in the width and the length of the panel;

trimming blades transversely movable by operation of the programmable control to respective positions separated by the width of the panel with the quilted pattern substantially centered between the trimming blades, the trimming blades adapted to cut the quilted material web in the longitudinal direction;

a cross cutting blade adapted to cut the quilted material web in a transverse direction substantially perpendicular to the longitudinal direction; and

the programmable control being operable to cause the trimming blades and the cross cutting blade to cut the panel to the width and the length, respectively, with the quilted pattern substantially centered in the panel.

2. The apparatus of claim 1 wherein the first detector is movable in the longitudinal direction by operation of the programmable control.

3. The apparatus of claim 1 further comprising a second detector being movable in the longitudinal direction by the programmable control, the second detector detecting an edge of the moving quilted material web, and the programmable control being operable to cause the cross

cutting blade to cut the panel to the length with the quilted pattern substantially centered in the length in response to the second detector detecting the edge.

4. The apparatus of claim 1 wherein the first detector is movable in the longitudinal direction by operation of the programmable control.

5. The apparatus of claim 4 wherein the first detector is movable in the longitudinal direction to an upstream position separated from the cross cutting blade by a distance substantially equal to one-half the length of the panel.

6. The apparatus of claim 5 wherein the programmable control is operative to terminate motion of the quilted material web in response to the first detector detecting a position of a mark and thereafter, move the cross cutting blade transversely to cut a leading edge of the panel.

7. The apparatus of claim 5 wherein the programmable control is operative to terminate motion of the quilted material web in response to the first detector detecting a position of a mark and thereafter, move the trimming blades transversely to the positions separated by a width of the panel with a quilted pattern substantially centered between the trimming blades.

8. The apparatus of claim 7 wherein the programmable control is then operative move the cross cutting blade transversely to cut a leading edge of the panel.

9. The apparatus of claim 8 wherein the second detector is movable to a downstream position displaced from the cross cutting apparatus by a distance in the longitudinal direction substantially equal to the length of the panel.

10. The apparatus of claim 9 wherein the programmable control is further operative initiate motion of the quilted material web to cut longitudinal side edges of the panel and then, stop motion of the quilted material web in response to the second detector detecting edge of the moving quilted material web and then, initiate motion of the cross cutting blade transversely to cut a trailing edge of the panel.

11. The apparatus of claim 1 wherein the first detector is a vision camera.

12. The apparatus of claim 11 wherein the second detector is an edge sensor.

13. The apparatus of claim 12 wherein the edge sensor is a photocell.

14. The apparatus of claim 1 wherein the mark on the backside of the moving quilted material web is dimensionally related to a center of the quilted pattern.

15. The apparatus of claim 1 further comprising:

a quilted material web movable in a longitudinal direction substantially parallel to a length thereof, the web having an upwardly facing front side and a downwardly facing backside;

a mark located on the backside of the quilted material web within the width and the length of the panel, the mark being dimensionally related to a center of the quilted pattern.

16. An apparatus for cutting, from a quilted material web, panels having respective transverse widths extending between respective longitudinal side edges and respective lengths extending between respective transverse leading and trailing edges with respective quilted patterns disposed therein, the quilted material web being movable in a longitudinal direction substantially parallel to a length of the quilted material web, the apparatus comprising:

a table adapted to contact and support a backside of the quilted material web for longitudinal movement over a surface thereof, the quilted material web having an opposite side presenting the quilted pattern;

a first detector positioned below the table and providing first output signals in response detecting positions of respective marks located on the backside of a moving quilted material web, each panel having only a single mark located within a width and a length of a respective panel, and each single mark on the backside of the moving quilted material web being dimensionally related to a center of the quilted pattern;

a programmable control operable for each panel to move the first detector longitudinally to a first position and then operable in response to the first output signals to locate a width and a

length of a respective panel with respect a position of a respective mark so that a respective quilted pattern is substantially centered in the width and the length of the respective panel;

trimming blades movable transversely by operation of the programmable control for each panel to respective positions with respect to the marks separated by a width of a respective panel with a respective quilted pattern substantially centered between the trimming blades, the trimming blades adapted to cut the quilted material web in the longitudinal direction;

a second detector being movable in the longitudinal direction by the programmable control, the second detector providing second output signals in response to detecting leading edges of the moving quilted material web;

a cross cutting blade adapted to cut the quilted material web in a transverse direction substantially perpendicular to the longitudinal direction; and

for each panel, the programmable control being further operable in response to the first and the second output signals to cause the trimming blades and the cross cutting blade to cut a respective panel to a respective width and length with a respective quilted pattern substantially centered in the respective panel.

17. The apparatus of claim 16 wherein for each of the respective panels, the programmable control is further operative to terminate motion of the quilted material web in response to the first output signals and thereafter move the cross cutting blade transversely to cut a leading edge of the panel.

18. The apparatus of claim 16 wherein for each of the respective panels, the programmable control is operative to terminate motion of the quilted material web in response to the first output signals and thereafter move the trimming blades transversely to positions separated by a width of the respective panel with a respective quilted pattern substantially centered between the trimming blades.

19. The apparatus of claim 18 wherein the programmable control is then operative to move the cross cutting blade transversely to cut a leading edge of the respective panel and then, initiate motion of the quilted material web to cut longitudinal side edges of the respective panel with the trimming blades and then, stop motion of the quilted material web in response to detecting a

second signal and then, move the cross cutting blade transversely to cut a trailing edge of the respective panel.

20. The apparatus of claim 19 wherein the programmable control is then operative to then initiate motion of the quilted material web to finish cutting the longitudinal edges of the respective panel.

