United States Patent

Curtis

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[54] METHOD AND APPARATUS FOR LIDDING CARTONS

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[73] Assignee: **International Paper Company,** New York, N.Y.

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[21] Appl. No.: **55,106**

[52] **U.S. Cl.**.....**53/38,** 53/287, 53/306, 53/387, 93/55.1 P, 156/69

[51] **Int. Cl.** **B65b 7/28,** B65b 51/02

[58] **Field of Search**.....53/38, 287, 306, 341, 383, 53/387; 93/36 MM, 55.1 P; 156/69, 475, 483, 484

[56] **References Cited**

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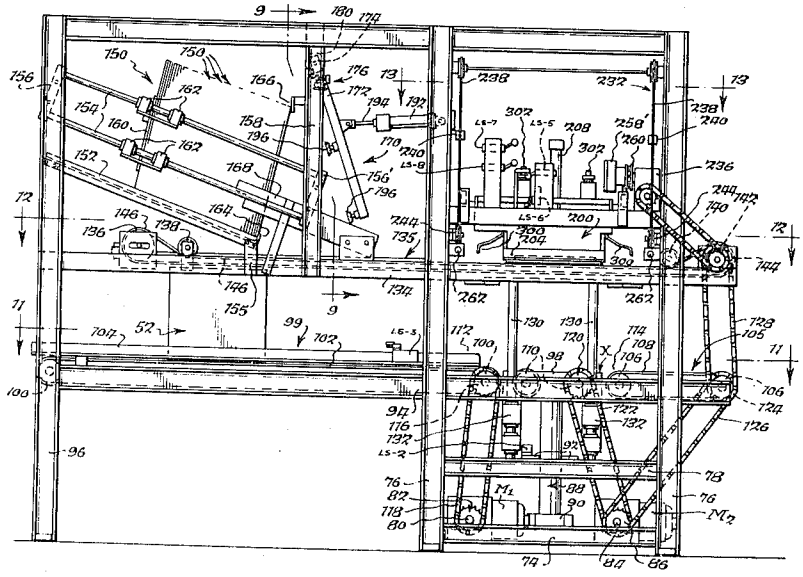
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Primary Examiner—Robert L. Spruill
Attorney—Charles B. Smith

[57] **ABSTRACT**

An apparatus for forming a lid around an open top of a container in which the lid of the container is a flat sheet. The lid is placed over and centered on the open top of the container, and overlaps the sides of the container. The container is raised into a die-forming assembly which folds down the overlapping ends of the flat lid around the container. Glue is applied to the overlapping ends of the lid while the ends are being folded to secure the ends of the lid around the container.

18 Claims, 29 Drawing Figures



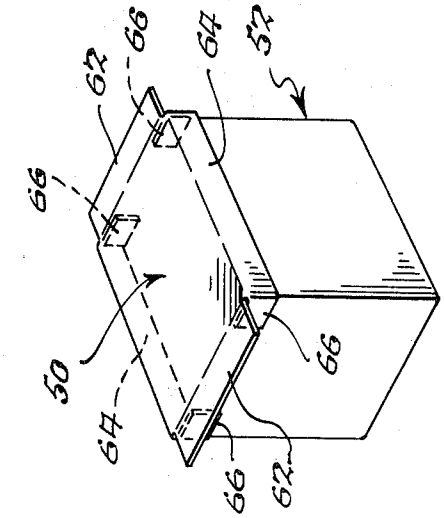


Fig. 3.

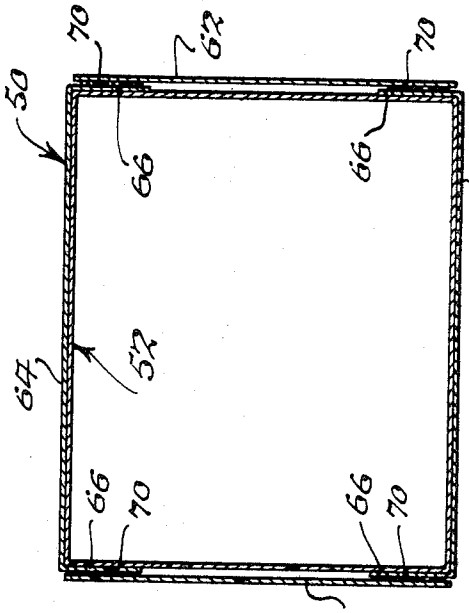


Fig. 6.

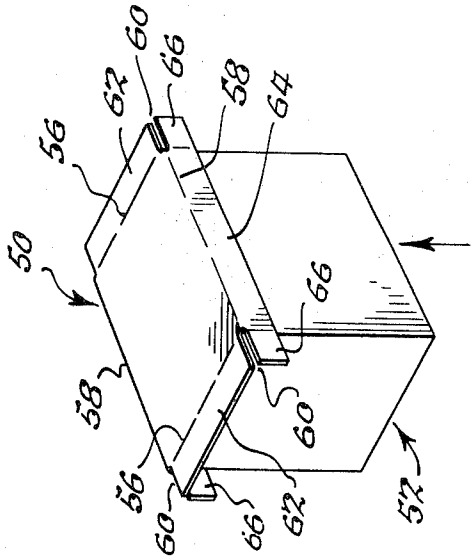


Fig. 2.

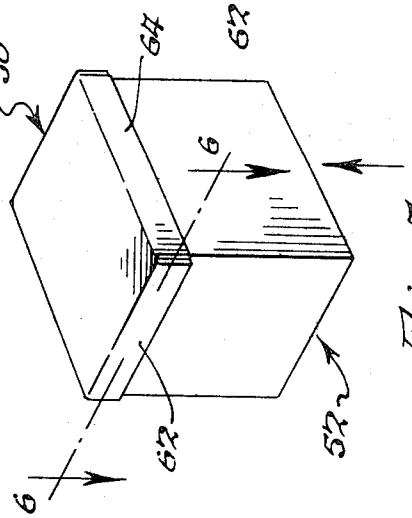


Fig. 5.

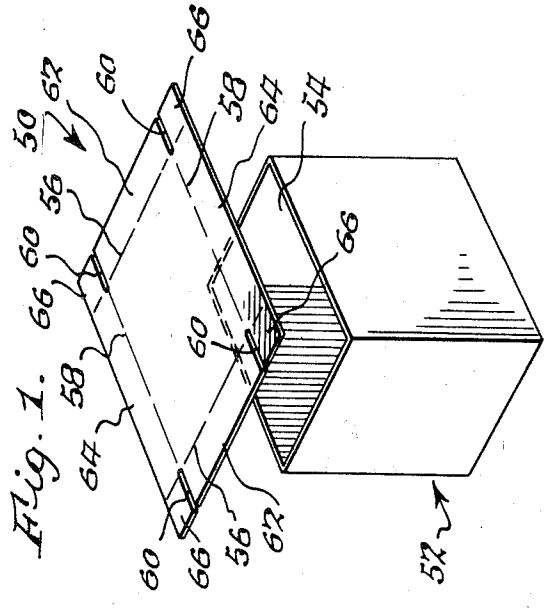


Fig. 1.

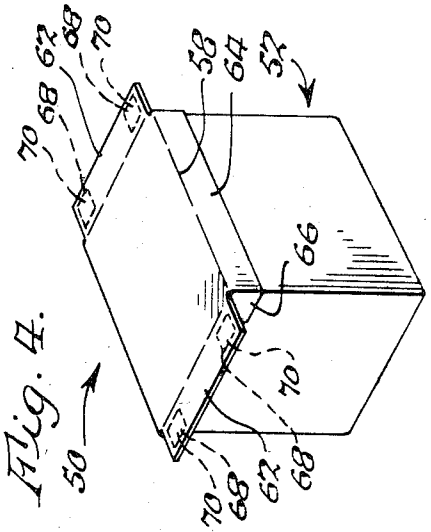


Fig. 4.

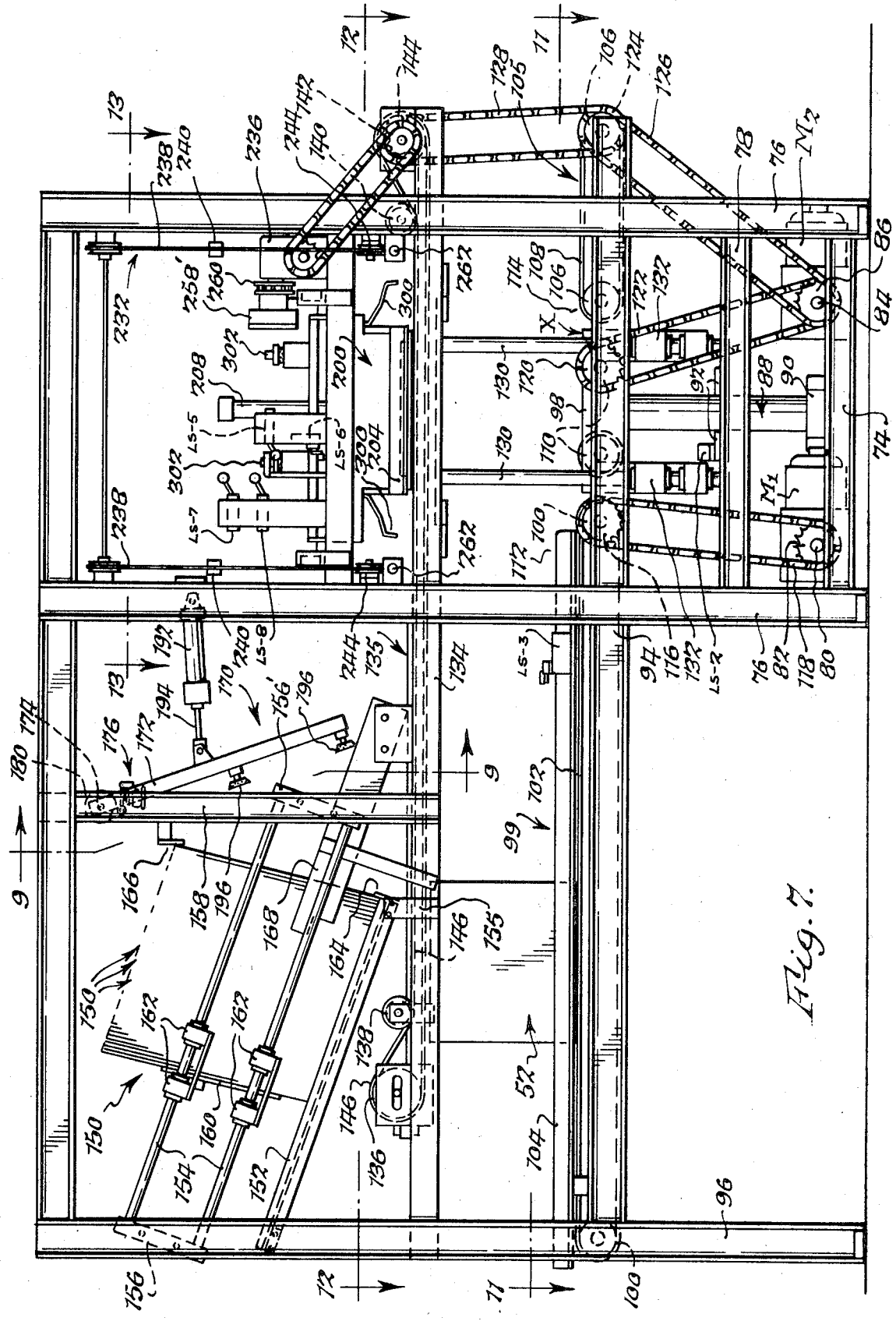


Fig. 7.

