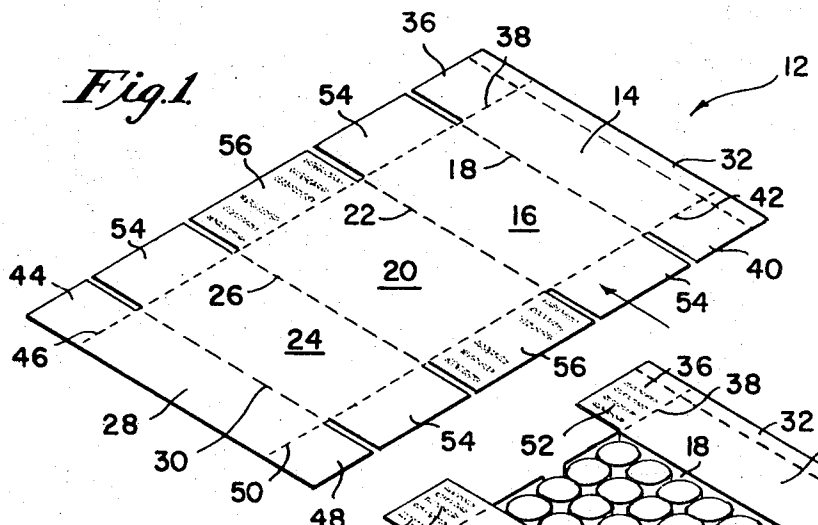
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PACKAGING APPARATUS

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Fig. 1.



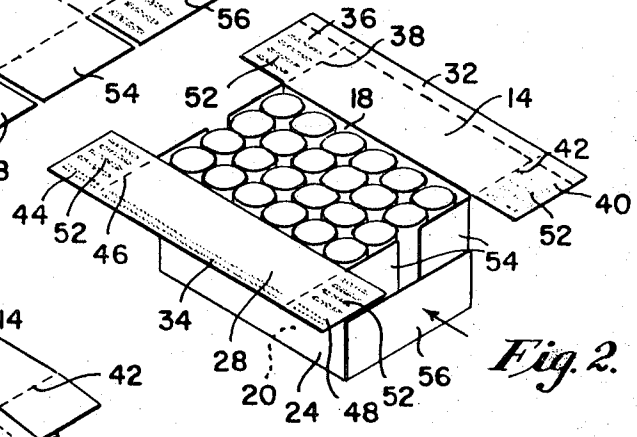


Fig. 2.

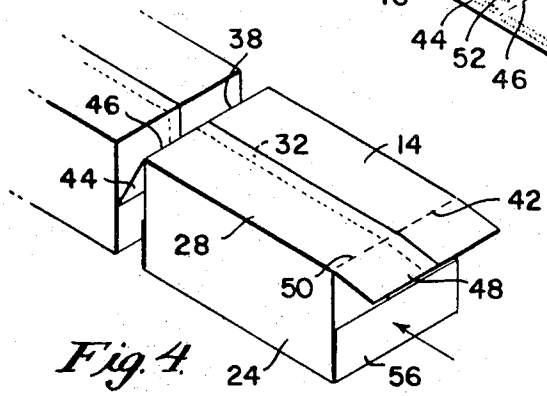


Fig. 4.

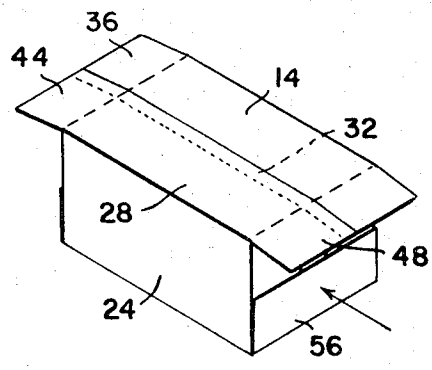


Fig. 3.

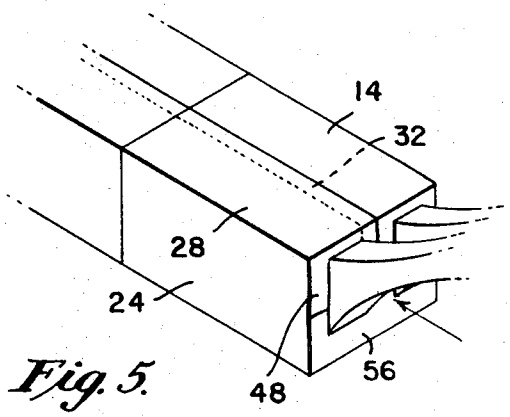


Fig. 5.

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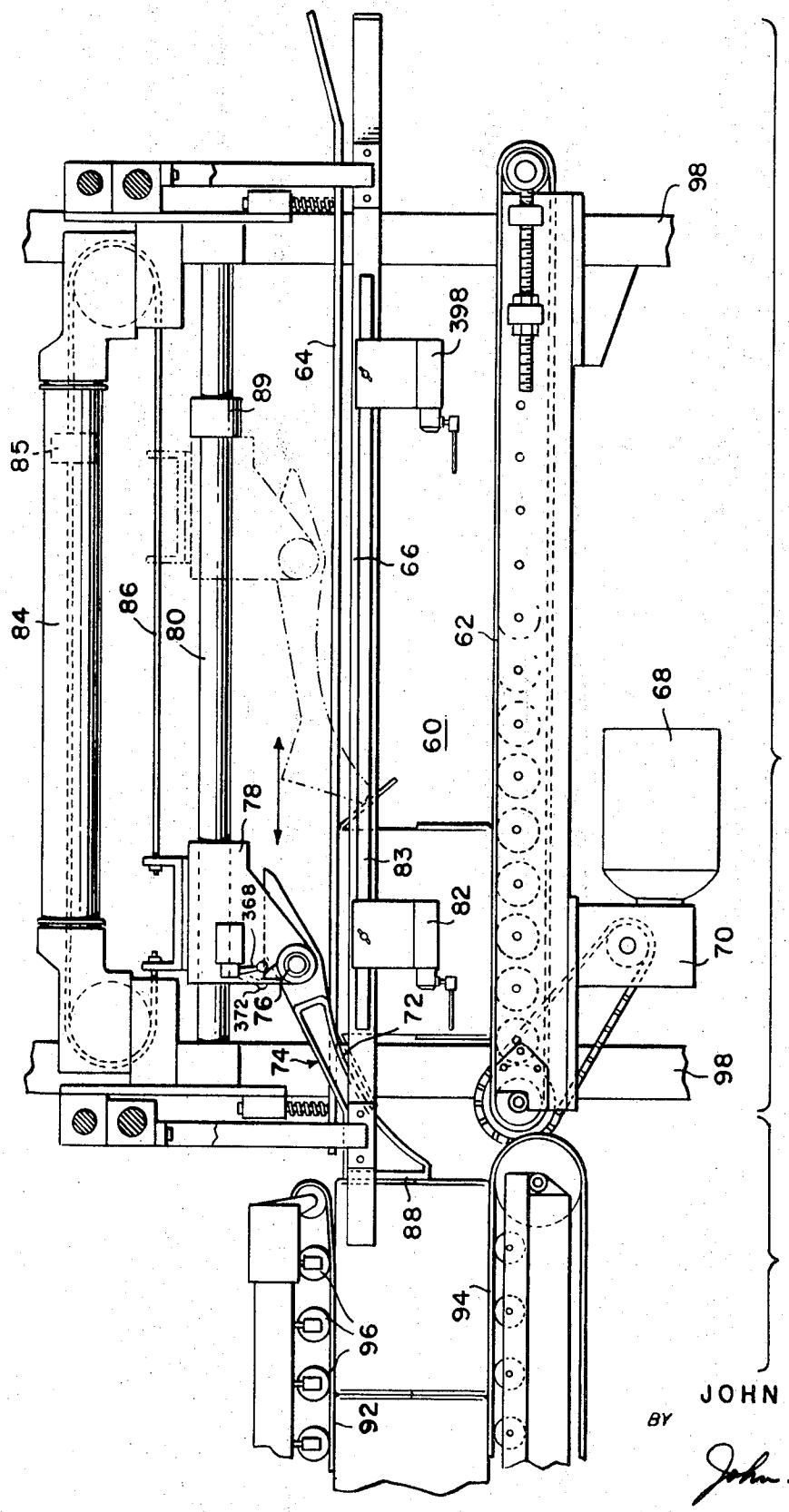


Fig. 6.

