United States Patent

Johnson

[15] **3,665,675**

[45] **May 30, 1972**

[54] PACKAGING MACHINE

[72] Inventor: **Richard H. Johnson,** Arlington Heights, Ill.

[73] Assignee: **Stone Container Corporation,** Chicago, Ill.

[22] Filed: **Feb. 11, 1970**

[21] Appl. No.: **10,584**

[52] **U.S. Cl.** **53/223,** 53/387

[51] **Int. Cl.** **B65b 11/18**

[58] **Field of Search** 53/207, 210, 222–224, 53/230, 231, 387, 388

[56] **References Cited**

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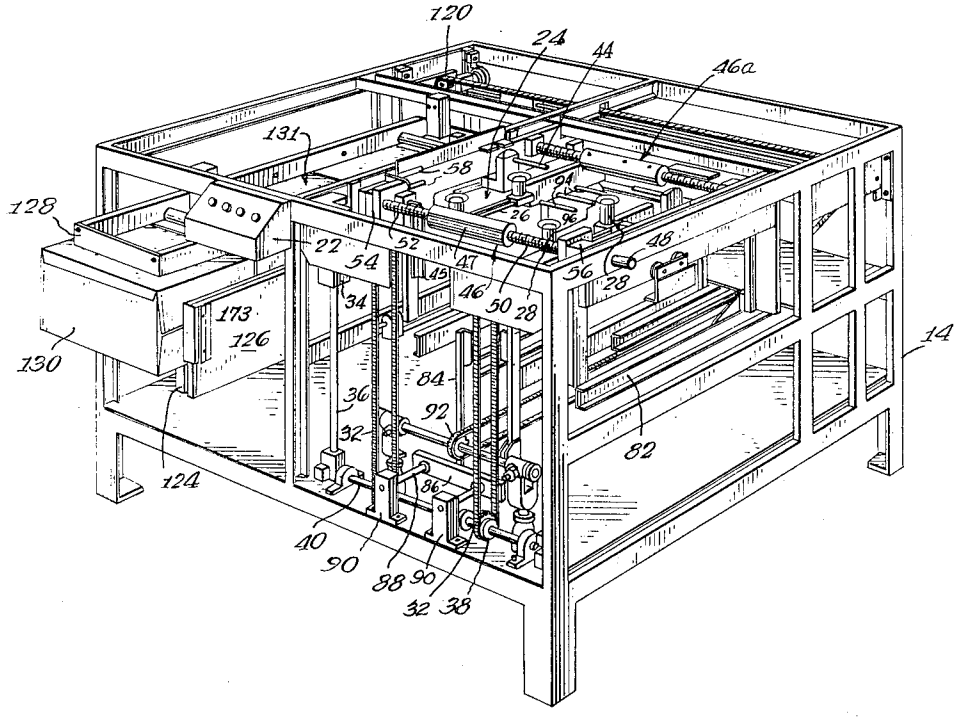
Primary Examiner—Theron E. Condon
Assistant Examiner—Neil Abrams
Attorney—Silverman & Cass

[57] **ABSTRACT**

An automatic machine for forming a paperboard box from an integral blank, about the articles to be packaged. The machine has an infeed opening to an erection chamber over which is disposed the blank, carrying articles. A vertically movable vacuum assembly or elevator in the chamber is movable from an upper position past a plurality of surrounding forming rods and abutments to a lower position so as to cause the front, side and rear wall forming panels of the blank to be erected partially. The semi-erected blank is then moved toward the rear of the machine along a horizontal path past other folding members to fold top and side wall-forming panels downwardly. The partially erected box is then received by a carriage and moved laterally in the same horizontal plane toward an elongate compression section, during which movement the front-forming flap, also known as a corner-joining flap, is folded to complete assembly or erection of the box. At the end of the carriage travel, the completed box is pushed forwardly into the compression section for ejection through a discharge chute at the front end of the machine. Several completed packages are accumulated in the compression section and when the machine is operating one box is discharged or ejected from the chute as a completed box is pushed forward from the lateral carriage path. The rearward, lateral and forward movements of the partially and completely erected box are along a U-shaped path lying in a single horizontal plane. The discharge chute is provided with inwardly pressing side plates to firmly hold the side flaps against the side panels during the setting of the glue.