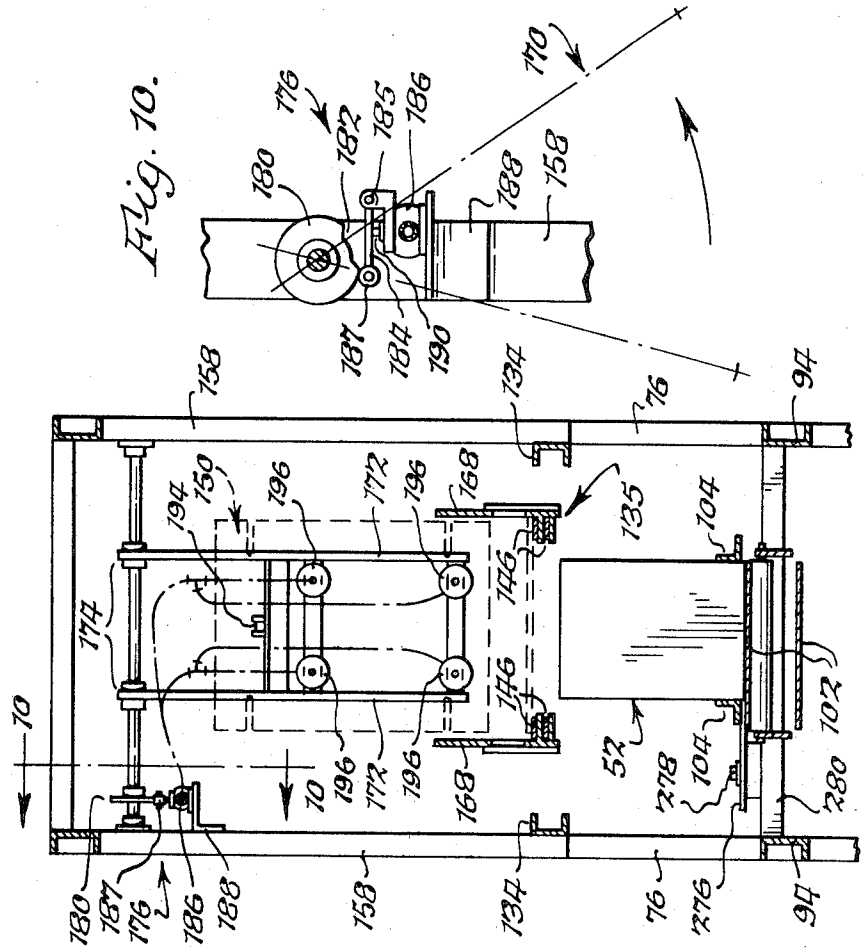


Fig. 10.

Fig. 9.

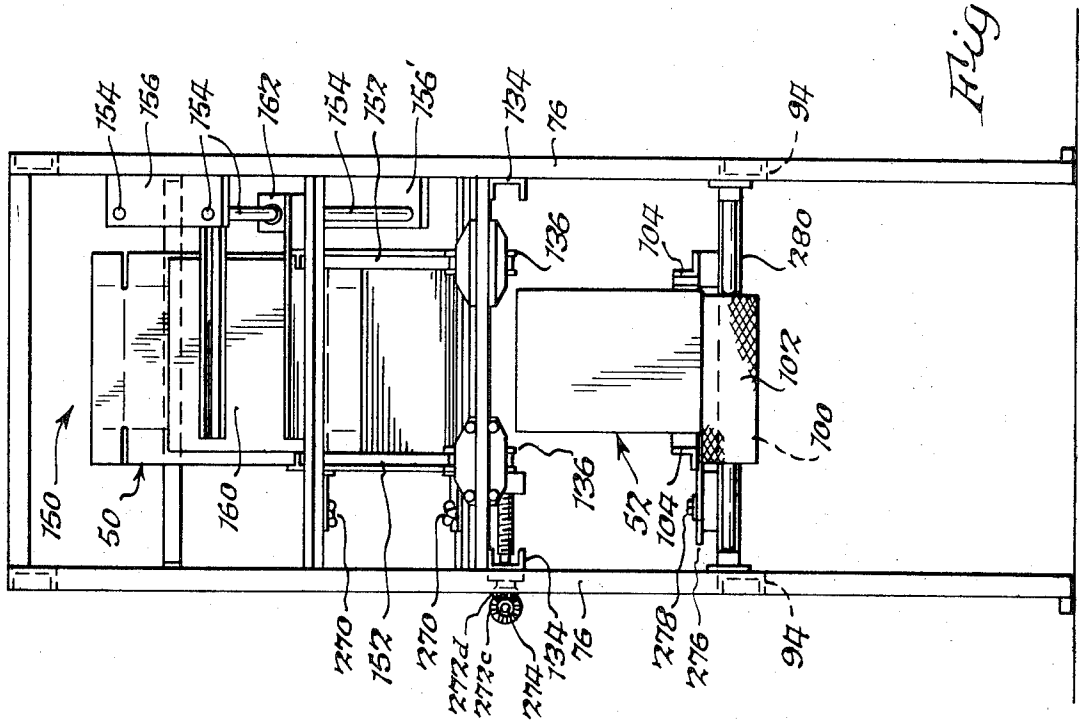


Fig. 8.

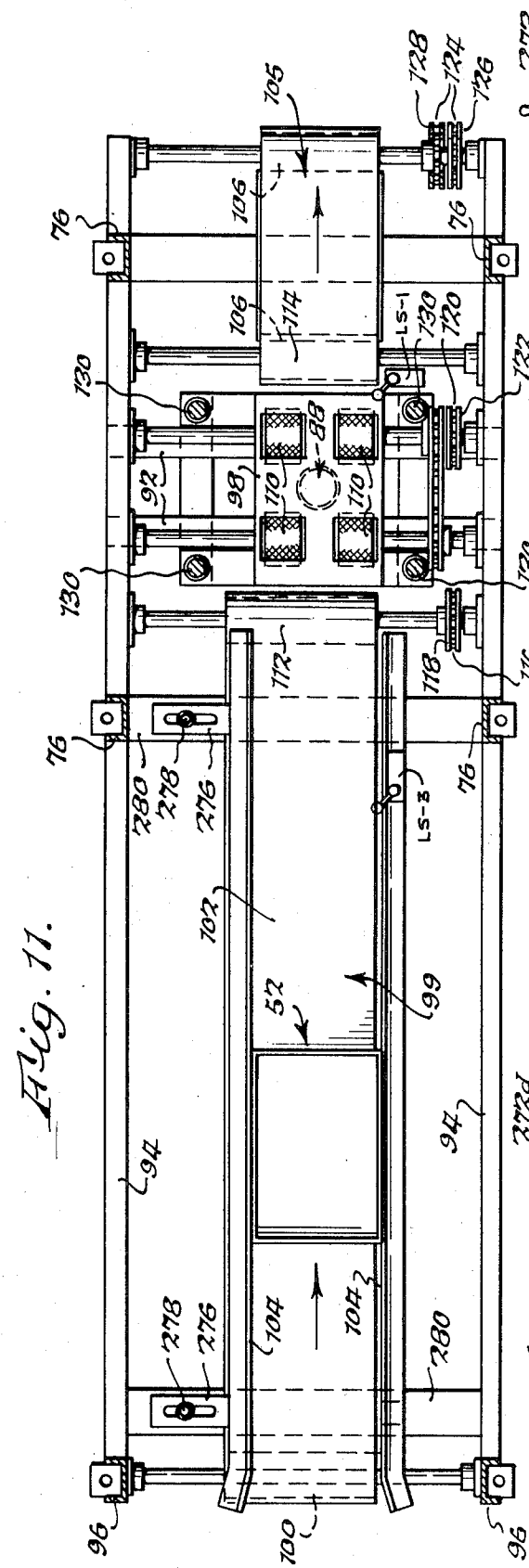


Fig. 11.

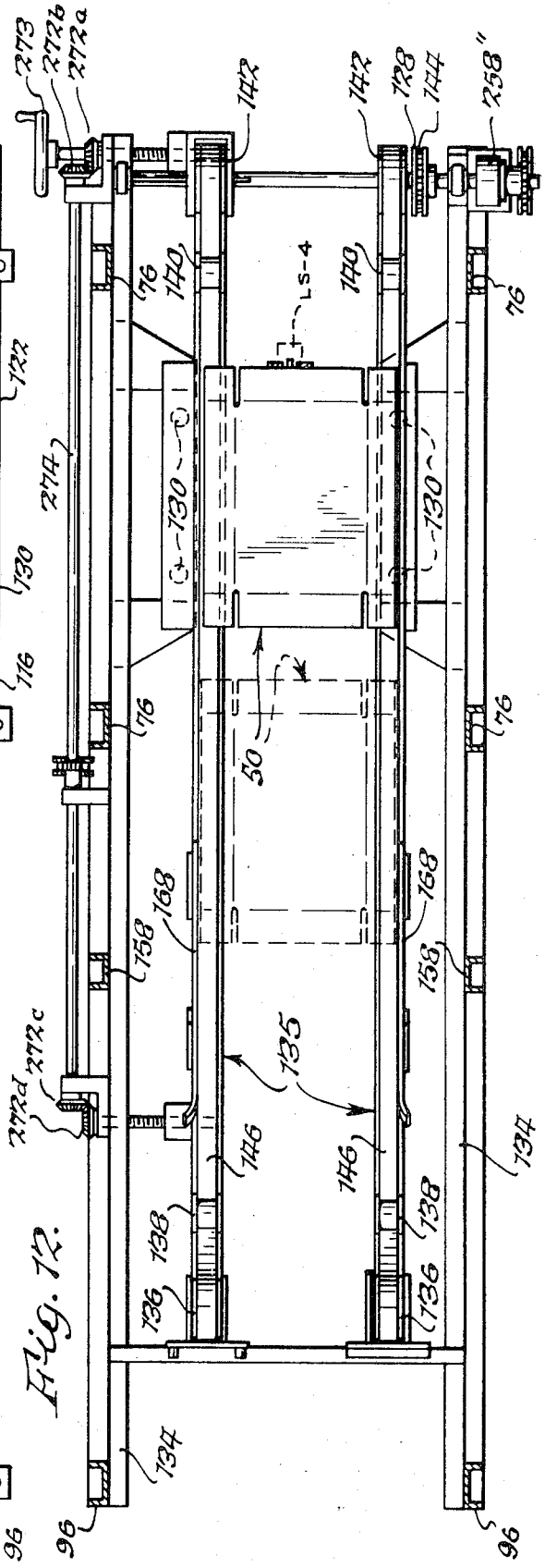


Fig. 12.