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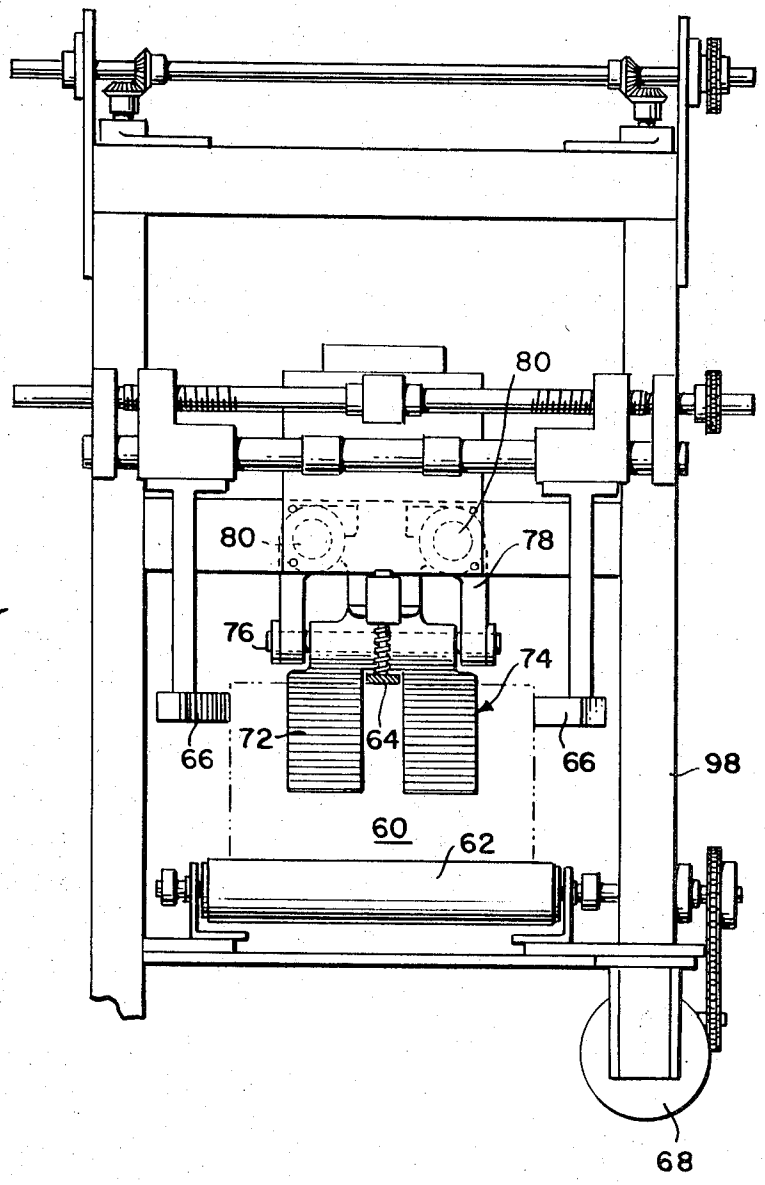


Fig. 7.

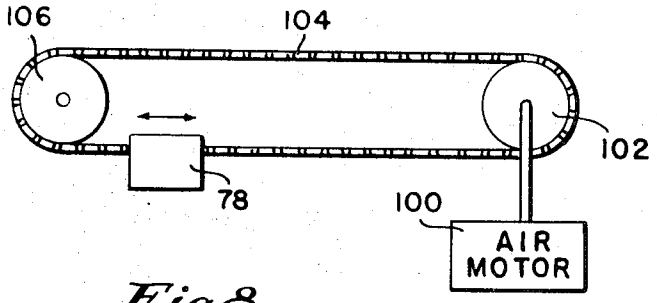


Fig. 8.

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Fig. 9.

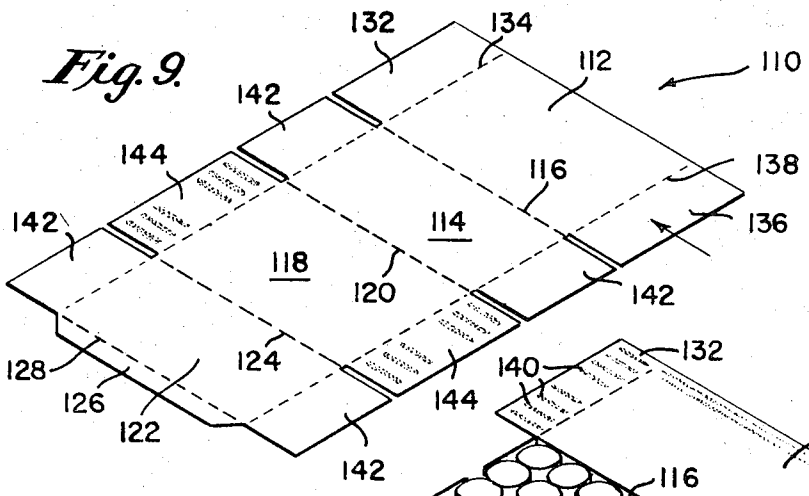


Fig. 10.

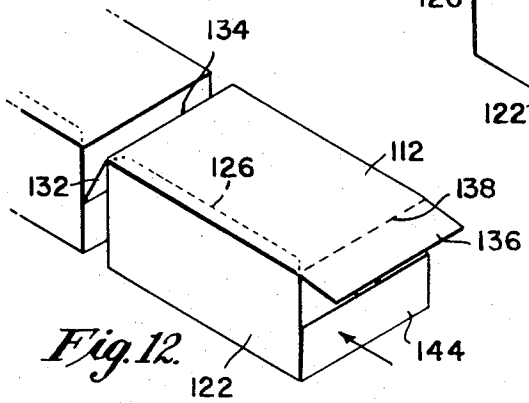
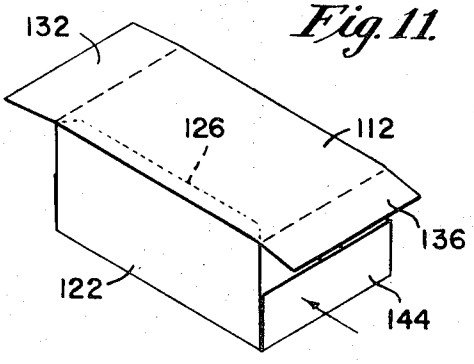


Fig. 12.

Fig. 11.



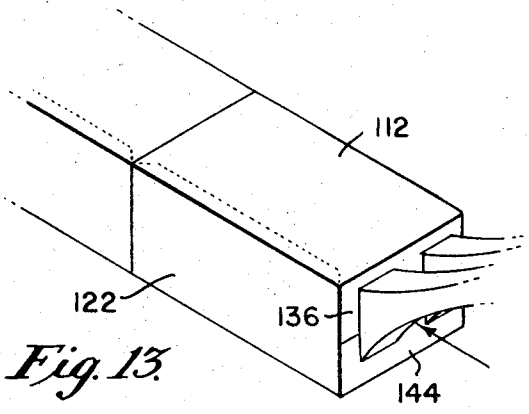


Fig. 13.

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Fig. 14.

