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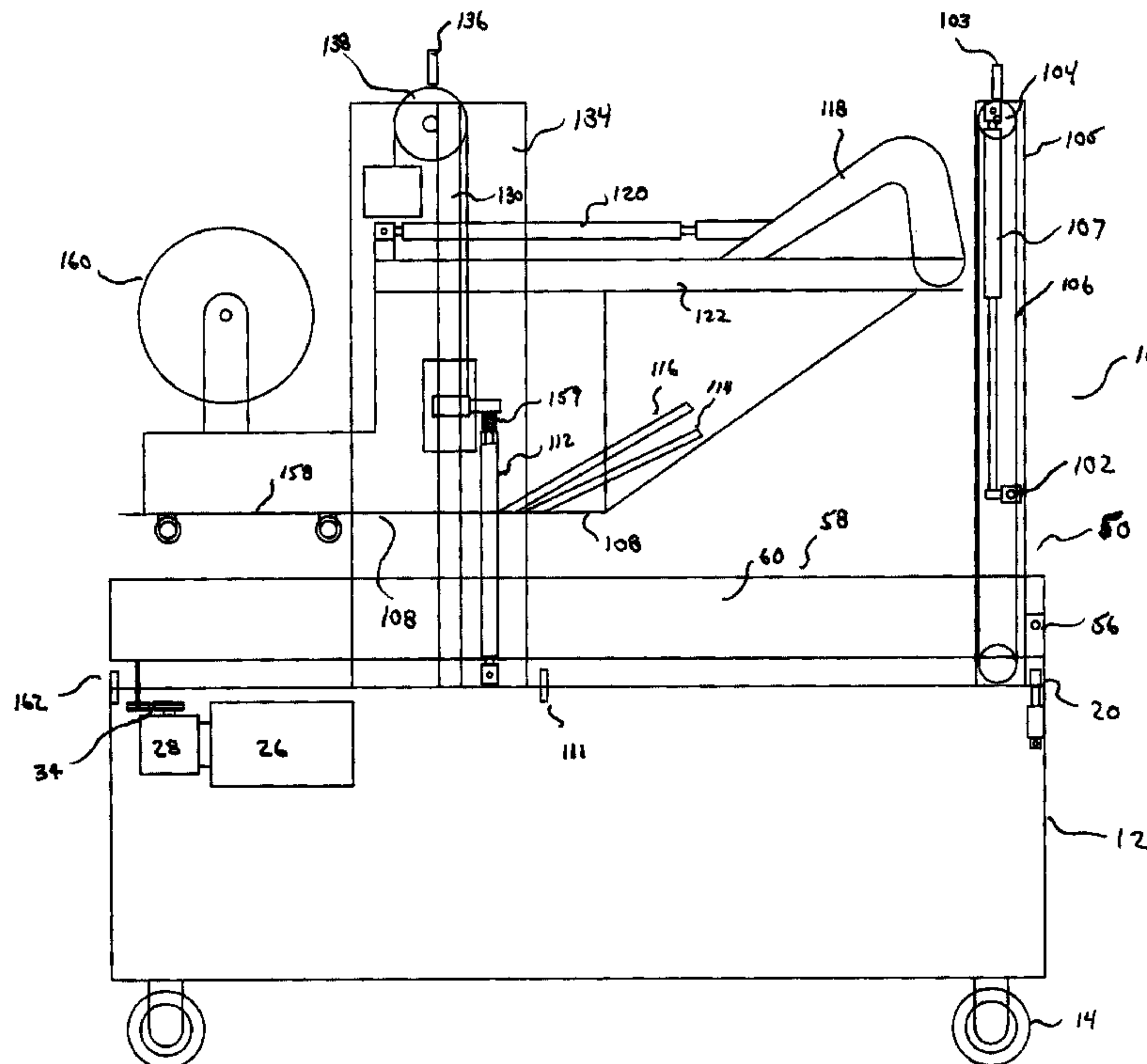
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(54) Titre : SCELLEUSE DE BOITES ALEATOIRE ENTIEREMENT AUTOMATIQUE

(54) Title: FULLY AUTOMATIC RANDOM BOX SEALER



**Title of the Invention****FULLY AUTOMATIC RANDOM BOX SEALER****Field of the Invention**

This invention relates to box or case sealers for closing the open ends of cardboard boxes or cartons.