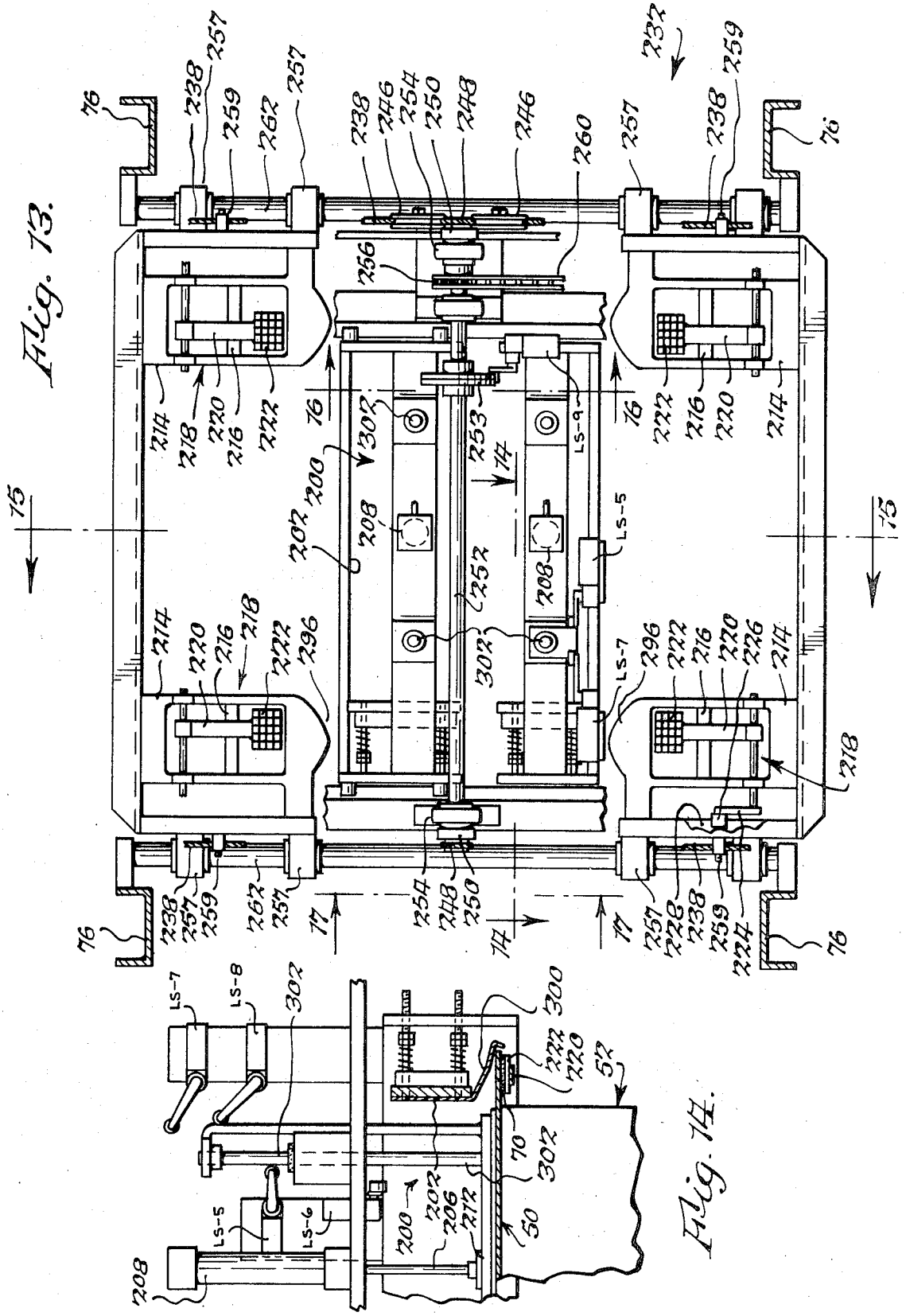

76
238
257
259
262
246
254
250
248
260
236
214
218
220
216
222
200
207
208
252
253
302
LS-9
LS-5
LS-7
296
226
17
14
75

Fig. 13.

LS-7
LS-8
LS-6
LS-5
302
300
222
220
52
70
50
206
212
207
200
208

Fig. 14.

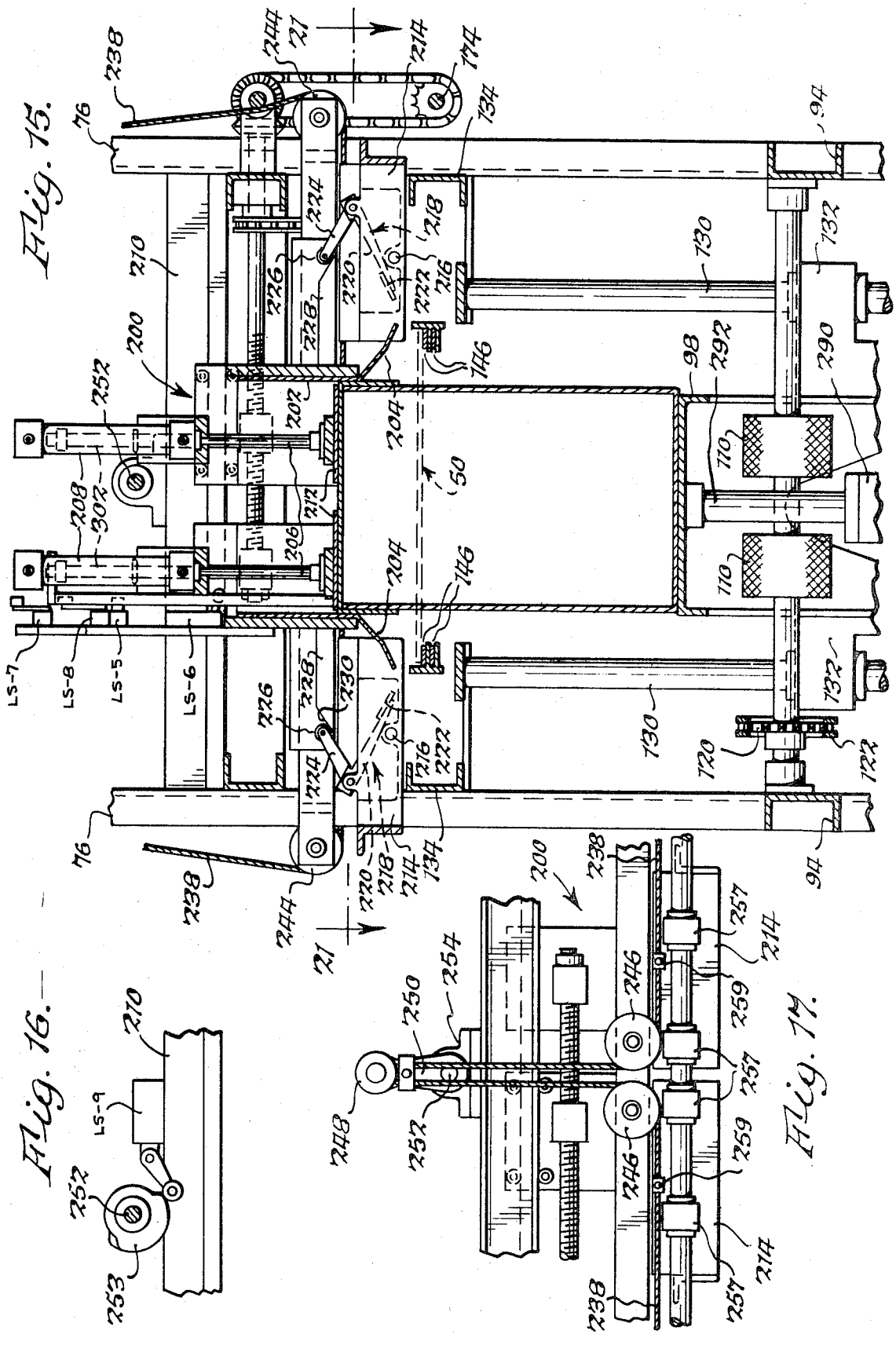
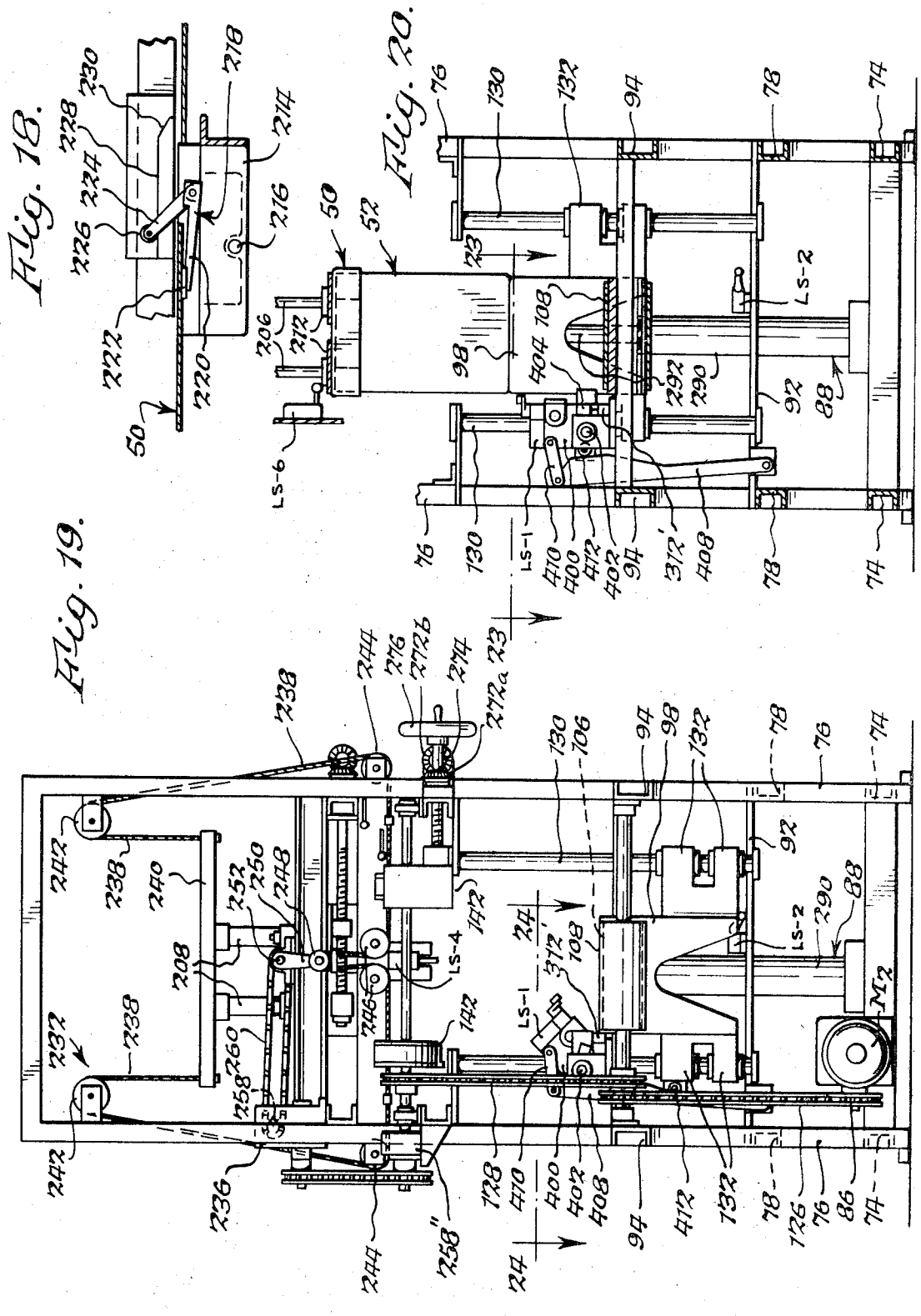
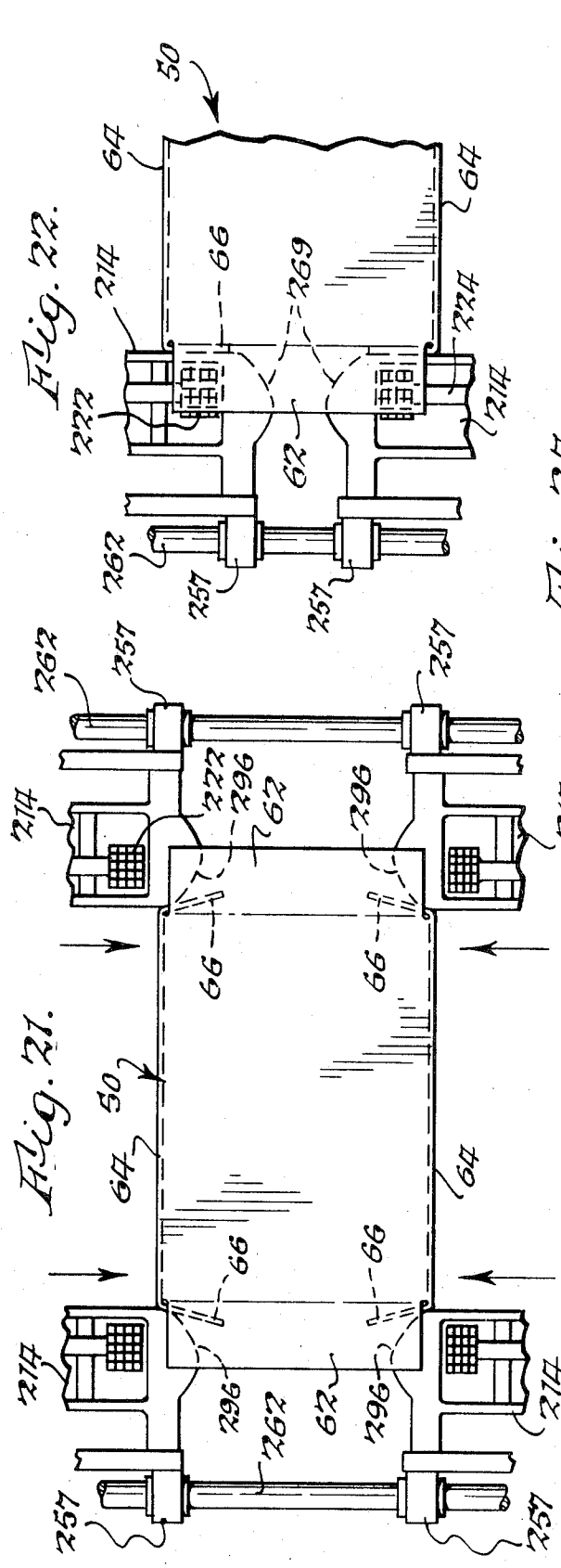


