United States Patent [19]

Grobman

[11] **3,892,168**

[45] **July 1, 1975**

[54] **COUNTER EJECTOR**

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[73] Assignee: **Molins Machine Company, Inc.**, Camden, N.J.

[22] Filed: **Jan. 14, 1974**

[21] Appl. No.: **433,328**

[52] **U.S. Cl.** ..... **93/93 C**; 93/93 DP; 214/6 H; 271/195; 271/218

[51] **Int. Cl.** **B31b 1/98**

[58] **Field of Search** ..... 93/93 R, 93 C, 93 DP; 214/6 H; 271/189, 195, 217, 218, 220

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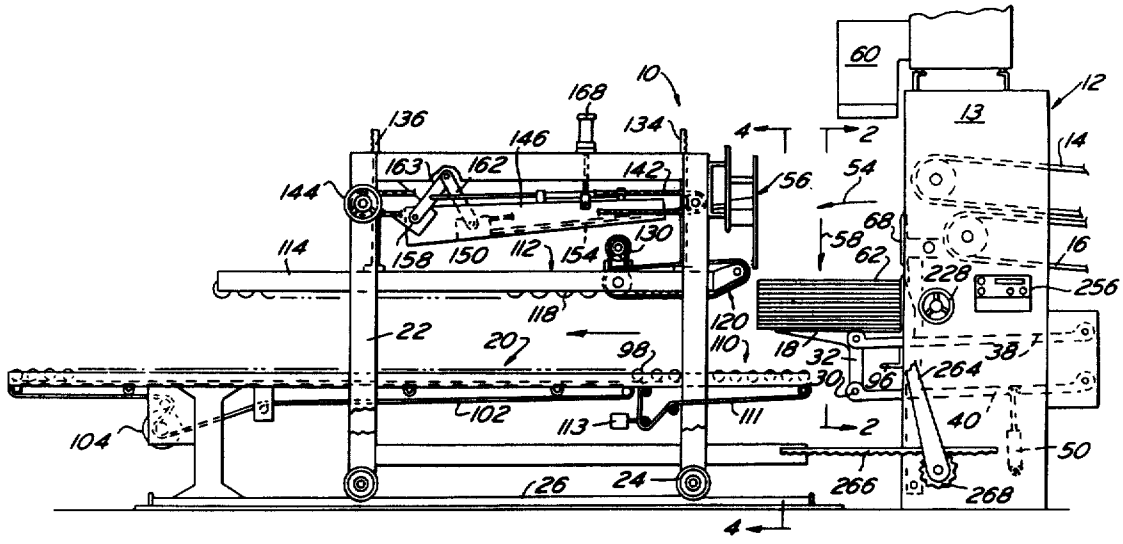
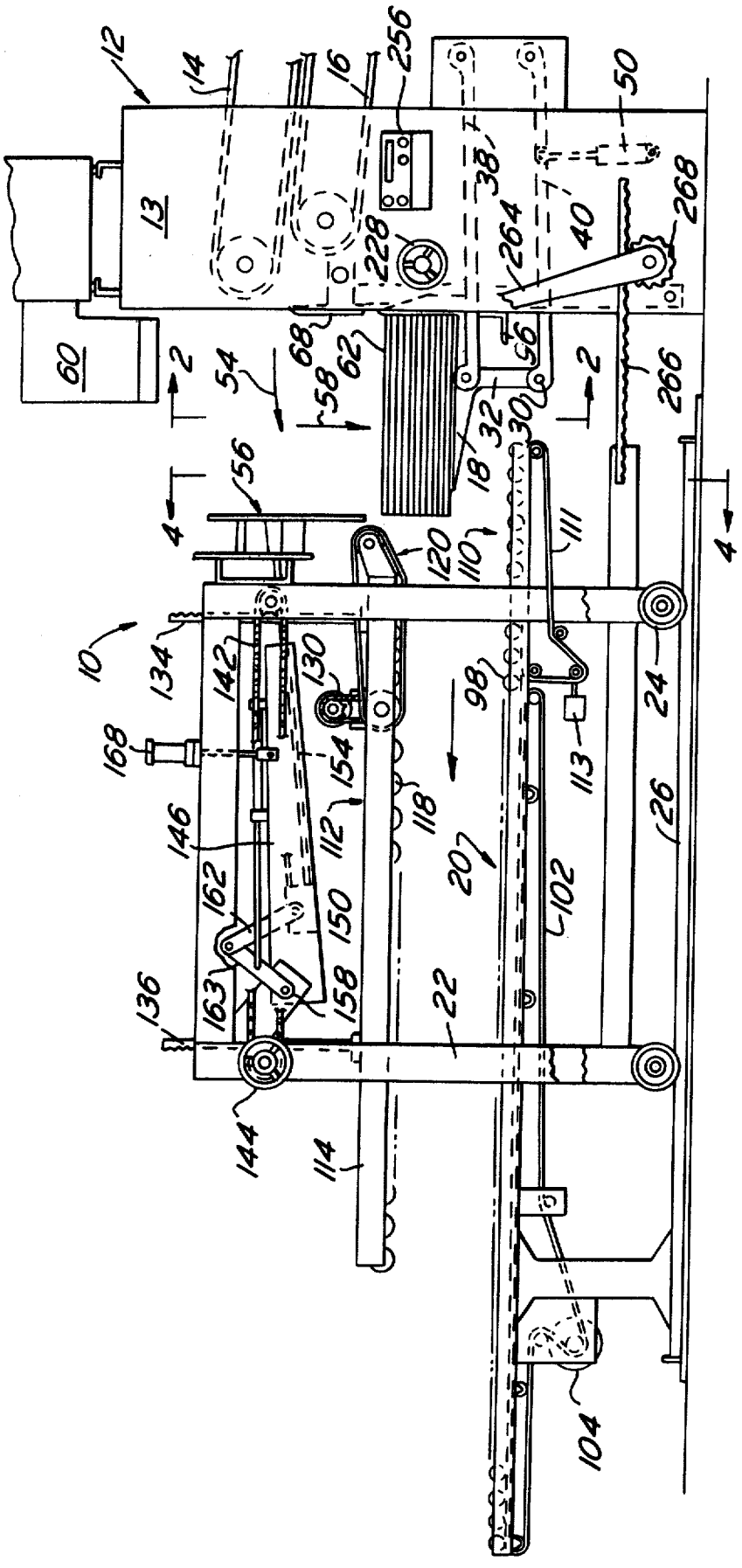
Primary Examiner—Roy Lake
Assistant Examiner—James F. Coan
Attorney, Agent, or Firm—Seidel, Gonda & Goldhammer

[57] **ABSTRACT**

The elevator of a counter ejector is permitted to descend a predetermined distance in seriatim movements by means of a hydraulic circuitry cooperating with a parallelogram linkage support for the elevator. While a stack of boxes is being removed from the elevator, incoming folded boxes are intercepted by fingers which also direct a blast of air downwardly against the top of the stack.