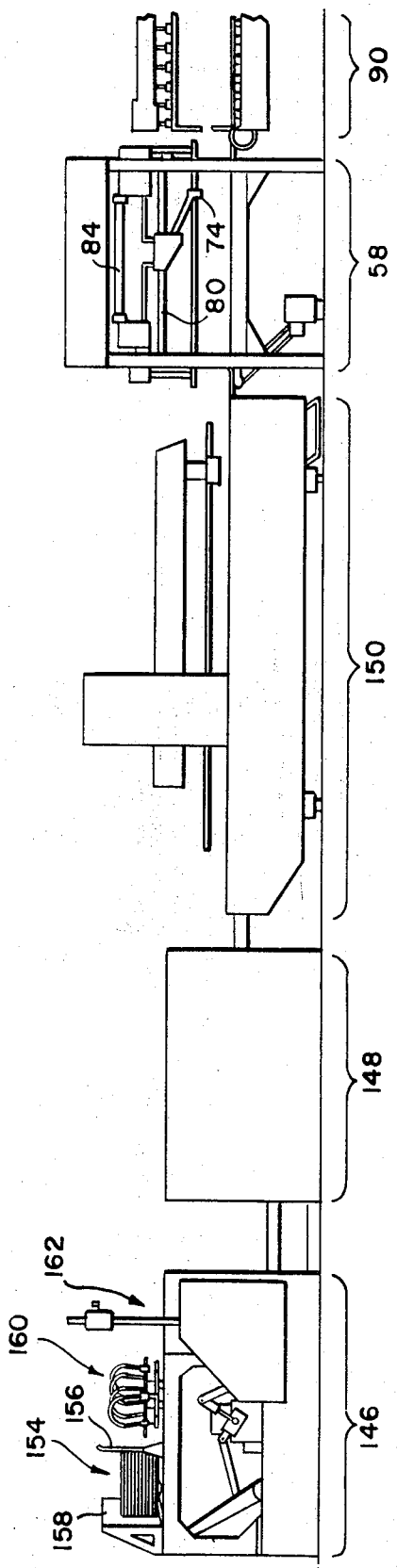
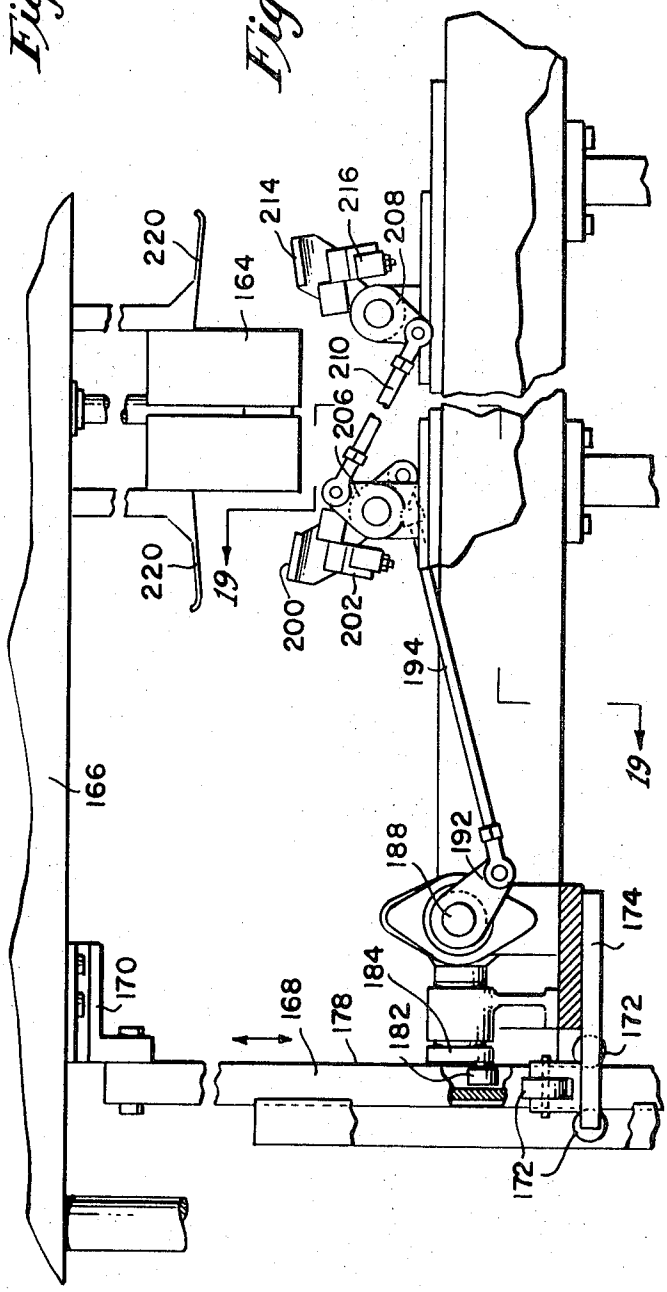


Fig. 18.



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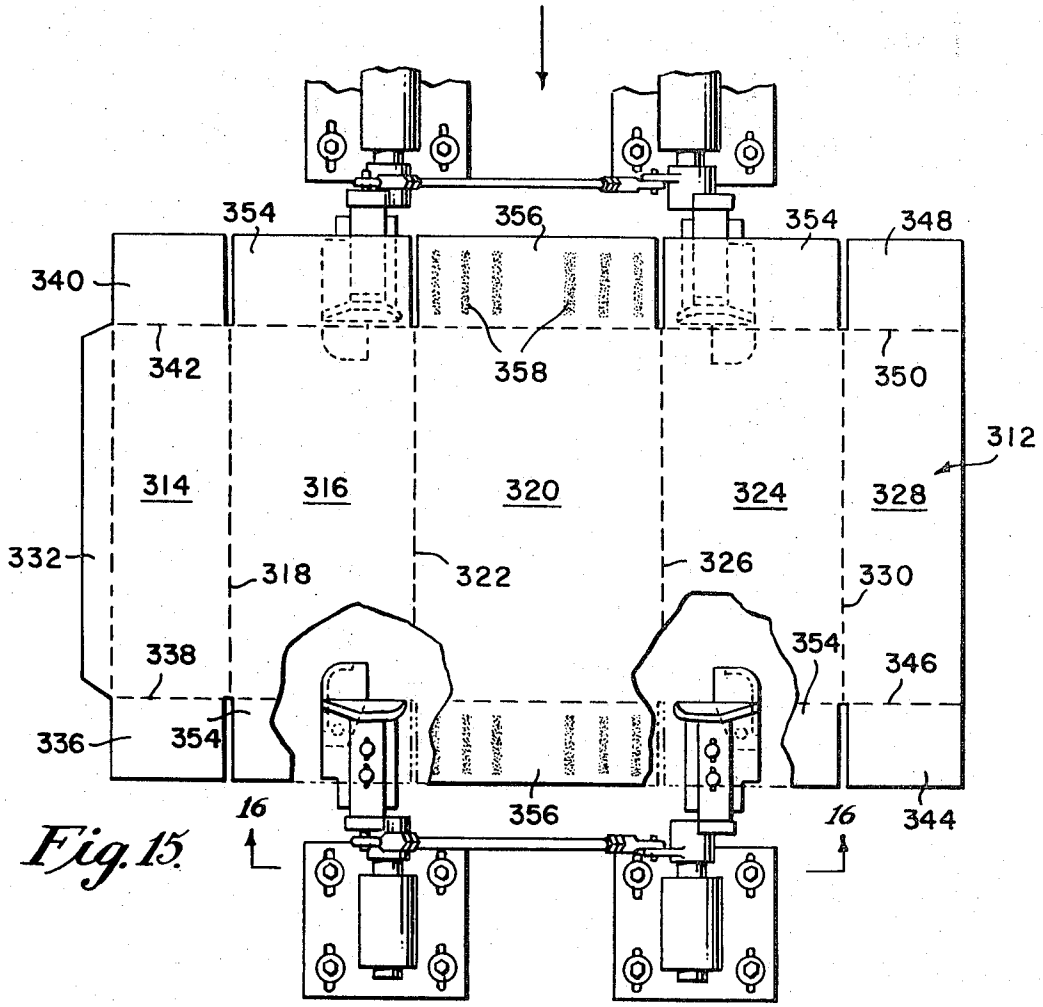


Fig. 15.

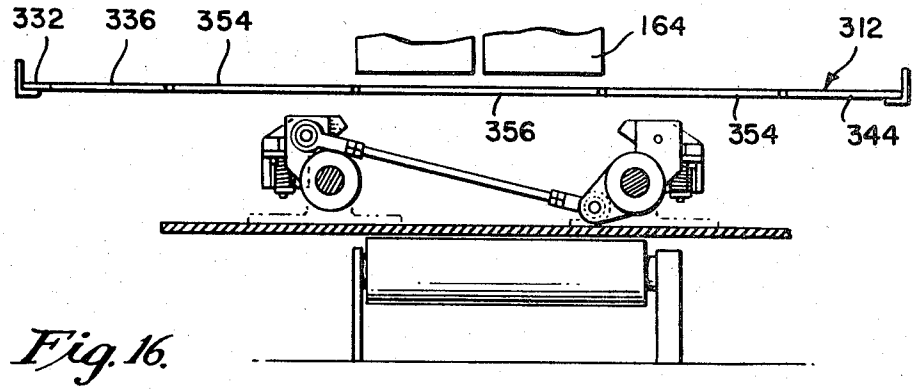


Fig. 16.

