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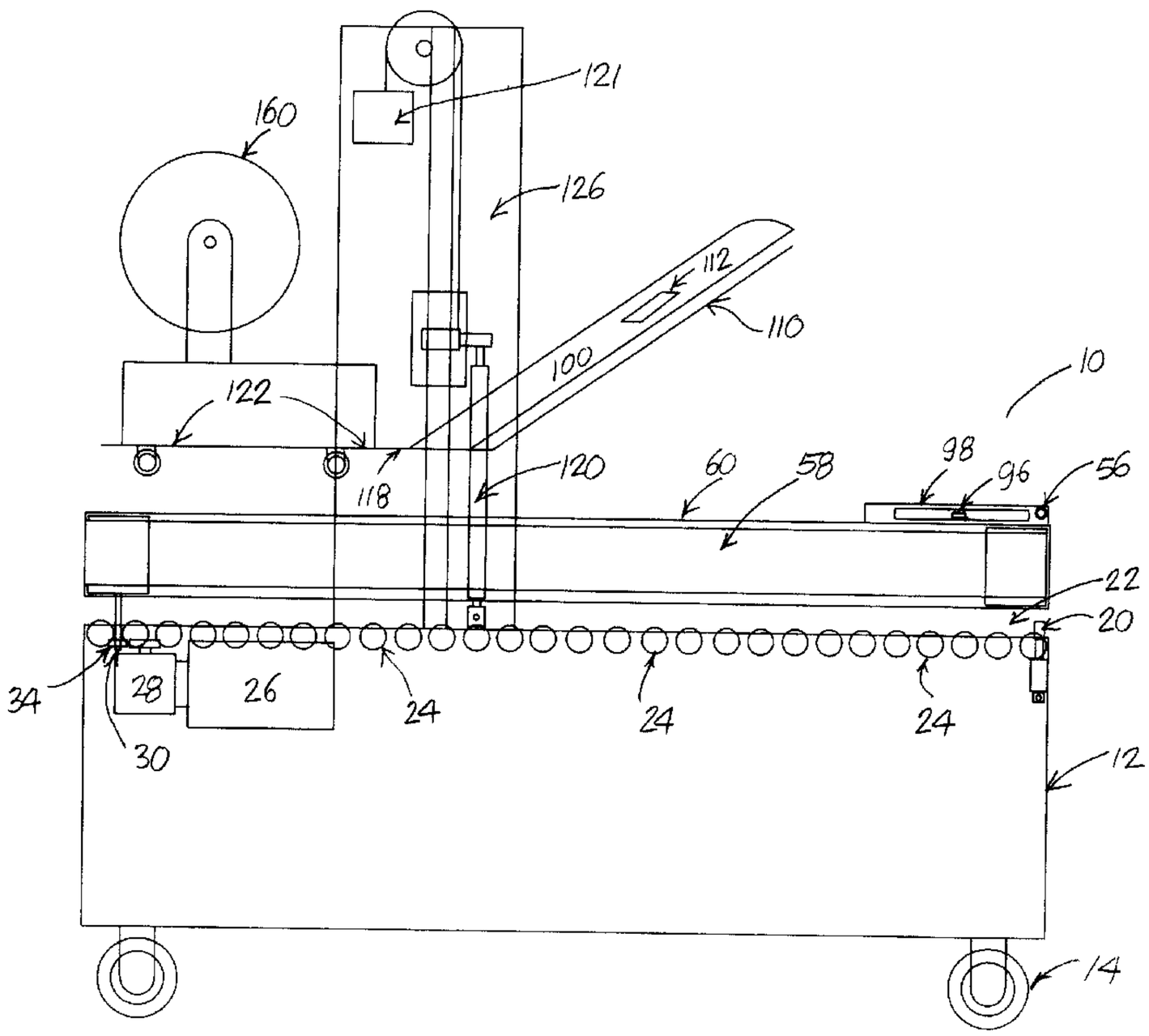
(54) Title: SEMI AUTOMATIC RANDOM BOX SEALER



Tile of the Invention

FULLY AUTOMATIC CASE SEALER

Field of the Invention

This invention relates to box or case sealers for sealing the folded flaps of the 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 of the box usually has end and side flaps that are folded inwardly and downwardly by an operator or by a box sealer which has a flap folding device. The box can be sealed by applying glue to the inside of 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 the apparatus that will apply adhesive or tape thereto is not particularly difficult to do. The apparatus can be adjusted to suit the known width and 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 being packed. In these instances, a random case sealer is required, wherein the apparatus for applying adhesive or tape thereto adjust automatically to suit the size of the box.

In prior art random case sealer, 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 adjustment mechanisms together with suitable control devices, have been used to adjust the position of the various sealing components to suit the position and the size of the box being sealed. A difficulty with the prior art devices, however, is that the boxes 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.