19 Claims, 9 Drawing Figures

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32
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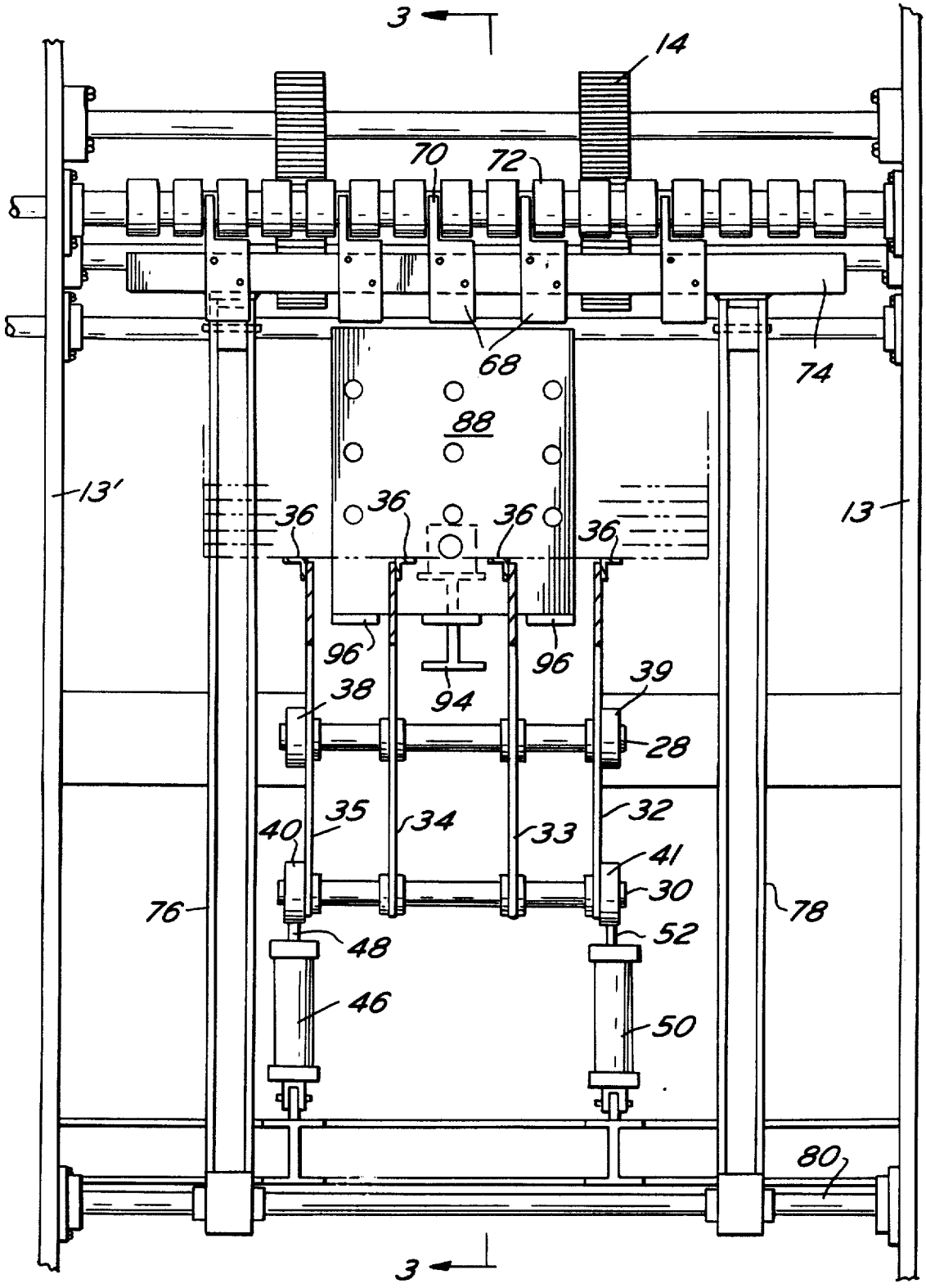
266
56
4
120
110
111
10
134
142
130
98
24
168
154
113
146
112
118
126
162
150
20
102
136
163
158
22
144
114
104

FIG. 1

FIG. 2


3
14
70
72
68
74
88
13'
13
36
36
36
36
96
96
94
39
38
28
35
34
33
32
40
41
30
76
78
48
52
46
50
80
3

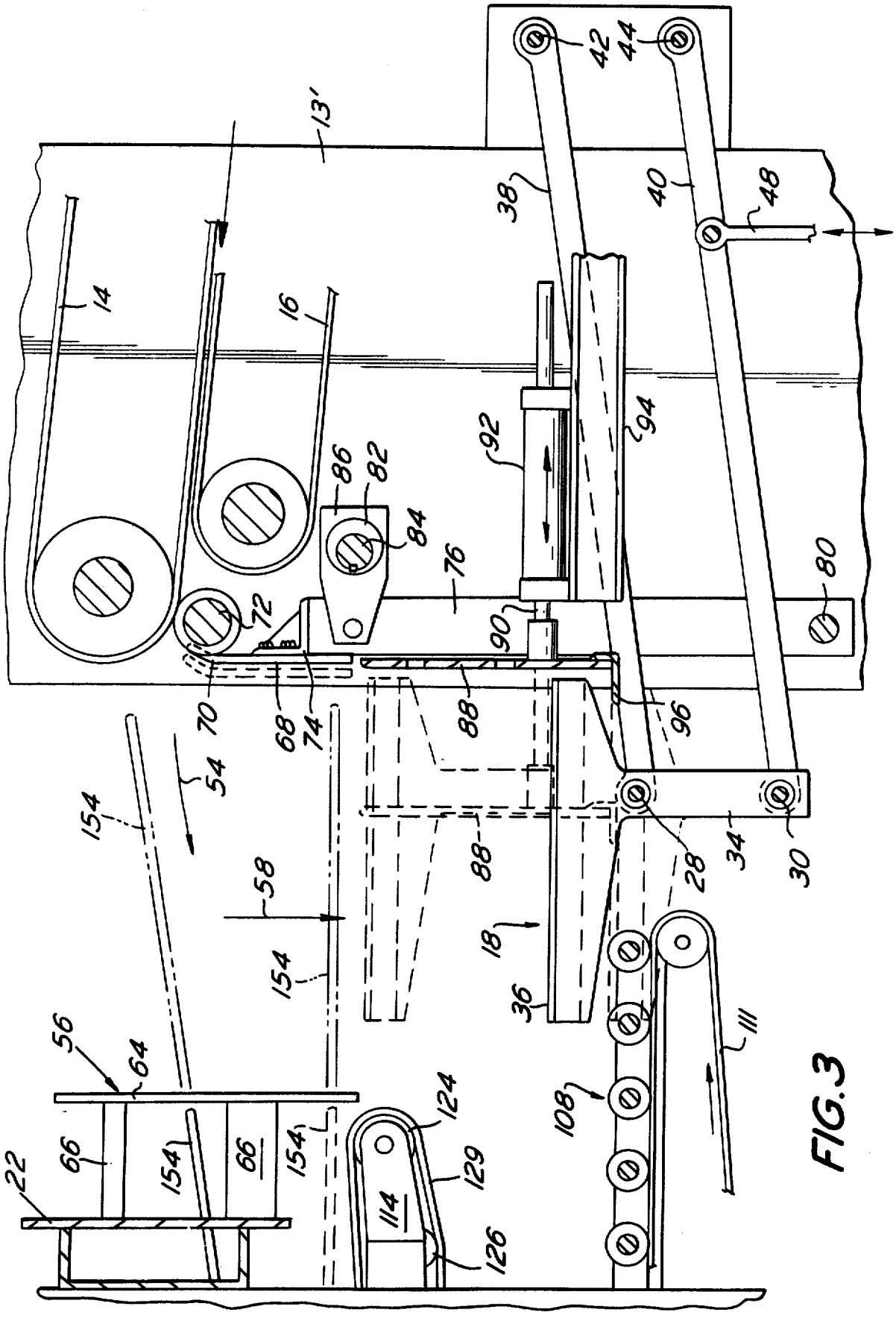

42
44
13'
38
40
48
14
16
92
94
86
82
84
76
80
72
90
70
68
74
88
96
54
154
58
18
36
28
34
30
56
64
66
154
124
129
114
126
22
108
111