**Background of the Invention**

In the packaging industry, many products are packed in cardboard boxes or cartons for shipping. Often, one end of the box, namely the bottom, is sealed shut before the box is filled, and after the box is filled, the open top end of the box usually has end and side flaps that are folded inwardly and downwardly. The box can be sealed by applying glue to the inside of the mating surfaces of the folded flaps prior to them being folded shut, or by applying tape to the outside of the flaps after they have been folded shut.

In many cases, the boxes are uniform in size, so providing apparatus that will fold the flaps and apply adhesive or tape thereto is not particularly difficult to do. The apparatus can be adjusted to suit the known width and the height of the boxes and there is usually no problem running the boxes through the case sealer once it has been adjusted properly.

However, sometimes the boxes are of different sizes coming down the same conveyor line. In these instances, a random case sealer is required, wherein the apparatus for folding the box flaps and applying adhesive or tape thereto adjusts automatically to suit the size of the box.

In prior art random case sealers, various sensors have been used to try to determine the exact size or position of the boxes entering the case sealer, and numerous actuators or other adjust mechanisms together with suitable control devices, have been used to adjust the position of the various folding and sealing components to suit the position and size of the box being sealed. A difficulty with the prior art devices, however, is that the boxes are often misshaped or underfilled or overfilled, so that they are not uniform in shape, so the sensors often cannot determine the optimum position adjustments. The result is that the boxes get jammed in the apparatus shutting down the packaging line.

The jamming problem was largely overcome by the box sealer apparatus described in United States patent No. 5,685,814 issued to Tuan Vinh Le. In this patent, the folding and sealing components of the apparatus are gravitationally biased and positioned by contact with the actual box being sealed, so any variations in the shape of the box are automatically accommodated. Sometimes, however, the cardboard or box board used to make the cartons is not as thick or strong as it should be, or the boxes are underfilled, in which case the boxes can still be deformed during the sealing operation with undesirable results.

**Summary of the Invention**

In the present invention, the folding and sealing components of the apparatus are positioned by contact with the actual box being sealed, thus accommodating non-uniformity of the boxes, yet the forces on the box components are controlled, so as to avoid the application of excessive force to the boxes.

According to the invention, there is provided a case sealer comprising a frame including a low friction conveyor having an entrance portion and a longitudinal axis along which boxes entering the case sealer are moved. A measuring stage is located adjacent to the entrance portion and has a pair of longitudinal, spaced-apart lateral conveyors for receiving boxes entering the case sealer. Linking means are provided for linking the lateral conveyors together for simultaneous inward and outward movement. The case sealer also includes entry sensor means for sensing a box entering the measuring stage. The case sealer further includes width sensing and actuation means responsive to the entry sensor means for moving the lateral conveyors from an outward position inwardly to a box contacted position. A proximity sensor is located in the measuring stage for measuring the height of a box therein. The width sensing and actuation means also include means for moving the lateral conveyors to the width of a box. A flap folding stage has a pair of longitudinal, spaced-apart lateral conveyors. A floating head is spaced above the lateral conveyors. The floating head includes an entrance ramp adapted to engage and fold inwardly a forward end flap on a box. Means are coupled to the proximity sensor for lifting the floating head upwardly to the box height, which allows the entry ramp to fold the box forward flap inwardly. The floating head includes a pivoting arm assembly pivotable downwardly after the box passes there under to fold inwardly a rearward end flap on the box. The floating head further includes diverging side bars for engaging and folding inwardly side flaps on the box after the rearward end flap has been folded inwardly. A seal dispensing platform is located above the lateral conveyors. The seal dispensing platform includes holding means for holding box flaps shut and means for locating the holding means adjacent to the box flaps, the seal dispensing platform being adapted to mount a seal dispenser thereon for sealing the box flaps shut.

### **Brief Description of the Drawings**

Preferred embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a side elevational view of a preferred embodiment of a case sealer according to the present invention;

Fig. 2 is a plan view of the low friction conveyor used in the case sealer of Fig. 1;

Fig. 3 is a plan view of the lateral conveyors and means for linking them together in the case sealer of Figs. 1 and 2;

Fig. 4 is an elevational view similar to Fig. 1, but with components removed for the purposes of clarity, illustrating the operation of the pivoting arm assembly;

### **Detailed Description of the Preferred Embodiments**

Referring to the drawings, a preferred embodiment of a case sealer according to the present invention is generally indicated in the drawings by reference numeral 10. Case sealer 10 includes a frame 12 mounted on castors 14, so that the case sealer is easily transportable or movable from one packaging line to another. Retractable feet (not shown) may be threadably mounted in frame 12 to engage the floor and make case sealer stationary, if desired. Frame 12 has a longitudinal axis 18 (see Fig. 2) which indicates the direction in which boxes or cartons or cases travel to be closed and sealed shut in case sealer 10.