Summary of the invention

In the present invention, the sealing components of the apparatus are positioned by direct 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 conveyor portion and a longitudinal axis along

which boxes entering the case sealer are moved. A pair of longitudinal, spaced-apart, lateral conveyors receives boxes entering the case sealer. Linking mechanisms 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 sealer. The case sealer further includes with 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 floating head is spaced above the lateral conveyors. The floating head includes an entrance ramp adapted sensor bar. The sensor bar is coupled to the limit switch sensor for lifting the floating head upwardly to a height to allow the box passes throughout the sealer. The floating head also includes a seal dispensing platform. 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 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 elevation 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 seal filled boxes one at a time. However, boxes or cartons could be manually placed on case sealer 10. A gate mechanism 20 can be provided to space the cases apart prior to being sealed, as will be described further below.

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 filled and the flaps are folded down to be ready to enter case sealer 10 are normally held back by the gate mechanism 20. When the entrance gate 20 is open and the box is advanced to the sealer 10 by the operator to be sealed, the entry photo-electric eye 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 (see Fig:2). Photo-electric eye 56 is an entry sensor means, and it could be any type of proximity sensor, or limit switch other than a photo-electric eye.

Referring next to Figs. 3 and 4, lateral conveyors 58 and 60 are 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 there-through. 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 80 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 on the cross member of frame 12 and acting through a spring mount 88 attached to the frame of lateral conveyor 60. 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 there-between. If a box traveling between lateral conveyors 58 and 60 is off center, it will hit one of the lateral conveyor belts 90 or 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 actuate limit switches behind them. When a box hits one of the centering sensors 96 or 98, the sensor retracts opening its limit switch (see electrical description), 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 opened, 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. When the rear of the box passes entry photo-electric eye 56, gate 20 is raised to hold back the next box (see electrical description).

Referring next to Figs. 3 and 4, when a box enters case sealer 10 and blocks the entry photo-electric eye 56 the lateral conveyors 58, 60 either move inwardly or wait until the top leading edge of the box engages an upwardly limit switch sensor 110 which is mounted underneath the entrance ramp 100 of the sealing head 118 (see the electrical description). The limit switch 112 mounted at the back of the sensor bar 110 is activating when the leading edge of the box is pushing up. The lateral conveyors 58, 60 are moved inwardly and outwardly by a cylinder 86. The sealing head 118 is moved vertically by a ~~cylinder~~ 120 which is activated by the limit switch 112.

As the box continues to advance in case sealer 10, when the rear of the box passes the photo-electric eye 56, the entrance gate 20 will pop-up to prevent the following box from entering the sealer. At this point the timer in the control box is turned on. This timer will be timed out based on the box clearing the sealer. Timed out means to open the entrance gate, to lower-down the sealing head, and to move the lateral conveyors outward for the next operation (see the electrical description Rung #5)

As the box is passing through the sealer, the box flaps are being held down by the entrance ramp 100 and also by the floating sealing head 118. Floating sealing head 118 has a transverse member (not shown) having opposed ends attached to slides, which are mounted on shafts in towers 126 with pneumatic cylinders 120 to move the floating head up and down and counterweight devices 121 to offset the weight of the floating head 118. Floating head 118 has a sealing dispensing platform 122 on which is mounted a tape head 160. The pneumatic cylinder 120 is operated by compressed air with a pressure between 60psi and 80psi to be flexible for the relative positioning of floating head 118 and to accommodate

some non- uniformity in the height of the boxes (up to 3 inches) such as may be caused by overfilling.

The floating sealing head may be adapted to a pair of longitudinal box side pushers to keep the gap between the two major flaps tight if desired (not shown)

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, and width, the gate mechanism 20 can be opened at regular intervals to provide a gap between the boxes of about 8 inches to allow the box to be sealed and the tape to be cut off properly. In this operation mode, while one box is being sealed, another box can be in the lateral conveyors 58 and 60. In this operation mode, after the first box has been in the lateral conveyors and underneath the floating sealing head, the box size being sealed is known, the lateral conveyors 58, 60 and the height of floating head 118 can be set by turning a select switch (see the electrical description). Thereafter the lateral conveyors and the floating sealing head will not move.

In the second mode of operation where the packed boxes are light, the lateral conveyor delay switch must be turned to the on position. In this operation mode, the lateral conveyors are delayed until the top leading edge of the box hits the limit switch sensor bar 110 to send a signal to the control box. The lateral conveyors and the floating sealing head now are activated to be able to advance the box through the sealer to seal the box (see the electrical description). In this operation mode, only one box is in the sealing machine at a time.