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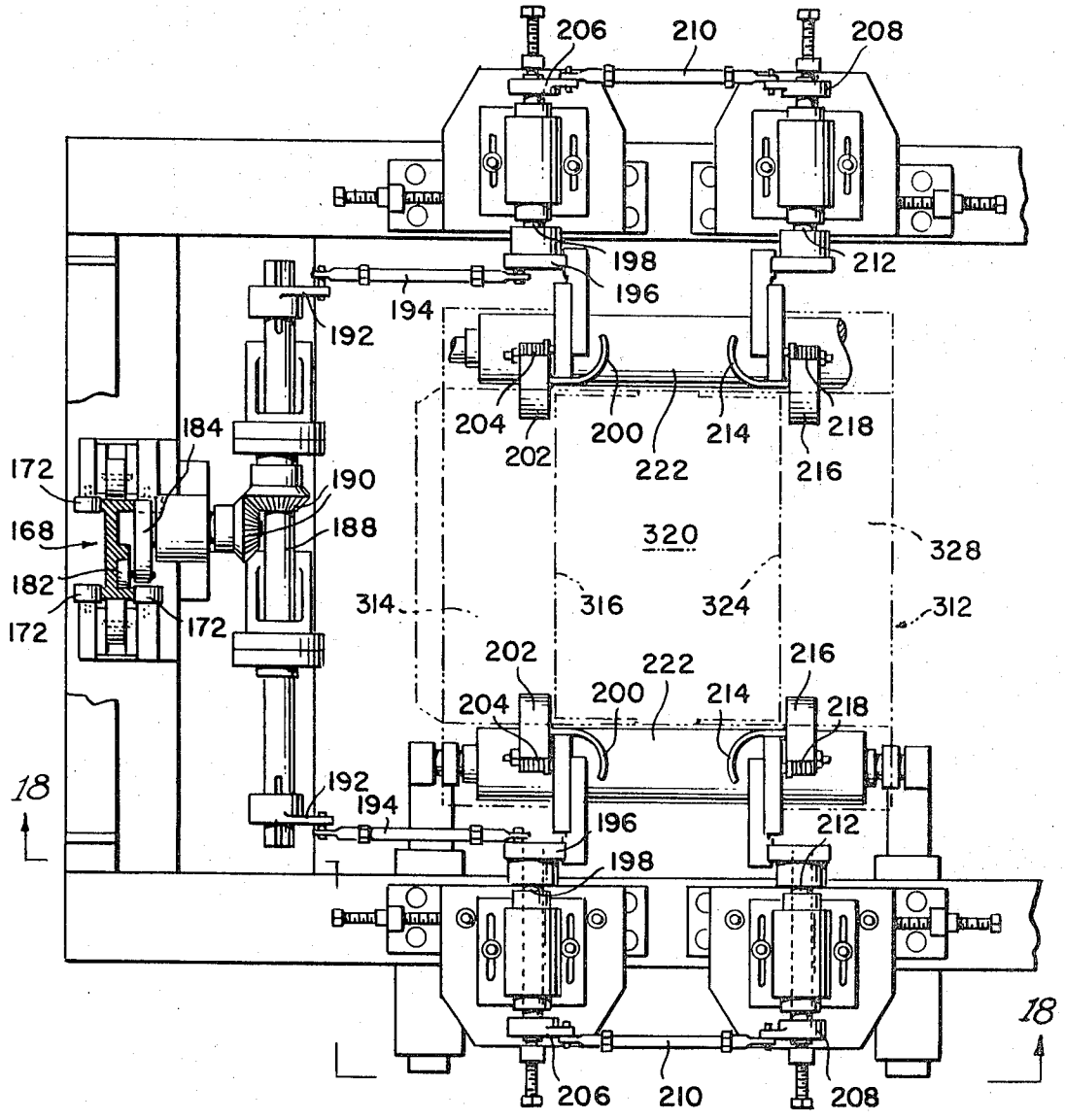


Fig. 17.

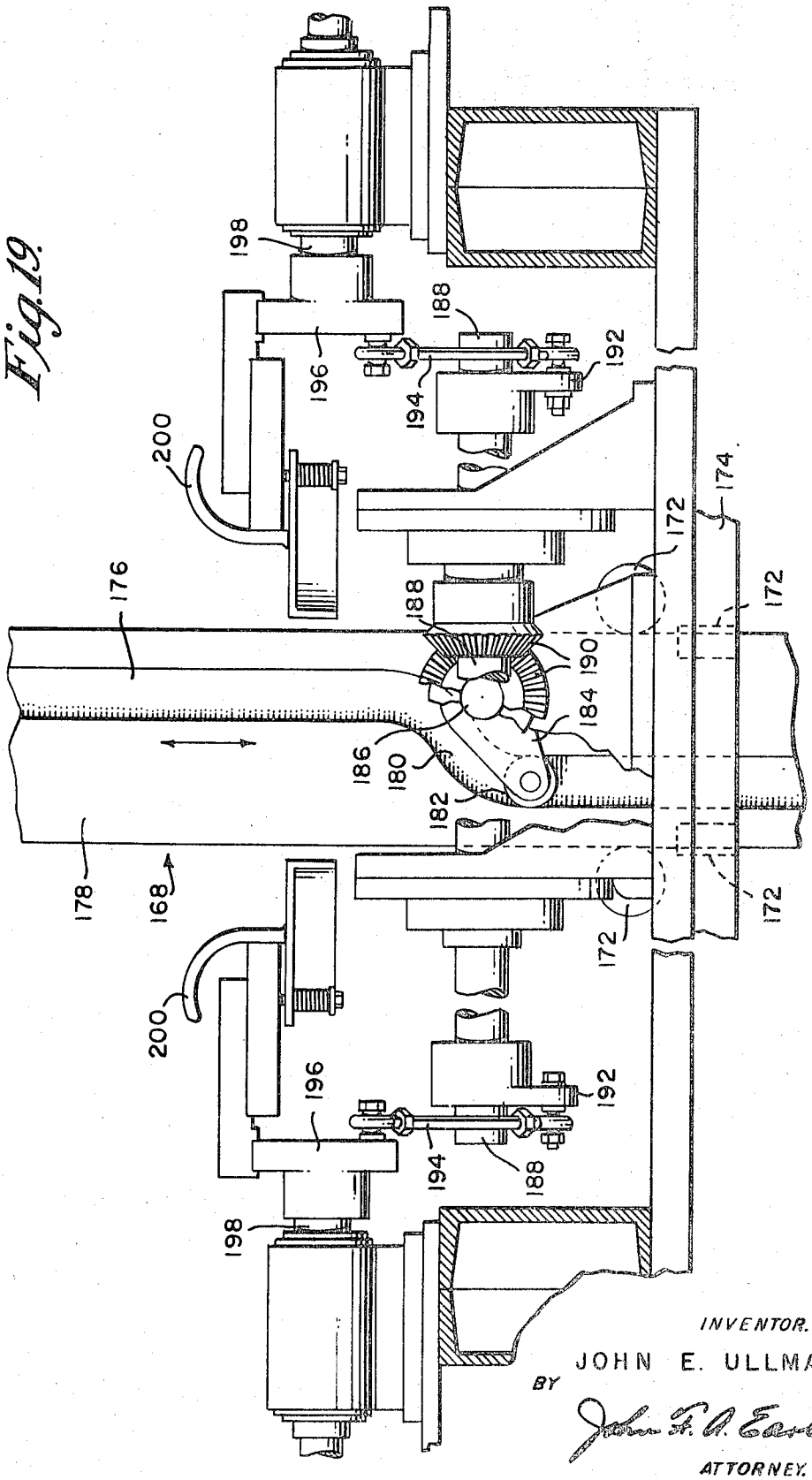
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Fig. 19.



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Original Filed April 25, 1966 9 Sheets-Sheet 9

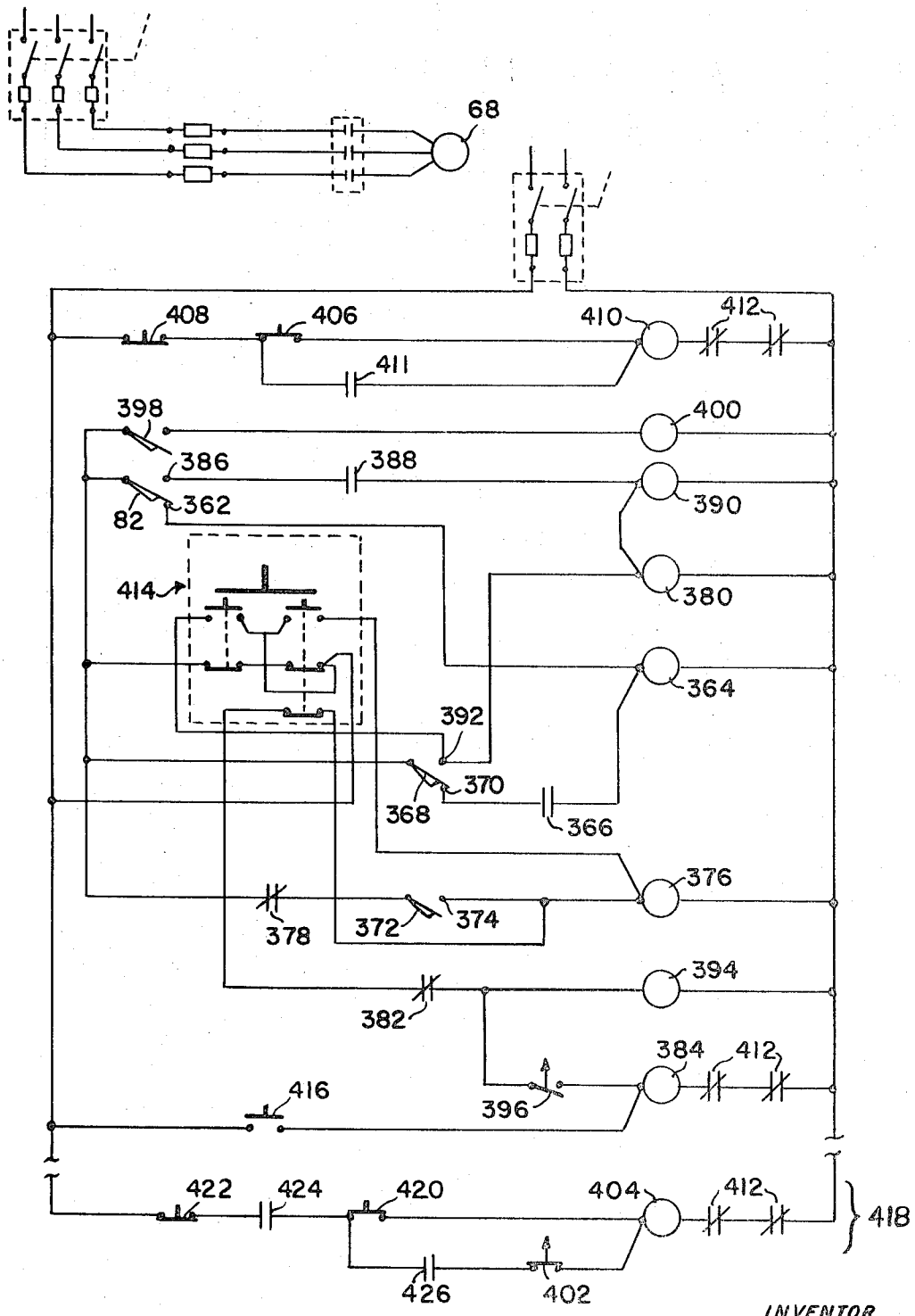


Fig. 20.

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United States Patent Office 3,543,469 Patented Dec. 1, 1970

3,543,469

PACKAGING APPARATUS

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Original application Apr. 25, 1966, Ser. No. 544,738, now Patent No. 3,397,509, dated Aug. 20, 1968. Divided and this application May 22, 1968, Ser. No. 731,242

Int. Cl. B65b *43/10, 47/04, 51/14*

U.S. Cl. 53—29 4 Claims

ABSTRACT OF THE DISCLOSURE

A method of forming an end-closing case comprising the steps of applying adhesive to the bottom flaps, folding the side panels at right angles to the bottom panel, folding the side flaps at right angles to the side panels, folding the bottom flaps at right angles to the bottom panel, pressing the side and bottom flaps together to adhesively seal them, folding the top panels outwardly from the case, filling the case, applying adhesive to a top panel and to the top flaps, folding the top panels over so that the manufacturer's flap laps said top panel, pressing the manufacturer's flap and said top panel together to adhesively seal them, folding the top flaps down, and pressing the top flaps and the side flaps together to adhesively seal them.

In another embodiment of the invention, one of the top panels comprises a manufacturer's flap, and the method steps include folding the manufacturer's flap at right angles to the side panels so that it laps the top panel, and pressing the top panel and manufacturer's flap together to adhesively seal them.

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a division of my patent application Ser. No. 544,738, filed Apr. 25, 1966, now U.S. Pat. No. 3,397,509, issued Aug. 20, 1968.

BACKGROUND OF THE INVENTION

This invention relates to packaging, and more particularly concerns a case, and apparatus for forming, filling, and sealing the case.

Cases or cartons made of corrugated paperboard or the like are widely used in the packaging of cans or similar articles. For example, 24 cans of soup or beer are quite commonly packaged in a corrugated paperboard case and shipped therein to supermarkets or other distributors.

Such cases usually fall into two types: (1) top and bottom closing cases, and (2) end-closing cases. The top-closing cases include two side panels connected together by two end panels, with top and bottom flaps extending from the side and end panels. The top flaps are folded over and fastened together by an adhesive to form the top of the case, and the bottom flaps are folded over and fastened together to form the bottom.

An end-closing case differs from a top-closing case in that it has end flaps instead of top and bottom flaps. Accordingly, an end-closing case comprises a top panel and a bottom panel connected together by a pair of side panels, with end flaps extending from the top, bottom, and side panels. The end flaps at the front end of the case are folded over and fastened together by adhesive to form the front end of the case, and the rear end flaps are folded over and fastened together to form the rear end.

Since many cases today are long and flat, the end flaps of an end-closing case are smaller than the top and bottom flaps of a top-closing case of the same size.

Accordingly, the blank of an end-closing case is smaller and uses less paperboard, with paper savings as high as about 30 percent as compared to the paperboard in the blank of a top-closing case of the same case size.

Therefore, many packers would prefer to use the end-closing case instead of the top-closing case because of the saving in paperboard. However, the end-closing case is difficult to load. Conventionally, an end-closing case is supplied by the manufacturer in the form of a flattened tube, with a small flap called a manufacturer's flap extending from the top panel and connected to a side panel by gummed tape, staples or an adhesive. To fill the case with cans, the panels are pulled away from each other to open the tube so that the side panels form right angles with the top and bottom panels, and the cans are pushed through one end of the case tube. Then the case is sealed by folding over the end flaps and fastening them together with adhesive.

But shoving a load of cans into one end of such a tube is very difficult, especially if a snug fit is desired. And packers prefer a tight, snugly-fitting case because the cans are less likely to be damaged in handling and shipping.

Packers also prefer a case which can be top-loaded, i.e., a case which may be loaded by passing the cans into the case through its top, because many loading machines are adapted for this type of loading. Top-loading is easier than end-loading.

Another reason which prevents many packers from adopting end-closing cases, even though such are less costly than the top-closing type, is that they have bought, and have present in their plants, conventional case sealing machines with horizontal compression units for sealing the cases, and such compression units are not usually adaptable for sealing end flaps of end-closing cases. Horizontal compression units are provided with top and bottom conveyor belts which pass around horizontal rollers. The upper rollers are spring-backed and exert a downward pressure on the top belt. Accordingly, pressure is exerted against the top and bottom flaps of filled top-closing cases passing between the belts, and this pressure holds the flaps in position and thereby assists in setting the glue or other adhesive which fastens the flaps together.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to overcome the problems of the prior art.

It is another object to provide a transfer unit which feeds an end-closing case into a horizontal compression unit in such a manner that the case may be sealed therein.

It is another object to provide a modified end-closing case which may be sealed in a horizontal compression unit.

It is another object to provide a case former which partly forms a case and adapts it for top-loading.

It is another object to provide a method for forming an end-closing case, loading it from the top, and sealing the case.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of this invention, including its simplicity and economy, as well as the ease with which it may be adapted to existing equipment, will further become apparent hereinafter and in the drawings, in which:

FIG. 1 is a view in top perspective of a flat, five-panel case blank;

FIG. 2 is a view in perspective of the case blank with its bottom formed into set-up condition filled with cans,

and with adhesive having been applied ready for final sealing action;

FIG. 3 is a view in perspective which shows the case as it appears when entering a transfer unit with the top panels folded over and the top end flaps extending substantially horizontally from the case;

FIG. 4 shows the case after the front top flaps have been turned down by the bottom portion of a pusher element of the transfer unit and shows the front top flaps in contact with a preceding case;

FIG. 5 shows the case at a later stage in operation of the transfer unit with the front flaps abutting the preceding case, and with the rear end top flaps having been turned down and being pushed forwardly by the pusher element;

FIG. 6 is a view in side elevation of a transfer unit constructed in accordance with this invention;

FIG. 7 is a view in elevation of the transfer unit looking from the right of FIG. 6;

FIG. 8 is a partial view in side elevation of another embodiment of the transfer unit;

FIG. 9 is a view in side elevation of another embodiment of case blank;

FIG. 10 is a view in perspective of the case blank of FIG. 9 with its bottom in set-up condition, filled with cans, and with adhesive having been applied ready for final sealing action;

FIG. 11 is a view in perspective of the case of FIG. 10 as it appears when entering a transfer unit, with the top panel folded over the manufacturer's flap, and with the top end flaps extending substantially horizontally from the case;

FIG. 12 shows the case after the top front flap has been turned down by the bottom portion of a pusher element of the transfer unit and shows the front top flap in contact with a preceding case;

FIG. 13 shows the case of FIG. 10 at a later stage in operation of the transfer unit with the front flap abutting the preceding case, and with the rear end flap having been turned down and being pushed forwardly by the pusher element;

FIG. 14 is a view in side elevation, partly schematic, showing the overall packaging apparatus including bottom former, loader or packer, gluer and top folder, transfer unit or end sealer, and horizontal compression unit;

FIG. 15 is a view in top plan of a flat five-panel carton blank positioned in the bottom former before the downward stroke of the forming mandrel;

FIG. 16 is a view in section taken as indicated by the lines and arrows **16—16** which appear in FIG. 15;

FIG. 17 is a view in top plan of the five-panel carton after the downward stroke of the forming mandrel and shows the carton with its bottom formed into set-up condition;

FIG. 18 is a view in section taken as indicated by the lines and arrows **18—18** which appear in FIG. 17;

FIG. 19 is a view in section taken as indicated by the lines and arrows **19—19** which appear in FIG. 18; and

FIG. 20 is a diagrammatic view of the electrical circuit of the end compression unit forming part of the invention.

Although specific terms are used in the following description for clarity, these terms are intended to refer only to the structure shown in the drawings and are not intended to define or limit the scope of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to the specific embodiments of the invention selected for illustration in the drawings, there is shown in FIGS. 1–5, a five-panel case blank **12** which comprises a first top panel **14**, a first side panel **16** connected to top panel **14** along a transverse crease line **18**, a bottom panel **20** connected to first side panel **16** along a transverse crease line **22**, a second side panel **24** connected to bottom panel **20** along a transverse crease line **26**, a second top panel **28** connected to second side panel **24** along a transverse crease line **30**, and a top sealing manufacturer's flap **32** extending from first top panel **14** and adapted to be overlapped by second top panel **28** so that the top panels **14** and **28** may be connected together by a layer of adhesive **34** between panel **28** and flap **32**.

A front end top flap **36** is connected to first top panel **14** by a longitudinal crease line **38**, and a rear end top flap **40** is connected to the rear of first top panel **14** by a longitudinal crease line **42**. Similarly, second top panel **28** is provided with a front end top flap **44** connected to it by a longitudinal crease line **46**, and a rear end top flap **48** connected to it by a longitudinal crease line **50**.

As is shown in FIG. 2, stripes **52** of adhesive have been applied to the inner surfaces of flaps **36**, **40**, **44**, and **48**, and these flaps are adapted to be fastened to the outer surfaces of end flaps **54** which extend from side panels **16** and **24**. A similar adhesive layer fastens end flaps **56**, which extend from bottom panel **20**, to end flaps **54**. End flaps **54** and **56** are connected to their associated panels by longitudinal crease lines.

When the case blank **12** is erected, filled, closed, and sealed, the panels and flaps are in folded position along the crease lines and form a six-sided case with an adhesive layer **34** connecting top-sealing manufacturer's flap **32** to top panel **28**, an adhesive layer connecting the front end flaps together to form the front end of the case, and an adhesive layer connecting the rear end flaps together to form the rear end.

Referring now more particularly to FIGS. 6–7 of the drawings, there is shown a transfer unit **58** that is constructed in accordance with the invention and is adapted to close a filled case. In general, the transfer unit comprises means for turning down the front end top flaps **36** and **44**, means for moving flaps **36** and **44** against a preceding case to hold the flaps in compression to aid in setting the adhesive thereon, means for turning down the rear end top flaps **40** and **48**, and means for moving a succeeding case against the rear flaps **40** and **48** to hold them in compression to aid in setting the adhesive. The transfer unit also includes means for pressing the top sealing flap **32** against the lapped top panel **28** to aid in setting the adhesive layer **34** therebetween.

The cases are delivered to transfer unit **58** from a case gluer with top panels **14** and **28** folded over and with top-sealing flap **32** lapping top panel **28**, and with top flaps **36**, **44**, **40** and **48** extending outwardly from the case in substantially horizontal fashion. The cases are delivered to a receiving channel **60** formed by a bottom conveyor belt **62**, a top guide rail **64**, and a pair of side guide rails **66**. Side guide rails **66** serve to guide the cases and keep them in line, and top guide rail **64** presses downwardly on the top panels to keep them closed until the case enters the compression belt section.

Conveyor belt **62** is driven by a motor **68** and gear box **70** and moves the cases forwardly so that end flaps **36** and **44** contact curved bottom portion **72** of a pusher member **74** and are turned down thereby. Belt **62** has a smooth surface and keeps moving when a case is stopped by a preceding case, because of its slipping engagement with the case.

Pusher member **74** hangs downwardly from a pivot pin **76** mounted in a bracket **78** which is reciprocable on a pair of rods **80**.

As conveyor belt **62** continues to push a case forwardly, the front end of the case actuates a limit switch **82**, such as a microswitch, that is adjustably mounted on a base **83** supported on a side guide rail **66**. Switch **82** moves bracket **78** and pusher member **74** rearwardly by actuating a piston **85** in air cylinder **84**. The piston is connected to both ends of bracket **78** by a cable **86** so that it is adapted to move bracket **78** both forwardly and rearwardly.

When pusher member **74** reaches the rear end of the case, it drops downwardly by gravity about its pivot pin **76**, and pusher plates **88**, which are at the front of pusher

member 74, turn down rear end flaps 40 and 48 during the course of this downward movement. Adjustable stop blocks 89 are mounted on rods 80 to prevent bracket 78 and pusher plates 88 from traveling too far rearwardly. If pushers 88 overtravel, i.e. go past the end of the trailing flaps, the pushers could push forwardly against the end of the flap, instead of bending it down, and crush the flap. Accordingly, pusher plates 88 contact rear flaps 40 and 48, bend them to the fully closed vertical position, and push the case in the forward direction. The case is pushed against the rear end of a preceding case which folds front flaps 36 and 44 to the fully closed position and holds them in compression against side flaps 54.

The case is received by a horizontal compression unit 90 which includes top and bottom conveyor belts 92 and 94. The top belt 92 is trained around spring-loaded rollers 96 which exert a downward pressure on the belt that, in turn, exerts pressure on the top panels 14 and 28 and top sealing flap 32 to assist in setting the adhesive layer 34.

Sealing pressure is exerted against the front flaps 36 and 44 by the preceding case, and against rear flaps 40 and 48 by the following case.

In order to keep sealing pressure on the end flaps, the conveyor belts of the compression unit 90 are not free-wheeling. Instead, belts 92 and 94 are driven by a motor provided with a brake. Conveyor belts 92 and 94 are driven at a slower speed than conveyor belt 62 in transfer unit 58 to insure that the end flaps of the cases are held in compression.

The elements of the transfer unit are supported in a frame 98 and are adjustable as to position in order to accommodate cases of various sizes. The conveyor belts of compression unit 90 are similarly adjustable.

Referring now to FIG. 8, there is shown an alternative embodiment of the transfer unit wherein pusher member 74 is driven by a reversible air motor 100 instead of by the air cylinder 84. Air motor 100 drives a sprocket 102 and a chain 104 which passes around an idler sprocket 106. Chain 104 is connected to bracket 78 and is adapted to move the bracket back and forth in response to the movement of air motor 100.

In operation, a filled case is delivered from a case gluer to transfer unit 58 with its bottom end flaps 56 adhesively fastened to its side and flaps 54, and with its top panels 14 ad 28 folded over so that top sealing flap 32 is in contact with adhesive layer 34. The top end flaps 36, 44, 40 and 48 extend outwardly from the case and have stripes 52 of freshly applied adhesive on their inner surfaces. The channel 60 of transfer unit 58 receives the case, and conveyor belt 62 moves it forwardly while guide rail 64 holds the top panels 14 and 28 in closed position ready for insertion into the compression belts. As belt 62 continues to move the case forwardly, front flaps 36 and 44 contact curved bottom portion 72 of pusher member 74 and this contact turns down the flaps 36 and 44 to the extent shown in FIG. 4. The forward movement of the case moves the front flaps 36 and 44 into contact with a preceding case so that the flaps are prevented from resuming their horizontal position. As the case moves forward, it actuates switch 82 which moves bracket 78 and pusher member 74 rearwardly, with pusher member 74 remaining in contact with the forward top flaps until they make contact with the previous case, and pusher member is pivoted upwardly and moves rearwardly over the moving case.

When pusher member 74 reaches the rear end of the case, it drops downwardly by gravity about its pivot pin 76, and air cylinder 74 is reversed to move the piston and bracket 78 and pusher member 74 forwardly.

Pusher plates 88 press the rear flaps 40 and 48 against the case and push the case forwardly into contact with the preceding case in compression unit 90. Accordingly, at the end of the forward stroke of pusher member 74, the front flaps 36 and 44 are held in compression by a preceding case in compression unit 90, the top panels 14 and 28 and the sealing flap 32 are held in compression by top belt 92, and the rear flaps 40 and 48 are held in compression by pusher plates 88.

Because of the sealing action of pusher plates 88 against the rear flaps 40 and 48, those flaps remain in place when pusher plates 88 are withdrawn to act upon a succeeding case which has been delivered to transfer unit 58.

By the time the cases complete the course of travel through the compression unit 90, they are thoroughly sealed.

Referring now to FIGS. 9–13, there is shown another embodiment of a case blank 110, a four-panel case with a manufacturer's flap extending from the top of a side panel. Blank 110 comprises a top panel 112, a first side panel 114 connected to top panel 112 along a transverse crease line 116, a bottom panel 118 connected to first side panel 114 along a transverse crease line 120, a second side panel 122 connected to bottom panel 118 along transverse crease line 124, and a top-sealing manufacturer's flap 126 connected to second side panel 122 along a transverse crease line 128. Flap 126 is adapted to be overlapped by top panel 112 in order to connect panel 122 to panel 112.

A front end top flap 132 is connected to top panel 112 by a longitudinal crease line 134, and a rear end top flap 136 is connected to the rear of top panel 112 by a longitudinal crease line 138.

As is shown in FIG. 10, stripes 140 of adhesive have been applied to the inner surfaces of flaps 132 and 136 in a case gluer, and these flaps are adapted to be fastened to the outer surfaces of end flaps 142 which extend from the side panels 114 and 122. Similar adhesive stripes already fasten end flaps 144, which extend from bottom panel 118, to end flaps 142. End flaps 142 and 144 are connected to the panels by longitudinal crease lines 134 and 138.

The operation of the transfer unit in closing and sealing a case made from case blank 110 is similar to the operation previously described with reference to a case made from case blank 12. A filled case is delivered from a case gluer to the transfer unit 58 with its bottom end flaps 144 adhesively fastened to side end flaps 142, and with top panel 112 and top-sealing manufacturer's flap 126 folded over so that the sealing flap 126 is overlapped by top panel 112 and has an adhesive layer therebetween. The top flaps 132 and 136 extend outwardly from the case and have stripes 140 of adhesive applied to their inner surfaces. The channel 60 of transfer unit 58 receives the case, and conveyor belt 62 moves it forwardly while rails 66 guide it and top rail 64 presses on the top panels to keep them closed until the case enters the compression belt section. As belt 62 continues to move the case forwardly, front flap 132 contacts curved bottom portion 72 of pusher member 74 and is turned downwardly. The continued forward movement of the case moves the front end flap 132 into contact with a preceding case which folds flap 132 into completely closed position and prevents it from resuming its horizontal position. Forward movement of the case causes it to actuate switch 82 to move the piston in air cylinder 84 and thus move bracket 78 and pusher member 74 rearwardly, with the pusher member moving upwardly to ride rearwardly on the top panel 112.

When pusher member 74 reaches the rear end of the case, it drops downwardly by gravity about its pivot pin 76, and air cylinder 84 is reversed to move the piston and bracket 78 and pusher member 74 in the forward direction.

During this forward motion, pusher plates 88 press the rear flap 136 against the case and push the case forwardly into contact with the preceding case in compression unit 90. Accordingly, at the end of the forward stroke of pusher member 74, the front flap 132 is ver-

tically positioned and is being compressed by the preceding case in compression unit **90**, the top panel **112** and the manufactuer's flap **126** are held in compression by top belt **92**, and the rear flap **136** is held in compression by pusher plates **88**. During its course of travel through compression unit **90**, rear flap **136** is held in compression by a succeeding case which is pushed into compression unit **90** by pusher plates **88**.

There are many advantages to the transfer unit of the present invention. It enables a packer to use an end-closing case which is usually less expensive than a top-closing case because it requires less paperboard. It also permits a packer to load his cases from the top, which is an easier method of loading. Moreover, it permits the packer to use equipment which he already has in his plant, such as packing machines, case gluers, and horizontal compression units. Some minor modifications may have to be made to the existing equipment to allow their utilization.

Referring now to FIG. 14, there is shown the overall packaging apparatus for forming, filling, and sealing a top-closing case having top, bottom, and side panels and top, bottom, and side end flaps. The apparatus comprises a bottom former **146** that forms the bottom and side panels and flap into set-up condition with the bottom flaps adhesively connected to the side flaps, a packer or loader **148** which is adapted to fill the cases with material, such as cans, through the top of the case. Loader **148** is of conventional cosntruction.

After the case has been filled with cans or other material, it is passed to a gluer and top folder **150** which applies an adhesive to the top flaps and to a top panel if the case includes a manufacturer's flap which is to be adhesively connected to the top panel. Gluer **150** also folds over the top panel or panels to the position shown in FIGS. 3 and 11.

From the gluer **150**, the case is delivered to transfer unit **58** which closes the end flaps and presents the case to the compression unit **90**. The unit **90** presses down against the top overlapping flaps of the case, for example, glued area **34** of flap **28** is pressed down against manufacturer's flap **32** to form a seal, and moves the case at a rate of speed which is slower than belt **62**, whereby the succeeding cases, as moved by belt **62** and pusher **74**, push against the preceding cases so that the top end flaps are held in compression against the side end flaps by the pressure from the preceding and following cases.

Bottom former **146** is constructed in accordance with the case former disclosed in my U.S. Patent No. 3,196,761 which issued on July 27, 1965, and includes a loading station **154** with front stacker bars **156** and rear stack guides **158** which held a stack of flat end-closing case blanks. Bottom former **146** also includes a glue station **160** which applies glue to the bottom flaps of the case blank, and a forming station **162** which forms the bottom of the case into set-up condition with the side panels perpendicular to the bottom panel and the bottom flaps adhesively connected to the side flaps.

Gluer **150** includes means for moving the filled case through the gluer and applying an adhesive to the inside surfaces of the top flaps and panel where desired, and means for folding over the top panel or panels into set-up position. Gluer **150** is of conventional design.

Referring now to FIGS. 15–19, forming station **162** of bottom former **146** is shown in more detail. A vertically reciprocable mandrel **164** is connected to a crosshead **166**. Also connected to crosshead **166** is a vertically reciprocable cam body **168** which is attached thereto (FIG. 18) by a bracket **170**.

Cam-guide rollers **172** mounted on plate **174** serve to guide the vertical movement of cam body **168**.

A cam track **176** is formed in cam-body face **178** and the cam track **176** includes a bend **180**. A cam roller or follower **182** rides in track **176** and is mounted on a lever **184** attached to one end of a shaft **186**. A cross shaft **188** is connected to shaft **186** by mitre gears **190**. Levers **192** are mounted at each end of cross shaft **188** and are connected to push rods **194**. The other ends of push rods **194** are connected to levers **196** of turner rods **198**.

Mounted on rods **198** are side flap turners **200**. Pivotally mounted on side flap turners **200** are side panel turners **202** which include a return spring **204**.

Also mounted on turner rods **198** are levers **206** which are connected to levers **208** by push rods **210**. Levers **208** are mounted on turner rods **212** which rotate simultaneously with turner rods **198** but in the opposite direction of rotation.

Mounted on turner rods **212** are side flap turners **214**, and pivotally mounted on side flap turners **214** are side panel turners **216** which are provided with a return spring **218**.

In operation of forming station **162** shown in FIGS. 15–19, crosshead **166** moves downwardly to move mandrel **164** and cam body **168** in the downward direction. When cam follower **182** moves through bend **180**, lever **184** rotates shaft **186**. This motion is transmitted by mitre gears **190** to cross shaft **188** and rotates its levers **192**. Push rods **194** rotate levers **196** and cause rotation of turner rods **198** to actuate side flap turners **200** and side panel turners **202** to turn the side panels and flaps into set-up position, i.e., from the position of FIG. 15 to the position of FIG. 17.

Further, the motion of turner rods **198** is transmitted to turner rods **212** through levers **206**, push rods **210**, and levers **208**. Accordingly, side flap turners **214** and side panel turners **216** are actuated to turn the other side panel and flaps into set-up position.

As the mandrel **164** continues downward travel, mandrel arms **220** (FIG. 18) rotate side panel turners **202** and **216** against their springs to move side panel turners **202** and **216** out of the path of travel of the top panels of the case. Arms **220** extend downwardly slightly from mandrel **164** and bend the top panels past the horizontal so that the edges are lower than the top of the side panel. Accordingly, these edges are not contacted by a succeeding case as they pass through a cage beneath mandrel **164**.

Bottom flap rollers **222** roll the bottom flaps of the case into set-up position in contact with the side flaps.

On the upward stroke of mandrel **164**, cam follower or roller **182** again passes through cam bend **180** in cam track **176** and causes rotation of the shaft **186** and **188** to rotate levers **196** and to rotate turner rods **198** and **212** to their original positions through the action of push rods **194** and **210**. This returns side flap turners **200**, **214** and side panel turners **202**, **216** to their original positions as shown in FIG. 15, for example.

For illustrative purposes, a five-panel case blank **312** is shown in FIGS. 15 and 17. Case blank **312** comprises a first top panel **314**, a first side panel **316** connected to top panel **314** along a transverse crease line **318**, a bottom panel **320** connected to first side panel **316** along a transverse crease line **322**, a second side panel **324** connected to bottom panel **320** along a transverse crease line **326**, a second top panel **328** connected to second side panel along a transverse crease line **330**, and a top sealing manufacturer's flap **332** extending from first top panel **314** and adapted to be overlapped by second top panel **328** so that the top panels **314** and **328** may be connected together by a layer of adhesive between panel **328** and end flap **332**.

A front end top flap **336** is connected to first top panel **314** by a longitudinal crease line **338**, and a rear end top flap **340** is connected to the rear of first top panel **314** by a longitudinal crease line **342**. Similarly, second top panel **328** is provided with a front end top flap **344** connected to it by a longitudinal crease line **346**, and a rear end top flap **348** connected to it by a longitudinal crease line **350**.

Side end flaps 354 are connected to side panels 316 and 324 by longitudinal crease lines, and bottom end flaps 356 are connected to bottom panel 320 by longitudinal crease lines. Stripes 358 of adhesive have been freshly applied to the inner surface of bottom flaps 356.

In operation, case blank 312 is delivered to the forming station in the position shown in FIG. 15 and FIG. 16. Mandrel 164 descends and turner rods 198 and 212 are rotated from the position of FIG. 15 to the position of FIG. 17. Side flap turners 200 and 214 fold side flaps 354 into position perpendicular to side panels 316 and 324.

Side panel turners 202 fold side panel 316, and side panel turners 216 fold side panel 324 into position perpendicular to bottom panel 320.

Mandrel arms 220 fold top panels 314 and 328 outwardly into the position shown in FIG. 17, and then arms 220 turn side panel turners 202 and 216 out of the way to permit downward passage of top panels 314 and 328.

Also in the downward stroke of mandrel 164, bottom rollers 222 fold bottom flaps 356 into position against side flaps 354 and press those flaps together so that the stripes 358 of adhesive make good contact between them. The bottom-formed case blank 312 is caught and held by ratchet-like pawls at the end of the downward stroke of the mandrel. Then the mandrel moves upwardly to its original position and side panel turners 202 and 216 are returned to their original position by return springs 204 and 218.

Turner rods 198 and 212 are returned to their original position in response to the upward movement of cam body 178.

Referring more particularly to FIGS. 6 and 20, the operation of the transfer unit and its electrical circuit is as follows. In "machine ready" conditions, limit switch 82 is closed to contact 362 to energize the coil of control relay 364 and close its contacts 366. Since pusher 74 is in its down position, limit switch 368 is closed to contact 370, and limit switch 372 is closed to contact 374 to keep forward solenoid valve 376 energized through closed contacts 378 of control relay 380. Contacts 382 of relay 364 are open to keep compression belt motor switch 384 de-energized and belts 92 and 94 stopped.

An incoming case actuates case detector switch 82 and closes it to contact 386 and opens it to contact 362. Contacts 388 of relay 364, which had been previously closed, conducts power to energize rearward solenoid valve 390 and relay 380. Pusher 74 moves rearward.

When pusher 74 reaches its up position, relay 364 drops out, but not before switch 368 closes to contact 392 to maintain rearward solenoid valve 390 energized, even though contacts 388 open to isolate switch 82.

When pusher 74 reaches the rear flaps of the case and starts to drop, switch 368 opens to contact 392 to de-energize rearward solenoid valve 390 and relay 380.

Accordingly, pusher 74 stops and drops to the full down position, and closes switch 372 to energize forward solenoid valve 376 through contacts 378. Contacts 382 of relay 364, which are closed, conduct power to energize time delay relay 394. Pusher 74 pushes the case firmly against a preceding case and stalls against it for a predetermined time interval, and then "on delay" contact 396 of relay 394 closes to energize compression belt motor starter 384 to move the belts 92 and 94 forwardly for the length of a case. Belts 92 and 94 move the case at a slower speed than pusher 74 would move if it were not impeded by the slower moving case, but since pusher 74 is operated by air, the stalling of pusher 74 does not damage its operating mechanism. This stalling insures that pressure is being exerted on the ends of the case by pusher 75.

In other words, the speed of pusher 74 is greater than the speed of the compression belts 92, 94, but pusher 74 slows to compression belt speed.

When the case moves into compression unit 90, switch 82 no longer contacts it and returns to its original position closed to contact 362 to energize relay 364 and open contacts 382 to stop the motor driving the compression belts. In practice, this drive is equipped with a brake of sufficient capability to prevent the belts 92, 94, from drifting the case away from the extreme forward position of pusher 74. Relay 364 is also energized through switch 368 and contacts 366, since pusher 74 is in its down position. The circuit has now returned to the "machine ready" condition with switch 372 and contacts 378 closed to energize forward solenoid valve 376 to maintain air pressure on pusher 74 to exert pressure on the rear flaps of the case to seal them. Succeeding cases repeat the cycle.

Jam safety switch 398 is closed in normal operation and time delay relay 400 is energized by each case as it passes. If a case does not leave switch 398 before contact 402 of relay 400 opens, this indicates that a jam has occurred and gluer motor starter 404 is deenergized to stop the gluer.

Also included in the circuit are: start switch 406, stop switch 408, transfer motor starter switch 410 and its contacts 411, overload switches 412, selector switch 414, jog switch 416, and the gluer starter controls 418, including gluer start switch 420, gluer stop switch 422, transfer motor auxiliary switch contacts 424 of transfer motor switch 410 that insure that the transfer unit is operating before the gluer will run, and glue start switch contacts 426.

The case former of this invention is adapted to form a five-panel case having two top panels with a manufacturer's flap connecting the two top panels, a five-panel case having two top panels connected together by tape, and a four-panel case with a single top panel connected to a side panel by a manufacturer's flap extending from the top.

It is to be understood that the form of the invention herewith shown and described is to be taken as a presently preferred embodiment. Various changes may be made in the shape, size and arrangement of parts. For example, equivalent elements may be substituted for those illustrated and described herein, parts may be reversed, and certain features of the invention may be utilized independently of the use of other features, all without departing from the spirit or scope of the invention as defined in the subjoined claims.

What is claimed is:

1. A method of forming an end-closing case from a blank having a first top panel, a first side panel connected to the first top panel along a transverse crease line, a bottom panel connected to the first side panel along a transverse crease line, a second side panel connected to the bottom panel along a transverse crease line, a second top panel connected to the second side panel along a transverse crease line, a top-sealing manufacturer's flap extending from one top panel and adapted to lap the other top panel, top flaps connected to the first and second top panels along longitudinal crease lines, bottom flaps connected to the bottom panel along longitudinal crease lines, and side flaps connected to the side panels along longitudinal crease lines, comprising the steps of applying adhesive to the bottom flaps, folding the side panels at right angles to the bottom panel, folding the side flaps at right angles to the side panels, folding the bottom flaps at right angles to the bottom panel, pressing the side and bottom flaps together to adhesively seal them, folding the top panels outwardly from the case, filling the case, applying adhesive to the said other top panel and to the top flaps, folding the top panels over so that the manufacturer's flap laps said other top panel, pressing the manufacturer's flap and said other top panel together to adhesively seal them, folding the top flaps down, and pressing the top flaps and the side flaps together to adhesively seal them, wherein said top flaps have front end top flaps and rear end top flaps, said method including the step of moving the closed case along a horizontal path where said pressing is applied to the front end top flaps by a preceding case, and said pressing is applied to the rear end top flaps by a following case.

2. The method of claim 1 wherein the top flaps overlap, including the step of folding the top flaps so that they overlap, and sealing the overlapped top flaps to each other as well as to the side flaps.

3. A method of forming an end-closing case from a blank having a first top panel, a first side panel connected to the first top panel along a transverse crease line, a bottom panel connected to the first side panel along a transverse crease line, a second side panel connected to the bottom panel along a transverse crease line, a second top panel comprising a top-sealing manufacturer's flap connected to the second side panel along a transverse crease line, top flaps connected to the first top panel along longitudinal crease lines, bottom flaps connected to the bottom panel along longitudinal crease lines, and side flaps connected to the side panels along longitudinal crease lines, comprising the steps of applying adhesive to the bottom flaps, folding the side panels at right angles to the bottom panel, folding the side flaps at right angles to the side panels, folding the bottom flaps at right angles to the bottom panel, pressing the side and bottom flaps together to adhesively seal them, folding the first top panel outwardly from the case, filling the case, applying adhesive to the first top panel and top flaps, folding the first top panel at right angles to the side panels, folding the manufacturer's flap at right angles to the side panels so that it laps the first top panel, pressing the first top panel and manufacturer's flap together to adhesively seal them, folding the top flaps down, and pressing the top flaps and the side flaps together to adhesively seal them, said top flaps including a front end top flap and a rear end top flap, said method including the step of moving the closed case along a horizontal path where said pressing

is applied to the front end top flap by a preceding case, and said pressing is applied to the rear end top flap by a following case.

4. Packaging apparatus for forming, filling, and sealing a top-closing case having top, bottom, and side panels and top front, top rear, bottom, and side end flaps, comprising bottom forming means for forming the bottom and side panels and flaps into set-up condition with the bottom flaps adhesively connected to the side flaps, loader means for filling the case with material through the top of the case, gluer means for applying an adhesive to the top flaps and folding over the top panel, transfer means for folding the top flaps into contact with the side flaps, said transfer means including pusher means for moving the case into compression means and flattening said top front flap against a preceding case to hold said top front flap in compression to aid in setting the adhesive thereon, and compression means for holding the top flaps in compression until their adhesive sets.

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