Case sealer 10 is normally located adjacent to a packaging line (not shown) to close and seal, one at a time, filled boxes received from such a packaging line. However, boxes or cartons could be manually placed on case sealer 10 if desired. Where the cases are received from a packaging line, a gate mechanism 20 can be provided to space the cases apart prior to being closed and sealed, as will be described further below. However, the gate mechanism could be provided on the end of the packaging line rather than on case sealer 10, if desired.

Case sealer 10 includes a low friction conveyor 22 which has a plurality of spaced-apart, transverse, free-wheeling rollers 24, although any other type of low friction conveyor could be used in case sealer 10. Rollers 24 support the boxes thereon to be sealed in case sealer 10.

Boxes that are ready to enter case sealer 10 are normally held back by the gate mechanism 20. When it is desired that the first box on a packaging line enter case sealer 10, gate mechanism 20 is lowered and the packaging line conveyor feeds a box to case sealer 10 causing the first box to be moved on to an entrance portion 50 of conveyor 22. When the box to be sealed enters entrance portion 50, an entry sensor or a limit switch 56 senses that the front end of the box has passed that point, and a pair of longitudinal, laterally spaced-apart conveyors 58 and 60, move inwardly to contact the box entering case sealer 10 and move it along axis 18. Limit switch 56 is an entry sensor means, and it could be any type of proximity sensor other than a limit switch per se.

Referring next to Figs. 3 and 4, first lateral conveyors 58 and 60 are slidably mounted on transverse shafts 62 and 64 for inward and outward movement to adjust for the width of a box being sealed in case sealer 10. Lateral conveyors 58 and 60 are linked together for equal movement inwardly and outwardly to match the width of the box passing therethrough. The linking means includes a continuous belt 65 having a pair of belt portions 66 and 68 (see Fig. 3). Each belt portion has one respective end 70, 72 attached to the frame of lateral conveyor 60 at a fixed mount 74, and a second opposed respective end 76, 78 attached to the frame of lateral conveyor 58 at a fixed mount 80. Sheaves 82 and 84 are rotatably mounted in frame 12, so that the belt portion 66 passes around sheave 82 and belt portion 68 passes around sheave 84, and as a result, when lateral conveyor 58 moves outwardly away from the longitudinal center line 18 of case sealer 10, belt portion 68 acting through fixed mount 74 also causes lateral conveyor 60 to move outwardly away from the longitudinal center line of case sealer 10. Similarly, when

lateral conveyor 58 moves inwardly towards the center line 18 of case sealer 10, belt portion 66 acting through fixed mount 74 also causes lateral conveyor 60 to move inwardly towards the center line of the case sealer. Lateral conveyor 58 is moved inwardly and outwardly by a pneumatic cylinder 86 mounted cross member of frame 12 and acting through a spring mount 88 attached to the frame of lateral conveyor 58. Spring mount 88 provides some flexibility for the relative positioning of lateral conveyors 58 and 60 to accommodate some non-uniformity in the width of the boxes being sealed in case sealer 10. The belt portions 66 and 68 pass around sheaves 82 and 84 in a U-shaped fashion. Chains and sprockets could be used in place of belts and sheaves. Other devices, such as racks and a pinion could also be used to link the lateral conveyors together, so that outward and inward movement of one lateral conveyor causes respective outward and inward movement of the other lateral conveyor.

The normal starting position of lateral conveyors 58, 60 is in the outermost position, as seen in Fig. 3. When an incoming box hits entry sensor 56, cylinder 86 causes lateral conveyors 58, 60 to move inwardly to contact the box. Lateral conveyors 58 and 60 have respective conveyor belts 90 and 92 to move a box therebetween. If a box traveling between lateral conveyors 58 and 60 is off center, it will hit one of the lateral conveyor belts 90 and 92 first, and this conveyor belt will move the box over toward the center until it contacts the other of the lateral conveyor belts, and thus be centered.