In the third mode of operation where the boxes are heavy, the lateral conveyor delay switch and the uniform box size select switch must be turned off. In this operation mode, the operator advances the box to the sealer while the gate is open. When the box blocks the photo-electric eye, the lateral conveyors move inwardly to make contact with the box. The lateral conveyors are stopped from moving inwardly by the limit switches 96, 98 as described above. In this operation mode, only one box is in the sealing machine 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. Electrical relay logic is preferred for controlling the various components of the case sealer, but other types of controls such as PLC could be used as well. Limit switches have been described as the preferred position sensors, but other devices such as photo-electric, infrared or other motion sensors or proximity sensors could be used as well.

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. Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.

Semi Automatic Random Case Sealer

ELECTRICAL DESCRIPTION

I. 110VAC supply is connected to the two system E-stops (Left and Right).

II. When the e-stops are released power is applied to the control circuit and variable speed DC control board, via two fuses (6 amp and 3 amp respectively)

III. The Variable DC control board produces 0 to 90VDC out, depending on the potentiometer setting (which is connected to the board). This DC power controls a motor which powers both conveyors.

IV. 110VAC photo eye is located at the front of the machine, when it is blocked by the leading edge of the box, it energizes relay R2. See electrical drawing rung #3

V. Rung #4 a normally open limit switch (Head limit #1), is mounted under the entrance ramp of the sealer head. When the leading edge of the box makes contact with the switch, it energizes one side of a double acting solenoid valve (Head Up). This will bring the head up until the switch looses contact with the box. When the solenoid de-energizes the head will remain at the correct level. If the box is not of uniform height, it will make contact with the switch again, raising the seal head up to the new height of the box. Also when ever the solenoid is energized relay R4 is picked up.

VI. Rung #5 has a lateral conveyor delay selector shown. This switch has both normally open and normally closed contacts. When the switch is off, the branch with R4 is not active and therefore relay R1 is energized when relay R2 is picked up (when the leading edge of the box blocks the photo eye). If the selector switch is turned on, the rung with relay R2 is not active and relay R1 is delayed until the front of the box gets to the sealer head and R4 is picked up. Relay R1 will latch itself in until the contact TM-1 opens (timer based on the box clearing the machine). Basically, R1 determines if the lateral belts close when the leading edge of the box is at the machine entry, or if they close when the box is at the sealer head.

VII. Rung #6 has two normally closed limit switches. One is mounted to each conveyor. They are designed and wired to sense the sides of the box and center it in the machine. When the box enters the machine the switches are not engaged, therefore the conveyors will travel inward when R1 from the previous rung is energized. They will continue inward until both switches are engaged on the side of the box. Normally closed contacts from relay R3 will open (rung 7) when the box is engaged preventing the belts from traveling any further inward once the box comes off the switches. A normally closed, uniform box switch can be opened after the box is engaged to keep the conveyor from moving inward on the next cycle (i.e. running the same size boxes).

When R1 is not picked up and no box is engaged in the conveyors, the conveyor out solenoid will be energized and the head down solenoid will be energized ready for the next box.

VIII. Rung #7 has a normally open limit switch (side limit #2). This is a secondary contact on the conveyor limit explained in VII. When this switch is engaged on the side of the box and R2 is de-energized, it will pick up the timer, relay R3, and the gate solenoid. Essentially, this all happens when the rear of the box comes off the photo eye. If the uniform box selector is off, relay R3 will latch this rung on and allow the timer to time

out and the gate to stay up for the duration of the timer (based on box clearing the machine). If the uniform box selector is on, R3 will not latch this circuit and the gate is only one for the length of time side limit #2 is engaged. This provides quicker spacing for uniform boxes and keeps the timer from timing out and resetting R1

Operating Modes

Uniform width and height Box Sealing

In this mode the conveyor delay selector switch can be either on or off, but the uniform box selector switch must start in the off position. As the front of the box passes the photo eye, or hits the head limit (depends on delay selector setting) the conveyors will move inward until they are in contact with the box, and the head will move upward until it is at the right level. At this point the operator will need to turn the uniform box selector switch to the on position to lock in the box height / width settings for the following boxes.

As the rear of the box clears the photo eye the gate will extend to its upright position to block the following box. The gate will retract downward as the rear of the box clears the side limit switch (side limit #2). This reduces the box gap between boxes to approx. 8". Therefore the box per minuet will be increased. The conveyors and seal head will remain in the same position as set, and will not move until the uniform box selector is turned off.

Light Weight Random Case Sealing

For this mode the uniform box selector switch must be off and the conveyor delay selector switch must be on. As the box enters the machine no operation happens until the front of the box hits the sealer head. At this point the conveyors will move in and the head will move up until the correct heights/widths are met. When the rear of the box passes the photo eye the gate will extend upwards to block any following boxes. Now the box will travel through the machine until the rear exits the sealer. At this point the conveyors, gate, and head will return to their home positions, ready for the next random box size.