21. The apparatus of claim 16 wherein the second detector is movable to a downstream position displaced from the cross cutting blade by a distance in the longitudinal direction substantially equal to the length of the respective panel.

22. A quilted material web comprising:

a multilayered web of quilted material having a length defining a longitudinal direction, a pair of opposite edges parallel to the longitudinal direction, and a width of at least 80 inches extending between the opposite edges and defining a transverse direction perpendicular to the edges and the longitudinal direction, the multilayered web being formed of a web layer of facing material of a facing side of the multilayered web, a web layer of backing material on a backing side of the multilayered web, and at least one web layer of fill material between the web layer of facing material and the web layer of backing material, the layers being joined by a plurality of series of chain stitch sequences each formed of a needle thread on the facing side and a looper thread on the backing side;

a plurality of rectangular panel areas spaced longitudinally along the multilayered web, each defined by a quilted pattern formed of a plurality of the series of chain stitch sequences that shape the facing and backing layers into contoured surfaces, each panel area having a longitudinal centerline parallel to the length of the multilayered web and a transverse centerline perpendicular to the longitudinal centerline, the centerlines of the respective panel areas having an intersection defining a center of the respective panel area; and

a plurality of machine readable center marks longitudinally spaced on the layer of backing material within the panels on the backing side of the multilayered web, one mark on each of the panels near the center thereof.

23. The quilted material web of claim 22 wherein each of the panel areas has one of the center marks thereon that is located substantially at the center thereof on the intersection of the centerlines thereof.

24. The quilted material web of claim 22 wherein each of the panel areas has a pair of side edges parallel to the edges of the multilayered web, one of the side edges of each of the panels being longitudinally aligned and equidistant from one of the edges of the multilayered web.

25. The quilted material web of claim 22 wherein the plurality of the panel areas have respective longitudinal centerlines that are longitudinally aligned with each other and have respective center marks located substantially on the respective longitudinal centerlines.

26. The quilted material web of claim 22 wherein the center marks of respective panel areas are longitudinally aligned on the multilayered web.

27. The quilted material web of claim 22 wherein the panel areas thereon include panel areas of more than one width, the panel areas having opposed side edges parallel to the edges of the multilayered web, the side edges of each of the panel areas being longitudinally aligned with each other and being spaced and equidistant from the edges of the multilayered web, first panel areas comprise a first width and respective first center marks located on respective longitudinal center lines of the first panel areas and other panel areas comprise a second width and respective second center marks transversely offset from the longitudinal center lines of the first panel areas.

28. A method of cutting a quilted panel from a quilted web of multilayered material that includes a facing layer, a backing layer and at least one filler layer between the facing layer and the backing layer, wherein the quilted web of multilayered material includes a rectangular panel area having a pattern quilted thereon, the panel area having a width extending transversely across the web between opposite longitudinal side edges of the panel area, a length extending longitudinally along the web between opposite transverse leading and trailing edges of the panel area, and a center equidistant from the opposite transverse ends and the opposite longitudinal ends of the panel area, the method comprising:

applying a machine readable mark to the backing layer of the quilted web of multilayered material within the panel area of the quilted web near the center of the panel area;

advancing the quilted web of multilayered material longitudinally along a path;

detecting the center mark on the advancing web at a known position along the path;

stopping the quilted material web in response to the detecting of the center mark; and

cutting the quilted web of multilayered material transversely along at least one of a transverse leading edge and a transverse trailing edge.

29. A method of claim 28 wherein:

the applying of the machine readable mark includes applying the mark to the backing layer at a quilting station of a quilting machine.

30. A method of claim 29 further comprising:

quilting the pattern on the web at the quilting station by stitching a plurality of series of chain-stitches on the panel area with a plurality of needles from the side of the web on which is the facing layer and a plurality of loopers from the side of the web on which is the backing layer; and

the applying of the mark includes applying the mark with a mark applicator mounted adjacent the loopers and under the control of the quilting machine.

31. A method of claim 29 wherein:

the quilting machine is situated in-line with a panel cutter that comprises means for detecting the mark and means for cutting the web; and

the web extends continuously from the quilting station to the panel cutter.

32. A method of claim 28 wherein the cutting comprises cutting the leading edge of the panel with a first cutter spaced along the path approximately one-half the length of the panel downstream from the known position.

33. A method of claim 32 wherein the first cutter is fixed at a longitudinal position and after cutting the leading edge, the method further comprising:

advancing the web downstream a distance equal to the length of the panel; and

cutting the trailing edge of the panel with the first cutter to sever the panel from the web.

34. A method of claim 32 wherein the first cutter is movable in a longitudinal direction and after cutting the leading edge, the method further comprises:

moving the first cutter upstream a distance equal to the length of the panel, and

cutting the trailing edge of the panel with the first cutter to sever the panel from the web.

35. A method of claim 32 wherein the cutting further comprises cutting the trailing edge of the panel with a second cutter spaced upstream along the path from the first cutter a distance approximately equal to the length of the panel to sever the panel from the web.

36. A method of claim 28 further comprising:

trimming the web longitudinally along the opposite side edges of the panel equidistant from the center of the panel area with a pair of slitting cutters on opposite sides of the web of multilayered material, longitudinally trimming the web along the opposite side edges of the panel equidistant from the center of the panel area.

37. A method of claim 28 further comprising:

locating a length detector at a position displaced a distance substantially equal to the length of the panel downstream from a cross cutter situated along the path;

advancing the web downstream;

detecting the presence of the advancing web with the length detector; and

in response to the detecting of the advancing web by the length detector, cutting the trailing edge of the panel area to sever the panel from the web.