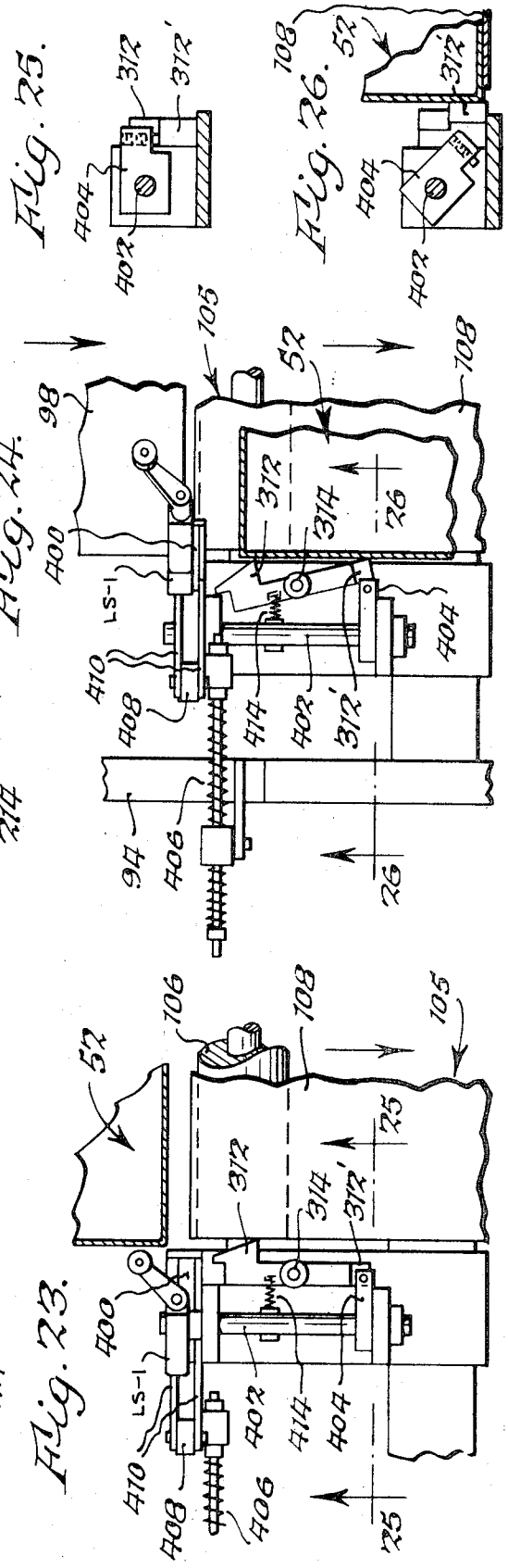
Fig. 15.

Fig. 16.

Fig. 17.


Fig. 18.
Fig. 20.
Fig. 19.
LS-1
LS-2
LS-4
LS-6
M2


Fig. 22.
Fig. 21.


Fig. 25.
Fig. 26.
Fig. 24.
Fig. 23.

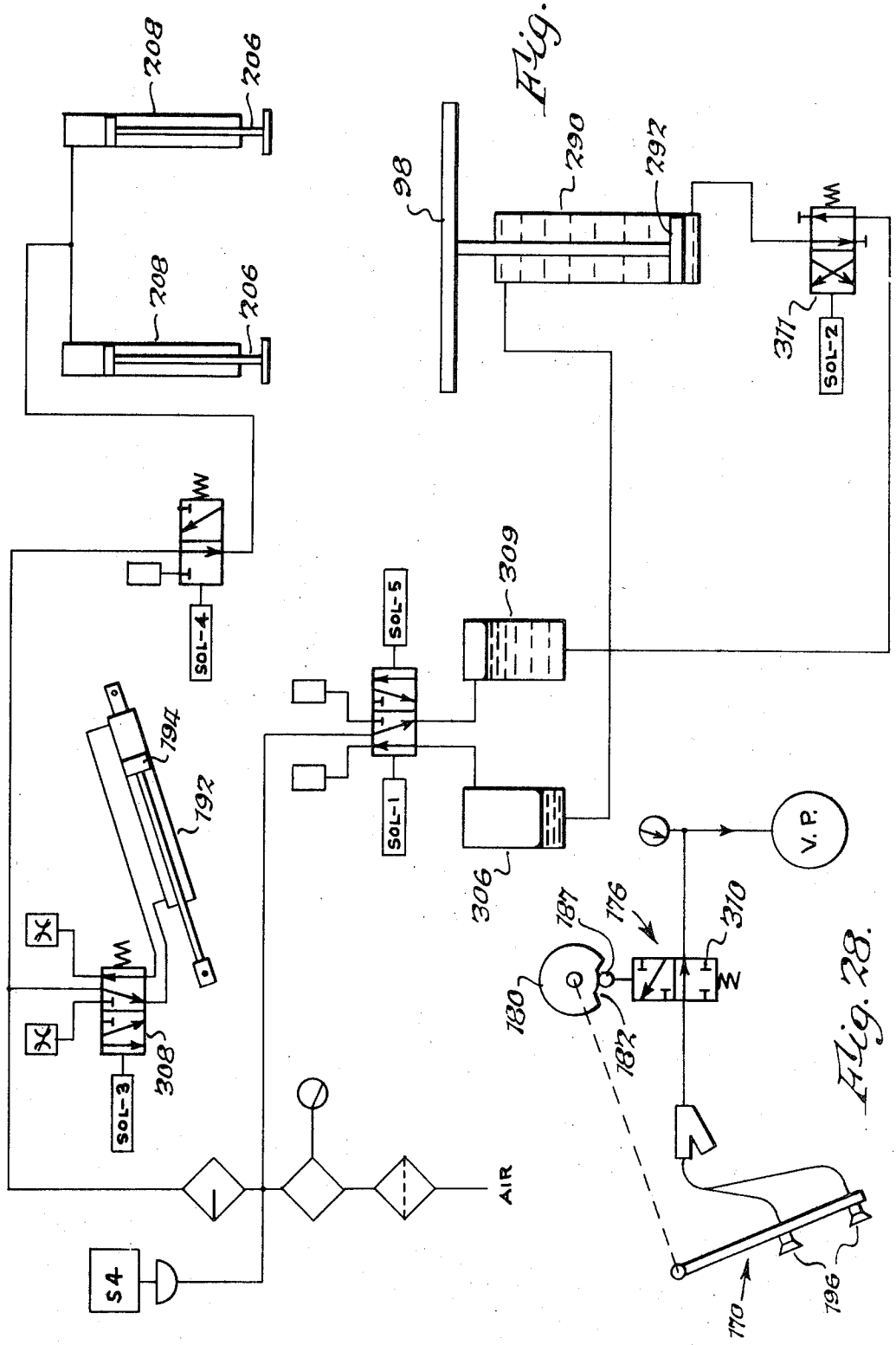

208
206
208
206
98
290
292
W
311
SOL-2
W
SOL-4
309
SOL-5
SOL-1
306
V.P.
194
192
W
308
SOL-3
187
176
310
180
182
AIR
S4
170
196

Fig. 27.

Fig. 28.