Heavy Weight Random Case Sealing

In this mode both the conveyor delay and uniform box size selector switches must be off. In this operation the sealer head starts in the down position and the conveyors are out. As the box passes the photo eye the conveyors travel inward until they are in contact with the box sides. Also the Head will travel upward until the head is at the same height as the top of the box. When the rear of the box travels past the photo eye the gate will come up to block any boxes following. The box will travel the distance of the machine until the rear of the box exits. At this point the conveyors, head and gate will return to their home positions, ready for the next random size box.

** The above could be altered at any time to incorporate PLC's as a desired choice of control instead of the relay logic described.

Application number / numéro de demande: 2446799

Figures: 4 Picture

Pages:

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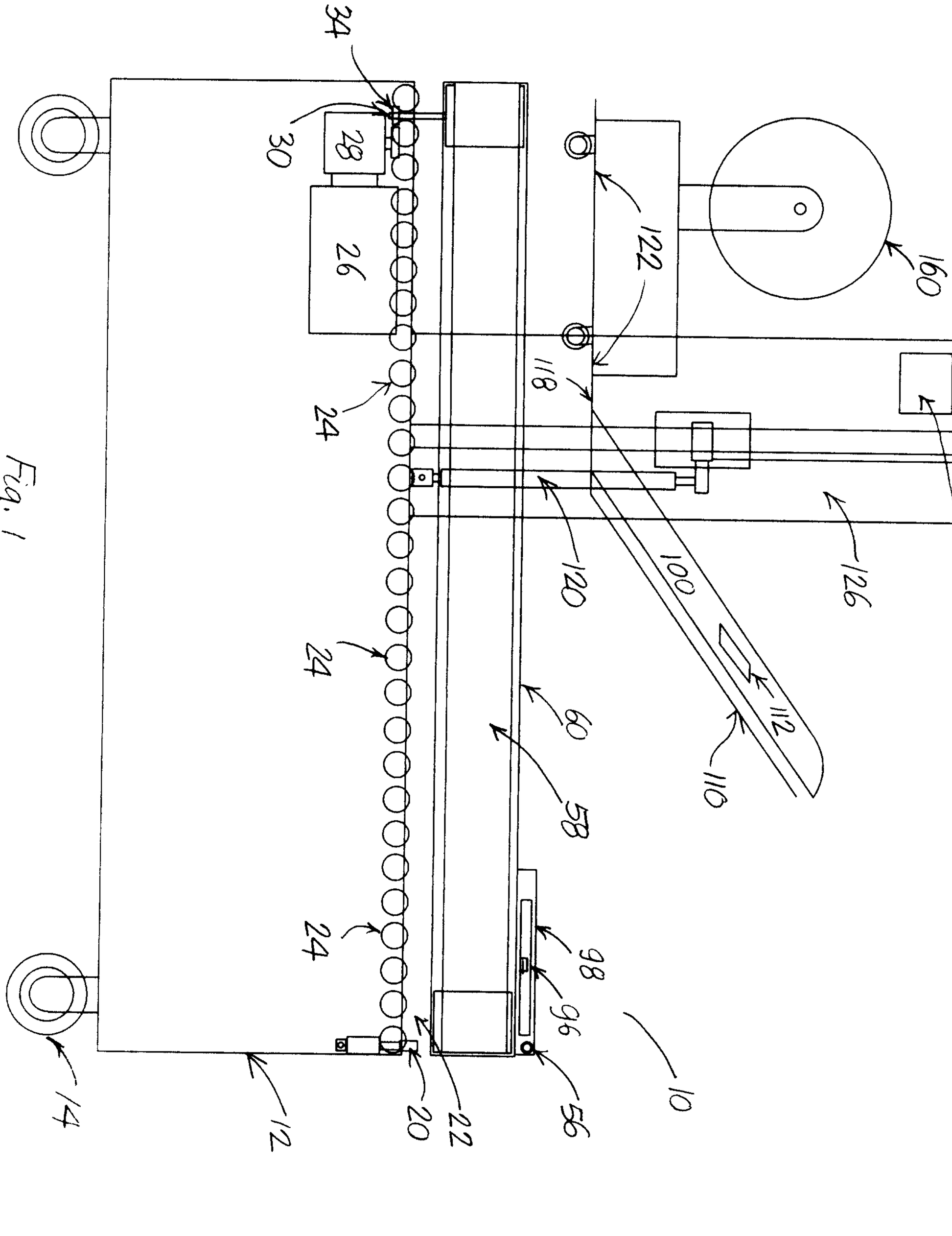
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Fig. 1