Lateral conveyors 58 and 60 also have centering sensors 96 and 98 mounted just above their respective conveyor belts 90 and 92. Centering sensors 96 and 98 are pivotably mounted bars that activate limit switches behind them. When a box hits one of the centering sensors 96 or 98, the sensor retracts opening its limit switch, but nothing happens until the box is moved over toward the center of the case sealer, and then it hits the other centering sensor. When both the centering sensors 96 and 98 are engaged by the box, the box is centered. The respective limit switches in sensors 96 and 98 are connected in parallel and when both switches are closed, this causes the lateral conveyors 58, 60 to stop moving inwardly. This also causes a signal to be recorded by a logic controller (not shown). Lateral conveyors 58, 60 then move the box along in case sealer 10. The speed of lateral conveyors 58, 60 is faster than the boxes are traveling on the packaging line conveyor that feeds case sealer 10, so a gap opens up between the box between lateral conveyors 58, 60 and the next following box. When the lower back lateral edge of the box passes entry sensor 56, gate 20 is raised to hold back the next box until the box presently between lateral conveyors 58, 60 clears those lateral conveyors and they open up again.

Referring next to Figs. 5 and 6, when a box enters case sealer 10 and hits entry sensor 56, a horizontal proximity sensor 100 and a vertical proximity sensor 103 are activated. These proximity sensors are of the inductive type that counts the teeth on sprocket. The sensor 100 is mounted on the frame 12 to count the teeth on the sheave 82 which attached to the belt 65 driven by the cylinder 86. The sensor 103 mounted on an upright post 105 to count the teeth on the sprocket 104 which turning by the chain 106 attached to the vertical cylinder 107. This cylinder is activated by photo-electric eye 102. Proximity sensors 100 and 103 send signals to the logic controller controlling case sealer 10 and

these signals are used to measure the width and height of the box entering lateral conveyors 58, 60. The height of the box after the flaps are closed down is equal the height of the box from the bottom, means from the conveyor 22 to the top of the side flap subtract  $\frac{1}{2}$  the width of the box. The area of case sealer 10 including lateral conveyors 58, 60 and proximity sensors 100 and 103 is called the measuring stage 25 of case sealer 10, because its primary function is to measure the height and width of the boxes as they enter case sealer 10. Entry sensor 56 and cylinder 86, together with linking belts 65, centering sensors 96, 98 and proximity sensor 100, constitute width sensing and actuation means in the preferred embodiment.

As the box continues to advance through case sealer 10 until the leading top flap of the box engages an upwardly inclined entry ramp 106 (see Figure 1) mounted in a floating head 108 spaced above the lateral conveyors 58 and 60. Before this happens, however, the controller actuates another pneumatic cylinder 112 to raise floating head 108 upwardly to the calculated box height. Proximity sensor 136 counts pulses from sprocket teeth 138 as the head moves upwardly to the desired height as calculated from the measurement stage 25. Incline entrance ramp 106 will fold down the leading flap of the box. As the box advances further, upwardly and outwardly disposed side bars 114 and 116 engage the box side flaps and fold them inwardly. Before the box side flaps are folded down, however, the trailing end flap of the box is folded downwardly by a pivot arm 118 actuated by another pneumatic cylinder 120. Pivot arm 118 is activated when the box hits another sensor point or limit switch 111. This limit switch may be replaced by the timer or the distance counting when the leading box blocks the photo-electric eye 56. Pivot arm 118 and pneumatic cylinder 120 are part of a pivot arm assembly 122 mounted in floating head 108.

Floating head 108 includes a transverse member (not shown) attached at its opposed distal ends to slides mounted for vertical sliding movement on shafts 130 in towers 134. Cylinders 112 mounted in towers 134 are connected to the slides to move the floating head 108 up and down, as mentioned above. The cylinder 112 mounted in tower 134 through spring mounts 159 to provide some flexibility for the relative positioning of floating head 108 and to accommodate some non-uniformity in the height of the boxes (up to 3 inches) such as may be caused by overfilling. Tower 134 further includes counterweight devices 136 attached to the slides to offset the weight of floating head 108. Counterweight devices 136 could be gravitational devices or coil spring type devices, as desired.

Floating head 108 has a seal dispensing platform 158 on which mounted a tape head 160. When the box passes under seal dispensing platform 158 and the rear corner of the box passes another sensor point or limit switch 162, the lateral conveyors 58 and 60 move outwardly.

As seen best in Figs. 1 and 3, lateral conveyors 58, 60 are driven by a motor 26 and gear box 28 driving a series of sprockets 34 and drive chains 30.