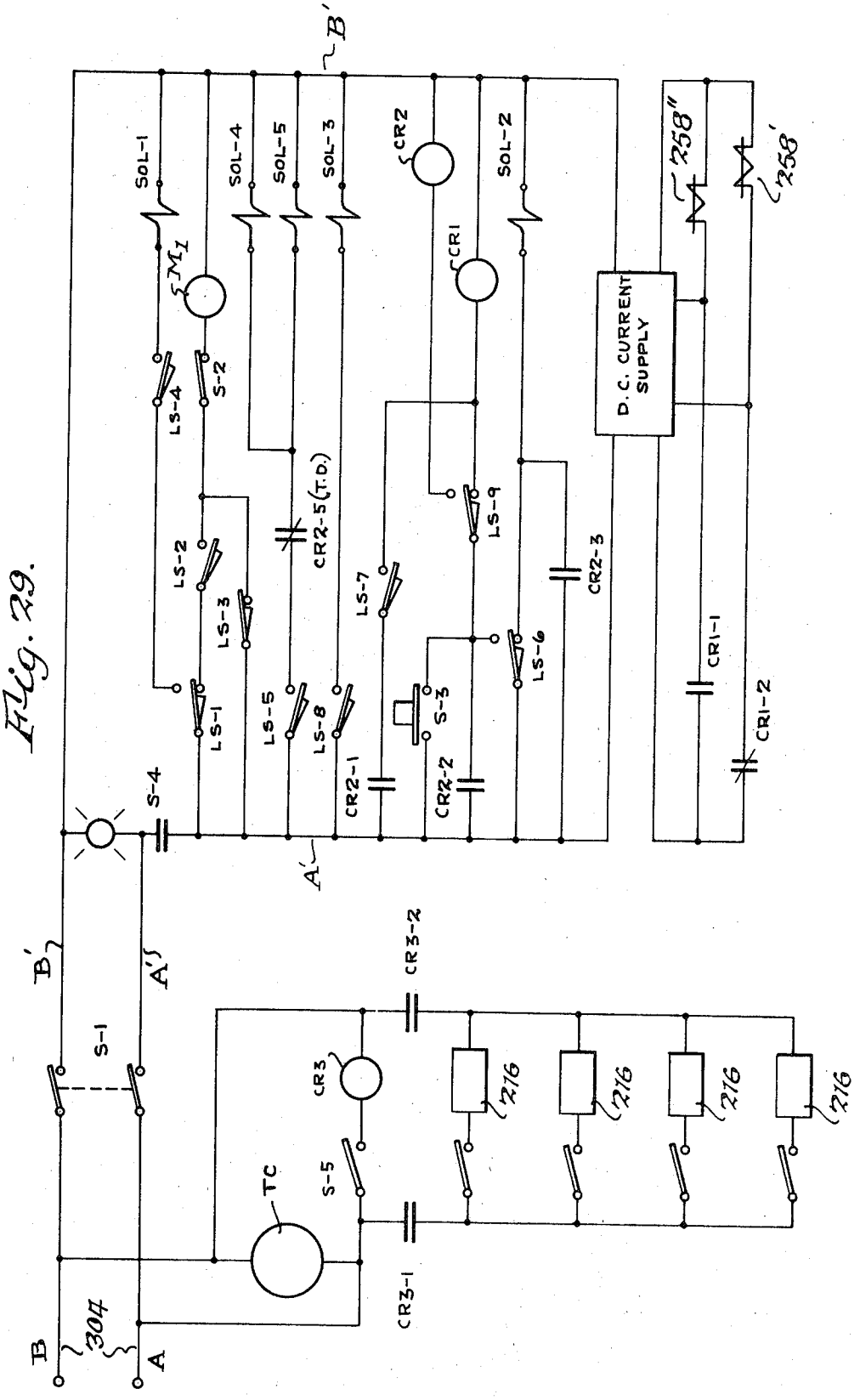

B'
SOL-1
SOL-4
SOL-5
SOL-3
CR2
SOL-2
CR1
M1
D.C. CURRENT SUPPLY
258"
258'
S-2
LS-4
LS-2
LS-3
LS-1
LS-5
LS-8
CR2-5(T.D.)
LS-7
LS-9
LS-6
CR2-3
CR1-1
CR1-2
S-3
CR2-1
CR2-2
S-4
A'
B'
A'
S-1
CR3-2
CR3
216
216
216
216
S-5
TC
CR3-1
B
304
A

Fig. 29.

METHOD AND APPARATUS FOR LIDDING CARTONS

BACKGROUND OF THE INVENTION

This invention relates to an apparatus for sealing a carton, and more specifically to an apparatus for forming a flat lid into a top around an open end of a carton. Previously, when a carton was filled, an opening, through which the filling had been accomplished, remained. A preassembled top was placed over the opening of the carton and secured to the carton. In many circumstances, the carton went along a conveyor belt and the preformed tops were placed manually on the open end of the container. This necessitated a great deal of labor and a great deal of storage space to house the assembled container tops.

Another problem which arose was alterations in the size of the container. A top of a different size was needed to accommodate any change in size of the container. A great number of different top sizes were required, as well as storage space for each top size and an accurate determination of the future consumption of tops.

This tied up a substantial amount of capital, as well as warehouse space. The situation was found to be unsatisfactory. Various types of lidding machines have been proposed to attempt to obviate the necessity for manual labor in placing a preformed top onto a container. However, these machines often did not eliminate the necessity for maintaining a large inventory of container tops of various sizes in either an unassembled or preformed condition.

SUMMARY OF THE INVENTION

In one aspect, the invention includes forming a precut, prescored container top around a filled container. The container top has a surface area which is similar in shape to and somewhat larger than the surface area which is to be covered. The container is passed along on a conveyor belt and the flat container top is centered on the open end of the container. The container and the container top are then raised upwardly into a die. The die has a central opening which is substantially equal in size and shape to the top surface of the container. As the container and the top are forced upwardly, two parallel sides of the die contact two opposed ends of the container top and force them downwardly until they are substantially parallel to the corresponding sides of the container.

Two pairs of pusher assemblies fold the overlapped extensions of each one of the folded ends of the top toward one another until they are substantially perpendicular to the folded portion of the top. Gluepots apply glue to the underside of the overlapping portion of the top. The container and the top are then forced further into the die to fold down the remaining overlap. As the glue contacts the extensions, it holds the overlapping extensions to the folded-down, folded-in portion of the top.

Another aspect of the invention includes forming a top around a filled container in which the top is cut and prescored. The top may be formed around any one of a number of containers, each one of which has an open end which is substantially different in cross-sectional area than that of the other containers.

In yet another aspect, the invention comprises an apparatus which selects a flat container top from a stack of tops and places the container top in a substantially central orientation onto an open end of the filled box. The ends of the top overlap the sides of the box. The apparatus then raises the box and the centered top into a die which folds down the overlapping ends of the top around the box while simultaneously applying glue intermediate the ends of the top to secure the folded ends of the top to one another.

In such an apparatus, the box may be filled, then passed along a conveyor line to the apparatus at which point the flat top, which has been prescored and cut to provide a pair of side flaps and two pairs of ears are placed over the box. The die in the apparatus is adjusted to have a cross-sectional area substantially equal in size and substantially similar in shape to the cross-sectional area of the open end of the box. Because the die in the apparatus may be variable and because the box top has not been preformed, boxes having widely varying cross-sectional areas may be sealed without necessitating a change in the container top blanks which are used.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a box with a lid blank in position over the box.

FIG. 2 is a perspective view of the box and the lid of FIG. 1 with the lid blank in position over the box and two sides of the lid blank turned downwardly.

FIG. 3 is a perspective view of the box and the lid blank with a pair of ears on each one of the lid sides folded inwardly.

FIG. 4 is a perspective view of the box and the lid blank with glue applied to the underside of the lid ends.

FIG. 5 is a perspective view of the sealed box.

FIG. 6 is a horizontal cross section taken along Line 6—6 of FIG. 5.

FIG. 7 is a side elevation of a lidding machine performing the sequence of operations shown in FIGS. 1 through 6 with certain portions of the apparatus removed for clarity.

FIG. 8 is a front elevation of the lidding apparatus viewed from the feed end of the apparatus.

FIG. 9 is a vertical cross section taken along Line 9—9 of FIG. 7.

FIG. 10 is a fragmentary vertical section taken along Line 10—10 of FIG. 9 showing a portion of a vacuum pickup used to position the container lids.

FIG. 11 is a horizontal cross section taken along the Line 11—11 of FIG. 7 showing a conveyor system and an elevator system for the lidding apparatus.

FIG. 12 is a horizontal section taken along Line 12—12 of FIG. 7 showing a lid conveyor assembly for use in the lidding apparatus.

FIG. 13 is a vertical cross section taken along Line 13—13 of FIG. 7 showing the arrangement of a number of gluepots of the lidding apparatus.

FIG. 14 is a fragmentary vertical section taken along Line 14—14 of FIG. 13 showing the lid engaging the box and the glue applied to one of the ends of the lid.

FIG. 15 is a vertical section taken along Line 15—15 showing the box and the lid partially inserted within the die of the lidding apparatus with two sides of the lid folded downwardly.

FIG. 16 is a fragmentary vertical section taken along Line 16—16 of FIG. 13 showing the mechanism for activating the flap-folding and glue-applicator mechanism of the lidding apparatus.

FIG. 17 is a vertical section taken along Line 17—17 of FIG. 13 showing a part of the glue-applicator mechanism.

FIG. 18 is a fragmentary view of a gluepot employed with the lidding apparatus.

FIG. 19 is an elevational view showing the discharge end of the lidding apparatus.

FIG. 20 is a fragmentary plan view of the discharge end of the lidding apparatus with the elevating mechanism shown in a raised position.

FIG. 21 is a fragmentary view of the container with the sides of the container top folded downwardly and the ears being folded inwardly.

FIG. 22 is a fragmentary plan view showing the ears folded inwardly and the glue being applied to the underside of one end of the lid.

FIG. 23 is a fragmentary horizontal section taken along Line 23—23 of FIG. 20 showing the discharge conveyor and a number of associated activation switches.

FIG. 24 is a fragmentary horizontal section taken along Line 24—24 of FIG. 20 with the stop mechanism in the "box-stop" position.

FIG. 25 is a vertical cross section taken along Line 25—25 of FIG. 23 showing the stop mechanism in a first position.

FIG. 26 is a vertical cross section taken along Line 26—26 of FIG. 24 detailing the "box-stop" switch.

FIG. 27 is a diagrammatic representation of the pneumatic and hydraulic system of the lidding apparatus.

FIG. 28 is a diagrammatic representation of the vacuum system employed in the lid pickup assembly of the lidding apparatus.

FIG. 29 is a diagrammatic representation of the electrical control system used to time and operate the lidding apparatus.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

In order to better understand the operation of the lidding apparatus, FIGS. 1 through 6 illustrate the sequence of placing and forming a lid around a filled container. In FIG. 1 a lid 50 is disposed above a filled container 52. The container 52 has an open end 54 through which it was filled. The lid 50 has a surface area which is greater than the cross-sectional area of the open end 54 and is of a substantially similar shape. The lid 50 has a first pair of parallel score lines 56 which extends from one edge of the lid 50 to the other edge of the lid. A second pair of parallel score lines 58 extends between the first pair of parallel score lines 56 and is substantially perpendicular to the first pair of score lines. The two pairs of score lines 56, 58 circumscribe an area which is substantially equal to the cross-sectional area of the open end 54.

The second pair of parallel score lines 58 has a number of cut extensions 60 which extend from the intersection of the first pair of score lines 56 with the second pair of score lines 58 to the free edges which are parallel to the first pair of score lines 56. The lid 50, therefore, has a pair of opposed end flaps 62, and a pair of opposed side flaps 64. Each one of the side flaps 64 extends into a pair of ears 66, opposed to one another, at the ends of the side flaps 64. The area circumscribed by the two pairs of parallel score lines 56, 58 is centered on the filled container 52 to overlap the entire open end 54 of the filled container.

FIG. 2 best illustrates the first step in forming the lid 50 around the filled container. The two side flaps 64 are folded downwardly by the lidding apparatus along the second pair of parallel score lines 58. Next, (FIG. 3) the ears 66 are pushed inwardly, underneath the end flaps 62. When the ears 66 have been folded inwardly, they will be substantially perpendicular to the side flap 64 to which they are attached. Because each ear 66 has been cut along the corresponding cut extension 60, it can be folded easily and without further manipulation. After the ears 66 have been folded, glue 70 is applied along the underside of each one of the end flaps 62 (FIG. 4). The glue 70 is applied to four substantially rectangular areas 68 each one of which contacts one of the ears 66, when the end flaps 62 are folded downwardly. This allows the lid 50 to be removed easily after the container has been shipped, while providing a surface on which the end flaps 62 can be secured.

After the glue 70 has been applied to the areas 68, the end flaps 62 are folded downwardly in a direction substantially parallel to the side flaps 64. Each end flap 62 will be forced against two of the ears 66, to allow the glue placed in the area 68 to come into contact with and adhere to the ears 66 (FIG. 5).

In FIG. 6 there is shown a cross-sectional view of the lidded container to illustrate the relative orientation of the various portions of the lid and container, as well as the glue. The side flaps 64 are folded downwardly and are immediately adjacent to two parallel sides of the container 52. Each one of the side flaps 64 extends into the two ears 66. Each one of the ears 66 is folded parallel to the other one of the ears associated with the same side flap 64. Both pairs of ears 66 are substantially adjacent to the other sides of the container 52. The ears 66 are approximately at a right angle to the associated side flap 64. The end flaps 62 extend between the ears 66 and are perpendicular to the side flaps 64. The end flaps 62 overlay the ears, with the layer of glue 70 disposed intermediate the end flap 62 and the respective ear 66.

A lidding apparatus which may be used to perform the lidding operation shown in FIGS. 1 through 5 is best illustrated in FIGS. 7, 11 and 12. The lidding apparatus comprises a motor base 74 on which a number of motors are situated. A pair of uprights 76 extend upwardly from the motor base 74 and are affixed securely to the motor base 74. A crossbeam member 78, which is substantially parallel to the motor base 74, is secured across the uprights 76 to maintain them in relative parallel alignment.