38. A method of claim 28 further comprising:

moving a camera to a position longitudinally displaced upstream from a cross cutter by a distance substantially equal to one-half the length of the panel;

the detecting of the center mark includes detecting the mark with the camera so positioned; and

the cutting of the quilted web includes cutting the quilted web of multilayered material transversely with the cross cutter.

39. A method of claim 38 wherein:

the camera has a field of view that is small relative to the panel area;

the applying of the mark includes applying the mark offset from the center of the panel area by a distance within the field of view of the camera.

40. A method of claim 28 further comprising:

in response to the detecting of the mark, locating a pair of trim blades at positions on opposite sides of the center of the panel area a distance substantially equal to one-half the width of the panel; and

trimming the quilted material web longitudinally to form two opposed parallel side edges of the panel that are equidistant from the center of the quilting pattern and separated by a distance substantially equal to the width of the panel.

41. A method of cutting a quilted material web having quilted patterns into panels, each of the panels having a width and a length with a respective quilted pattern disposed therein, the method comprising:

applying center marks to the quilted material web, the center marks identifying centers of respective quilted patterns;

providing a cross cutting apparatus for cutting end edges of respective panels;

providing an edge detector for detecting end edges of respective panels;

providing a trimming apparatus for cutting side edges of the panels;

providing a center detector for locating the centers of the quilted patterns by detecting the center marks;

moving the center detector to a position longitudinally displaced from the cross cutting apparatus by a distance substantially equal to one-half the length of a panel;

moving the quilted material web in the longitudinal direction;

detecting a position of a center mark;

stopping motion of the quilted material web in response to detecting the position of the center mark;

transversely centering the trimming apparatus relative to the center of the panels in response to the detecting of the position of the center mark;

operating the cross cutting apparatus to form a first end edge of the panel;

moving the length detector to a position longitudinally displaced from the center mark by a distance substantially equal to the length of the panel;

moving the quilted material web in the longitudinal direction;

operating the trimming apparatus to simultaneously longitudinally cut opposed side edges of the panel substantially equidistant from the center of the panel;

detecting the first end edge with the length detector;

stopping motion of the quilted material web in response to detecting the first end edge;

operating the cross cutting apparatus to form a second end edge of the panel, the first end edge and the second end edge being equidistant from the center of a panel.

42. A method of claim 41 wherein the quilted pattern is formed of chain-stitch sequences having a finish side on one side of the quilted material web, and the applying the center marks includes applying the marks to the side of the web that is opposite to the finish side of chain stitches forming the pattern.

43. A method of claim 42 wherein the applying of the marks includes printing the center marks on the side of the web opposite said finish side.