FIG.3

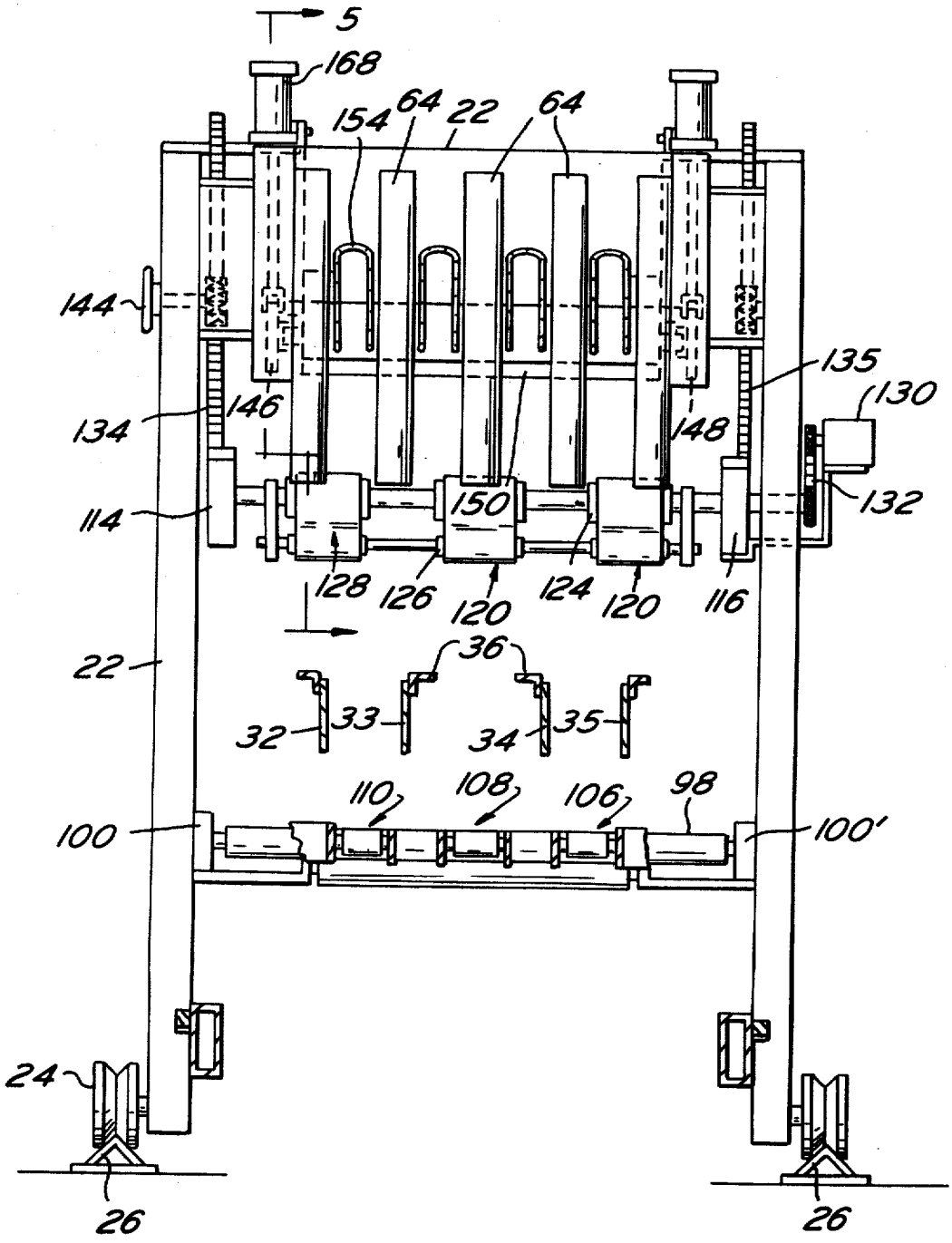
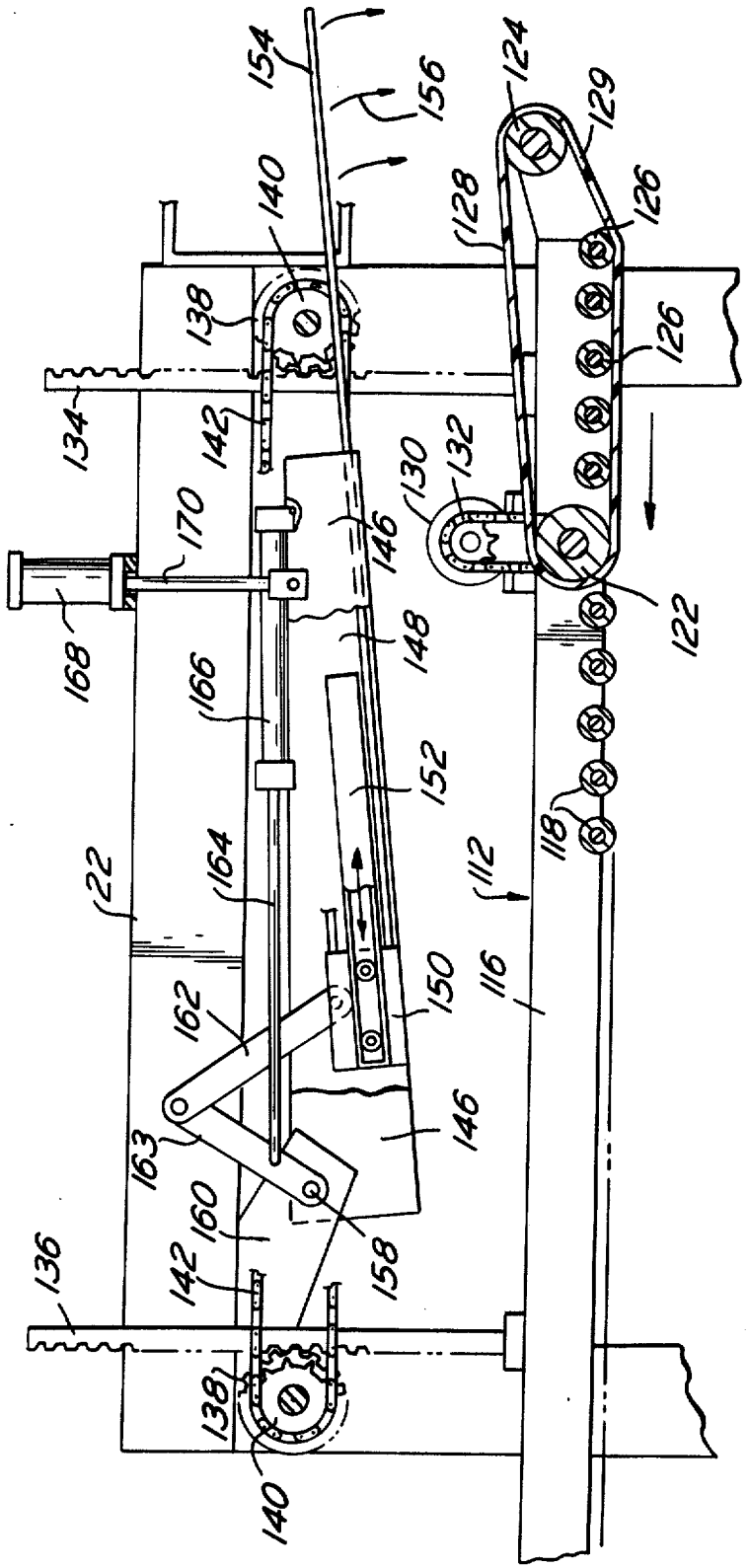

5
168
154
64
22
64
144
135
130
146
134
148
132
114
150
128
126
120
124
120
116
36
22
32
33
34
35
110
108
106
98
100
100'
24
26
26

FIG. 4


154
156
124
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128
126
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126
134
142
132
130
170
146
122
168
148
166
152
118
122
164
112
116
150
162
146
163
160
158
136
142
138
140

FIG. 5

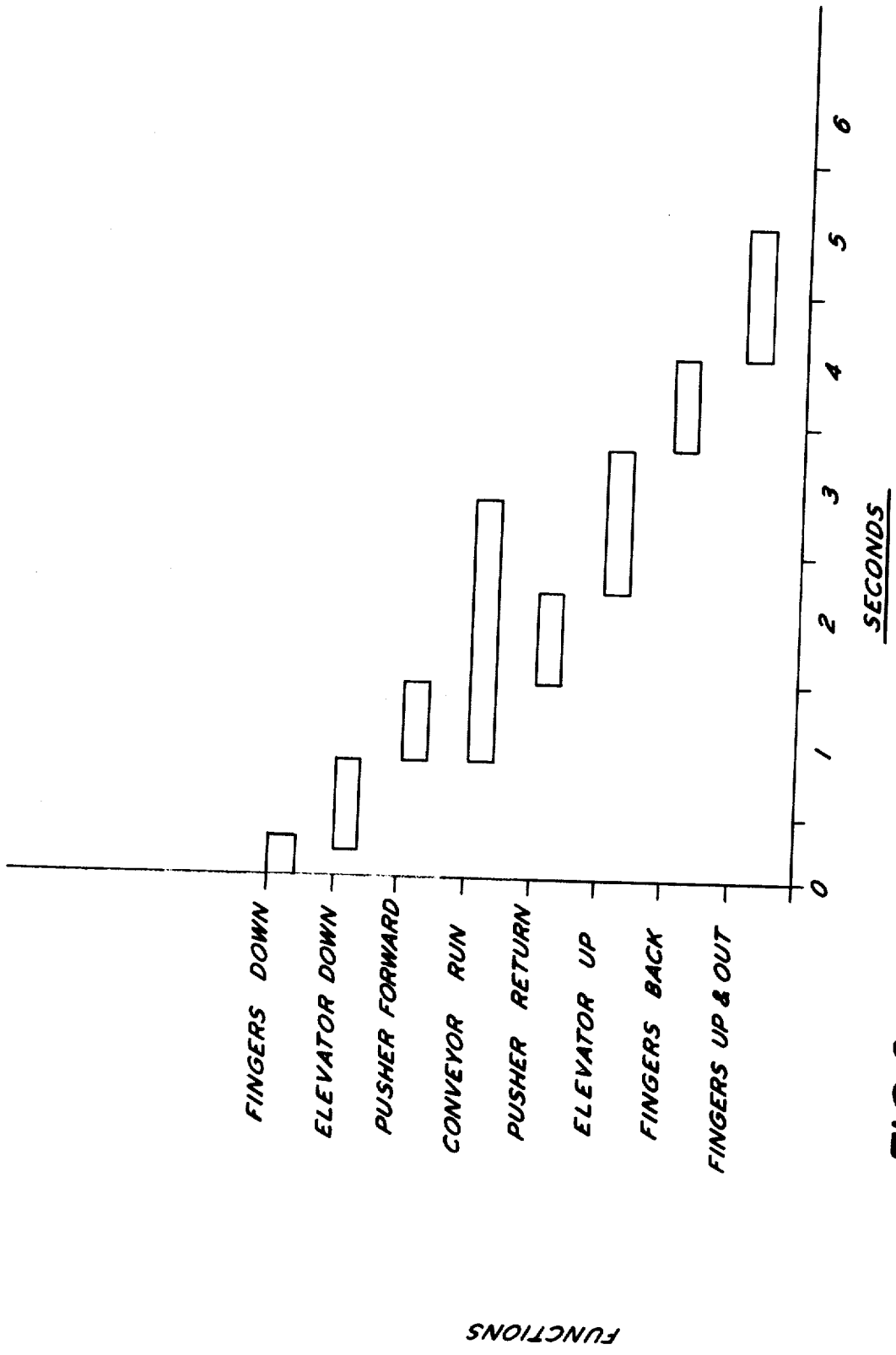
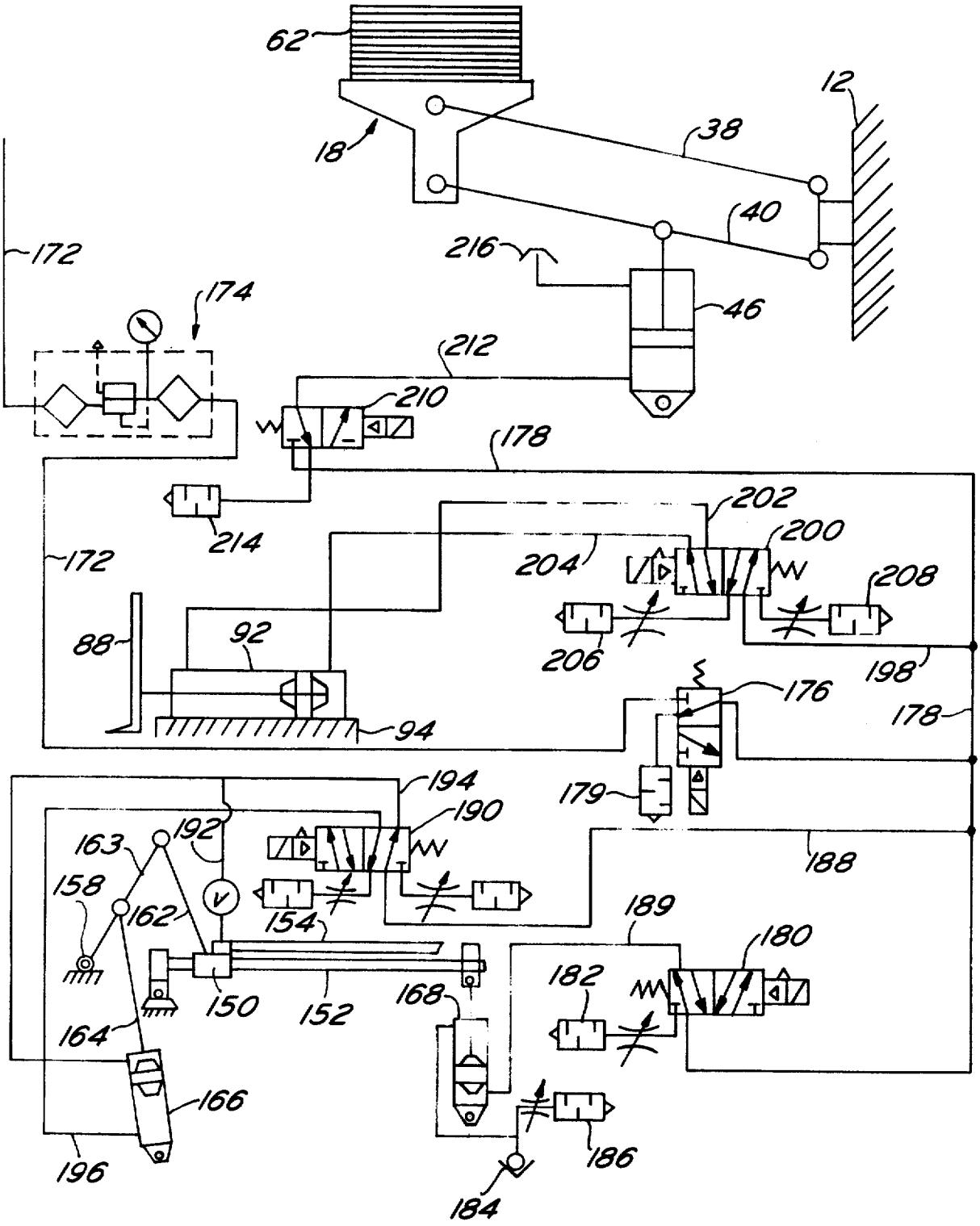

FINGERS DOWN
ELEVATOR DOWN
PUSHER FORWARD
CONVEYOR RUN
PUSHER RETURN
ELEVATOR UP
FINGERS BACK
FINGERS UP & OUT
0
1
2
3
4
5
6
SEGONDS
FUNCTIONS

FIG.6

FIG. 7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12
18
38
40
216
46
172
174
212
210
178
214
202
200
204
208
206
198
88
92
176
94
179
194
190
192
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158
162
154
189
180
182
150
152
168
164
166
196
186
184

FIG.8

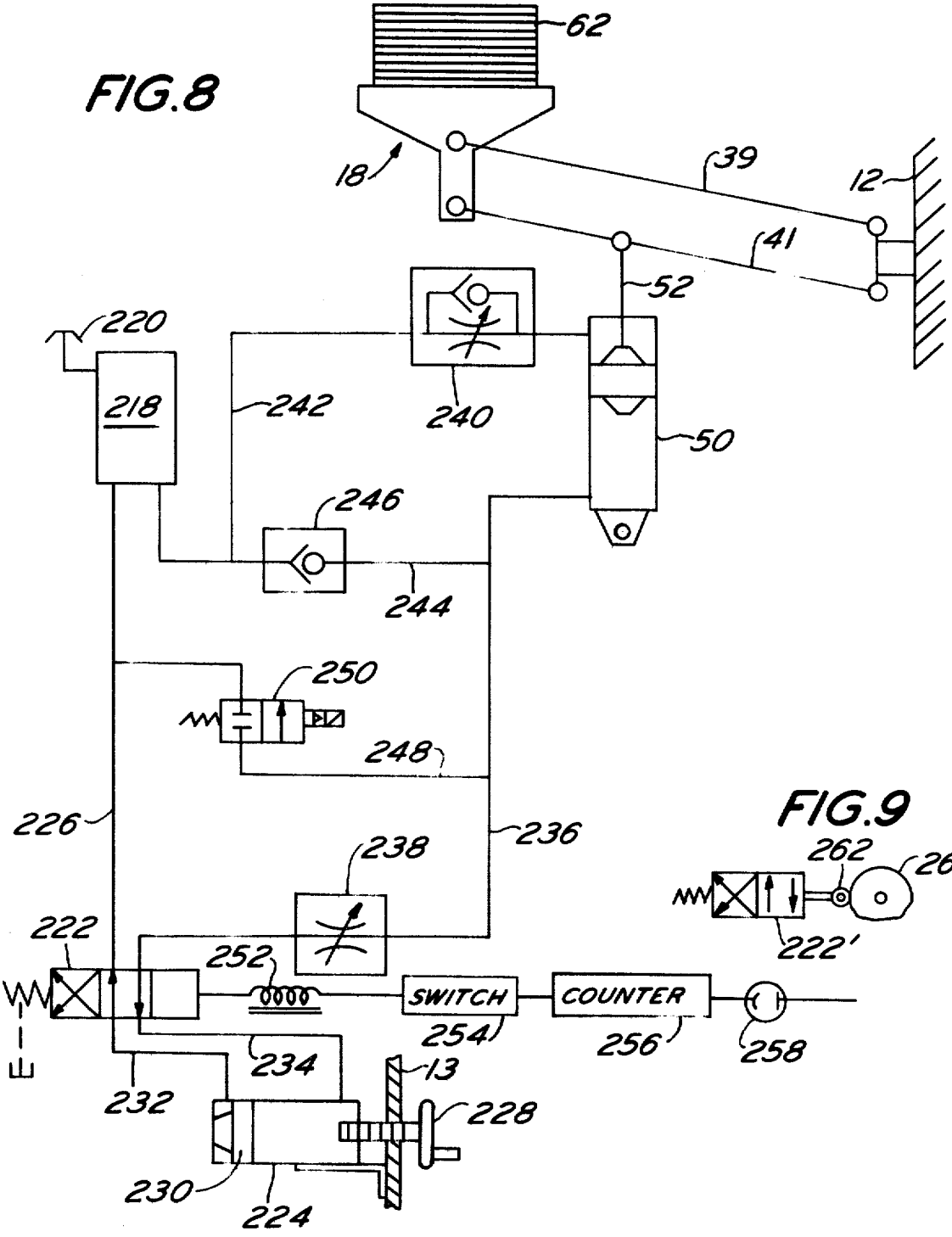
62
18
39
12
41
52
220
218
242
240
50
246
244
250
248
226
236
238
222
252
SWITCH
COUNTER
254
256
258
234
13
232
228
230
224

FIG.9

262
260
222'

COUNTER EJECTOR

This invention is directed to a counter ejector, namely apparatus which accumulates a number of sheets of accurate count in a stack on an elevator, and then ejects the stack while a new stack is accumulating. The sheets are preferably folded, collapsed paperboard boxes having their adjacent edges taped, glued or otherwise joined. The collapsed boxes are formed in a folder-gluer machine and then conveyed to the counter ejector. The elevator descends with seriatim movements as the stack accumulates thereon. When the elevator reaches its lowermost position, the stack is transferred to a conveyor and the elevator then ascends to receive a new partially accumulated stack.

A large number of counter ejectors have been proposed heretofore. Most of such counter ejectors were too complex and/or not capable of handling the inconsistencies inherent in manufacturing folded, glued corrugated boxes.

The counter ejector of the present invention includes a conveyor for feeding the folded boxes to the platform of an elevator. The elevator is preferably supported by a fluid cylinder connected to a parallelgram linkage. The elevator preferably descends under the control of a hydraulic circuit which periodically meters out a portion of hydraulic fluid in the cylinder supporting the elevator in response to a signal from a counter.

While the stack of boxes is on the elevator, a blower such as described in U.S. Pat. No. 3,292,503 causes an airstream to be directed downwardly to the top of the stack to keep the boxes under compression. If the boxes open, the newly bonded joint between adjacent edges of the collapsed box would be broken.

When the preselected number of boxes to form a bundle has accumulated in a stack on the elevator, fingers are moved to an extended operative position over the stack to intercept the continuous stream of boxes. The fingers are constructed and arranged to direct a stream of air downwardly onto the top of the stack supported by the elevator. After the fingers have reached the operative position, the elevator descends rapidly to a position in which its platform is adjacent a discharge conveyor. The stack is transferred off the elevator onto the discharge conveyor. After transfer of the stack, the elevator ascends to a position to receive the partially accumulated stack from the fingers which thereafter retract to an inoperative position. The fingers are preferably mounted on a common support movable toward and from the elevator support frame.

It is an object of the present invention to provide a counter ejector which is reliable, relatively simple and requires minimum maintenance.

It is another object of the present invention to provide a counter ejector with an elevator which descends successively in response to the number of boxes accumulated thereon.

It is another object of the present invention to provide a counter ejector having novel means for causing the elevator to move upwardly and downwardly.

It is another object of the present invention to provide a counter ejector wherein air pressure means is utilized to inhibit opening of folded, glued paperboard boxes.

Other objects will appear hereinafter.

For the purpose of illustrating the invention, there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIG. **1** is a side elevation view of a counter ejector in accordance with the present invention.

FIG. **2** is a sectional view taken along the line **2—2** in FIG. **1** but on an enlarged scale.

FIG. **3** is a sectional view taken along the line **3—3** in FIG. **2.**

FIG. **4** is a sectional view taken along the line **4—4** in FIG. **1** but on an enlarged scale.

FIG. **5** is a sectional view taken along the line **5—5** in FIG. **4** but on an enlarged scale.

FIG. **6** is a timing chart.

FIG. **7** is a diagrammatic illustration of pneumatic circuitry forming a part of the present invention.

FIG. **8** is a diagrammatic illustration of hydraulic circuitry forming a part of the present invention.

FIG. **9** is an alternative arrangement wherein a valve forming a part of FIG. **8** may be cam operated.

Referring to the drawing in detail, wherein like numerals indicate like elements, there is shown in FIG. **1** a counter ejector in accordance with the present invention designated generally as **10.**

The counter ejector **10** includes a stationary frame designated generally as **12** and having frame sides **13** and **13'**. Folded paperboard boxes are delivered to the counter ejector **10** in any desired manner such as by the coacting conveyor belts **14** and **16.** The counter ejector **10** includes an elevator **18** for receiving boxes from the conveyor belts **14** and **16** and transferring them to the discharge conveyor **20.** The conveyor **20** extends between the upright frame portions on a frame **22** which is mounted on wheels **24.** The wheels **24** travel on rails **26** so that the distance of the frame **22** from the frame **12** may be varied as will be described in greater detail hereinafter.

The mechanical details of the elevator **18** are as follows. Elevator **18** includes a pair of horizontally disposed shafts **28** and **30.** See FIGS. **2** and **3.** A plurality of generally T-shaped plate members **32, 33, 34** and **35** are disposed parallel to one another. The shafts **28** and **30** extend through aligned holes in the upright portion or leg of said members **32–35.** Each of the members **32–35** is provided with a portion defining a horizontal support surface **36.** Hence, the support surface **36** for a stack is defined by a plurality of spaced parallel surfaces.

A parallelogram linkage support mechanism is provided for the members **32–35.** Thus, link members **38** and **39** have one end pivotably connected to the shaft **28** and another end pivotably connected to a horizontally disposed shaft **42** supported by the frame **12.** Link members **40** and **41** have one end pivotably connected to shaft **30** and another end pivotably connected to shaft **44.** Shaft **44** is beneath shaft **42** and supported by the frame **12.** The distance between shafts **28** and **30** corresponds to the distance between shafts **42** and **44.** Also, the link members **38–41** are of the same length. Thus, as the elevator **18** moves up and down due to pivotable movement of the link members **38–41,** the support surfaces **36** remain horizontal.

A single motor means may be utilized to cause pivotable movement of the link members **38–41** to attain the up and down movement of the elevator **18.** I prefer to use separate motor means. Thus, a pneumatic cylinder **46** has one end pivotably connected to a rigid structural portion of the frame **12.** A piston rod **48** extends from

the other end of the cylinder **46** and is pivotably coupled to the link member **40.** Cylinder **46** is utilized to cause the elevator **18** to move upwardly. Circuitry associated with cylinder **46** is illustrated in FIG. **7** and will be described in detail hereinafter.

A cylinder **50** has one end pivotably connected to a structural portion of the frame **12.** The other end of the cylinder **50** has a piston rod **52** which is pivotably connected to the link member **41.** Cylinder **50** is a hydraulic cylinder and is utilized to support the elevator. Hydraulic circuitry including a shuttle valve is associated with cylinder **50** as shown in FIG. **8** and will be described in detail hereinafter. In FIG. **3,** the uppermost and lowermost positions of the elevator **18** are shown in phantom.

Folded paperboard boxes delivered to the elevator **18** by the conveyor belts **14** and **16** are discharged into the space above the elevator **18** as indicated by the arrow **54.** When following the trajectory of arrow **54,** the boxes contact the backstop **56** supported by the frame **22.** Since the frame **22** is adjustable with respect to the frame **12,** the position of backstop **56** is adjustable to accommodate different box sizes. As shown more clearly in FIG. **4,** the backstop **56** is comprised of a plurality of spaced upright plate members **64** which are parallel to one another and supported from the frame **22** by bracket members **66.**

As the boxes are accumulated on the support surfaces **36** of the elevator **18,** they form a stack **62.** A spanker is provided to repetitively engage a side edge of the stack **62** and cause the opposite edge of the stack **62** to contact the backstop **56** to thereby square the panels of each box and to align the stack **62.**

The spanker includes a plurality of spaced parallel spanker plates **68** having a narrow curved tongue **70** at their upper end. See FIGS. **2** and **3.** The tongues **70** are received in annular notches on the shaft **72.** Shaft **72** is an idler shaft supported by the frame **12** and over which the box blanks are discharged from the conveyor belts **14** and **16.** The extent of movement of the spanker plates **68** is illustrated by the solid lines and phantom lines shown in FIG. **3.**

Each of these spanker plates **68** is removably connected to a transverse member **74** adjacent to and parallel to the shaft **72.** Member **74** is supported at the upper ends of parallel arms **76** and **78** on opposite sides of the elevator **18.** See FIGS. **2** and **3.** The lower end of the arms **76** and **78** are rotatably supported by a transverse shaft **80.**

A means is provided to cause the arms **76** and **78** to pivot about shaft **80** in a repetitive manner. Any one of a wide variety of devices may be utilized to accomplish this function. As shown in FIG. **3,** such means includes a cam **82** secured to a shaft **84.** Cam **82** is eccentric with respect to the shaft and is rotatably received in a bore on a bracket **86.** Bracket **86** has one end pivotably coupled to the arm **76.** Hence, as shaft **84** rotates, the spaner plates **68** move from the solid line position to the phantom position shown in FIG. **3** in a repetitive manner.

A pusher means is provided to transfer a stack **62** from the elevator **18** onto the conveyor **20.** Referring to FIGS. **2** and **3,** there is provided an upright plate-like pusher member **88** connected to one end of a piston rod **90** extending from pneumatic cylinder **92.** Cylinder **92** is mounted on a convenient portion of the frame **12** such as beam **94.** Member **88** is provided at its lower end with spaced tines **96** which extend into the gap between adjacent ones of the members **32–35.** In FIG. **3,** the extended position of the pusher member **88** is shown in phantom with the retracted position shown in solid lines.

Referring to FIGS. **1** and **4,** it will be noted that the conveyor **20** includes side rails **100** and **100'** which rotatably support driven rollers **98** extending transversely thereacross at spaced points therealong. Rollers **98** may be driven in any convenient manner. As illustrated, the follers **98** are driven by an endless belt **102** which extends around various rollers including a roller driven by motor **104.**

The initial portion of conveyor **20** is narrower than the extent of rollers **98.** The initial portion includes a plurality of sets of rollers designated **106, 108,** and **110** which are preferably driven by belts **111** and motor **113.** See FIG. **1.** Each set of rollers **106, 108, 110** is orientated with respect to the elevator **18** so as to extend between two adjacent ones of the plate members **32–35** as will be apparent from FIG. **4.**

A subframe **112** is supported by the frame **22** at an elevation above the elevation of the conveyor **20.** The subframe **112** includes frame sides **114** and **116.** See FIGS. **1, 4** and **5.** Except for the initial portion of the subframe **112** adjacent the elevator **18,** the frame sides **114** and **116** rotatably support a plurality of idler rollers **118.** Said initial portion of the subframe includes a plurality of spaced parallel conveyors **120.**

Each conveyor **120** includes a driven roller **122** and an idler roller **124** supported by the frame sides **114** and **116** with the elevation of roller **124** being above that of roller **122** as shown more clearly in FIG. **5.**

A plurality of idler rollers **126** are supported by the frame sides **114** and **116** within the closed loop of an endless belt **128** which extends around the rollers **122** and **124.** Due to the elevation of roller **124,** the belt **128** includes an angled portion **129** which extends downwardly toward the conveyor **20** at an acute angle of about **30** degrees. Roller **122** is mounted on a shaft driven by motor **130** and chain **132** which are supported by one of the frame sides such as frame side **116.**

The subframe **112** is adapted to be selectively elevated with respect to the conveyor **20.** The elevating means may assume a wide variety of shapes and include a variety of different devices. In the preferred embodiment illustrated, the subframe **112** is selectively adjustable upwardly and downwardly by a means which includes a plurality of racks and pinions.

Referring to FIG. **5,** the right hand end of the subframe **112** is provided with a rack **134** on one side and a corresponding rack **135** on the opposite side. The other end portion of the subframe **112** is provided with correspondingly disposed racks **136.** Each of the racks **134–136** is meshed with a pinion **138** mounted on a common shaft with a sprocket **140.** Thus, there is a rack in each corner of the frame **22** with each such rack having associated therewith a meshing pinion **138** and juxtaposed sprocket **140.**

On one side of the frame **22,** a chain **142** extends around the sprockets **140.** A similar chain extends around the sprockets on the opposite side of the frame **22.** A hand wheel actuator **144** is coupled to a self-locking worm and worm wheel on the frame **22** for selectively rotating one of these sprockets **140** to facilitate movement of the subframe **112** in an upward or

downward direction so as to adjust the elevation of the idler rollers **118** and the angled portion **129** on the conveyors **120**.

The frame **22** includes longitudinally extending side members **146** and **148** pivotably supported by the frame **22**. A carriage **150** extends between the side members **146** and **148** and is supported thereby. The carriage **150** has rollers on its ends which extend into inclined tracks **152** which guide the movement of the carriage **150**. Each track **152** is supported by one of the side members **146** and **148**. See FIGS. **4** and **5**.

A plurality of fingers **154** are supported by the carriage **150** and extend to the right in FIG. **5**. The fingers **154** are preferably U-shaped and are orientated so as to extend between adjacent ones of the plates **64** as shown more clearly in FIG. **4**. The fingers **154** are hollow and have a plurality of air discharge ports on their lower surface as indicated by the dots in FIG. **4** whereby air will be discharged in the direction of the arrows **156** shown in FIG. **5**.

The side members **146** and **148** pivot about the transverse axis of pin **158** which pivotably couples the side member to an adjacent stationary bracket **160** on the frame **22**. A link member **163** has one end pivotably connected to the bracket **160** and its other end is pivotably connected to link member **162** which is pivotably connected to the carriage **150**. Line members **162** and **163** are provided for each end of the carriage **150**. One link member **163** is pivotably connected to one end of a piston rod **164** which extends from a cylinder **166**. Cylinder **166** has one end pivotably supported by the side member **146**. A similar piston rod and cylinder is supported by the side member **148**.

A cylinder **168** is pivotably supported on opposite sides of the frame **22**. Each cylinder **168** has a piston rod **170** disposed in an upright direction with its free end pivotably coupled to one of the side members **146** and **148**. Actuation of cylinder **168** causes the side members **146** and **148**, and the elements supported thereby, to pivot about the axis of pin **158** whereby the fingers **154** may move from the elevated phantom position in FIG. **3** to the lower phantom position in FIG. **3**. The purpose of such movement will be made clear hereinafter.

In FIG. **7**, there is illustrated a diagrammatic illustration of pneumatic circuitry with associated controls for those components of the counter ejector **10** which are pneumatically operated. An air supply conduit **172** is provided with a composite regulator **174**. Regulator **174** may include a demister, pressure gauge, outlet pressure regulator, and flow regulator.

The conduit **172** includes an on-off supply valve **176**. Valve **176** is preferably provided with a solenoid actuator and selectively communicates conduit **172** with conduit **178**. In the position shown in FIG. **7**, conduit **178** is vented to atmosphere through valve **176** and muffler **179**. Muffler **179** muffles the high pressure air so as to attenuate noise which would otherwise be present in the form of a whistling sound upon discharge to the atmosphere.

One end of conduit **178** communicates with one side of cylinder **168** by way of a solenoid operated valve **180** and conduit **189**. In the inoperative position of valve **180**, said one side of the cylinder **168** is vented to atmosphere by way of conduit **189**, a variable restrictor, and muffler **182**. The other end of the cylinder **168** communicates with atmosphere by way of a variable restrictor and muffler **186** or by way of an inlet check valve **184** to permit air to rapidly enter the cylinder **168**.

A conduit **188** extends from conduit **178** to a solenoid operated valve **190**. Valve **190** selectively communicates conduit **188** with opposite ends of the cylinder **166** by way of conduits **194** and **196**. As illustrated, conduit **188** communicates with conduit **194** while conduit **196** is vented to atmosphere by way of valve **190**, a variable restrictor, and a muffler.

A flexible conduit **192** extends from a manifold on the carriage **150** for transmitting air from conduit **194** to the fingers **154**. Conduit **192** preferably has associated therewith a selectively operable flow control valve which permits cycling of the piston in cylinder **166** without any air being discharged through the fingers **154**, if desired.

A conduit **198** extends from conduit **178** to solenoid operated valve **200** which, as illustrated, is in an inoperative disposition. Valve **200** selectively communicates conduit **198** with one of the conduits **202** and **204** which extend to opposite ends of the cylinder **92**. When one end of the cylinder **92** is connected to high pressure air in conduit **198**, the other end of the cylinder **92** is vented through one of the mufflers **206** or **208** each of which includes a variable restrictor.

The conduit **178** selectively communicates with conduit **212** by way of a solenoid operated valve **210**. Conduit **212** communicates with one end of the cylinder **46**. The other end of the cylinder **46** is vented to atmosphere by way of vent **216**. In the position of the valve **210** as illustrated, conduit **212** is vented to atmosphere by way of muffler **214**.

FIG. **8** diagrammatically illustrates a hydraulic flow diagram in conjunction with the cylinder **50** for causing the elevator **18** to successively descend by way of circuitry which performs in the manner of a ratchet jack. A supply tank **218** of hydraulic fluid, is provided. Tank **218** is vented to atmosphere through vent **220**.

The tank **218** is connected by way of conduit **226**, directional valve **222**, and conduit **232** to one side of a shuttle valve **224**. The shuttle valve **224** includes a shuttle member or piston **230**. An adjustable limit stop is provided for the piston **230** by way of hand wheel and screw **228** which may be supported on the frame side **13**. Conduit **234** extends from one end of the valve **224** and communicates with conduit **236** by way of valve **222**.

The conduit **236** extends from the valve **222** to one end of the cylinder **50** and contains a selectively adjustable flow regulator **238**. The upper end of the cylinder **50** communicates with the supply tank **218** by way of conduits **242** and **244**. Conduit **242** contains a selectively adjustable flow regulator and an associated bypass check valve, the composite of which is designated **240**. Conduit **244** includes a check valve **246** which is adapted to be opened by the upward movement of the piston in cylinder **50** occasioned by the upstroke of the piston in cylinder **46** (see FIG. **7**) which causes the elevator **18** to move to its uppermost position.

A conduit **248** extends between the conduits **226** and **236**. Conduit **248** includes a solenoid operated valve **250** which is shown in an inoperative position. When operated, valve **250** enables the elevator to descend in a rapid uninterrupted manner.

During normal operation, the elevator **18** descends in successive stages. Such descent is preferably correlated with the depositing of collapsed boxes on the support

surface **36** of the elevator **18**. Thus, boxes delivered to the elevator **18** are detected by the photocell **258** and counted by the counter **256**. The counter **256**, after a predetermined number such as **10** boxes is counted, activates switch **254** which in turn activates the solenoid coil **252** which causes the valve **222** to shift. Every time the valve **222** shifts, a predetermined volume of the hydraulic fluid is cycled from beneath the piston in cylinder **50**, by way of valves **222** and **224**, to the supply tank **218**.

In FIG. **9**, there is illustrated an alternative embodiment for periodically shifting the valve **222**. Thus, a cam follower **262** on the spool of valve **222'** may be activated by a cam **260** which is driven by the folder-gluer drive. In this manner, the valve **222'** will be shifted periodically as a function of the number of boxes being handled.

In FIG. **6**, there is illustrated a typical timing diagram of various functions versus time in seconds. The designation "fingers down" refers to fingers **154** being in the phantom horizontal position shown in FIG. **3**. The designation "elevator down" refers to the elevator **18** being in its lowermost phantom position in FIG. **3**. The designation "pusher forward" refers to the pusher member **88** being in the phantom position shown in FIG. **3**. The designation "conveyor run" refers to conveyors **120** being driven by motor **130**.

In FIG. **6**, the designation pusher return refers to the pusher member **88** returning to the solid line position shown in FIG. **3**. The designation elevator up refers to the elevator **18** being caused to ascend by means of the pneumatic cylinder **46**. The designation fingers back refers to the fingers **154** being withdrawn from the extended position shown in FIG. **3** or FIG. **5** to the retracted position shown in FIG. **1**. The designation "fingers up & out" refers to the fingers **154** being in the position shown in FIG. **5** and in phantom lines at the upper end of FIG. **3**.

The operation of the counter ejector **10** is believed to be apparent to those skilled in the art in view of the preceding detailed description and the following brief description of the sequence of operations. As a starting point, assume that the elevator **18** is in its uppermost phantom position in FIG. **3** while being supported by the hydraulic cylinder **50** with all other components of FIG. **3** being in their solid line positions except for the link members **38–41** which of course will be angled upwardly from right to left. Folded boxes delivered by conveyor belts **14** and **16** follow the trajectory of arrow **54**, contact the backstop **56**, and are deflected in the direction of arrow **58** to accumulate in a stack **62** on the support surfaces **36** of the elevator **18**.

It will be noted that the support surfaces **36** are closely adjacent to the horizontal trajectory of the collapsed boxes so that there is no opportunity for the boxes to nose dive. After a predetermined number of boxes, such as **10** boxes, has accumulated on the elevator **18**, valve **222** is shifted to a position wherein conduit **236** communicates with conduit **232** and conduit **234** communicates with conduit **226**. In this position, the hydraulic fluid within valve **224** and to the right of piston **230** flows through conduit **226** to the supply tank **218**. This allows the piston of cylinder **50** to descend a distance corresponding generally to the thickness of about **10** boxes on elevator **18**. Hydraulic fluid from the cylinder **50** enters the valve **224** by way of conduits **236** and **232** to cause the piston **230** to move to the right in FIG. **8**. The next time valve **222** is shifted, the components assume the position shown in FIG. **8** wherein all hydraulic fluid to the left of piston **230** is communicated to the tank **218**. Thus, the elevator **18** is by way of a hydraulic ratchet caused to periodically and successively descend an incremental distance which is a function of a predetermined number of boxes accumulating on the support surfaces **36**.

As the stack **62** accumulates, the boxes are repetitively spanked by the spanker plates **68** whereby the boxes are squared. If desired, side gates may be provided to assist in aligning the boxes. Pressurized air discharged downwardly from the blower **60** keeps the boxes compressed while the stack accumulates.

After the elevator **18** has accumulated the preselected number of boxes to form a stack and has descended the necessary distance, the relay **252** is actuated by the counter **256** and causes the following events to occur. Valve **190** is activated so that pressurized air from conduit **188** flows through conduit **194**. Simultaneously air is directed to fingers **154** through conduits **192** and **194** to cylinder **166**. Cylinder **166**, via link members **162, 163**, moves carriage **150** thereby causing fingers **154** to move toward frame **12** as shown in phantom in FIG. **3**. Valve **180** is then deactivated causing pressurized air to stop flowing from conduit **178** to conduit **189** thereby allowing the piston in cylinder **168** to descend, and the fingers **154** to lower to a horizontal position overlying the stack. Folded boxes subsequently delivered from conveyor belts **14** and **16** accumulate on fingers **154**. Since such subsequent boxes will be disposed between the stack **62** and the blower **60**, pressurized air is discharged through the holes on the bottom of the fingers **154** to maintain a compressive force on the boxes in the stack **62**.

Actuation of relay **252** by counter **256** in a manner indicative of a complete stack also shifts selector valve **250** whereby hydraulic fluid is directed from the lower section of cylinder **50** through conduit **248** to the tank **218**. This causes the elevator **18** to descend rapidly from its previous intermediate position to its lowermost or discharge position.