An intermittent gear drive motor M_1 is situated on the motor base 74. The intermittent drive motor M_1 has a power shaft 80. A toothed gear 82 is secured to and is coaxial with the power shaft 80. A continuous gear drive motor M_2 is also located on the motor base 74. The continuous gear drive motor M_2 has a power shaft 84. A toothed gear 86 is affixed coaxially to the power shaft 84.

An elevator shaft 88 extends vertically upward from an elevator collar 90 disposed on the motor base 74. The elevator shaft 88 extends through a positioning collar 92 situated on the crossbeam member 78. A crossbeam assembly 94 is located above and parallel to the crossbeam member 78. The crossbeam assembly 94 extends beyond the uprights and is secured at one of its ends to a vertical support member 96.

The elevator shaft 88 has an elevator platform 98 disposed on its uppermost end. The upper surface of the elevator platform 98 lies a distance X above the uppermost portion of the crossbeam assembly 94. The upper surface of the elevator platform 98 is substantially flat. The elevator platform is disposed between the uprights 76 and is centered on the elevator shaft 88. The distance between the center of the elevator platform 98 and any one of the uprights 76 is substantially equal.

A first set of infeed conveyor rollers 100 are disposed with their central longitudinal axes perpendicular to the crossbeam assembly 94 and rotatably affixed to the crossbeam assembly 94 on either side of the apparatus. An endless belt 102 is disposed around the conveyor rollers 100 to form an infeed conveyor system 99 between the input end of the lidding apparatus and a discharge end 112 in the vicinity of the elevator platform 98. A slide guide 104 is located along substantially the entire length of the endless belt 102 to position and otherwise guide the containers 52 as they travel from the input end of the lidding machine to the elevator platform 98.

A pair of outfeed rollers 106 are rotatably disposed at the other end of the crossbeam assembly 94 with their longitudinal axes disposed between and perpendicular to the crossbeam assembly 94. An endless belt 108 is placed around the pair of outfeed rollers 106 to provide a continuous outfeed conveyor 105 to remove lidded boxes. Four elevator positioning rollers 110 are located between the discharge end 112 of the infeed conveyor 99 and a pickup end 114 of the outfeed conveyor 105 and extend through the elevator platform 98. A sprocket 116 is secured coaxially to one of the infeed conveyor rollers 100. The sprocket 116 is connected to the intermittent gear drive motor M_1 by means of a drive chain 118. The drive chain extends between the toothed gear 82 of the intermittent gear drive motor M_1 and the sprocket 116.

A sprocket 120 is located on one of the elevator positioning rollers 118. The sprocket 120 is connected to the continuous drive motor M_2 by a drive chain 122. The drive chain 122 connects the sprocket 120 to the toothed gear 86 of the continuous drive motor M_2. A double sprocket 124 is connected coaxially to one of the outfeed rollers 106. The double sprocket 124 is driven by a drive chain 126 connected to the toothed gear 86. A second drive chain 128 also is driven by the double sprocket 124.

Four vertical guide rods 130 extend upwardly from the crossbeam member 78 and are secured rigidly to the crossbeam member. A guide bearing 132 is mounted slidably on each one of the vertical guide rods 130. Each one of the guide bearings 132 is secured rigidly to one corner of the elevator platform 98. When the elevator shaft 88 urges the elevator platform 98 upwardly or downwardly, the guide bearings 132

slides along their respective guide rods **130** to maintain the elevator platform **98** in a horizontal orientation.

A lid supply support member **134** is secured to both of the uprights **76** and to the vertical support member **96**. A lid conveyor assembly **135** is located on the lid supply support member **134**. The lid conveyor assembly **135** comprises a first roller **136** whose central longitudinal axis is substantially parallel to the central longitudinal axes of the infeed conveyor rollers **100**. The first roller **136** has a diameter "D." The first roller is disposed between the lid supply support members **134** on either side of the lidding apparatus. A second roller **138** having a diameter "*d*," smaller than the diameter "D" of the first roller **136**, is located intermediate the first roller **136** and one of the uprights **76**. A third roller **140**, having a diameter "*d*" substantially equal to the diameter of the second roller **138** is disposed downstream of the second roller. The third roller **140** is located between the lid supply support members **134** in the vicinity of the other one of the uprights **76**. A fourth roller **142** is located downstream of the third roller **140** in the vicinity of the end of the lid supply support member **134**. The fourth roller has a diameter "D," substantially equal to the diameter of the first roller **136**.

A sprocket **144** is located at one of the longitudinal ends of the fourth roller **142**. The second drive chain **128** from the double sprocket **124** drives the sprocket **144**. An endless belt **146** is placed around the first and fourth rollers and underneath the second and third rollers. The central longitudinal axes of all of the four rollers are in substantially the same plane. Because the second and third rollers have a smaller diameter than the first and fourth rollers, the endless belt **146** is effectively held down by the second and third rollers.

A lid tray assembly, generally designated as **150**, is situated in the vicinity of the first and second rollers **136**, **138**. The lid tray assembly **150** comprises an angularly disposed lid slide support **152** in which a number of lids rest. A pair of lid slide guides **154** are secured to the lid slide support **152** and are substantially parallel to and above the lid slide support. The lid slide support **152** is secured at one of its ends to the vertical support member **96** and at its other end to the lid supply support member **54** by means of a bracket **155**. The lid slide guides **154** are affixed at one of their ends to the vertical support member **96** by means of a bracket **156**, and at their other end to a vertical lid assembly support member **158**. The vertical lid assembly support member **158** is secured, at one of its ends to the lid supply support member **134**.

A weighted biasing plate **160** is slidably connected to the lid slide guides **154** by means of a pair of slide bearings **162**. The weighted biasing plate **160** and the slide bearings **162** urge the stack of lids **50** against a front stop **164** located at the discharge end of the lid slide support **152**. A slide stop **166** extends from the vertical lid assembly support member **158** in the direction of the vertical support member **96**. The slide stop **166** restrains the uppermost edge of the foremost lid in the stack of lids **50**. A lid ramp **168**, located in the vicinity of the discharge end of the lid slide support **152** and in close proximity to the lowermost lid slide guide **154**, extends upwardly at an angle substantially equal to the angle of inclination of the lid tray assembly **150**. The lid ramp **168** is secured rigidly at both of its ends to the lid supply support member **134**.

A lid pickup, generally designated **170**, is pivotally mounted on the vertical lid assembly support member **158** (FIGS. 8, 9). The lid pickup assembly **170** comprises a pickup rod **172** which is affixed pivotally at its uppermost end **174** to the vertical lid assembly support member **158**. A vacuum-triggering assembly **176** causes the rod to pick up the lids. The vacuum-triggering assembly **176** is best illustrated in FIG. **10**. The triggering assembly **176** comprises a cammed wheel **180** which is mounted rigidly to the pickup rod **172**, coaxial with the uppermost pivoting end **174** of the pickup rod. A cammed section **182** of the cammed wheel **180** is positioned above a triggering arm **184**. The triggering arm **184** is pivotally mounted at a first end **185** to a triggering switch **186** and has a bearing assembly **187** at its free other end. The triggering switch **186** is mounted rigidly to a crossbeam **188** which extends between the vertical lid assembly support member **158** on either side of the lidding apparatus. The triggering switch **186** has a depressible trigger point **190** which is situated in close proximity to the triggering arm **184**. The trigger point **190** is biased upwardly.

The lid pickup **170** is activated by a cylinder **192** which has a piston **194** extending therefrom. The cylinder **192** is secured at one of its ends to one of the uprights **76**. One end of the piston **194** extends into the cylinder while the other end is affixed pivotally to the pickup rod **172**. When the machine is activated, the piston **194** pivots the pickup rod **172** and the associated cammed wheel **180**. The cammed section **182** of the cammed wheel **180** causes the triggering arm **184** to be raised and lowered, thereby activating the depressible trigger point **190**. The vacuum-triggering assembly **176** activates a number of vacuum pickups **196** which are disposed along the pickup rod **172** and are capable of engaging and lifting the first lid **50** from the stack of lids on the lid tray assembly.

A lidding die is best illustrated in FIGS. **7**, **13**, **14** and **15**. The lidding die, generally designated **200**, comprises an inner forming well **202** which is substantially equal in size to the area circumscribed by the two pairs of parallel score lines **56**, **58**. Each side of the inner forming well **202** extends downwardly into an angularly disposed folding arm **204**. The folding arm **204** extends outwardly from the inner forming well **202**. A pair of biasing pistons **206** extend downwardly within the inner forming well **202**. Each one of the biasing pistons **206** extends upwardly into a biasing cylinder **208**. The biasing pistons **206** are biased downwardly by the biasing cylinders **208**. Each one of the biasing cylinders **208** is affixed rigidly to a platform **210** which is disposed above the lid supply support member **134** and is substantially parallel thereto. Each one of the biasing pistons **206** is affixed to a horizontal retention plate **212** at its lowermost end. Each horizontal retention plate **212** is substantially parallel to the lid **50** when the lid is forced upwardly into the lidding die **200**.

Four gluepots **214** are disposed around the periphery of the lidding die **200** (FIGS. **15**, **17** and **21**). Each one of the gluepots **214** is located in the vicinity of one of the ears **66**. An emersion heater **216** is located within each one of the gluepots **214**. The emersion heater **216** maintains the glue at the proper temperature for application. A glue applicator **218** transports the glue from one of the gluepots to the underside of one of the ears **66** (FIGS. **18**, **22**). The glue applicator **218** comprises an applicator arm **220** which extends into the glue within the gluepot **214**. The applicator arm **220** has a glue pad **222** at one end and is connected pivotally at its other end to the gluepot **214**. A cam follower **224** having a rotatable bearing **226** at one of its ends is affixed rigidly to the pivotally mounted end of the applicator arm **220**.

A ledge crossbar **228** having a pair of opposed beveled ends **230** is situated intermediate each pair of opposed gluepots **214**. The rotatable bearing **226** travels along the beveled end **230** of the ledge crossbar **228** and the ledge crossbar itself. As the rotatable bearing **226** moves up the beveled end **230**, the cam follower **224** is pivoted about its other end. This raises the applicator arm **220** from the gluepot **214** and swabs glue under each one of the ears **66**. This is best illustrated in FIG. **18** which shows the glue applicator **218** in an up, or application, position. Each glue pad **222** comes into contact with one ear **66** during the travel of the gluepot **214**. The rotatable bearing **226** is shown along the ledge portion of the ledge crossbar **228**.

A gluepot travel assembly, generally labeled **232**, is connected to the continuous gear drive motor M_2 by means of a chain drive **234**, running between the sprocket **144** which is coaxial with the fourth roller **142** and a gear drive **236** connected to the gluepot travel assembly **232**. The gluepot travel assembly **232** can best be seen in FIGS. **15**, **17** and **19**. The gluepot travel assembly **232** will be described in connection with two gluepots **214**. One gluepot travel assembly **232** operates each pair of opposed gluepots **214**. A cable **238** has both of its free ends affixed to a counterbalance **240**. The

cable 238 extends upwardly from the counterbalance 240. Each side of the cable 238 is looped over a pulley 242 which is secured rotatably to one of the uprights 76. Each pulley 242 causes the cable 238 to reverse direction and go downwardly. Each side of the cable 238 is then passed around a horizontal direction-change pulley 244 which causes the cable to alter its direction from a substantially vertical direction to a horizontal direction. Each one of the horizontal direction-change pulleys 244 is secured rotatably to one of the uprights 76.