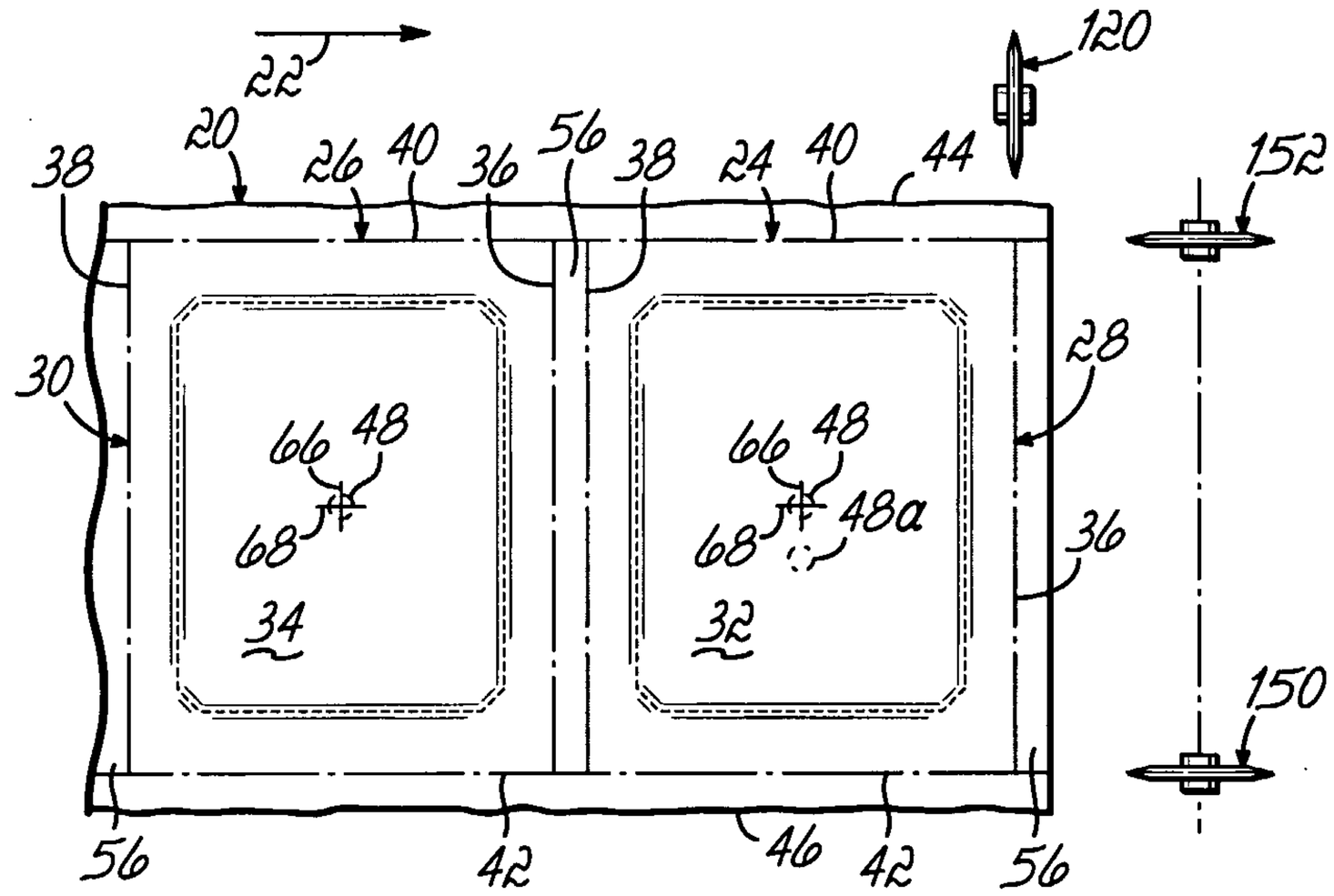

FIG. 1

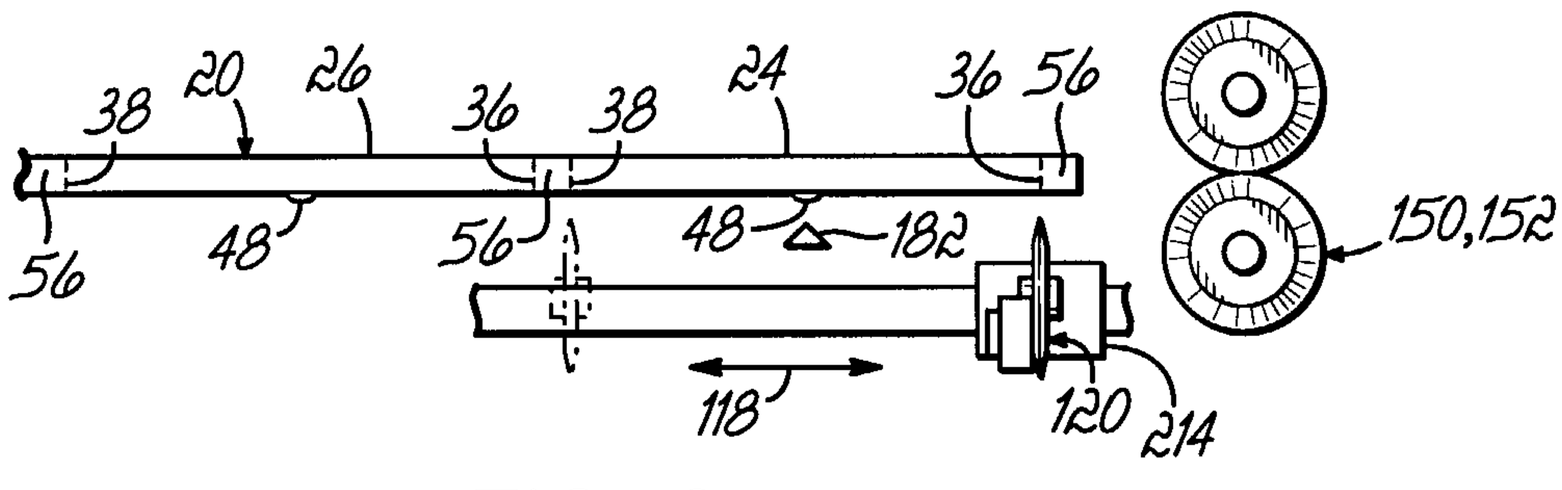

FIG. 6

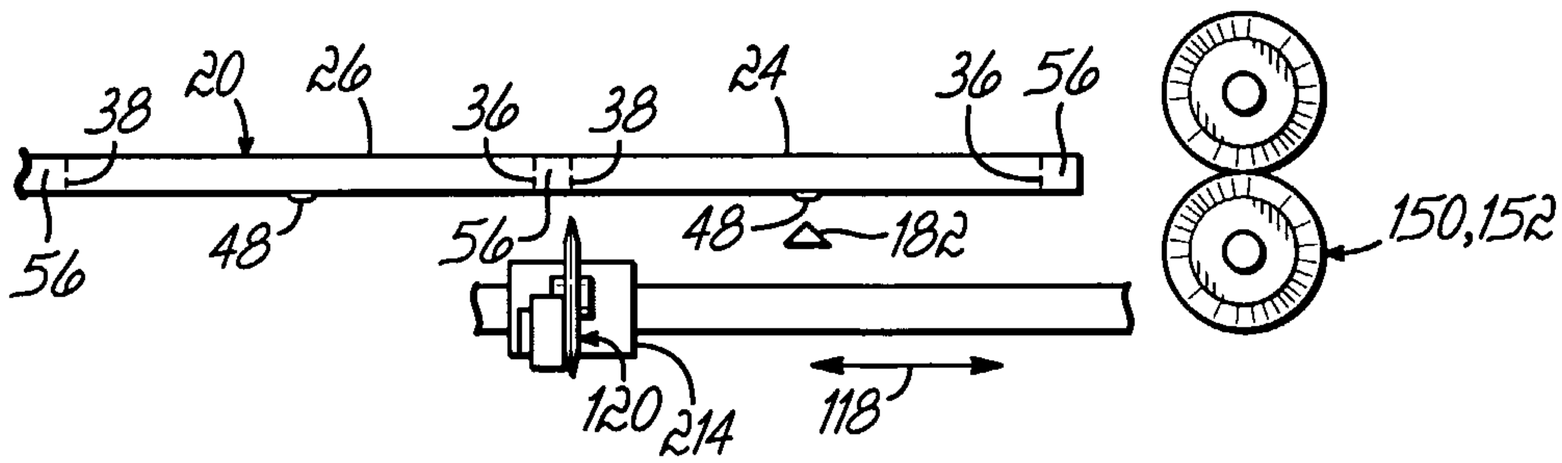