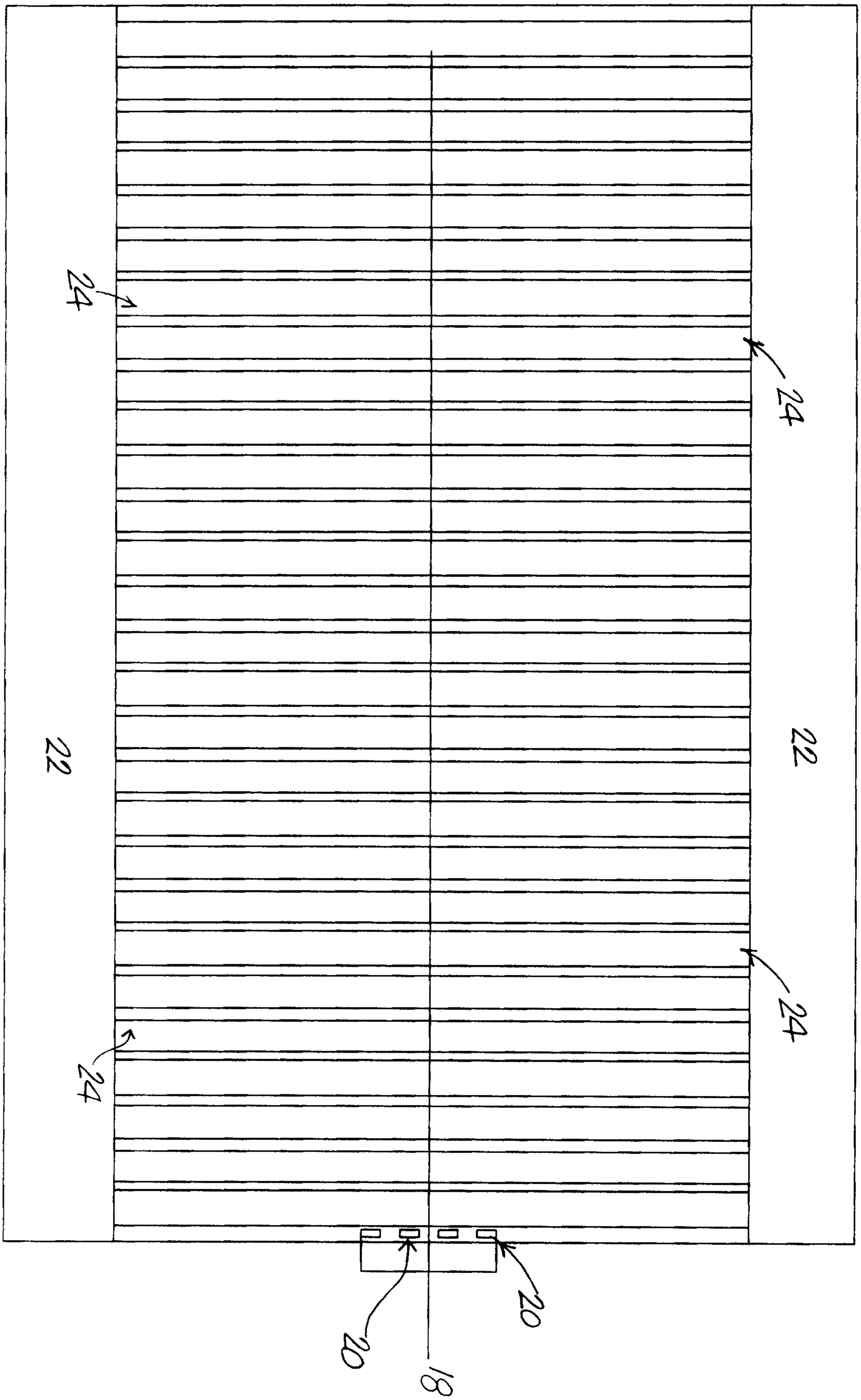

Fig. 2

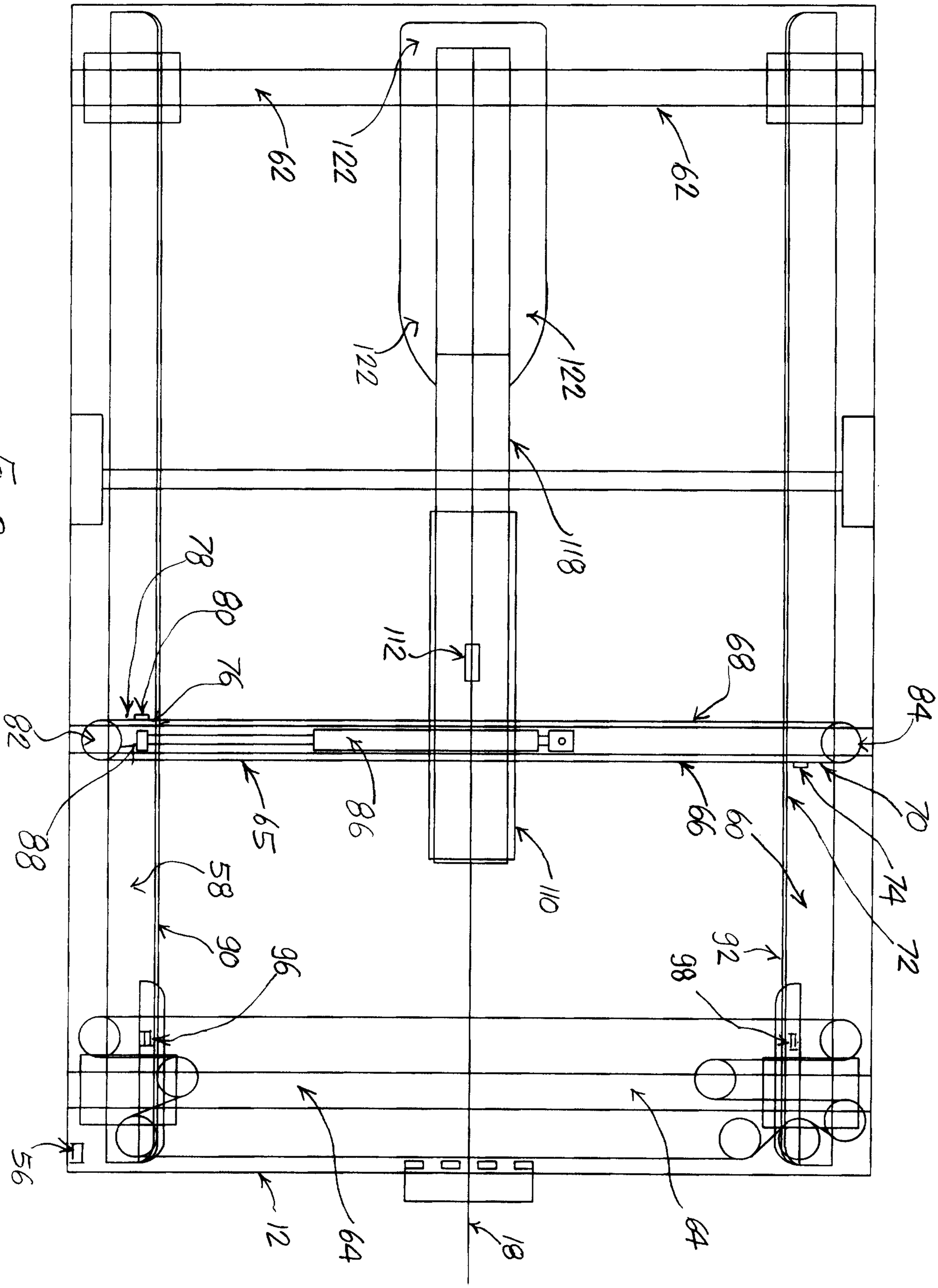
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Fig. 3