6 Claims, 12 Drawing Figures



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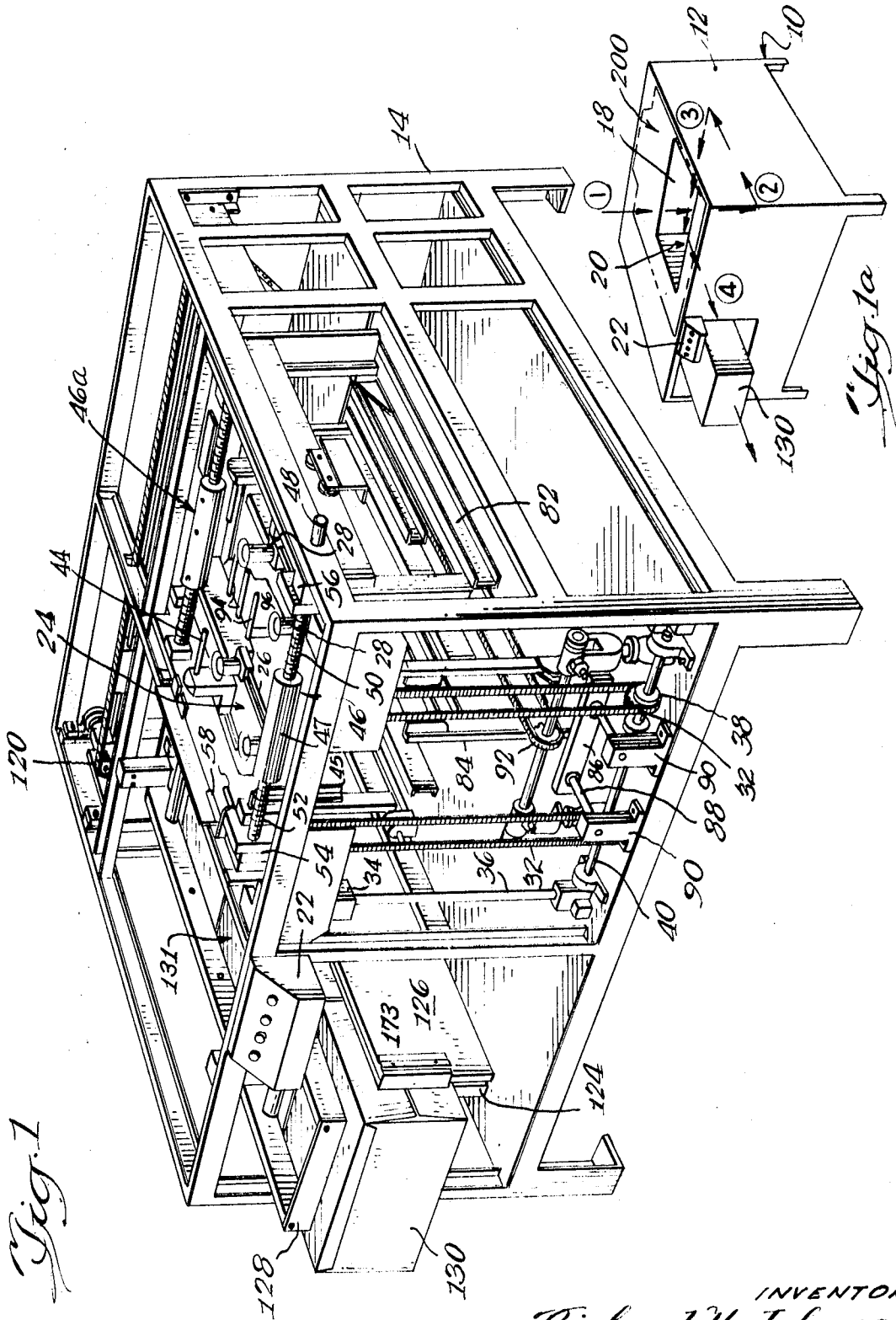


Fig. 1

Fig. 1a

INVENTOR
Richard H. Johnson
BY Silverman & Cass
ATTORNEYS

Fig. 2

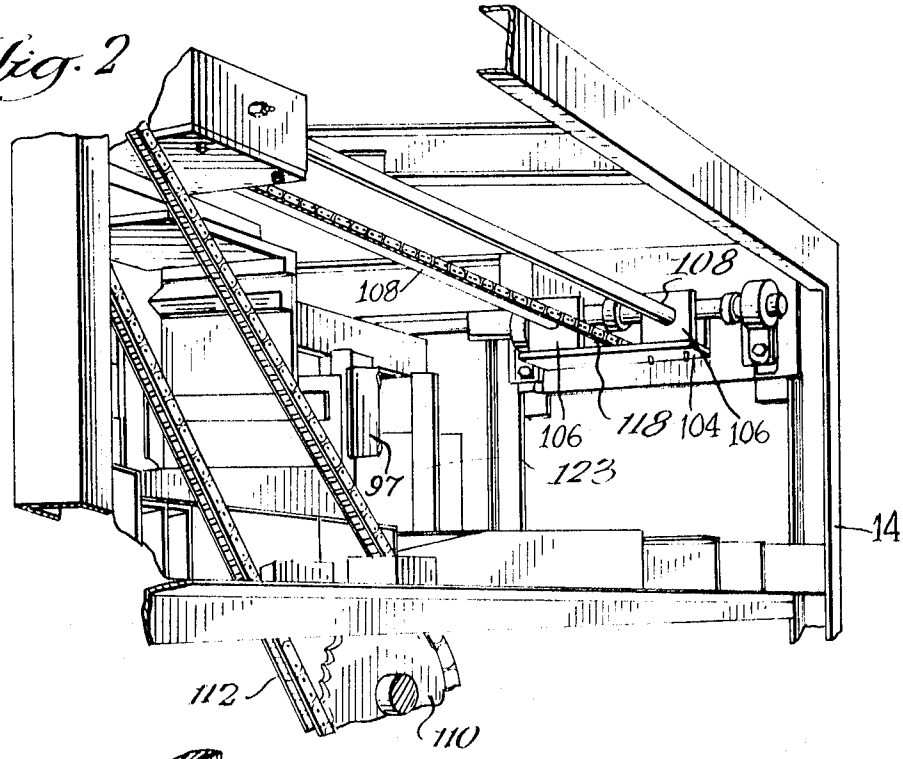


Fig. 3

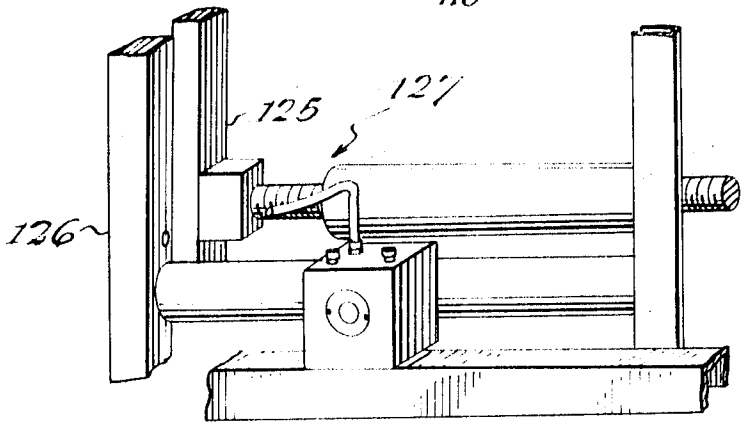
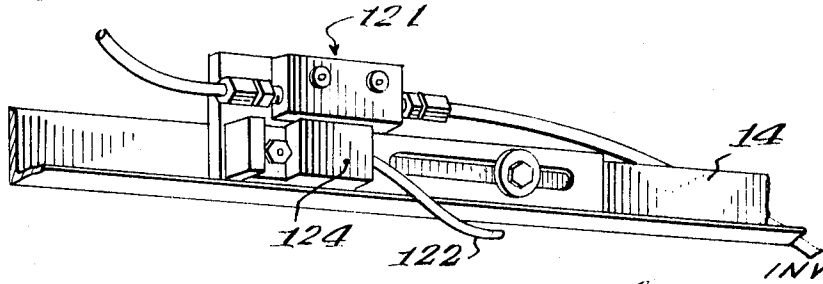