FIG. 7

FIG. 8

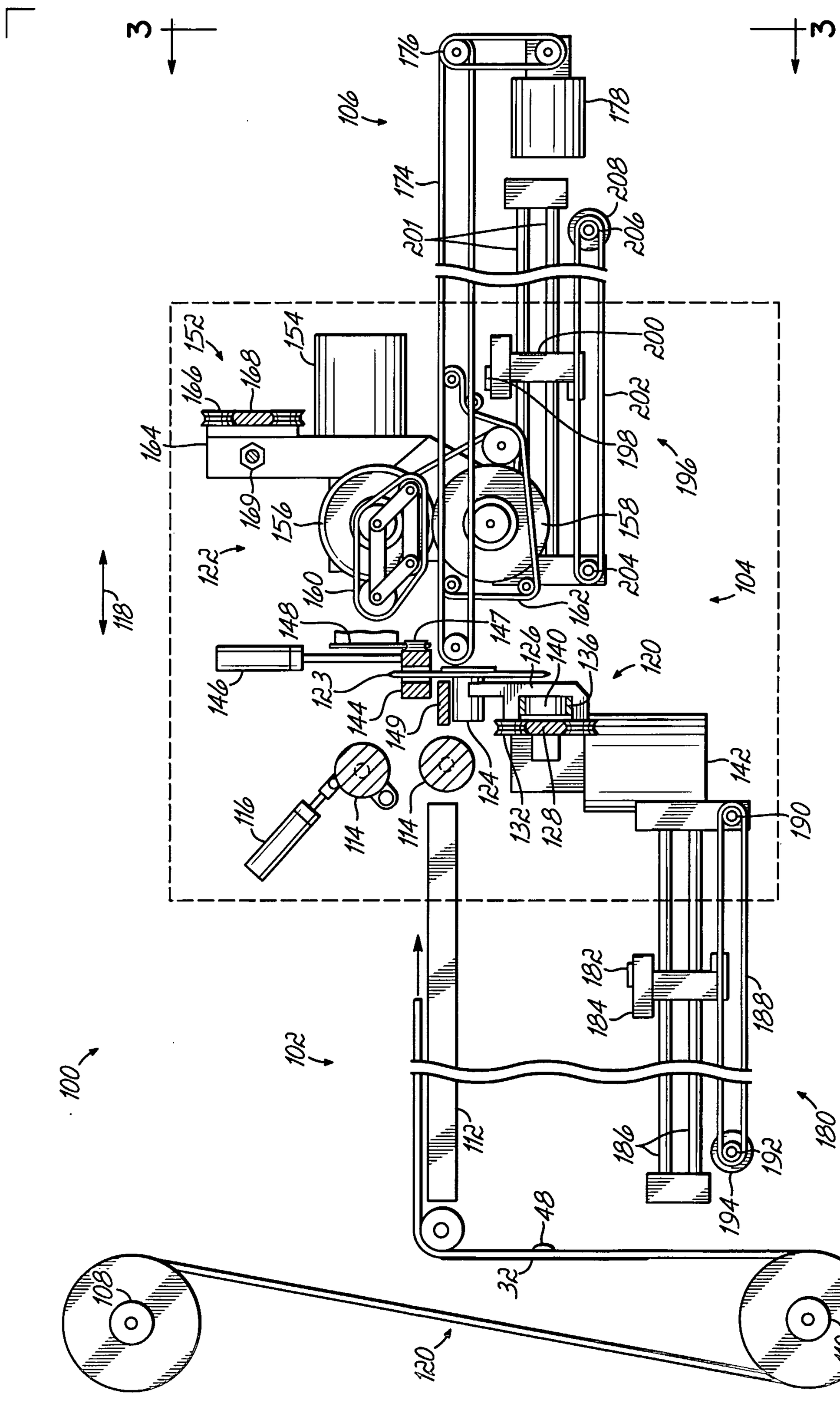
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FIG. 2

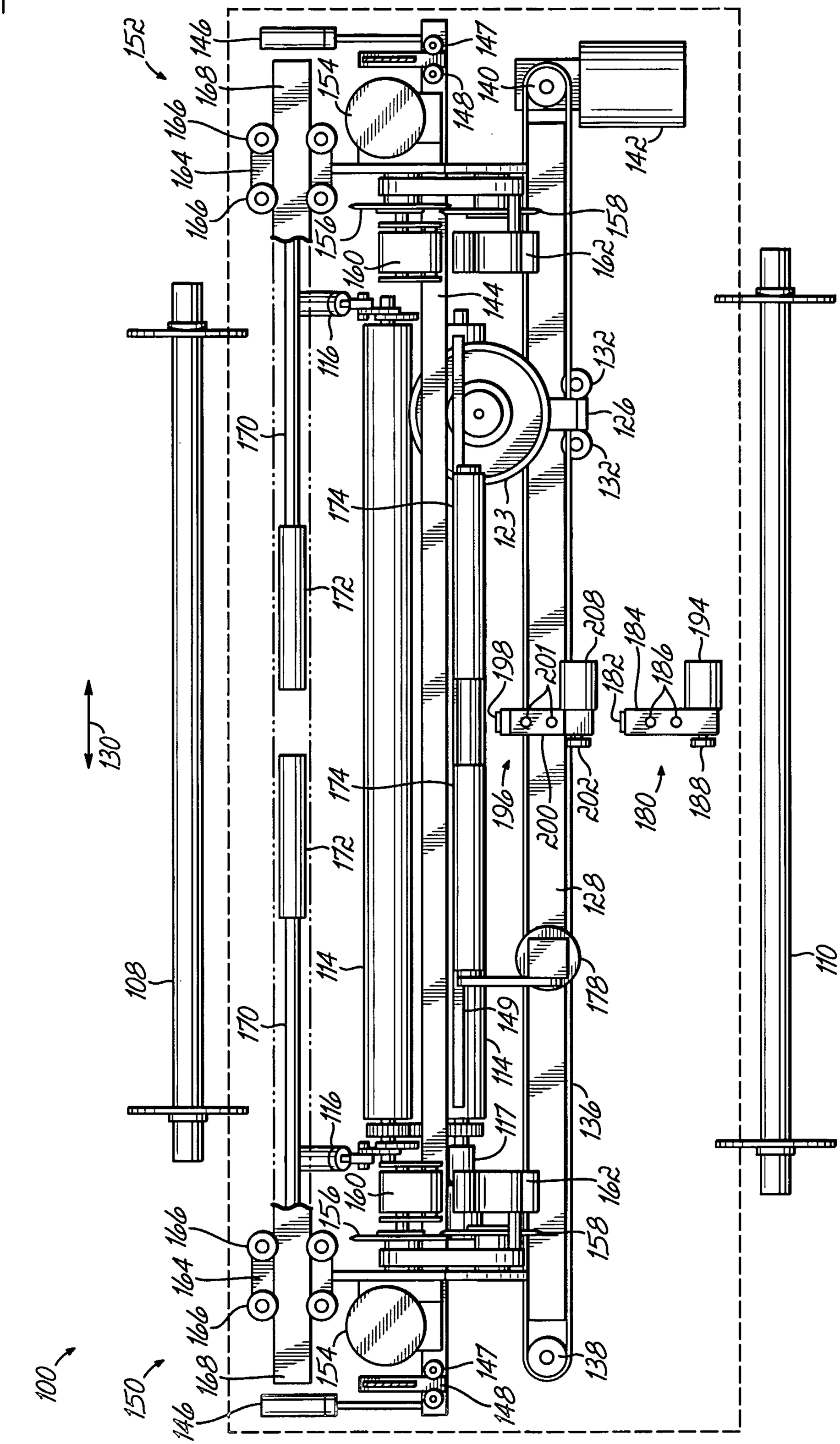
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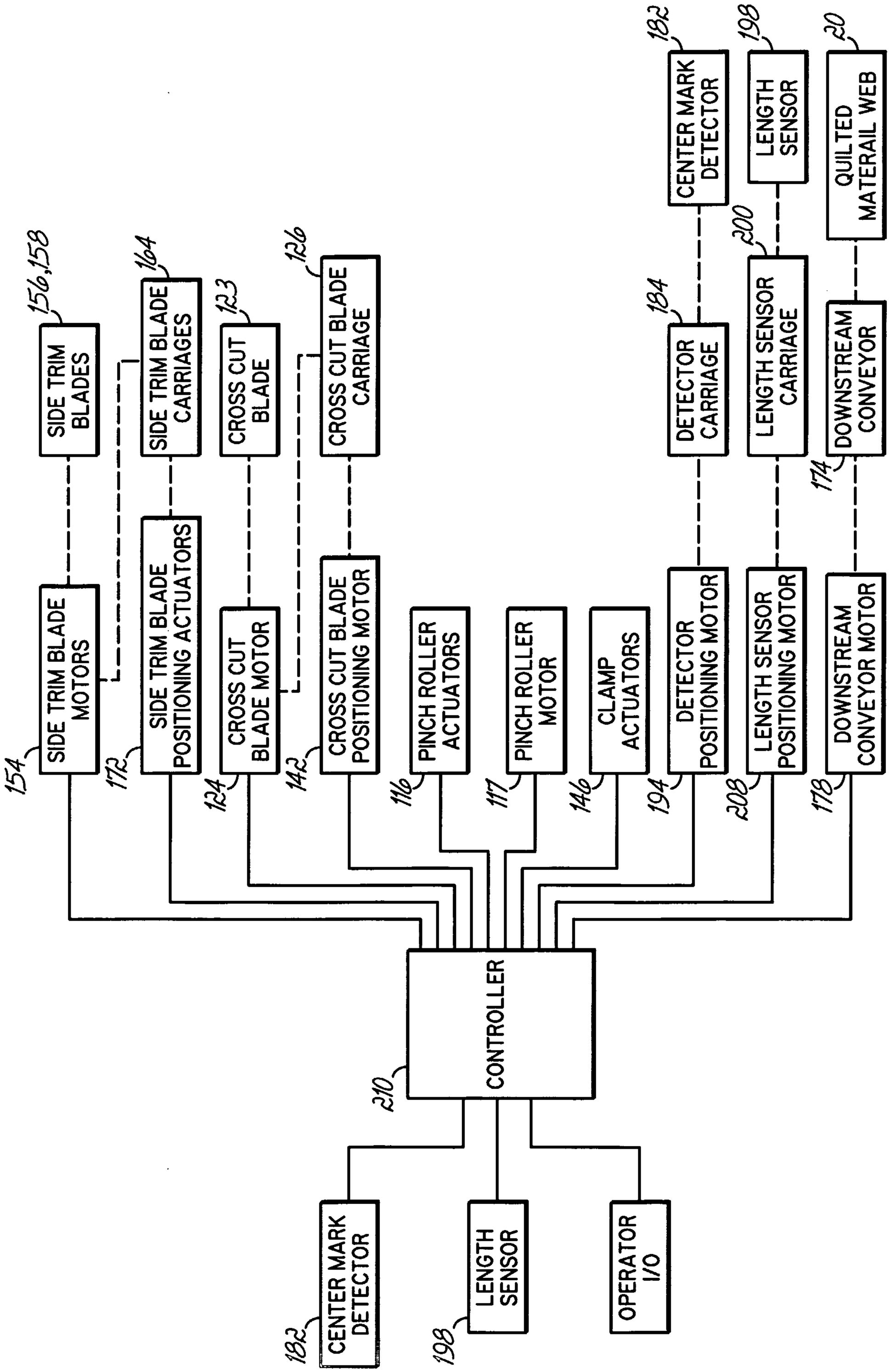
FIG. 3


182
CENTER MARK DETECTOR
198
LENGTH SENSOR
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QUILTED MATERAIL WEB
156,158
SIDE TRIM BLADES
164
SIDE TRIM BLADE CARRIAGES
123
CROSS CUT BLADE
126
CROSS CUT BLADE CARRIAGE
184
DETECTOR CARRIAGE
200
LENGTH SENSOR CARRIAGE
174
DOWNSTREAM CONVEYOR
154
SIDE TRIM BLADE MOTORS
172
SIDE TRIM BLADE POSITIONING ACTUATORS
124
CROSS CUT BLADE MOTOR
142
CROSS CUT BLADE POSITIONING MOTOR
116
PINCH ROLLER ACTUATORS
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PINCH ROLLER MOTOR
146
CLAMP ACTUATORS
194
DETECTOR POSITIONING MOTOR
208
LENGTH SENSOR POSITIONING MOTOR
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DOWNSTREAM CONVEYOR MOTOR
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CONTROLLER
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CENTER MARK DETECTOR
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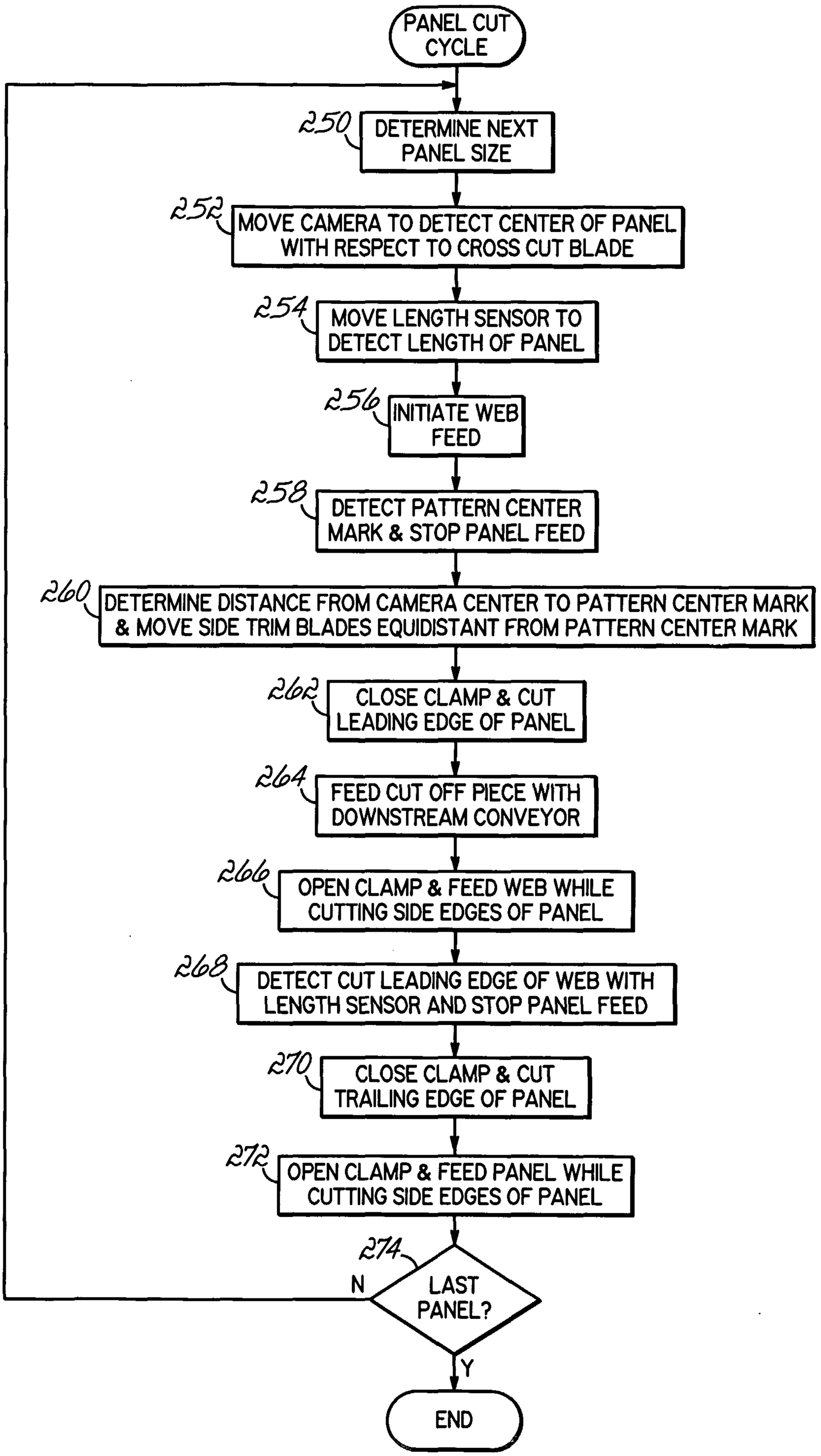
LENGTH SENSOR
OPERATOR I/O