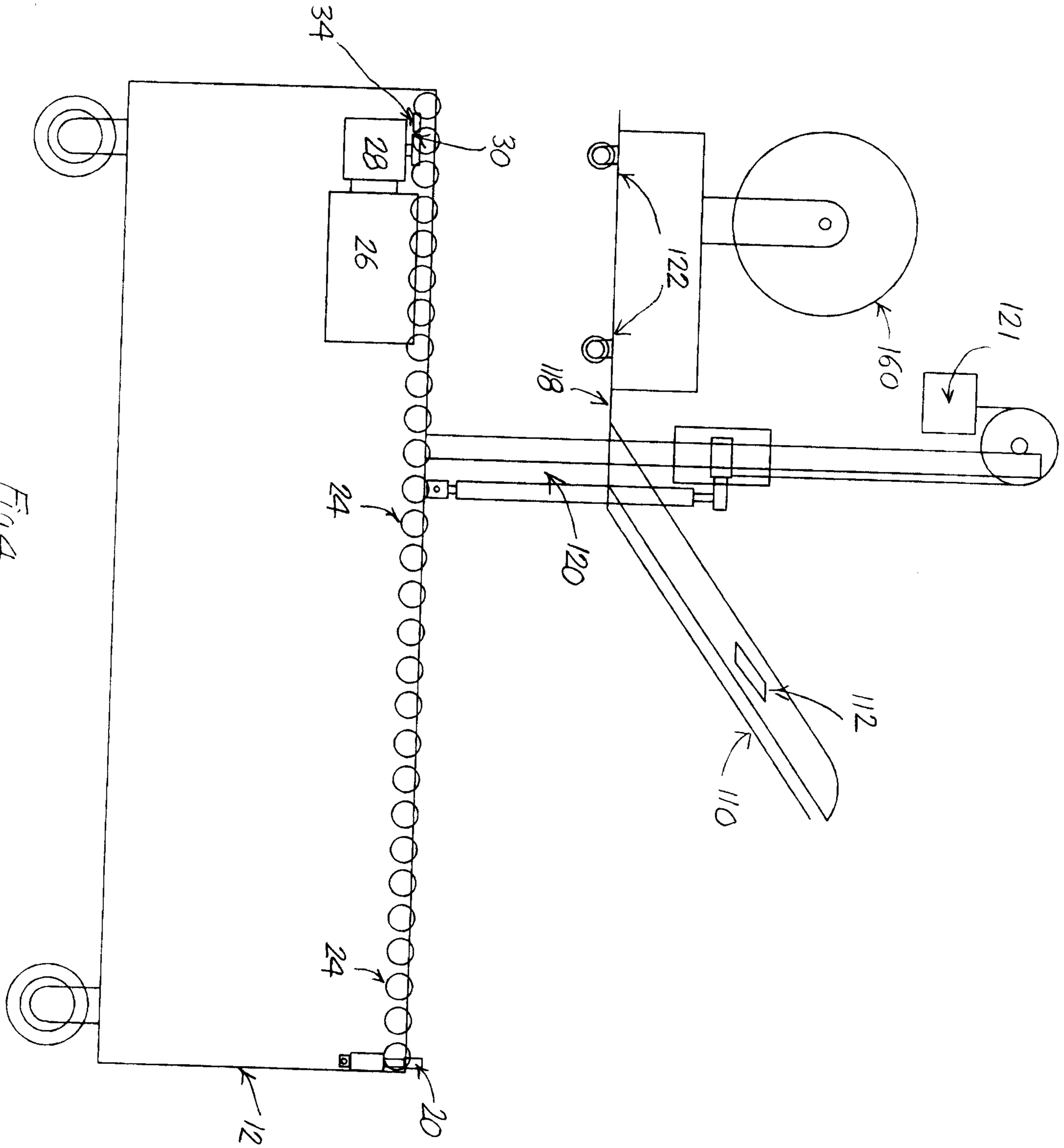
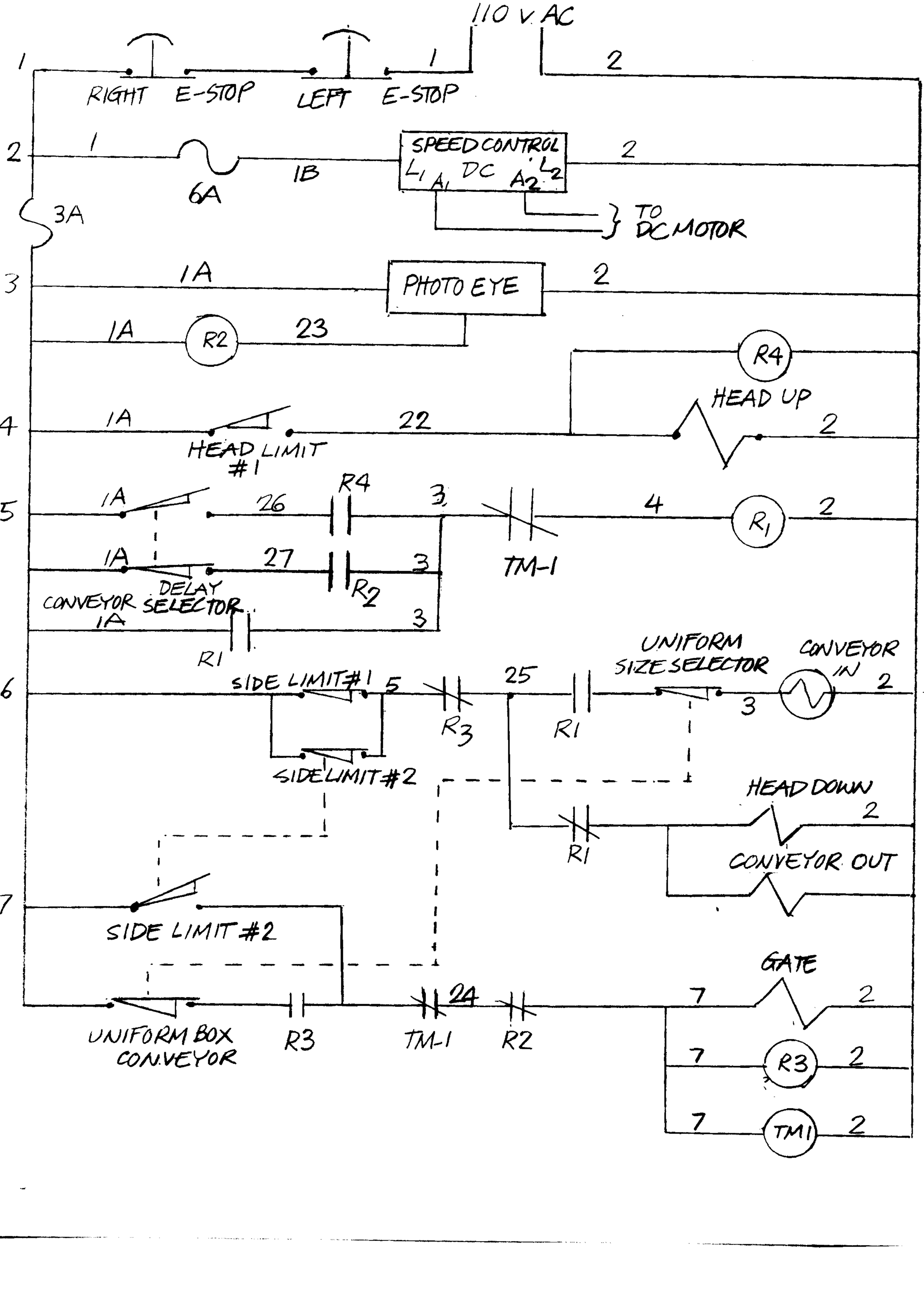