In the operation of case sealer 10, the case sealer can be made to operate in several different modes as selected by a control box (not shown) containing the logic controller for case sealer 10. Where the boxes are all of the same height, width and length, the gate mechanism 20 can be opened at regular intervals. As mentioned above, lateral conveyors 58 and 60 are moving faster than the feeding conveyor, so a space opens up for the gate 20 can pop-up to stop the next box from coming to the sealer 10 to provide a gap between the boxes of about 12 inches to allow the box rear flap to be folded down by pivot arm 118. The box can then be sealed by the floating sealing head 158 while another box is entering lateral conveyors 58 and 60 to have its flaps folded down by floating head 108. In this mode of operation, after the first box enters measuring stage 25, the height and width of the boxes being sealed are known, so lateral conveyors 56, 60 and the height of floating heads 108 can be set and not moved thereafter.

In a second mode of operation where the boxes vary in length, width and height between about 8 and 24 inches the gate mechanism 20 is not lowered to let the next box enter the case sealer until the previous box has passed limit switch 162 to reset the sealer. Reset means the floating sealing head 108 and the lateral conveyors 58, 60 are back to home position ready to receive the next box at the sealer entry.

In a third mode of operation, where the boxes are vary in width but the height is the same, after the first box enter the measuring state 25 the height of the boxes being sealed are known, so the floating sealing head 108 can be set and not moved thereafter. The lateral conveyors 58, 60 are still moving inwardly and outwardly to suit the exact size of the box. In this operation mode only one box is in the sealer at a time.

In a fourth mode of operation, where the boxes vary in height but the width is the same, after the first box enters the measuring stage 25 the width of the boxes being sealed is known, so the lateral conveyors 58, 60 can be set and not moved thereafter. The floating sealing head will still move downwardly and upwardly to suit the exact size of the box. In this operation mode only one box is in the sealer at a time.

Having described preferred embodiments of the invention, it will be appreciated that various modifications may be made to the structures described above. For example, instead of using pneumatic cylinders to control the various components of the case sealers, it will be appreciated that hydraulic devices or electric motors or solenoids could be used as well. Programmable logic controllers are preferred for controlling the various components of the case sealers, but other types of controls could be used as well, such as simple timers. Limit switches have been described as the preferred position sensors, but other devices such as photoelectric, infrared or other motion sensors or proximity sensors could be used as well. Alternatively, the logic controller could provide the necessary inputs that are provided by limit switches 111 and 162.

As will be apparent to those skilled in the art in light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the spirit or scope thereof.

Application number / numéro de demande: 2446802

Figures: 4 photos

Pages: \_\_\_\_\_

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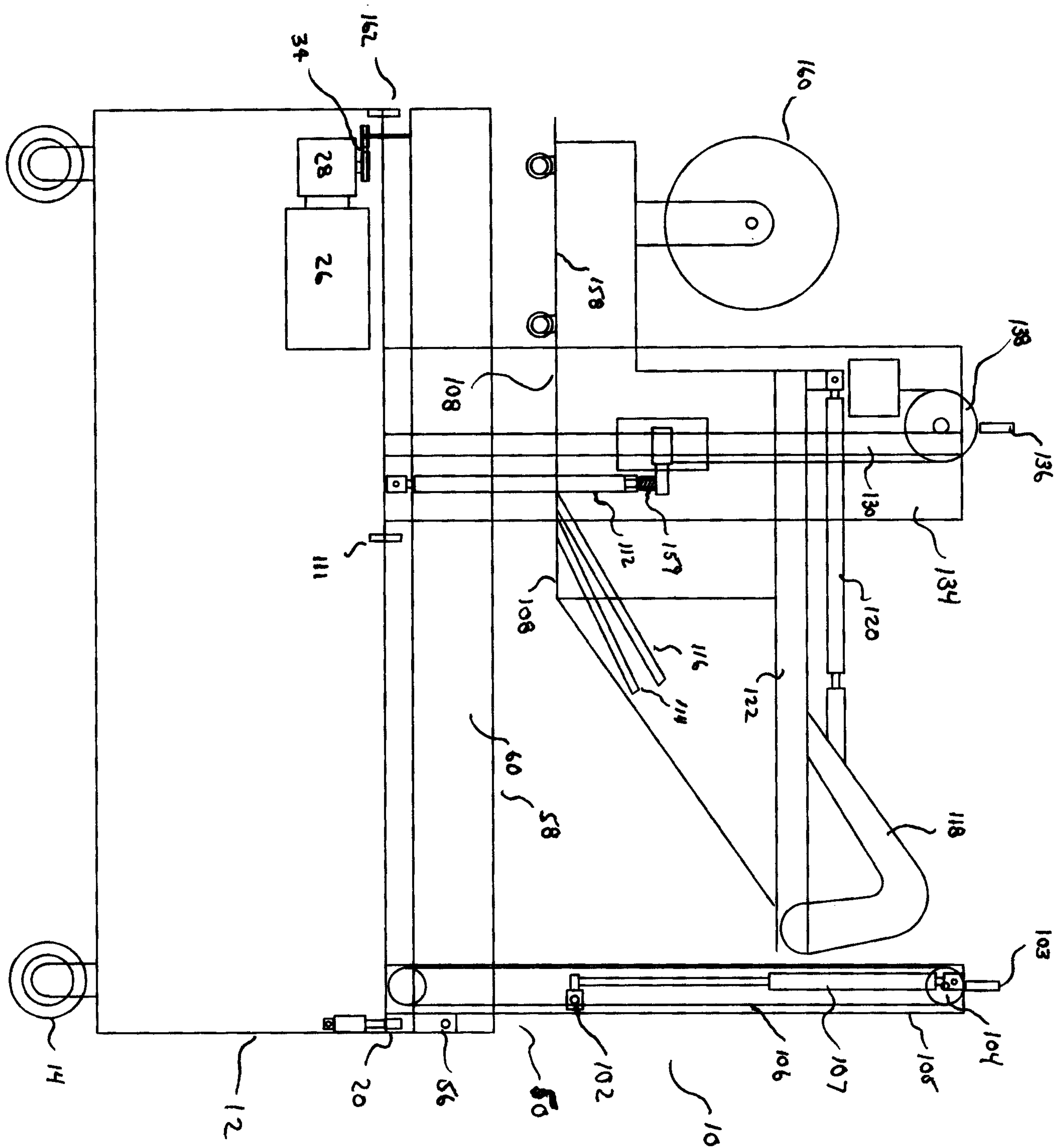


FIGURE 1

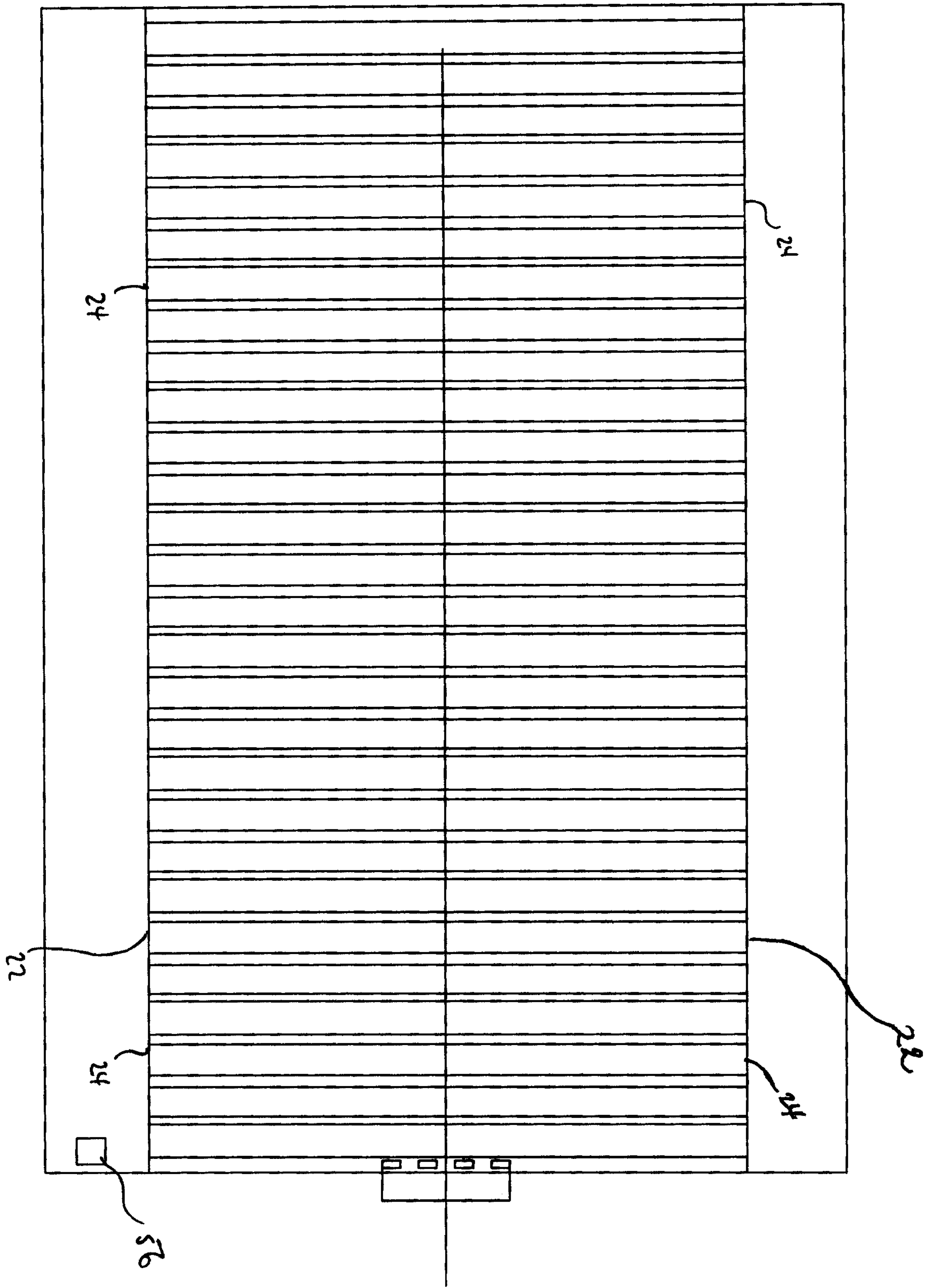