FIG. 4


PANEL CUT CYCLE
250
DETERMINE NEXT PANEL SIZE
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MOVE CAMERA TO DETECT CENTER OF PANEL WITH RESPECT TO CROSS CUT BLADE
254
MOVE LENGTH SENSOR TO DETECT LENGTH OF PANEL
256
INITIATE WEB FEED
258
DETECT PATTERN CENTER MARK & STOP PANEL FEED
260
DETERMINE DISTANCE FROM CAMERA CENTER TO PATTERN CENTER MARK & MOVE SIDE TRIM BLADES EQUIDISTANT FROM PATTERN CENTER MARK
262
CLOSE CLAMP & CUT LEADING EDGE OF PANEL
264
FEED CUT OFF PIECE WITH DOWNSTREAM CONVEYOR
266
OPEN CLAMP & FEED WEB WHILE CUTTING SIDE EDGES OF PANEL
268
DETECT CUT LEADING EDGE OF WEB WITH LENGTH SENSOR AND STOP PANEL FEED
270
CLOSE CLAMP & CUT TRAILING EDGE OF PANEL
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OPEN CLAMP & FEED PANEL WHILE CUTTING SIDE EDGES OF PANEL
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LAST PANEL?
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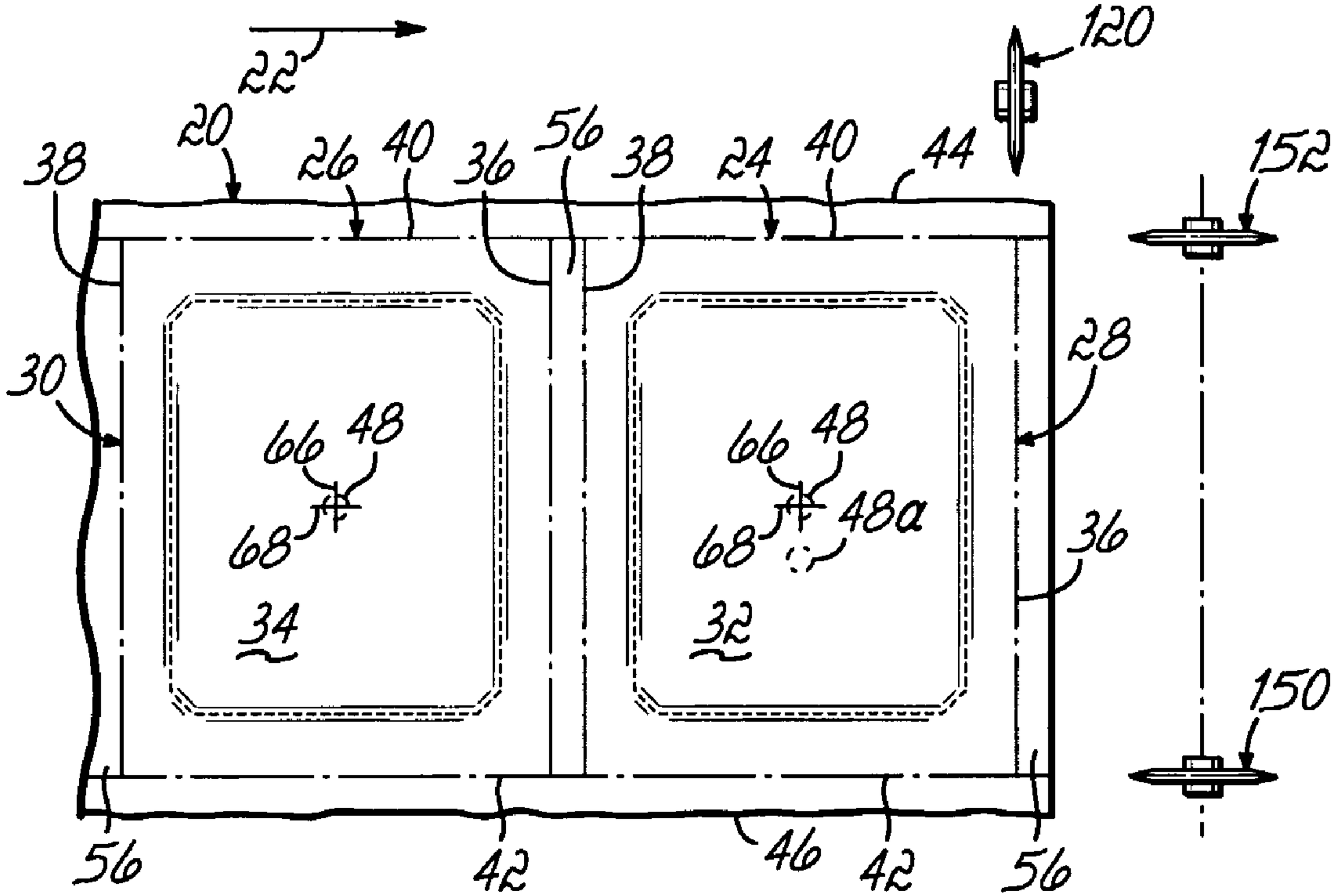
END

FIG. 5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