Fig. 4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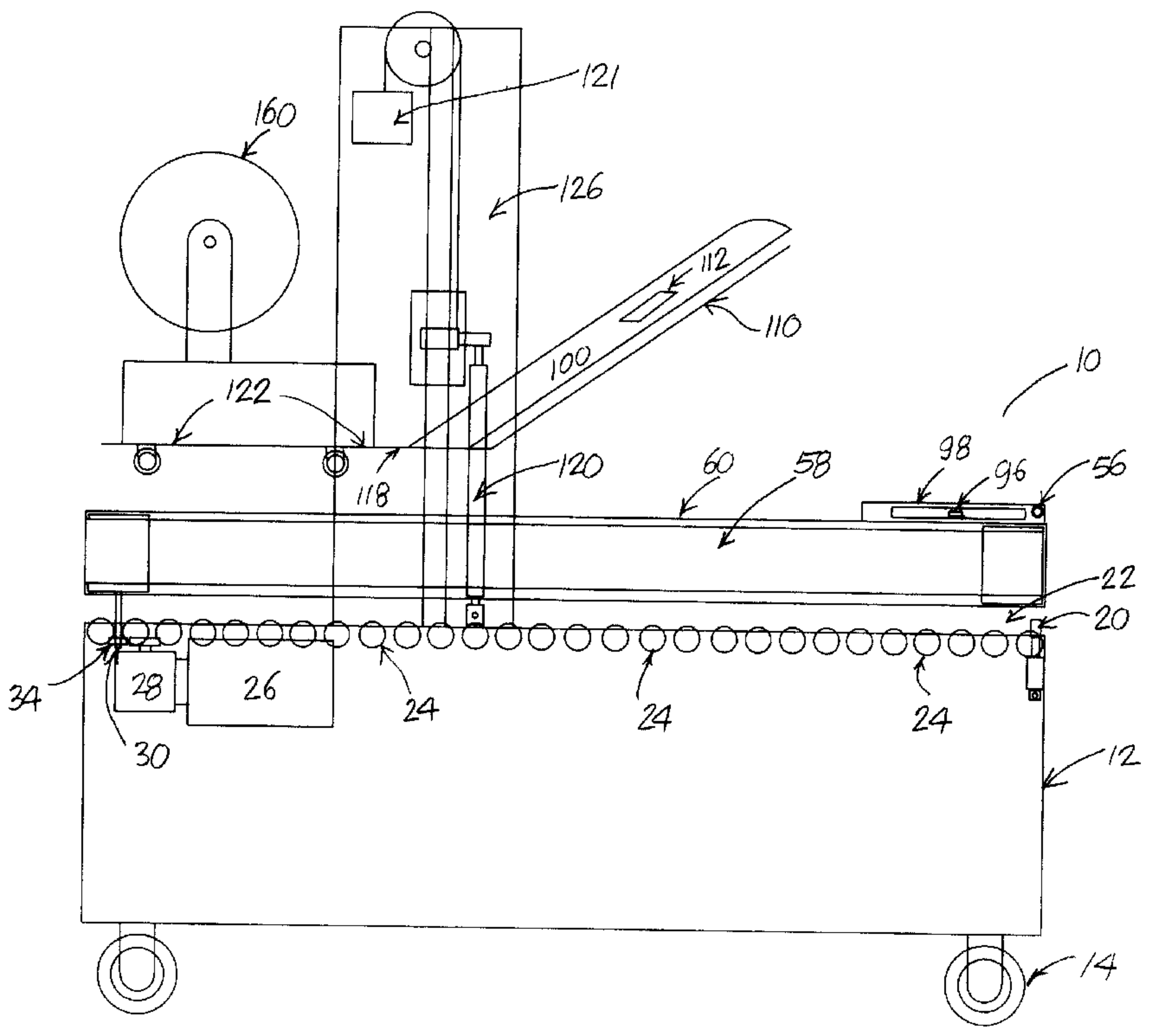
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