When the elevator **18** reaches its lowermost position wherein the surfaces **36** are meshed with the sets of idler rollers **106–110** on the conveyor **20**, a limit switch is tripped which causes the following events to occur. Valve **200** is activated so that pressurized air from conduit **198** flows through conduit **204** to move the pusher member **88** from the solid line position in FIG. **3** to the phantom position in FIG. **3**. Pusher member **88** transfers the stack **62** from the elevator **18** onto the conveyor **20** with the uppermost portion of the stack being engaged by the angled portion **129** on the conveyors **120** which at this time are being driven. The conveyors **120** slightly compress the stack **62**.

The pusher member **88** is immediately recycled to the solid line position shown in FIG. **3** and in doing so trips a switch which activates solenoid operated valve **210** whereby pressurized air from conduit **178** is communicated by way of conduit **212** to the cylinder **46** for the purpose of raising the elevator **18** to its uppermost position.

Pusher member **88** is perforated so as to have little air resistance as it moves between its operative and inoperative positions. If it is desired to change counter **256** for the total height of the stack **62**, hand wheel **144** will be turned to raise or lower the subframe **112**. As

the size of the boxes being processed changes, the frame **22** is moved toward or away from the frame **12** by rotating the lever arm **264** which rotates pinion **268** meshed with rack **266.** In the event of a jam up, or for any other desired purpose, the elevator **18** may be caused to rapidly and uninterruptedly descend by manually activating the solenoid valve **250.** Adjustment of hand wheel **228** adjusts the stroke of piston **230** which in turn adjusts the amount of descent of the elevator **18** each time that valve **222** is shifted. Adjustment of flow regulator **238** controls the rate at which hydraulic fluid may flow from conduit **236** to the valve **224.**

Thus, it will be seen that the counter ejector of the present invention accumulates a stack **62** of boxes on the elevator **18** and periodically causes the elevator **18** to descend a predetermined distance by means of a hydraulic circuit while the stack is maintained slightly compressed due to pressurized air from blower **60.** When a stack is being transferred off the elevator, fingers **154** temporarily support the incoming boxes continuously fed to the counter ejector and the fingers also perform the function previously performed by blower **60.** That is, pressurized air is discharged downwardly from the fingers **154** to maintain the stack **62** under compression until the function of compression is transferred to the conveyors **120.** As previously referred to, the compression of the boxes in the stack is necessary to prevent the joint of the boxes from opening or separating.

Pallets may be stored and loaded adjacent the left hand end of the conveyor **20** in FIG. **1.** If desired, the stack **62** may be tied while supported upon conveyor **22** and thereafter stacked on the pallets.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. Apparatus for accumulating a stack of sheets such as folded boxes comprising an elevator having a surface on which sheets may accumulate to form a stack, a first conveyor means for feeding sheets to said elevator, circuitry including fluid means for sequentially causing the elevator to descend in discrete increments correlated with the number of sheets fed to the elevator, second conveyor means for receiving a stack from said elevator, pusher means for transferring a stack from said elevator to said second conveyor means, a backstop facing said first conveyor means, and means above said elevator to apply a downwards compressive force to a stack while a stack is on the elevator.

2. Apparatus in accordance with claim **1** including a parallelogram linkage for supporting said elevator, said fluid means including a fluid cylinder coupled to said linkage.

3. Apparatus in accordance with claim **1** wherein said fluid means includes a hydraulic cylinder coupled to said elevator for controlling the descent of said elevator and a pneumatic cylinder coupled to said elevator for causing the elevator to ascend.

4. Apparatus in accordance with claim **1** wherein said means for applying a compressive force includes a blower for directing a blast of air toward the elevator.

5. Apparatus in accordance with claim **1** including a plurality of fingers mounted for reciprocation from an inactive position to an active position, said fingers being above the elevator for temporarily supporting incoming sheets when the fingers are in their active position, means for moving and guiding the fingers along an upwardly inclined plane when the fingers are moved from their inactive to their active position, and means for pivoting the fingers from an inclined position to a horizontal position when the fingers are in their active position.

6. Apparatus in accordance with claim **5** wherein said fingers are hollow and connected to a source of pressurized air associated with said circuitry, said fingers having discharge ports on a surface thereof for discharging air toward said elevator.

7. Apparatus in accordance with claim **1** including a vertically adjustable means for engaging and maintaining a compression force on a stack while the stack is supported by said second conveyor means.

8. Apparatus in accordance with claim **1** wherein said circuitry includes means for counting sheets fed to the elevator and a valve for sequentially permitting the escape of a predetermined volume of fluid whereby said elevator descends in predetermined increments.

9. Apparatus for accumulating a stack of sheets such as folded boxes comprising an elevator having a surface on which sheets may accumulate to form a stack, a first conveyor means for feeding sheets to said elevator, circuitry including means for sequentially causing the elevator to descend in discrete incremental distances correlated with the number of sheets fed to the elevator, second conveyor means for receiving a stack from said elevator, pusher means for transferring the stack from said elevator to said second conveyor means, a backstop facing said first conveyor means, means to apply a downward compressive force to a stack while a stack is on the elevator including a plurality of fingers selectively movable from a retracted position to an extended position, said fingers overlying the elevator in their extended position and being hollow, and said fingers having a plurality of discharge ports for directing pressurized air downwardly toward the elevator when said fingers are in their extended position.

10. In a counter ejector for forming a stack of paperboard folded boxes comprising an elevator, a first frame supporting said elevator, means adjacent one side of the elevator for delivering sheets to the elevator, a backstop adjacent an opposite side of said elevator, a plurality of fingers selectively movable from a retracted inoperative position to an extended position wherein the fingers are over the elevator, a second frame mounted for movement toward and away from said first frame, said backstop and said fingers being supported by said second frame, circuitry including a hydraulic cylinder supporting said elevator and for causing the elevator to descend in discrete increments correlated to delivery of boxes to said elevator, said circuitry including valve means for permitting escape of a predetermined volume of hydraulic fluid from a lower end of said cylinder and means for repetitively cycling said valve means, and means for transferring the stack from said elevator at a discharge position of the elevator.

11. In a counter ejector in accordance with claim **10** wherein said fingers are hollow, said circuitry including means for introducing pressurzied air into said fingers when the fingers are in their extended position only.

and said fingers having air discharge ports on their lower surface thereof.

12. In a counter ejector in accordance with claim **10** wherein said circuitry includes a pneumatic cylinder for moving said elevator in an upward direction.

13. In a counter ejector in accordance with claim **10** including a parallelogram linkage extending between a frame and said elevator for supporting said elevator.

14. Apparatus in accordance with claim **10** wherein said valve means includes a cam actuated valve.

15. In a counter ejector in accordance with claim **10** wherein said valve means includes a solenoid actuated valve coupled to a counter for counting boxes delivered by said conveyor means to said elevator.

16. In a counter ejector in accordance with claim **10** including a blower supported by a frame above the elevation at which said delivery means delivers boxes to said elevator.

17. In a counter ejector for forming a stack of paperboard folded boxes comprising an elevator, means for delivering sheets to said elevator, circuitry including a hydraulic cylinder supporting said elevator and for causing the elevator to descend in increments correlated to delivery of boxes to said elevator, said circuitry including valve means for permitting escape of a predetermined volume of hydraulic fluid from said cylinder and means for repetitively cycling said valve means, means for transferring the stack from said elevator at a discharge position of the elevator, said elevator being defined by a plurality of spaced parallel horizontally disposed surfaces, a discharge conveyor positioned to receive a stack from the elevator in a discharge position of the elevator, said conveyor having spaced parallel portions adapted to mesh with the spaced surfaces on the elevator.

18. Apparatus in accordance with claim **17** wherein said fingers extend between portions of the backstop and in their extended position temporarily support incoming sheets while a stack is being transferred from the elevator to said second conveyor means.

19. Apparatus for accumulating a stack of sheets such as folded paperboard boxes comprising an elevator, first conveyor means for feeding sheets to the elevator, means for causing the elevator to descend as a stack of sheets accumulates on said elevator, a blower above the elevator for directing air toward the elevator to apply a compressive force to a stack on the elevator, finger means movable from a retracted position to an extended position, said finger means in its extended position being below the elevation of said blower and over said elevator, said finger means having discharge ports for directing pressurized air toward the elevator when said finger means is in its extended position.

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