FIGURE # 2

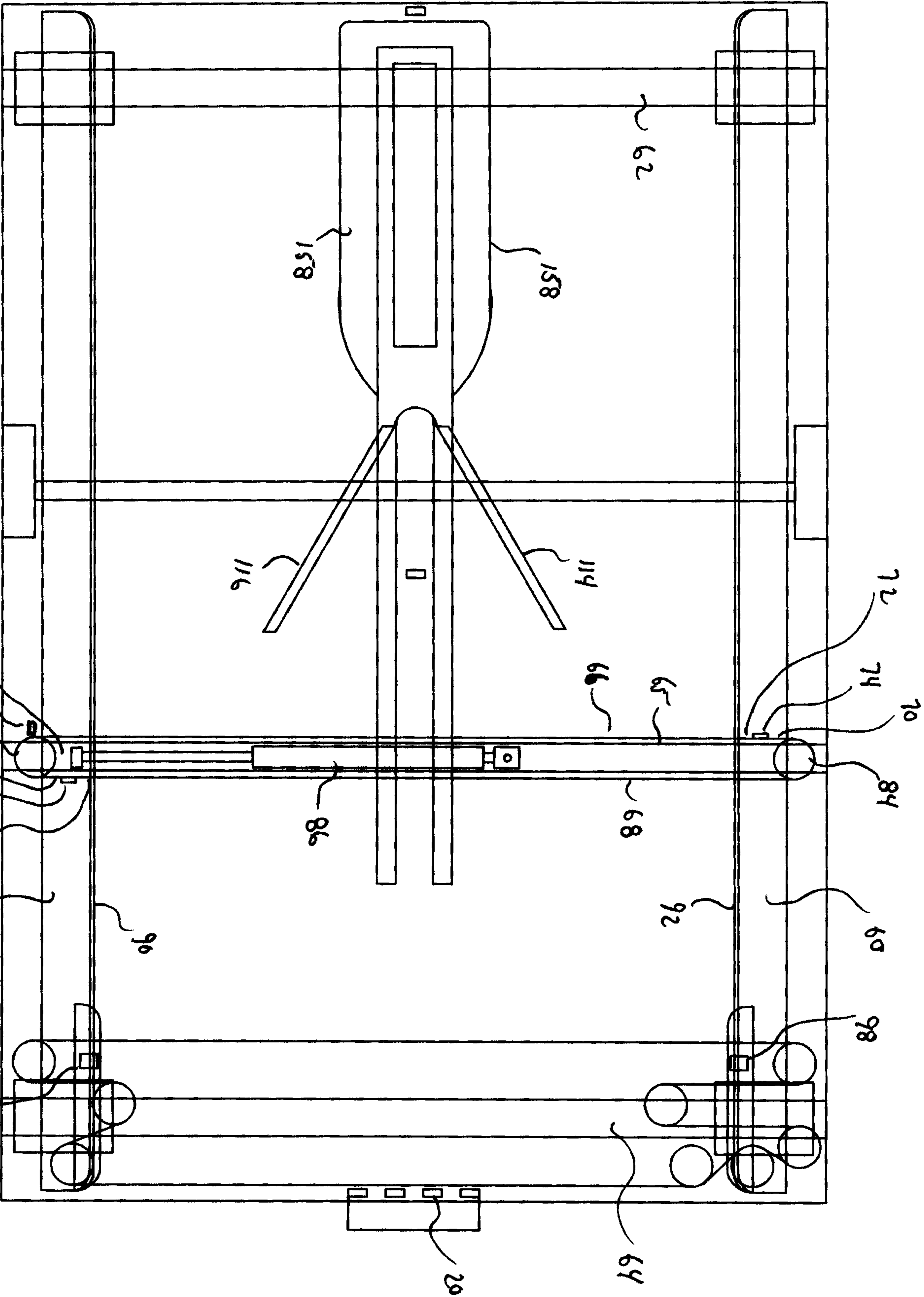


FIGURE 3