Fig. 4



INVENTOR
Richard H. Johnson
BY Silverman & Cass ATTORNEYS

Fig. 5

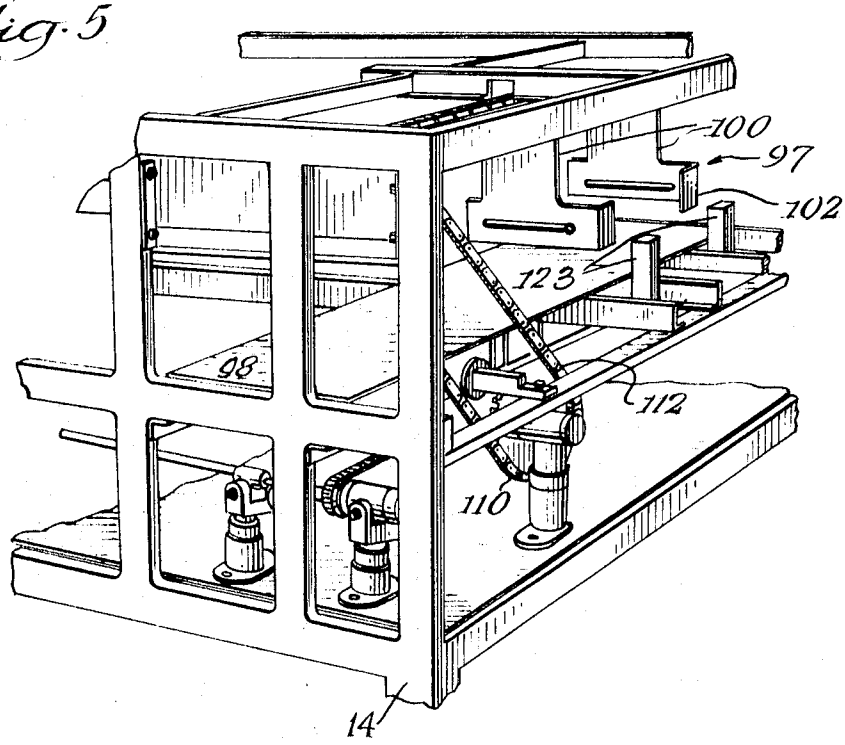
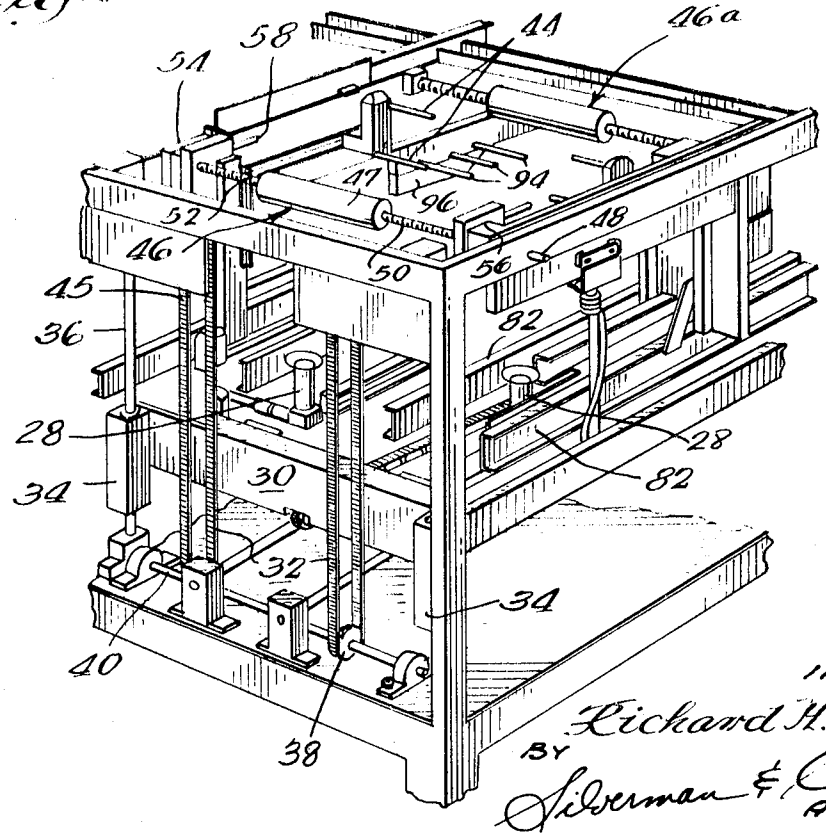