A second pair of horizontal direction-change pulleys 246 is placed on a horizontal line with the first pair of horizontal direction-change pulleys 244. The cable 238 is looped under each one of the second horizontal direction-change pulleys 246 and looped over a single securing bearing 248 (FIG. 17). The securing bearing 248 is rotatably mounted at one end of an arm 250. The other end of the arm 250 is rigidly affixed to a power shaft 252. The power shaft 252 extends between the arm 250 of each one of the gluepot travel assemblies 232. Each arm 250 is rotatably mounted in a saddle 254. The power shaft 252 has a gear drive 256 situated at one of its ends.

As is seen in FIG. 19, the gear drive 256 is connected to a power drive gear 258 by a chain 260. The power drive gear 258 is driven by the continuous motor M_2. When the power drive gear is engaged it causes the chain to travel and hence rotates the power shaft 252. This causes the arm 250 to circumscribe an arc and raises the securing bearing 248 from the position shown in FIG. 19 to the "glue-apply" position shown in FIG. 17.

When the arm 250 is raised, the cable 238 is pulled around the two second horizontal direction change pulleys 246. Because the cable 238 is connected to each one of the gluepots 214 by a connector bolt 259 (FIG. 17), the gluepots 214 slide along a gluepot guide 262. A bearing 257 on each side of the gluepots 214 is mounted slidably on the gluepot guide 262 and secured rigidly to the respective gluepot 214. The rotation of the power shaft 252 causes the gluepots 214 to oscillate back and forth. The gluepots 214 are returned to the outer position by the weight of the counterbalance 240 which is connected to each end of the cable 238.

FIG. 8 best illustrates the lidding apparatus as viewed from the infeed end. The level of the die 200 relative to the uprights 76 may be adjusted by loosening a pair of wingnuts 270 which secure the die 200. This varies the height of the die to accommodate for containers of various heights. The size of the lidding die 200 may also be altered by the beveled gear arrangement 272. A first one of the beveled gears 272*a* has a handle 273 connected to it (FIG. 12). The beveled gear 272*a* mates with a second bevel gear 272*b* which is secured to a shaft 274. As the first beveled gear 272*a* is rotated, it causes the second beveled gear 272*b* to rotate and, simultaneously, causes the shaft 274 to rotate. The shaft 274 is connected to a second pair of beveled gears 272*c*, 272*d* which is mounted at the infeed end of the lidding machine. The beveled gears 272*a*, 272*b*, 272*c*, and 272*d*, translate the motion of the handle to separate the sides of the lid conveyor in accordance with the dimensions of the box which is to be lidded. Hence, the lidding apparatus may be used with a variety of boxes of differing sizes.

FIGS. 11 and 12 best illustrate the travel path of the container and the lid. In FIG. 11, the container 50 is shown traveling along the infeed conveyor between the pair of slide guides 104. One of the slide guides 104 has a pair of adjustment brackets 276 which are secured rigidly to the slide guide 104 and positioned slidably on a holddown bolt 278. The holddown bolt is threaded into a set of crossbeams 280 which extend between the lid supply support members 134.

FIGS. 13, 21 and 22 best illustrate the gluing mechanism in various stages of operation. In FIG. 13, the gluepots 214 are in the fully withdrawn position and the glue applicators 218 are submerged in the glue. The four gluepots 214 are distributed at the corners of the lid 50. Each one of the gluepots 214 has a rounded leading edge 296. The leading edges 296 of opposed gluepots 214 face one another. After the container 52 has been forced upwardly into the lidding die 200, and particularly the inner forming well 202 of the lidding die, the two side flaps 64 will have been bent downwardly. As the container and lid are forced further up into the lidding die, they trigger the gluepot travel assembly 232. This causes the gluepots 214 which are opposed to one another to travel toward one another.

As can be seen in FIG. 21, each one of the rounded leading edges 296 folds in one of the ears 66. As the gluepot 214 continues its travel, it flattens the corresponding ear 66 against the side of the filled container 52 (FIG. 22). During the inward travel, the cam follower 224 goes along the ledge crossbar 228 and raises the applicator arm 220. This causes glue to be deposited on the underside of each one of the end flaps 62.

After the glue has been deposited, the filled container 52 and the lid 50 are forced further into the lidding die 200. A second pair of angular-disposed folding arms 300 is located one on either side of the container in close proximity to the end flaps 62. The second pair of angularly disposed folding arms 300 is located perpendicular to the first set of folding arms. The second set of folding arms 300 is capable of folding the end flaps downwardly into intimate contact with the ears of the lid.

At least one travel limit indicator rod 302 is affixed to one of the horizontal retention plates 212 and extends vertically upwardly therefrom. As the horizontal retention plates are raised by the action of the elevator platform 98, in raising the filled container 52, the travel limit indicator rod 302 will trip a number of limit switches LS8 and LS7, to activate various operations in the cycle (See FIG. 14).

The hydraulic system of the lidding apparatus is best illustrated in FIGS. 27 and 28. This will be discussed in conjunction with the electrical system which is represented illustratively in FIG. 29. The lidding apparatus is supplied with current from a power source (not shown) having a pair of terminals A and B. The power source is of a suitable voltage. Modifications in the power source are within the knowledge of those skilled in the art. A powerline 304 carries the current to the lidding apparatus. The powerline 304 (illustrated in FIG. 29) is a two-line cable, A', B'. A time clock TC is connected in parallel across the two lines A', B' of the power line 304. A double-pole, single-throw, on-off switch S–1 is connected to the two lines of the powerline. A signal light R is applied across the two lines A', B' to indicate when current is being supplied to the circuit. The time clock TC can be employed to turn on the emersion heaters 216 within the gluepots 214 a predetermined time before the machine is to be operated. This allows the operator to use the lidding apparatus immediately, rather than wait for the glue to warm up.

Assume that the cycle is about to be started and that neither a lid nor a filled container is in position. A switch LS–5 and a time delay contact CR2–5 (TD) are concurrently closed. This energizes two solenoids, SOL–4 and SOL–5. Looking at FIG. 27, when solenoid SOL–4 is energized, air is supplied to the upper chamber of each one of the biasing cylinders 208. This causes the respective biasing pistons 206 to be depressed downwardly. Simultaneously, with solenoid SOL–5 energized, increased air pressure is applied to an air-oil hydraulic cylinder 306. The hydraulic cylinder 306 will, in turn, exert pressure on the upper portion of the elevator cylinder 290. This will force the elevator piston 292 downwardly into the cylinder and will lower the elevator platform 98. The elevator platform is now ready to receive a carton.

When the elevator piston 292 is fully within the elevator cylinder 290, it will trip, and close a switch LS–2. With LS–2 closed, current flows through a stop switch LS–1, the switch LS–2, and through a manually closed switch S–2. This supplies power to the intermittent gear drive conveyor motor M_1 and connects it across the powerline 304. The intermittent gear drive conveyor motor M_1 drives one of the infeed conveyor rollers 100 and consequently the endless belt 108. This conveys a carton 52 which has been placed on the pickup end of

the infeed conveyor by a conveyor system and passes it by a conveyor switch LS–3 until it reaches the stop switch LS–1, which is interposed into the path of the container. When the carton goes by the conveyor switch LS–3, it opens that switch. However, this has no effect, as can be seen in FIG. 29, because the switch LS–2 has been closed. If stop switch LS–1 were in an open condition, because a carton had already engaged it at the elevator platform 98, or if LS–2 were open because the elevator platform 98 were in any position but the "full-down" position, and hence incapable of accepting a carton, the power to the intermittent gear drive motor M_1 would be cut off by opening the switch LS–3. This would stop the infeed conveyor and prevent the carton from doing any damage.

While the filled container 52 is moving along the conveyor assembly to the elevator platform 98, (FIG. 14), the horizontal retention plates 212 are biased downwardly by the biasing piston 206 to trip a limit switch LS–8. The limit switch LS–8 is tripped in a down, or closed position. This allows current to flow from the A' side of the line to a solenoid SOL–3. The solenoid SOL–3 is energized which, in turn, energizes a valve 308 associated with the solenoid. When the valve 308 is opened, it provides air to the chamber of the lid pickup cylinder 192. This causes the lid pickup piston 194 to extend outwardly. The pickup rod 172 pivots about its uppermost end 174 and moves the vacuum pickups 196 in the direction of the stack of lids 50. The movement of the pickup rod 172 causes the cammed wheel 180 to rotate. This alters the portion of the cammed section 182 which contacts the vacuum triggering assembly 176.

As the cammed section 182 moves, it opens a pickup valve 210 (see FIG. 28). A partial vacuum is created in the vacuum pickups 196. When the vacuum pickups come into contact with one of the lids 50, they adhere to the lid. The cammed wheel 180 continues to rotate further to activate the vacuum-triggering assembly 176. This reverses the air flow in the valve 308, and forces air into the frontal portion of the lid pickup cylinder 192. The lid pickup piston 194 moves backwardly in response to the reversal in the air pressure. The pickup rod 172 thus rotates in the opposite direction, thereby rotating the cammed wheel 180. When the cammed wheel 180 has reached a certain point, the vacuum-triggering assembly 176 is turned off, releasing the lid 50 and causing it to fall onto the lid ramp 168.

The lid 50 on the lid ramp 168 is picked up by the endless belt 146 of the lid conveyor assembly. The lid is conveyed to its position above the filled container 52. A lid stop switch LS–4 senses the presence of the lid 50 and is closed when the lid contacts the switch. This activates the solenoid SOL–1. With the lid 50 and the container 52 in position, current flows through the combination of switch S–4, the limit switch LS–1, a limit switch LS–4 and through the solenoid SOL–1 to line B'. This energizes the solenoid SOL–1. A valve 307, associated with the solenoid SOL–1, allows air into a second air-oil tank 309 to force oil down through a valve 311 associated with the solenoid SOL–2. This energizes the solenoid SOL–2 and causes air to flow upwardly into the bottom of the elevator cylinder 290 to raise the elevator piston 292. As the elevator platform 98 rises, it engages the bottom surface of the container 52 and raises it above the elevator position rollers 110.

The open end 54 of the filled carton 52 engages the lid 50. Because the pressure in the bottom of the elevator cylinder 290 is greater than the combined pressure holding down the biasing pistons 206, the pistons 206 are forced into the biasing cylinders 208. The biasing pistons 206 are raised and the travel limit indicator rod 302 engages and triggers a limit switch LS–8. When LS–8 is closed, a solenoid SOL–3 is energized, to reactivate the valve 308 associated with the lid pickup assembly 170. The next lid 50 is picked up from the stack.

Further upward movement of the elevator platform 98 and, correspondingly, the carton 52 and the lid, 50, triggers a limit switch LS–6. Triggering the limit switch LS–6 deenergizes solenoid SOL–2. A valve 311 associated with the solenoid SOL–2 is spring-biased and is closed upon deactivation of the solenoid SOL–2. This causes the hydraulic fluid which initially raised the elevator piston 292 to be maintained within the elevator cylinder 290. The elevator platform 98 is maintained at a given level sufficient to fold fully the side flaps 64.

With the limit switch LS–6 energized, current flows through the upper contact of the limit switch LS–6, through CR–1 limit switch LS–9 and through a relay CR–1 to line B'. This energizes the relay CR–1. Energizing relay CR–1 opens the relay's contacts, thereby deenergizing a brake (not shown) on the power shaft 252 of the gluepot travel assembly, while concurrently energizing the power shaft 252 by engaging a clutch 258' shown in FIG. 7. The clutch 258' connects the power shaft 252 to the continuous gear drive motor M_2 (see FIGS. 12, and 19). As the power shaft 252 rotates, it causes the arm 250 to revolve. The gluepots move inwardly in response to the arm's rotation. The ears 66 are folded inwardly by the leading edges of the gluepots 214 while the applicator arms 220 apply glue to the underside of the end flaps 62.