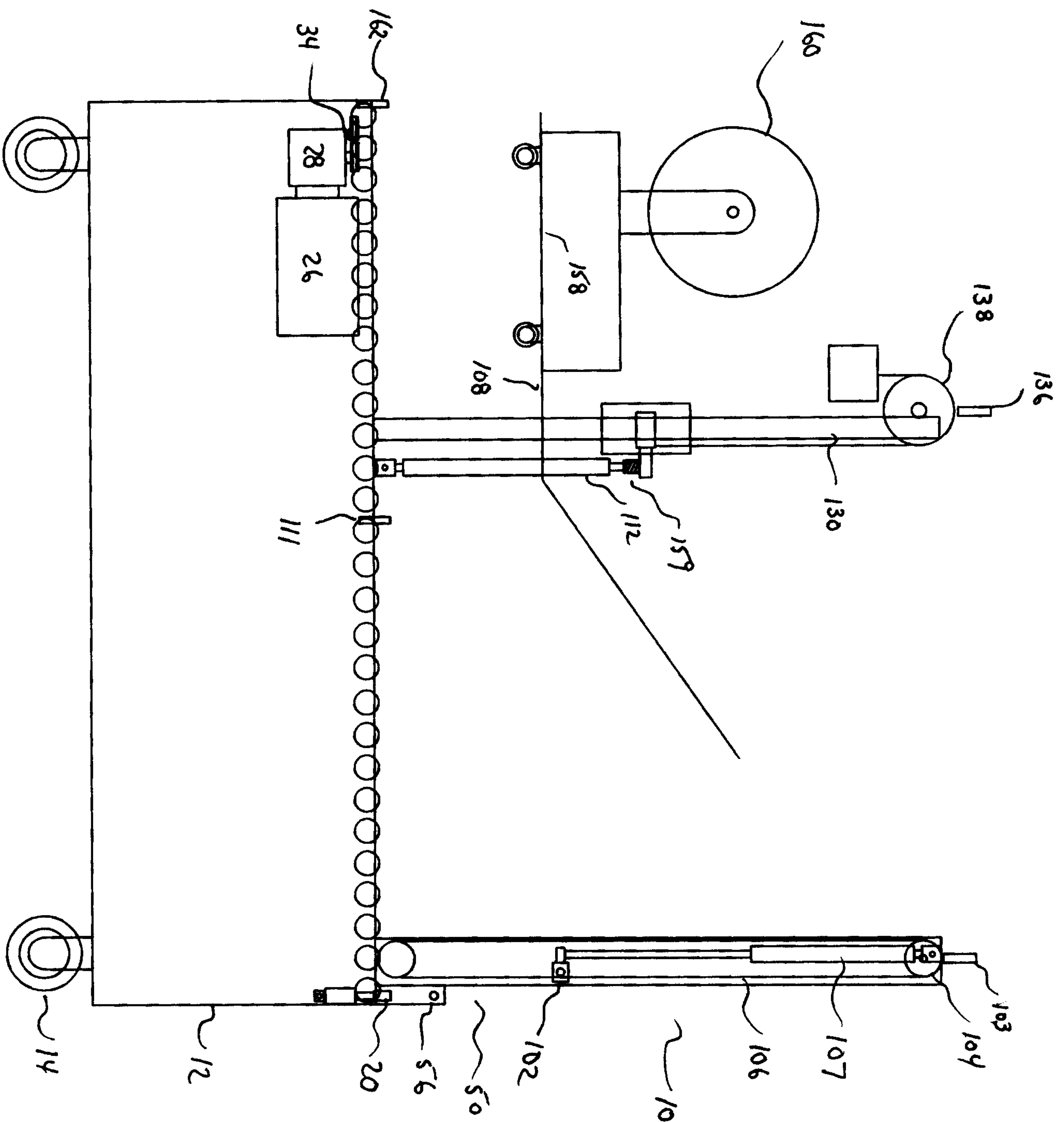


FIGURE #4