Fig. 6



INVENTOR
Richard H. Johnson
BY
Silverman & Cass
ATTORNEYS

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Fig. 7

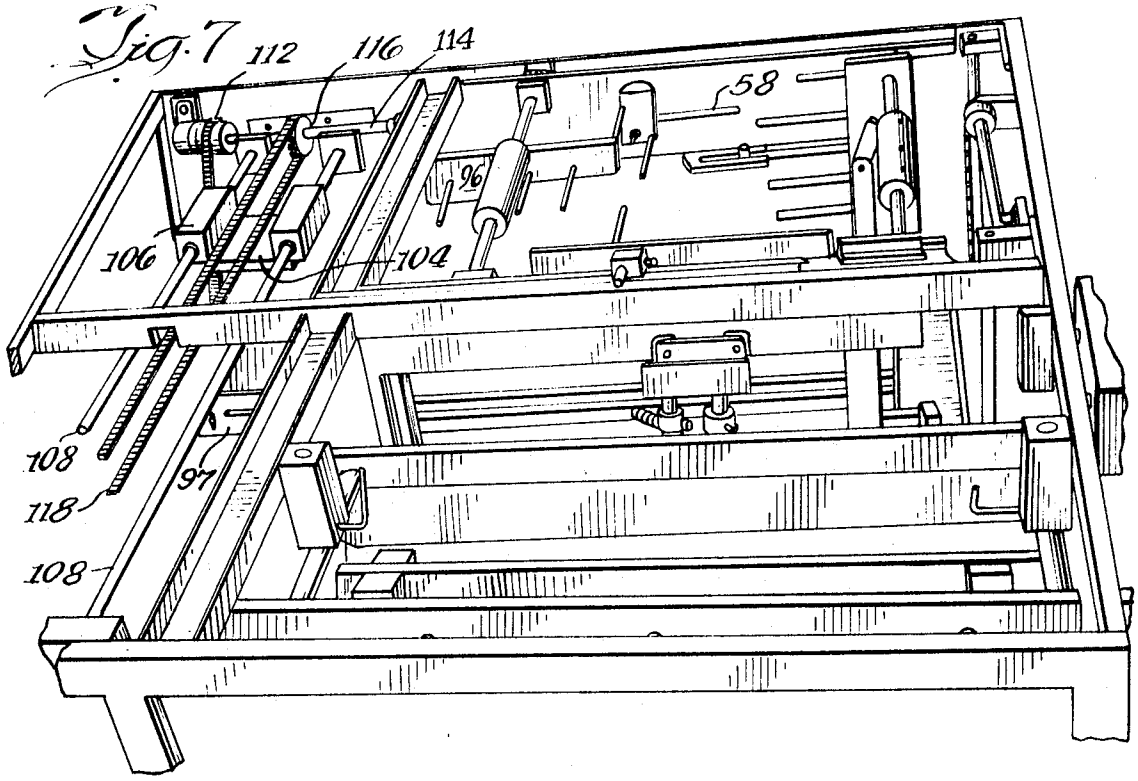
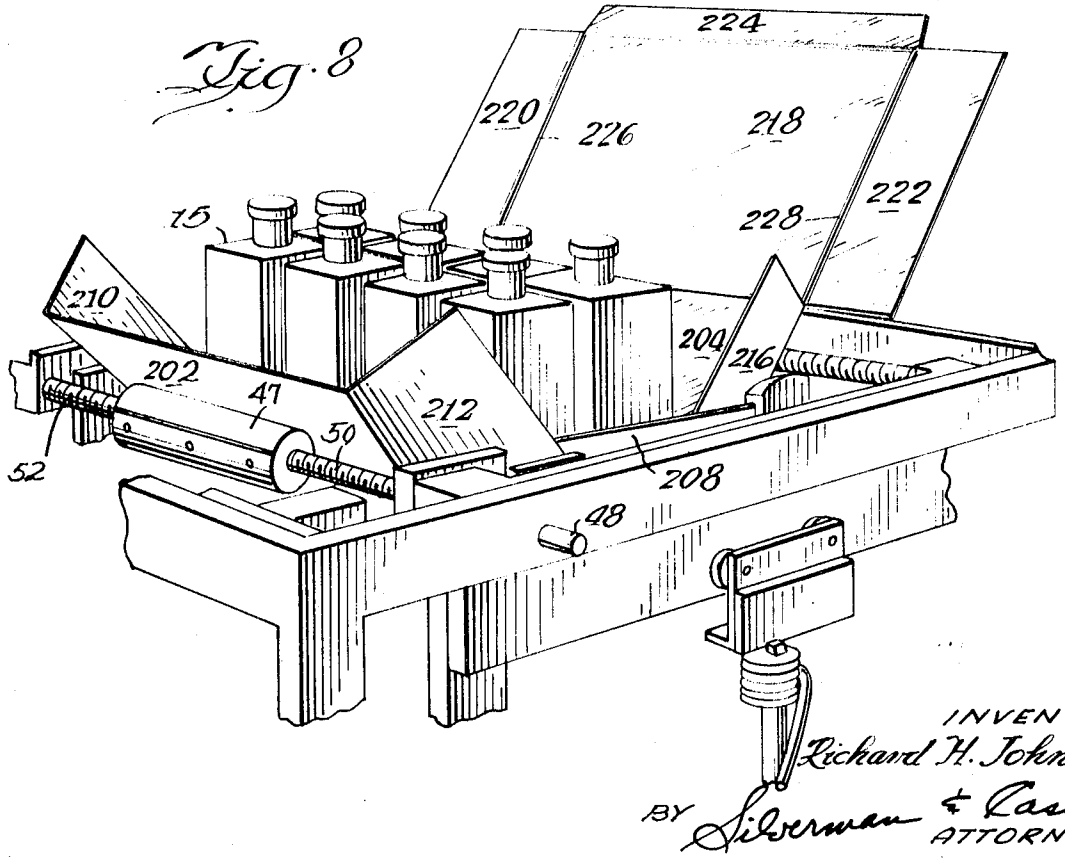


Fig. 8



INVENTOR
Richard H. Johnson
BY Silverman & Cass
ATTORNEYS

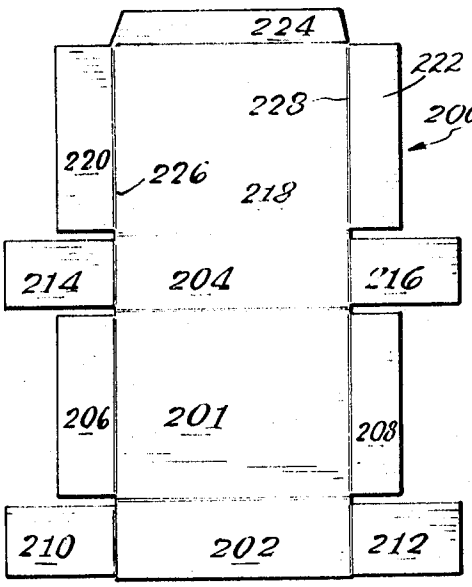


Fig. 9

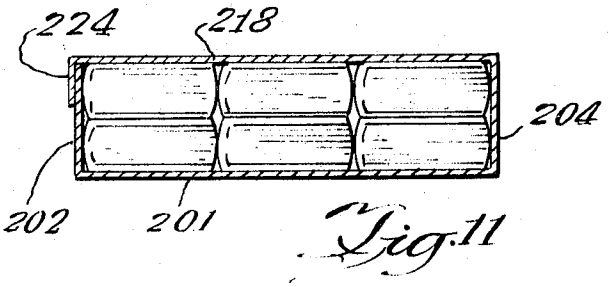


Fig. 11

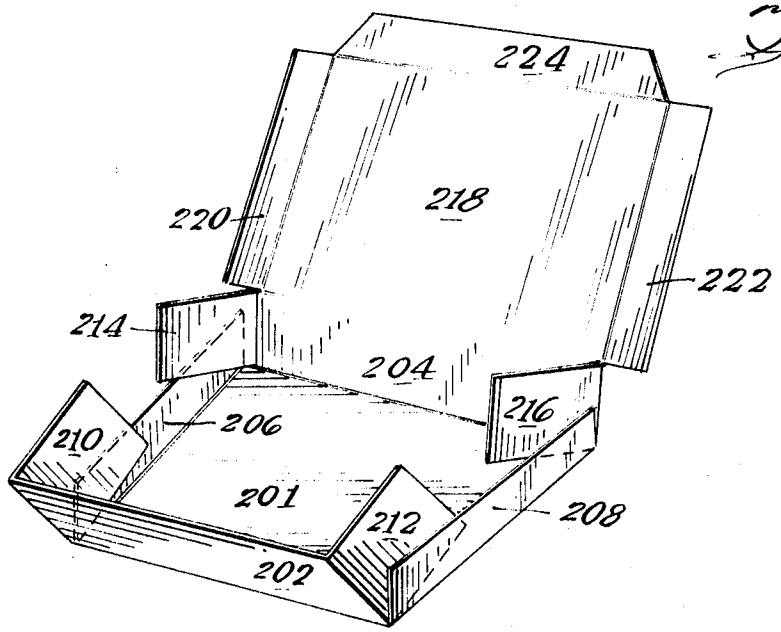


Fig. 10

INVENTOR
Richard H. Johnson

BY Silverman & Cass
ATTORNEYS

PACKAGING MACHINE

BACKGROUND OF THE INVENTION

This invention relates to automatic packaging machinery for erecting a paperboard box from a one-piece blank carrying articles which are to be packaged in the box, and particularly, relates to improvements in such packaging machinery by means of which important efficiency advantages are realized.

In copending patent application Ser. No. 691,796, filed Dec. 19, 1967, now U.S. Pat. No. 3,531,914, assigned to the assignee of the herein patent application, there is disclosed an automatic packaging machine for erecting paperboard boxes from a one-piece blank. Said packaging machine employs a vertical drying chamber in which the glued boxes are stacked before discharge. The chamber is vertically oriented so as to enable the applied glue to set and adhere before the package is discharged from the machine. The sealed box is then discharged at about floor level. Thus, the machine was inconvenient to operate since it was loaded at a waist-high level, but the boxes were discharged at a floor level. Furthermore, the orientation of the drying chamber added to the size of the machine and necessitated five movements with five associated mechanisms to erect the box.

SUMMARY OF THE INVENTION

There is provided an automatic packaging machine for erecting a paperboard box from a one-piece blank carrying the articles which requires only four distinct movements of the blank so as to erect the box in a single cycle of operation of the machine. Three of the four movements of the blank take place in a single plane along a horizontally oriented U-shaped path, which enables the completed package to be discharged at an elevated and hence, a more convenient and accessible level. Moreover, the vertically oriented drying chamber is eliminated.

The cycle of operation commences with the bottom-forming panel of a paperboard blank located over an infeed opening in the top of the machine with the goods to be packaged set on said panel. A vertically movable vacuum assembly or elevator engages the bottom surface of the blank and draws it downwardly into the machine past a plurality of rods and abutments which act as folding members; if the goods are sufficiently heavy the elevator need not have a vacuum assembly associated therewith since the weight of the goods will keep the bottom panel of the blank in engagement with the elevator surface as the elevator descends into the erection chamber. When the elevator has reached the lower position, the side, front and back panels which are interconnected to the bottom panel of the box are erected about the goods. The semi-erected box is then pushed along the rearward leg of the U-shaped path during which movement glue is applied to various surfaces and the top panel is folded downwardly into a horizontal position; secured to the top panel are flap members which are also folded downwardly into contact with the glued surfaces. The almost completely folded box is then received in a carriage for lateral movement along the back leg of the U-shaped path. The laterally movable carriage can engage the side panels of the container so as to hold them firmly while the glue sets. During said lateral movement, glue is applied to the front flap before it is folded downwardly into a vertical position for gluing to the front panel to complete the so-called "-manufacturer's joint." After the carriage completes its lateral movement, means are activated to push the box forwardly from the carriage into the rear end of a discharge chute. Then the carriage is returned to its initial carton-receiving position to receive another partially erected box in the next cycle of operation.

The discharge chute or compression section is sufficiently long to accommodate several completed boxes concurrently. When the most recently completed box is pushed into the chute, it automatically pushes forwardly on the remaining boxes and causes the completed box at the discharge opening to be discharged from the front end of the chute. This box is discharged at the same level as the U-shaped path which is normally about one box height below the top or loading surface of the machine or about 18 inches above the floor. Side compression plates which engage the side panels of the container can be provided; the plates include a thick sponge rubber section and are provided on their inner surfaces with a high-density polyethylene facing.

BRIEF DESCRIPTION OF THE DRAWINGS

A specific emdobiment of the present invention will be described in connection with the accompanying drawings in which:

FIG. **1** is a perspective view of the packaging machine embodying the invention showing the inner mechanisms of the machine;

FIG. **1***a* is a perspective view of the machine with a one-piece paperboard blank shown in phantom and the path of movement shown diagrammatically;

FIG. **2** is a fragmentary view showing the carriage and its drive mechanism;

FIG. **3** is a fragmentary top view of the discharge system showing an arrangement for adjusting the width of the discharge chute support rails;

FIG. **4** shows a trip lever for controlling the flow of glue to a glue discharge nozzle during the lateral movement of the semi-erected box along the lateral leg of the U-shaped path;

FIG. **5** is a fragmentary perspective view showing the carriage arms for receiving and laterally moving the box and the associated drive means;

FIG. **6** is a fragmentary view of the erection chamber with the vacuum assembly shown in its lower position and also depicting the folding members and the arrangement for adjusting the width of the chamber;

FIG. **7** is a perspective view of the top of the machine depicting the infeed opening, carriage drive means, and discharge chute;

FIG. **8** is a fragmentary perspective view showing a blank carrying the articles to be packaged at a point in its downward movement into the erection chamber;

FIG. **9** is a plan view of a blank for erection into a shipping container of different size;

FIG. **10** is a perspective view of said container, partially erected, with the top still open; and

FIG. **11** is a sectional view showing a plurality of small packages in the completed shipping container.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. **1***a*, the operating components of machine **10** embodying the invention are enclosed within a cabinet **12** which is formed by various panels mounted to a support frame **14**. The machine **10** is fed sequentially, either manually or automatically, a paperboard blank which is moved through the machine along a path on which it is subjected to folding and gluing operations in a predetermined sequence. The path of movement of a blank during a single cycle of operation is comprised of four principal segments of movement effected seriatim in order to form the box. The first segment of movement is the downward movement denoted by the path segment **1**; the second is a rearward movement shown as path segment **2**; the third is laterally along path segment **3**; and the fourth is the forward discharge movement along path segment **4**. Each of these segment movements comprising the entire path and the associated mechanisms will be described in detail hereinafter.

Turning now to FIG. **9**, a one-piece paperboard blank **200** suitable for use with the machine **10** is shown. When erected, the blank **200** provides certain walls and flaps for the completed package. To achieve this, the blank is cut, creased, and scored to provide panels and flap members which will provide such walls and flaps for the package. The same characters of indicia will be used for the blank segments and package walls and flaps in the interests of clarity.

The blank has a bottom wall-forming panel **201** connected with a wall-forming front panel **202**, a back wall-forming panel **204** and two side wall-forming panels **206** and **208**. Side flaps **210** and **212** are interconnected with the front panel **202** and flaps **214** and **216** are similarly connected to back panel **204**. A top wall-forming panel **218** is connected to the back panel **204**. Side panels **220** and **222** and the front or "manufacturer' s joint" flap **224** are associated with the top panel **218**.

Initially, the blank **200** is placed on the top or loading surface of the machine with bottom panel **201** aligned with the opening **18**. The articles **15** to be packaged are placed on the bottom panel or the blank **200** may be loaded on the machine already carrying the articles **15**. The blank and articles are ready to be moved down into the erection chamber designated **20**. A control panel **22** is mounted to the front of the machine having control members for initiating specific operations of the cycle.

The loaded blank is moved downwardly into the erection chamber **20** by a vertically movable vacuum assembly or elevator **24**. A vacuum system is normally employed with the elevator so as to grasp the bottom panel of the blank; however, if the articles to be packaged are sufficiently heavy to maintain the bottom panel in engagement with the elevator during its downward movement, the vacuum system need not be activated or even present. In the description hereinafter, a vacuum system will be described but it will be understood that it need not be employed in all instances. The vacuum assembly **24** includes a pair of horizontally oriented rearwardly projecting arms **26** on each of which is mounted a pair of suction heads **28**. As seen in FIG. **6**, the arms **26** are mounted to a cross member **30** which is secured to a pair of vertically movable chains **32** for moving the suction heads vertically. Also mounted to the cross member **30** are a pair of guide bushings **34** which slide vertically on the fixed shafts **36**. The chains **32** are driven by a sprocket **38** which is mounted to the driven shaft **40**. A conventional vacuum source is provided in communication with the suction heads which can be activated and de-activated selectively either automatically or manually.

To operate the vacuum assembly, the suction heads are moved to their elevated position, at which time the vacuum is actuated. The shaft **40** is then driven so as to rotate the chains **32** in a clockwise direction thereby moving the cross member **30**, arms **26** and suction heads **29** downwardly. The assembly is lowered to a position at the bottom of the chamber **20**, at which time the drive system is stopped or disengaged manually or by appropriate limit switches, which need not be illustrated insofar as this invention is concerned.

A plurality of folding members is provided in the upper portion of the erection chamber **20** and surrounding the vacuum assembly. In general, as the blank is drawn down into said chamber, these various folding members fold the front and the back panels **202** and **204** as well as the side panels **206** and **208** and flaps **210**, **212**, **214** and **216** into a vertical position. A set of horizontally disposed rods **44** are provided for vertically folding the back panel **204**; the front panel **202** is erected by the vertically extending guides **45**; the side panels are erected by the horizontally disposed rods **58**.

An arrangement **46** which includes a coupling member **47** and a pair of oppositely threaded shafts **50** and **52** is used to adjust the lateral dimension of the erection chamber. The threaded shafts engage the side supports **54** and **56** so that as the shaft **48**, which is coupled to shaft **50**, is rotated the members **54** and **56** are caused to move inwardly or outwardly. By adjusting the lateral dimensions of the chamber the lateral dimension of the infeed opening is also controlled. Thus, the width of the infeed opening is controlled to accommodate various width boxes. In order to assure that the opening has a uniform lateral dimension, the arrangement **46***a* is synchronized in its movement with the arrangement **46** by virtue of a sprocket and chain arrangement (not shown). For every rotation of the arrangement **46**, there is a like rotation for the arrangement **46***a*.

As the box blank **200** is being drawn downwardly, the front panel **202** is folded upwardly by the vertical guides **45** and the side panels **206** and **208** hingedly connected with the bottom panels are folded into their vertical position by the rods **58** and the rear panel by the rods **44**.

In FIG. **8**, a blank having several bottles **15** disposed thereon is shown in a position intermediate the bottom and top of the vacuum assembly movement. From this it can be seen that the front panel **202** is folded upwardly and the rear panel **204** is also being folded upwardly. The side flaps **212** and **216** are folded into their vertical position and side panel **208** is folded vertically and over the flaps **212** and **216**. Thus, when the vacuum assembly reaches the lower position, all panels except the top panel **218**, its interconnected side panels **220** and **222** and the "manufacturer's joint" or front flap **224** will have been erected.

As seen in FIG. **6**, in their lowered position, the suction heads **28** are positioned below a plurality of parallel, horizontal and rearwardly disposed rails **82** so that the bottom panel **201** of the partially erected box rests on the top surface of the rails **82**. At this point, the vacuum to the suction heads **28** is de-activated automatically, and the partially erected box is prepared for its rearward movement.

A pair of upstanding arms **84**, which engage the front panel **202** of the partially erected box, are mounted to a horizontally disposed support member **86** which moves along the horizontal shafts **88**. These shafts are held in place by the shaft support blocks **90**, a pair of which is provided on each shaft. The support cross member **86** is also secured to a driving chain **92**. As the chain is driven, the cross member **86** and upstanding arms **84** are moved either forwardly or rearwardly. After the partially erected box is positioned on the rails **82**, the upstanding arms **84** engage the front panel **202** when the drive mechanism is actuated to push the box rearwardly toward the path segment **3**. Since the surface upon which the box is being supported is a plurality of rails, the arms **84** move in the rearwardly extending slots defined by the rails. As the box moves rearwardly, the top and side panels engage the folding members **94** and **44** which fold the top panel into a horizontal position. The plow or folding members **96** then fold the side panels **220** and **222** downwardly and into a vertical position. As the box is being moved rearwardly, a pair of glue guns or glue dispensers (not shown) are actuated (by means to be described subsequently) to apply adhesive or glue to the upper and lower outer surfaces of the side flaps **210**, **212**, **214**, and **216**. Thus, as the panel **220** is folded downwardly and into contact with the flaps **210** and **214**, it contacts and adheres to those flaps. When panel **206** is folded upwardly and held against flaps **210** and **214**, it is secured thereto. Panels **208** and **222** are glued in the same manner as panels **206** and **220**.

Means are similarly provided for de-actuating the glue guns when the front panel **202** of the box passes the location thereof. The upstanding arms **84** continue to push the partially erected box rearwardly until the box is received by a carriage mechanism **97** generally, The rearward drive mechanism is disengaged when the box is completely in the path for lateral movement and has been received by the carriage **97**. Thus, the arms **84** do not travel into the lateral path of movement. The bottom panel slides from rails **82** onto a support surface **98**, seen in FIG. **5** as the box is received by the carriage **97**.

In general, during the rearward movement along path **2** the top panel **218** and side panels **220** and **222** are folded as glue is being applied at an upper and lower position to the vertically disposed side flaps **212** and **216** and the corresponding flaps on the opposed side. Thus, when the side panel **222** is folded downwardly, it contacts the glued surfaces, adheres thereto and forms a sealed joint.

After being drawn into the erection chamber, the panels **208** and **206** do not remain in the vertical position but spring outwardly from the box at an angle of about 45°, to provide clearance for glue heads which will apply glue on flaps **210**, **214**, **212**, and **216**. When the partially erected box is moved rearwardly, glue is applied to both lower and upper portions of

the side flaps. During the movement of the box rearwardly, the lower side panels **206** and **208** are rotated upwardly and into contact with the lower glued surfaces. At this point all the side panels and flaps are in contact at glued surfaces. The erected and glued box is then received by carriage **97** for its lateral movement along path **3**.

The carriage **97** comprises a pair of laterally adjustable depending arms **100** which have adjustable back stop-plates **102** for engaging the back panel **204** of the box. Thus, a wide or narrow, a shallow or deep box can be accommodated by the carriage by adjusting arm width or the stop-plates, respectively. The carriage arms **100** are mounted to and depend from a carriage support plate **104** which is carried on the bushing blocks **106** that slide laterally on horizontal shafts **108**. The shafts **108** are mounted at both ends to the frame **14**. Another chain drive system is provided for laterally moving the carriage. A lower sprocket **110** drives a chain **112** which in turn drives a shaft **114** on which a sprocket **116** is mounted. A chain **118** is trained about sprocket **116** and an idler sprocket **120** supported at the opposite end of the lateral path **3** near the discharge path **4**. The carriage support plate **104** is mounted to the lower side of chain **118** for movement with the chain along the shafts **108**.

When the partially erected box is received by the carriage arms **100** the lateral drive means is actuated causing the chain **118** to rotate in a clockwise manner thereby moving the carriage **97** from its receiving position toward the discharge chute.

The carriage arms **100** which engage the sides of the partially erected box have a lateral opening adjusted to hold loosely the sides of the box. As the carriage moves laterally, the front flap **224** is folded downwardly into a vertical position by plow means (not shown).

Prior to the folding of the front flap and as the box is moved laterally, the top panel **218** and leading edge **226** actuates a glue dispenser **121** by moving the depending lever **122** upwardly thereby actuating a valve mechanism within the housing **124** to allow glue to flow to a nozzle. (See FIG. **4**). The lever **122** is maintained in its upward position until the trailing edge **228** of the top panel **218** passes its position; then the lever **122** returns to its downward nonactuating position. When the glue applicator is actuated, a line of glue is applied to the under portion of the front flap **224** so that when it is folded against the front panel **202** the box will be sealed. A bottom lead edge actuated lever can be used interchangeably with the lever shown; or both can be used.

When the carriage **97** reaches the end of its travel at the discharge chute **131**, a pair of upstanding arms **123** move forward from their rearward receiving position and engage the back panel **204** of the box. The arms then push the box forwardly out of engagement with the carriage arms off support surface **98**, and into the discharge chute which forms path **4**. The operation of the arms **123** is quite similar to the operation of the arms **84** in that they are slidably mounted to a pair of shafts and may be moved forwardly and rearwardly by the action of a chain drive. The surface **98** is provided with a pair of slots through which the arms **123** move back and forth. The travel of the arms **123** is from the rear edge of the support surface **98** and to a point just forward of that surface. The box is pushed by the arms **123** off the support surface **98** onto a pair of runners **125** which support the bottom of the box. Side plates **126** which have a sponge rubber section and a high-density polyethylene facing **173** are provided for pressing the side panels inwardly so that the glue will adhere the panels to the side flaps thereby completely sealing the box. An adjusting arrangement **127**, similar to the arrangement **46** and **46***a* is provided below the path **4** to control the lateral dimension of the discharge chute by moving the runners **125** and/or plates **126** inwardly and outwardly. An upper guide member **128** is also provided to prevent cocking or misalignment of the box. The pusher arms **123** after completing their excusion, are returned to their rearward receiving position to disengage the next box from the carriage. The completed boxes are pushed forward until the chute is completely filled with boxes. Once the chute is filled and the arms **123** push the next box forward, a box **130** is discharged from the front end of the chute. This process continues as long as boxes are being made. The front panel and manufacturer's flap of the box being pushed into the chute engages the rear panel of the immediately forward box thus holding the flap in engagement with the front panel and permitting the glue to set and close the box.

It will be noted that the box **130** is discharged at an elevated level above the floor, namely about 18 inches. This is quite advantageous since it readily lends itself to a conveyor system for removing the box from the chute or manually removing the box. In the conveyor system, a slight downward slope to the conveyor will permit gravity to cause the box to move therealong.

Recapping for a moment the sequential operation of this machine, a blank is drawn downwardly into the erection chamber by the vacuum assembly. The vacuum is then released and a pair of upstanding arms push the semi-erected box rearwardly along path **2** to fold the top and side panels thereof. At this point, the vacuum assembly is in its lower position and the folded box is pushed rearwardly by a pair of arms into a carriage for lateral movement. The front flap is folded and glued as the carriage moves laterally to a discharge position where a second pair of arms pushes the folded and glued box from the carriage and into a discharge chute while the carriage remains in its discharge position. Each operation can be controlled manually or automatically by means of various limit and position indicator switches.

In the foregoing description, the machine **10** has been described with respect to a single blank or box moving therethrough. The machine can be operated so that a plurality of functions occur simultaneously. For example, the blank **200** is drawn into the erection chamber **20** at the same time that the empty carriage **97** is returned to its receiving position. In the next phase of operation, the partially erected box is moved rearwardly by the upstanding arms **84** toward the carriage **97** as the upstanding arms **123** return to their receiving position. The carriage **97** then is moved to its discharge position as the empty vacuum assembly **20** is moved to the upper position. In the last phase of the cycle, the arms **123** move the box from the carriage **97** as the arms **84** return to their receiving position. The cycle is repeated when the vacuum assembly is moved downward. With this synchronization, certain operations can be performed simultaneously, thereby increasing the rate of production.

From the previous discussion, it is seen that the paths **2**, **3**, and **4** lie in a horizontal plane and are generally in a U-shaped configuration. By virtue of the U-shaped configuration, the number of movements necessary to completely erect a box blank have been reduced to four. This means that the number of mechanisms necessary to accomplish the movements have been reduced and the machine simplified. Moreover, the machine is now in a sense human-engineered in that the top loading surface is at a convenient height for the loading of the blank and articles while the discharge chute is at a convenient height for manual or automatic removal of finished boxes.

In an embodiment of this machine, the chains are driven by pneumatic or hydraulic cylinders. However, it is apparent to one skilled in the art that other electrical and mechanical devices can be used. For example, a gear and shaft system electrically driven could be used.

A blank as shown in FIG. **9** may be used with the above-described machine. This blank differs from that shown in FIG. **8** only in actual size and proportions. There are the same number of flaps and panels which are erected in essentially the same configuration and manner as described above. The blank of FIG. **9** is shown in the partially erected condition in FIG. **10**. The blank of FIG. **9** is particularly suitable for folding into a container for shipping prepackaged articles and FIG. **11** shows the erected blank of FIG. **9** in cross section with said articles packaged therein.

In the foregoing description blanks capable of forming Regular Slotted Containers (RSC) have been shown; that is containers in which the side panels abut but do not overlap. It is understood that the machine as described can erect Overlap Slotted Containers (OSC); these are containers in which the bottom side panels normally either partially or completely overlap the top side panel. In the OSC the glue is applied to the bottom side panel before the top side panel is folded thereover.

What is desired to be secured by Letters Patent of the United States is:

1. A machine for sequentially erecting creased paperboard blanks carrying articles into completed packages, said blanks each including at least a front flap and a front panel adapted to cooperate when assembled with adhesive therebetween to form the manufacturer's joint of each package, said machine comprising:

a. a support frame providing an infeed opening in the upper surface of the machine and an erection chamber positioned below said opening;

b. elevator means movable within the chamber between an elevated position adjacent said opening and a retracted or lower position within the frame;

c. first folding means for partially erecting the blanks during their movement in the chamber, said folding means being mounted to the frame within and about the periphery of the chamber between said opening and said lower position of the elevator means;

d. rearward pusher means for moving the partially erected blanks from said lower position rearwardly out of said erection chamber;

e. second folding means positioned rearward of said chamber for folding at least the top panel of said partially erected blanks;

f. carriage means for receiving said partially erected blanks from the rearward pusher means and moving said blanks laterally to form said manufacturer's joint;

g. an elongate compression section having a discharge chute elevated above the base of the machine forward of said carriage means, the compression section including a pair of laterally adjustable side plates;

h. forward pusher means for disengaging the packages from said carriage means and moving said packages forwardly into said compression section such that the packages are maintained within the compression section by the side plates in abutting relationship with the manufacturer's joint of each package sandwiched by the immediately preceding package to maintain the joint in tight assembled condition during setting of an adhesive applied thereto;

i. the rearward, lateral and forward movement of said blanks forming a substantially horizontal single plane path of generally U-shaped configuration.

2. The machine as claimed in claim 1 wherein a plurality of packages are accumulated in the compression section for ejection sequentially, there being one package ejected concurrently with insertion of a blank into the compression section.

3. The machine as claimed in claim 1 wherein said compression section includes means for adjusting the lateral dimension of said section.

4. The machine as claimed in claim 3 wherein the compression section lateral adjusting means include:

a. a pair of mountings each having an oppositely threaded bore and each mounting being fixedly secured to a side plate;

b. a pair of aligned oppositely threaded shafts, each shaft engaging the mating bore of a mounting; and

c. means for coupling the shafts so that when said shafts are rotated the side plates move inwardly or outwardly with respect to one another.

5. The machine as claimed in claim 4 wherein said compression section further comprises a plurality of rearwardly extending support rails along which the packages move and are supported.

6. The machine as claimed in claim 5 wherein each support rail has a threaded bore extending laterally therethrough, and each bore threadably engages the threaded portion of said shaft so that said rail is laterally movable.

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