The power shaft 252 has a cammed wheel 253 coaxial with the power shaft. The cammed wheel 253 is secured to the power shaft and rotates with it. The cammed wheel 253 contacts the limit switch LS–9 and maintains it in a closed position while the gluepots 214 are moving inwardly. As the shaft continues to rotate, the cammed wheel 253 trips the limit switch LS–9 when the gluepots 214 reach the innermost limits of their travel. Tripping the limit switch LS–9 brakes the circuit to relay CR–1 while making a circuit to a relay CR–2. When the relay CR–2 is activated it closes its contacts CR2–1, CR2–2, CR2–3, and CR2–5. CR2–5 is a time delay control contact which closes after a predetermined time.

Relay CR–1 then is opened. However, the closing of contact CR2–3 completes the circuit through solenoid SOL–2 and again energizes the solenoid. This solenoid had previously been deenergized by the change of position of the limit switch LS–6. With the solenoid SOL–2 again energized, the elevator platform 98 and hence the filled carton 52 and the lid 50 travel upwardly. This forces the entire assembly further into the inner forming well 202 of the lidding die 200 and closes the end flaps 62.

As the elevator platform continues to travel upwardly, the travel limit indicator rod 302 triggers a limit switch LS–7. This causes current to flow through the closed contact CR2–1, closed limit switch LS–7 and relay CR–1. This alters the switching relationship of the contacts of relay CR–1. CR1–1 will be closed and CR1–2 will be opened. This activates the clutch and releases the brake to return the gluepots 214 to their normal, or "out" position. As the gluepots are being returned to their normal position, the cammed wheel 253 rotates, thereby deactivating limit switch LS–9 to its "down" position. This reenergizes relay CR–1 and deenergizes relay CR–2. By properly timing the sequence of operations, the time delay contact CR2–5 (TD) will close at this point in time and energize solenoid SOL–4 and SOL–5.

Because the horizontal retention plate 212 is at its uppermost position, a limit switch LS–5 is closed this allows current to flow through the limit switch LS–5, and shifts the valve of the solenoid LS–5 to force oil out of the left air-oil tank 306 and increase the hydraulic pressure on the upper chamber of the elevator cylinder 290. The elevator piston 292 thus is depressed. This lowers the elevator platform 98. As is best seen in FIGS. 18, 19, 23, and 24, a latch-mounted stop switch LS–1 is located adjacent to the discharge end of the elevator platform 98. The stop switch LS–1 is pivotally mounted on an arm 400. The arm pivots about a pivot shaft 402 which is secured to the frame of the apparatus. FIGS. 19 and 24 best illustrate the arm 400 and the stop switch LS–1 swung into the path of the carton whereas FIGS. 20 and 23 show them swung out of the path of the carton. When the elevator platform 98 descends, the bottom surface of the carton is contacted by the continuously rotating positioning rollers 110 and is driven onto the discharge conveyor 105 to be discharged from the apparatus.

A pivotally mounted latch member 312 is biased by a spring 414 which urges one of the ends of the latch member into the path of the carton. As the carton passes the latch member 312, it causes it to pivot and to move its other end into intimate contact with the pivot shaft 402 of the arm 400. A spring 406 urges a lever 408, connected by a set of links 410 to the arm 400, to swing the switch LS–1 into the path of the carton. This position is the stop position for halting the unlidded carton which is to be raised into the forming die.

FIG. 20 best illustrates a roller 412 mounted on the elevator. The roller 412 pushes a lever 408 as the elevator rises with a carton. This movement is transmitted through above-described set of links 410, the arm 400, and the pivot shaft 402 to recock the stop switch LS–1 and again place it in the stop position.

In all cases, it is to be understood that the above-described arrangements, in particular the electrical configuration and the particular conveying systems employed in the instant lidding apparatus are merely illustrative of a particular embodiment of many possible applications of the principle of the invention. Numerous and varied other arrangements in accordance with the principles may readily be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. An apparatus for forming a cover around at least one side of a container, comprising; a forming die, said forming die having a downwardly opening forming well with a cross-sectional area substantially similar in shape and in size to the side of the container to be covered; means for positioning the container in close proximity to and underneath said forming well, with the side of the container to be covered uppermost; means for situating the cover intermediate said forming well and the side of the container to be covered, the cover having a cross-sectional area substantially similar in shape to and greater in size than the side of the container to be covered, and overlapping the periphery of the side of the container; means for elevating the container and the cover into said forming well of said forming die, said means for elevating being disposed underneath said forming well of said forming die; means for simultaneously folding a portion of said overlapping cover and applying glue to said overlapping cover in the vicinity of the folded portion of said overlapping cover, said means being mounted slidably in close proximity to said forming well of said forming die.

2. An apparatus according to claim 1 in which said forming die comprises; a first pair of downwardly extending sides substantially opposed to one another, each one of said sides having a free end extending angularly outwardly from said forming well of said forming die.

3. An apparatus according to claim 2 in which said forming die further comprises; a second pair of forming arms opposed to one another, each one of said second pair of forming arms having a free end which extends outwardly from said forming well of said forming die, each one of said free ends of said second pair of forming arms being disposed above said free ends of said first pair of forming arms.

4. An apparatus according to claim 1 in which said means for positioning the container comprises; an infeed conveyor having an infeed end and a discharge end opposed to one another, said discharge end being in close proximity to said forming well and wherein said means for elevating the container are disposed in close proximity to the discharge end of the infeed conveyor.

5. An apparatus according to claim 4 in which said conveyor comprises; a multiplicity of rollers, disposed with the central longitudinal axes of said rollers substantially parallel to one another and in substantially the same plane; and an endless belt disposed around the rollers to form a conveyor belt.

6. An apparatus according to claim 5 further comprising; gearing means disposed coaxially with regard to the central longitudinal axis of one of said rollers; a motor having a drive shaft; and driving means disposed between said gearing means on said roller and said drive shaft on said motor for imparting motion to said conveyor system.

7. An apparatus for forming a cover around at least one side of a container comprising; a forming die, said forming die having a downwardly opening forming well with a cross section substantially similar in shape and size to the slide of the container to be covered; a conveyor means having a pickup end and a discharge end, said discharge end of said conveyor means being in close proximity to said downwardly extending opening of said forming well; lid conveyor means, having a pickup end and a discharge end, said discharge end being intermediate said forming well and the side of the container to be covered, the cover having a cross-sectional area substantially similar in shape to and greater in size than the side of the container to be covered, and overlapping the periphery of the side of the container; an elevator platform, said elevator platform being disposed in close proximity to said conveyor means for positioning the container; an elevator piston having an uppermost end, said uppermost end being affixed securely to said elevator platform; means for raising said elevator piston and said elevator platform upwardly into urging relationship with said forming well of said forming die; two pairs of glue applicator mechanisms, each one of said glue applicator mechanisms having a leading edge, said leading edges of each pair of glue applicator mechanisms being opposed to one another, a slide assembly secured rigidly to said apparatus intermediate each one of said pair of glue applicator mechanisms, said glue applicator mechanisms being slidably mounted on said slide assembly to allow said opposed leading edges of said glue applicator mechanisms to move toward and away from one another.

8. An apparatus according to claim 7 in which; said forming well is substantially rectangular and each one of the four sides of said rectangular forming well has a downwardly extending leading end, said leading ends on said sides opposed to one another extending angularly out from one another and from the center of said forming well.

9. An apparatus according to claim 7 in which said means for positioning the lid comprises; a lid guide having an input end and a discharge end; a lid-biasing plate slidably mounted on said lid guide to urge the lids from the input end to the discharge end; a lid carrier mechanism having a pickup and a discharge end, said pickup end of said carrier mechanism being in close juxtaposition to said discharge end of said lid assembly and said discharge end of said lid carrier being in close proximity to and underneath said forming well of said forming die.

10. An apparatus according to claim 9 in which said lid-positioning means further comprises; a pickup rod, one end of which is pivotally mounted on said apparatus; at least one suction pickup affixed to said pickup rod in the vicinity of a free end of the pickup rod; and, means for activating and deactivating the vacuum in said suction pickup, said means for activating secured to said pivotally mounted end of said pickup rod and capable of complementary pivotal motion with said rod.

11. An apparatus according to claim 7 in which each of said glue applicator mechanisms comprises; a gluepot, slidably mounted on said travel slide; a glue applicator arm having a first and second free end, pivotally mounted at said first end of said gluepot and capable of extending into said gluepot with said second free end; and an arm elevator rod having a first and a second end, rigidly secured at said first end to said applicator arm, said first end also being pivotally affixed to said gluepot, coaxial with said applicator arm pivot point, to pivot said applicator arm and raise said second free end of said applicator arm from said gluepot.

12. An apparatus according to claim 11 in which said glue applicator mechanism further comprises; a glue applicator pad affixed to said free end of said applicator arm; and a heater situated within and secured to said gluepot.

13. An apparatus according to claim 12 in which said glue applicator mechanism further comprises; an activator bar secured to said apparatus intermediate each one of said pair of gluepots, said bar having a first and a second opposed beveled ends, said beveled ends being beveled inwardly, each one of said beveled ends disposed in close proximity to said second end of said arm elevator rod, said second free end of said arm elevator rod being capable of movement along said beveled end of said rod; and, motor means connected to said gluepots for urging the gluepots from the beginning of said beveled ends of said rod to the vicinity of said center of said rod.

14. An apparatus according to claim 13 in which said glue applicator mechanism further comprises; a gluepot return apparatus, comprising; a biasing weight; a cable having two free ends, the first one of said free ends being connected to said biasing weight and said second one of said free ends being connected to said gluepot; and, at least one pulley, mounted rotatably on said apparatus, said cable being looped over said pulley to translate vertical motion of said biasing weight to horizontal motion of said glue applicators.

15. An apparatus according to claim 14 in which; at least one of said cable and pulley arrangements is associated with each one of said gluepots.

16. An apparatus according to claim 14 in which; said leading edge of each one of said glue applicator mechanisms has a rounded frontal portion and a flat inner side, and the distance between two opposed flat inner sides of two of said gluepots associated with different pairs is substantially similar to the width dimension of the container.

17. The method of closing a container having an open end, comprising the steps of:

a. positioning said container with said open end beneath a flat cover blank, said blank having score lines defining opposed side flaps and opposed end flaps and having open-ended notches separating the respective ends of the side flaps from the adjacent ends of the end flaps, said notches forming bendable tabs in the ends of said side flaps, the portion of said blank within said score lines corresponding substantially in size, shape and location to said open end of said container;

b. moving said container upwardly into contact with said blank and with a forming die having a downwardly opening forming well having a cross-sectional area corresponding substantially in size, shape and location to said portion of said blank to bend said side flaps downwardly and into intimate contact with the corresponding sides of said container;

c. bending said respective tabs around and into intimate contact with the corresponding ends of said container, while simultaneously applying adhesive to said end flaps in the vicinity of said tabs;

d. bending said end flaps downwardly and into intimate contact with the corresponding ones of said tabs and the corresponding ends of said container.

18. The method according to claim 17 further comprising the steps of:

a. moving said container downwardly from within said downwardly opening forming well after said end flaps have been bent downwardly; and

b. removing said closed container from said downwardly opening forming well.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,634,995 Dated January 18, 1972

Inventor(s) Arthur E. Curtis

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 9, line 32 - "210" should be -- 310 --;

Col. 10, line 7 - delete "CR-1" and insert -- a --;

Col. 11, lines 12 & 13 - after "through" delete "above described" and insert -- the --;

Col. 12, line 7 - "slide" should be -- side --.

Signed and sealed this 28th day of November 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents