Sept. 18, 1934. H. I. STAGE 1,974,165

PAPER FOLDING DEVICE

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FIG. 1

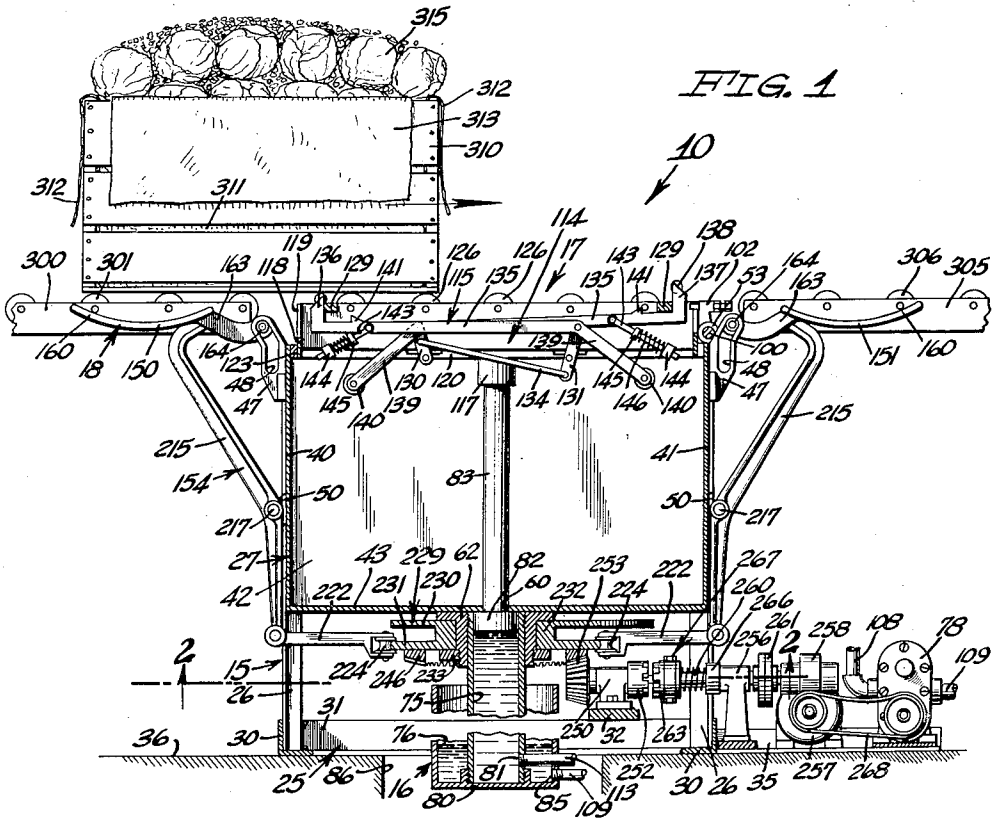
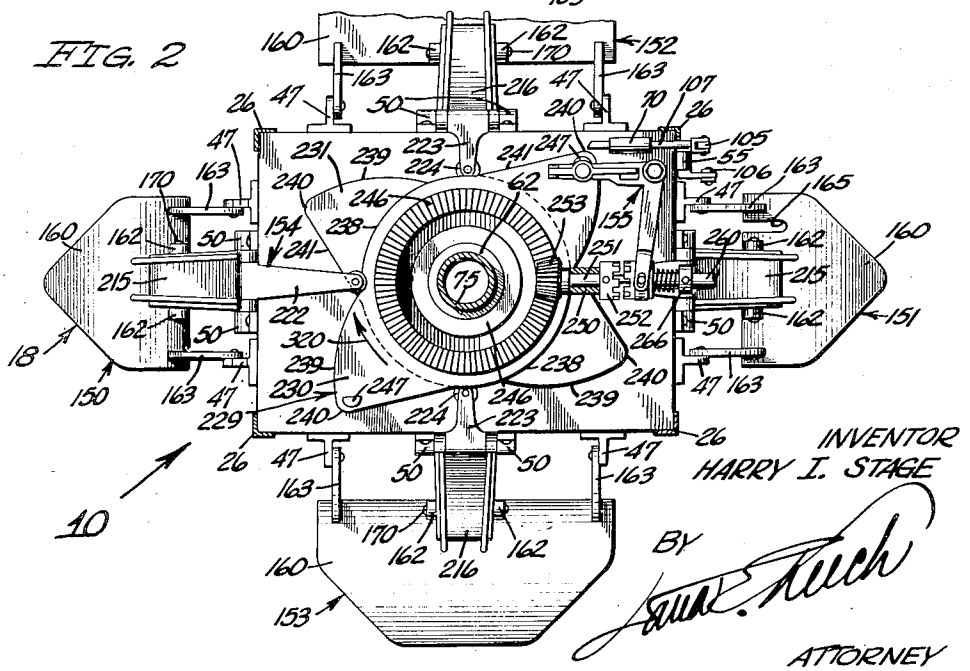


FIG. 2



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FIG. 3

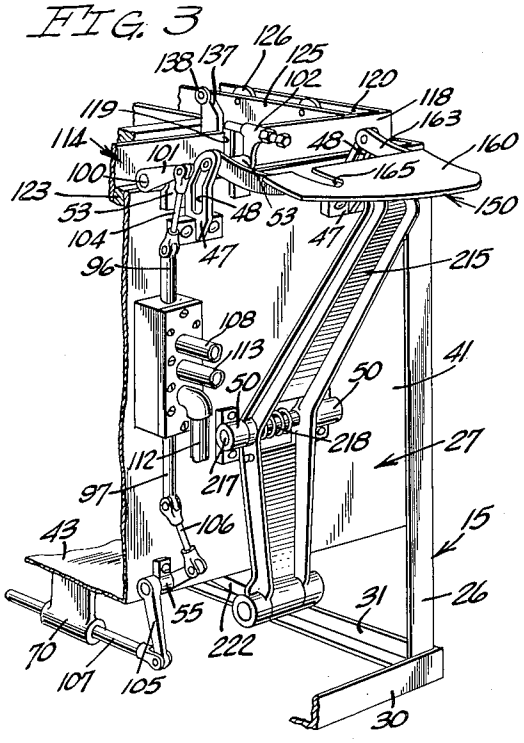


FIG. 5

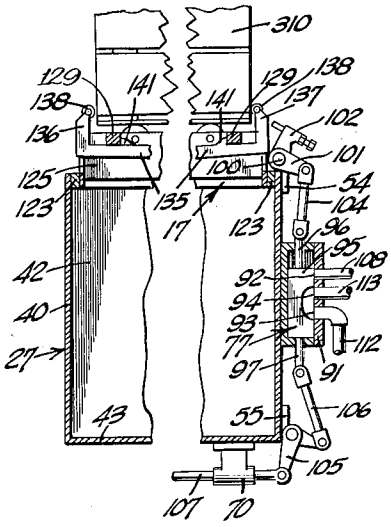
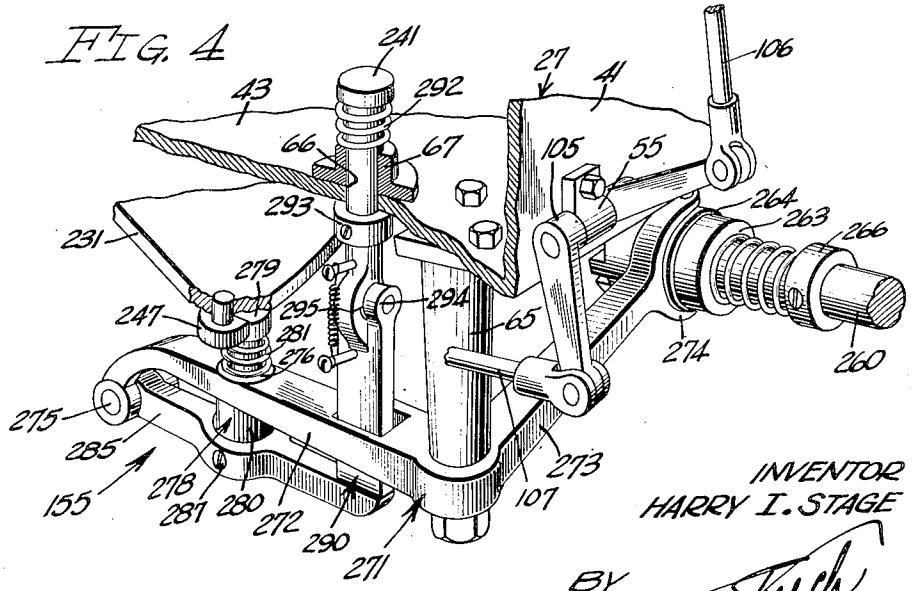


FIG. 4



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FIG. 6

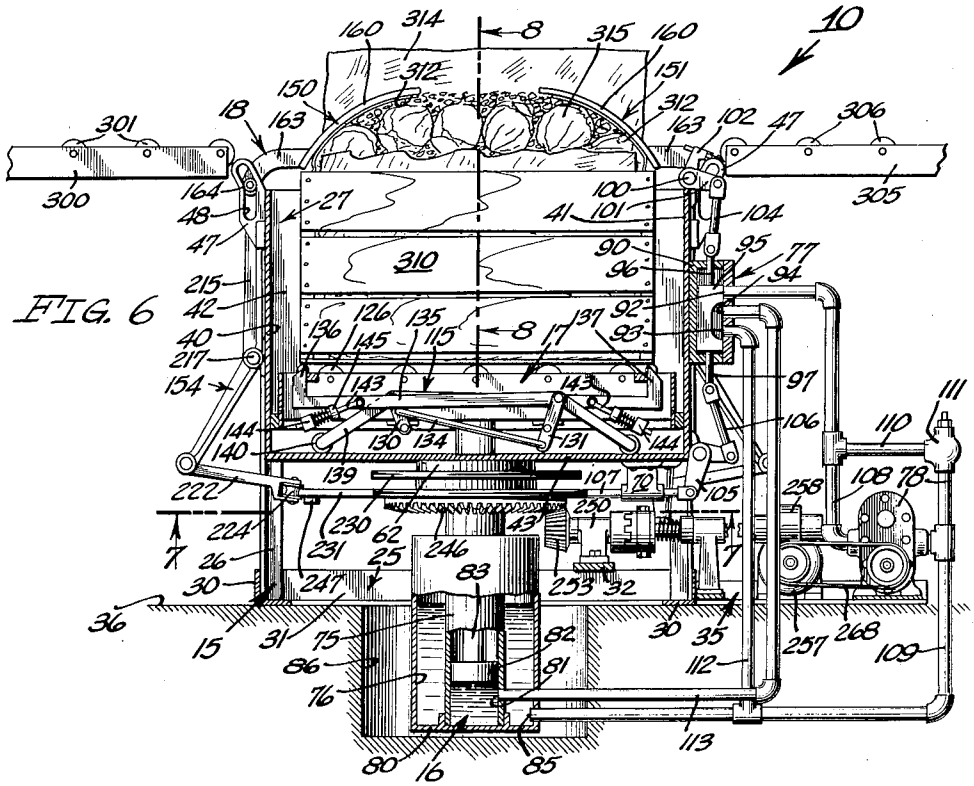
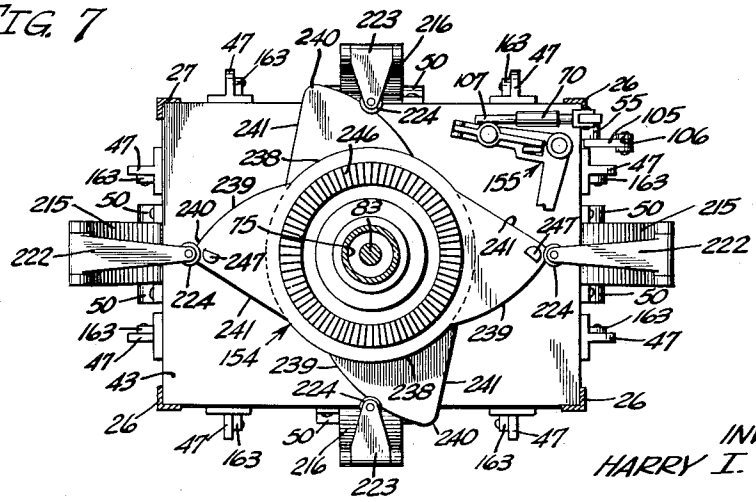


FIG. 7



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FIG. 8

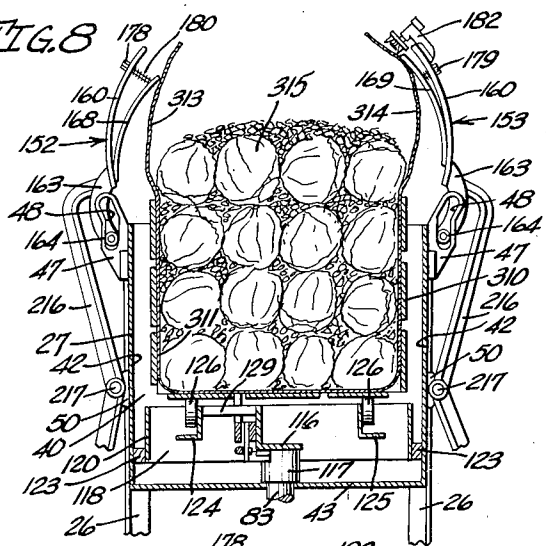


FIG. 9

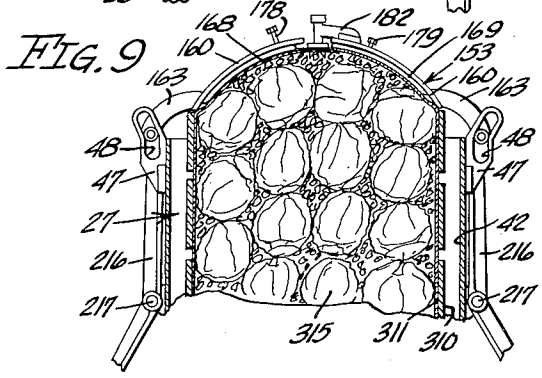


FIG. 10

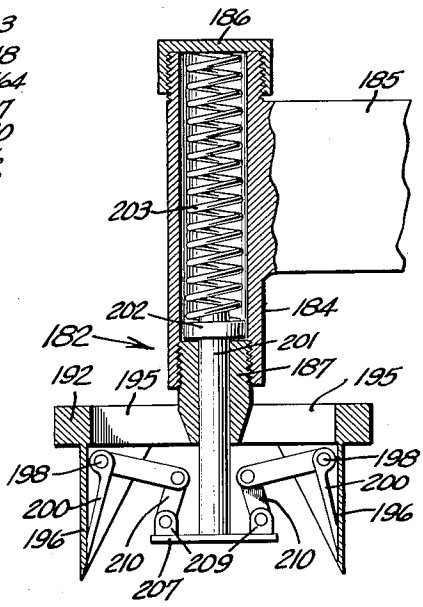


FIG. 11

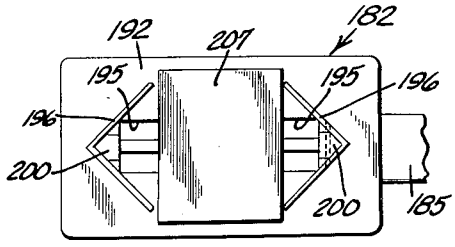
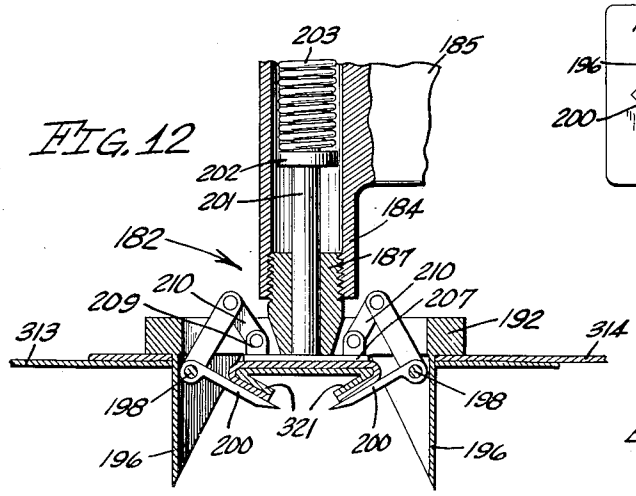


FIG. 12



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FIG. 13

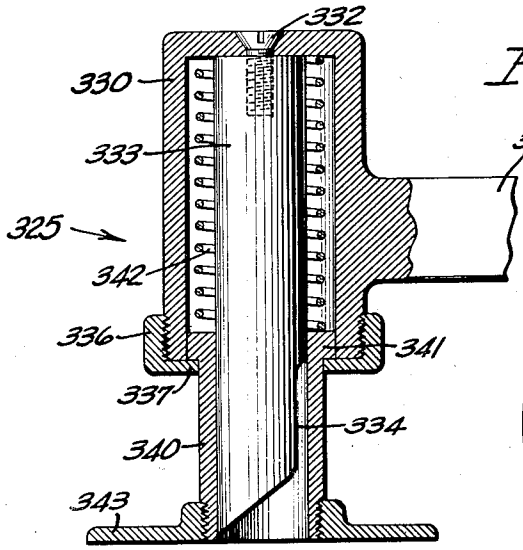


FIG. 14

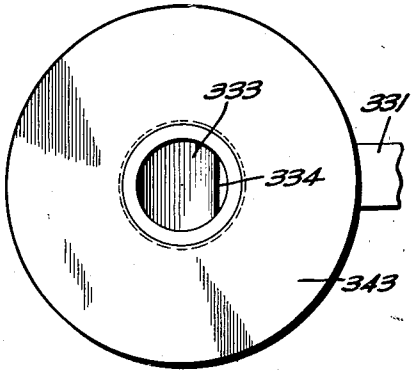
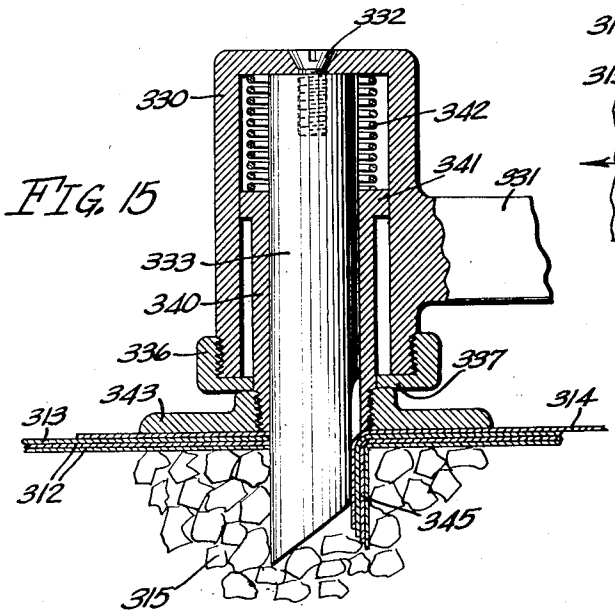


FIG. 15



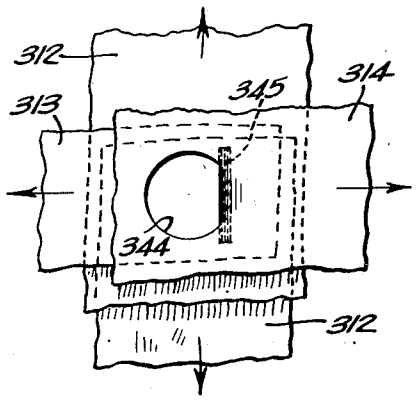


FIG. 16

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Patented Sept. 18, 1934 1,974,165

UNITED STATES PATENT OFFICE

1,974,165

PAPER FOLDING DEVICE

Harry I. Stage, Sanger, Calif., assignor, by mesne assignments, to Paxton Credit Corporation, Sanger, Calif., a corporation of California

Application July 29, 1932, Serial No. 625,769

10 Claims. (Cl. 93—2)

My invention relates to the packing of agricultural produce, and the like, for shipment, and is particularly useful in the folding of packed crate liner flaps over the contents of such crates.

The shipping crates commonly used for shipment of agricultural produce, such as lettuce and the like, are provided with paper liners, these liners comprising two sheets of oiled paper, one sheet lining the bottom and ends of the crate while the other sheet covers the bottom and sides of the crate. The loose ends of these paper sheets form end and side flaps which are allowed to hang loosely outside the crate until the crate is packed. Prior to the lidding of these packed crates the end and side flaps are manually folded over the top of the contents of the crate, the services of several men being required to fold the crate flaps at a sufficient rate of speed to keep a single crate lidding machine supplied with packed crates.

It is, therefore, an object of my invention to provide a machine for automatically folding the flaps of a packed crate liner over the top of the contents of the crate.

In the present manner of manually folding the liner flaps of packed crates no means is provided for securing these flaps over the contents of a crate once they are folded, and, as a result, the flaps often become displaced before the crate is lidded.

Therefore, a further object of my invention is to provide a machine as above noted which will secure together certain of the flaps of a packed crate after these are folded so as to retain them in folded position.

Many agricultural produce shipping crates are packed so that a portion of the pack is disposed above the upper edges of the sides and ends of the crate comprising what is commonly known in the art as an overfilled pack or crown pack. Prior to the lidding of such crown packed crates the portions of the pack resting on top of the sides and ends of the crate must be gathered and tucked inward from over the edges of the crate to prevent injury to the pack during the lidding operation.

Therefore, a still further object of my invention is to provide a packed crate liner flap folding machine which will press the flaps firmly down upon the contents of the crate and simultaneously function to gather and tuck the contents of an overpacked crate inward from over the edges of the crate.

Another object of my invention is to provide a flap folding machine which is automatic in operation and which requires a minimum of attention.

Further objects and advantages will be made evident in the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a vertical sectional view of the preferred machine of my invention.

Fig. 2 is a horizontal sectional view taken on the line 2—2 of Fig. 1.

Figs. 3 and 4 are fragmentary perspective views of portions of the machine shown in Fig. 1.

Fig. 5 is a fragmentary vertical sectional view illustrating a stage in the operation of the machine shown in Fig. 1.

Fig. 6 is a view similar to Fig. 1 showing another stage in the operation of the preferred embodiment of my invention.

Fig. 7 is a horizontal sectional view taken on the line 7—7 of Fig. 6.

Fig. 8 is a fragmentary vertical sectional view taken on the line 8—8 of Fig. 6.

Fig. 9 is a view similar to Fig. 8, illustrating another stage in the operation of mechanism shown in Fig. 8.

Fig. 10 is an enlarged vertical sectional view of a crimping mechanism embodied in my invention.

Fig. 11 is a bottom plan view of the mechanism shown in Fig. 10.

Fig. 12 is a view similar to Fig. 10 illustrating the operation of the mechanism disclosed therein.

Fig. 13 is an enlarged vertical sectional view of a modified form of crimping tool.

Fig. 14 is a bottom plan view of the tool shown in Fig. 13.

Fig. 15 is a vertical sectional view showing the operation of the crimping tool shown in Fig. 13.

Fig. 16 is a fragmentary top plan view of the overlapped portions of crate liner flaps after the latter have been crimped by the tool shown in Fig. 13.

Referring specifically to the drawings, the preferred embodiment of my invention illustrated therein comprises a packed crate liner flap folding machine 10, which includes a frame 15, an elevator 16, a crate receiving and supporting platform 17, and a flap folding mechanism 18.

The frame 15

The frame 15 includes a suitable base 25, ver-

tical legs 26, and a metal box 27. The base 25 has transverse members 30 and longitudinal members 31, a bar 32 being supported transversely by the longitudinal members 31 as shown in Fig. 1. Secured to the right-hand transverse member 30 is an auxiliary frame 35, the base 25 and the frame 35 being adapted to rest on a packing house floor 36.

The box 27 is supported in spaced relation with the base 25 by the legs 26, the box including left and right-hand end walls 40 and 41, respectively, side walls 42, and a bottom 43. Mounted on the outside and adjacent the upper edges of the walls 40, 41, and 42 of the box 27 are pairs of aligned brackets 47 having slots 48 provided therein. Also secured to the outside of the walls 40, 41, and 42 are pairs of aligned bearing blocks 50, as shown in Fig. 2. Mounted on the right-hand end wall 41 of the box 27 adjacent the upper edge thereof is a pair of aligned bearing blocks 53, a single bearing block 55 being secured to the wall 41 adjacent the lower edge thereof, as shown in Fig. 3.

The bottom 43 of the box 27 has a central opening 60, as shown in Fig. 1. Secured to the under side of the bottom 43 in concentric relation with the opening 60 is an annular body 62 which has internal and external threaded portions as shown. Also secured to the under side of the bottom 43 is a depending post 65, as shown in Fig. 4. Provided in the bottom 43 in close proximity with the post 65 in an opening 66 which registers with a flanged bearing 67. The purpose of the post 65 and bearing 67 will be made apparent hereinafter. Depending from one corner of the bottom 43 of the box 27 is a horizontal bearing block 70, as shown in Fig. 3.

The elevator 16

The elevator 16, shown clearly in Fig. 6, includes a hydraulic cylinder 75, a reservoir 76, a control valve 77, and a pump 78. The hydraulic cylinder 75 is hung vertically below the box 27, being threadedly received by the annular body 62, the lower end of the cylinder 75 being closed by a head 80. Provided in the wall of the cylinder 75 adjacent the head 80 is an inlet and outlet port 81. Adapted to be reciprocated vertically within the cylinder 75 is a piston 82 which is secured to the lower end of a piston rod 83, the latter extending into the box 27 through the hole 60 provided in the bottom thereof.

The reservoir 76 is disposed concentrically about the cylinder 75, as shown, and is open at the top and closed at the bottom thereof by the head 80 of the cylinder 75. Provided in the wall of the reservoir 76 adjacent the lower edge thereof is an opening 85, as shown in Fig. 6. The portions of the cylinder 75 and reservoir 76 which extend below the level of the floor 36 are accommodated by a well 86 provided in the floor as shown.

The control valve 77 is mounted on the end wall 41 of the box 27, as shown in Figs. 3 and 6, this valve having a body 90 and cover plate 91, the latter being provided with upper, lower, and intermediate ports 92, 93, and 94 respectively. Reciprocally mounted within the body 90 and in communication with ports of the plate 91 is a conventional slide valve 95 having upper and lower push rods 96 and 97, respectively, the latter extending through suitable openings provided at opposite ends of the body 90.

Rotatably received by the above described bearing blocks 53, shown in Figs. 1 and 3, is a shaft 100, to opposite ends of which an arm 101 and an adjustable stop 102 are fixed, the arm 101 being operatively connected to the upper push rod 96 of the valve 95 by a link 104. Pivotally mounted below the valve 77 on the aforementioned bearing block 55 is a bell crank 105, one leg of which is operatively connected with the push rod 97 of the valve 95 by a link 106, the lower leg of the bell crank 105 being received by the bifurcated end of a horizontal rod 107, the latter being slidably received by the aforementioned horizontal bearing block 70 on the bottom 43 of the box 27.

The pump 78 is suitably mounted on the auxiliary frame 35, as shown in Fig. 6. The discharge side of the pump communicates with the upper port 92 of the valve 77 by means of a pipe 108, and the opposite or intake side of the pump 78 communicates with the opening 85 of the reservoir 76 through a suitable pipe 109. Joining the pipes 108 and 109 is a by-pass circuit 110 which includes an adjustable relief valve 111. The lower port 93 of the control valve 77 communicates with the pipe 109 by means of a pipe 112 and the central port 94 of the control valve 77 is joined to the port 81 of the cylinder 75 by a pipe 113.

The platform 17

The crate receiving and supporting platform 17, shown clearly in Figs. 1, 6, and 8, includes a suitable frame 114 upon which a crate stopping and aligning mechanism 115 is mounted. The frame 114 includes a central longitudinal member 116 which is secured to the upper end of the piston rod 83 by means of a collar 117. Secured to opposite ends of the member 116 are transverse members 118 which have open slots 119, the purpose of which will be described hereinafter. Fixed to opposite ends of the transverse members 118 are longitudinal members 120, as shown in Fig. 8, the transverse members 118 and longitudinal members 120 forming a continuous rectangular wall. Fastened to the outside of the members 118 and 120 adjacent the lower edge thereof is a continuous packing strip 123, the latter slidably contacting the inner surfaces of the walls of the box 27. Supported at opposite ends thereof by the transverse members 118 is a pair of longitudinal angle irons 124 and 125, these having idle rollers 126 rotatably mounted thereon. Interposed between the members 124 and 120 at opposite ends of the frame 114 are short transverse members 129.

Crate stop mechanism 115

Pivotally mounted on the longitudinal member 120 of the platform frame, as shown in Figs. 1 and 6, is a pair of levers 130 and 131, these being operatively connected by a diagonal rod 134. Pivoted on the upper ends of the levers 130 and 131 are bars 135 disposed in overlapping relation as shown. The outwardly disposed ends of the bars 135 have upwardly extending crate stops 136 and 137, these having rollers 138 mounted thereon. Provided on the inwardly disposed ends of the bars 135 are downwardly inclined extensions 139, the latter having rollers 140 rotatably mounted on the lower ends thereof. Positioned on the upper edges of the bars 135 in spaced relation with the crate stops 137 are stop lugs 141 as shown. Pivotally secured to each of the bars 135 are downwardly inclined rods 143, the lower ends of these rods being slidably received by blocks 144, the latter being

pivotally mounted on the under side of the central member 120 of the frame 114. The rods 143 have fixed collars 145 and compression springs 146, the latter being disposed between the blocks 144 and collars 145, as shown. The rods 143 yieldably urge the bars 135 upwardly and inwardly so that the bars normally contact the under sides of the short transverse frame members 129 while the stops 136 and 137 contact the outside edges of the members 129 as shown by the position of the right-hand stop 137 in Fig. 1.

The flap folding mechanism 18

The crate liner flap folding mechanism 18, shown in Figs. 1, 2, and 4, includes left and right end folding arms 150 and 151, respectively, and front and rear side folding arms 152 and 153, respectively, the arms 150 to 153 inclusive being actuated by a power driven mechanism 154, the latter being controlled by an automatic control mechanism 155.

The arms 150, 151, 152, and 153 are similar in structure, having arcuate plates 160 to the under sides of which pairs of eye lugs 162 and arcuate links 163 are secured, as shown in Figs. 2 and 3. Rotatably mounted on the free ends of the links 163 are idle rollers 164, these being received by the slots 48 in the aforementioned brackets 47 on the side walls of the box 27. The plate 160 of the right-hand end folding arm 151 has an open slot 165 on the inner edge thereof, the purpose of which will be made evident hereinafter. As shown in Fig. 8, the plates 160 of the side folding arms 152 and 153 have secondary plates 168 and 169, respectively, these being pivotally mounted on pins 170 which pass through the eye lugs 162 of each of the plates 160. The movement of the secondary plates 168 and 169 relative to the plates 160 is limited by bolts 178 and 179 respectively, these passing loosely through suitable holes in the plates 160 and being threaded into the secondary plates 168 and 169. It will be noted in Fig. 8 that the bolt 178 is longer than the bolt 179, thus allowing greater relative movement between the plate 168 and its plate 160 than between the other side folding plate 160 and the secondary plate 169 thereof. The plates 168 and 169 are normally urged away from the plates 160 by compression springs 180 carried by the bolts 178 and 179.

Rigidly secured to the plate 160 of the rear side folding arm 153 adjacent the outside edge thereof is a crimping tool 182, shown in Figs. 8 to 11 inclusive, this tool having a tubular body 184 which is integral with an attaching bracket 185. The body 184 has a cap 186 threadedly mounted on the upper end thereof, the lower end of the body being internally threaded to receive a hollow threaded stud 187, the latter having a rectangular head 192 formed integral therewith. Provided in the head 192 on opposite sides of the stud 187 are openings 195. Secured to the head 192 in right angular relation therewith is a pair of V-shaped paper cutting blades 196, these having pins 198 on which bell cranks 200 are pivotally mounted. Slidably received by the hollow stud 187 is a plunger 201 having a collar 202 fixed to the upper end thereof. The plunger 201 is normally urged to the position shown in Fig. 10 by a compression spring 203 which bears against the collar 202 and the cap 186 as shown. Secured to the lower end of the plunger 201 is a rectangular plate 207 having a pair of ears 209 fixed thereon, the latter being connected to the inwardly extending legs of the bell cranks 200 by links 210.

The power driven mechanism 154

The power driven mechanism 154 which actuates the folding arms 150, 151, 152, and 153 includes end levers 215 and side levers 216 which are pivoted on pins 217, opposite ends of the latter being supported by the aforementioned pairs of bearing blocks 50 on the side walls of the box 27. The levers 215 and 216 are normally urged to the position shown in Fig. 1 by torsion springs 218, one of the latter being clearly shown in Fig. 3. The upper ends of the levers 215 and 216 are pivotally secured to the eye lugs 162 of the folding arms 150, 151, 152, and 153 by the aforementioned pins 170. The lower ends of the levers 215 and 216 extend a short distance below the bottom 43 of the box 27, the levers 215 being pivotally secured to relatively shorter side links 223, the inner ends of these links being bifurcated for the reception of grooved rollers 224, as shown in Fig. 2.

Rotatably mounted on the annular body 62 on the bottom 43 of the box 27, as shown in Figs. 1 and 2, is an operating cam member 229 having upper and lower cams 230 and 231, these being secured to a common hub 232, the latter being rotatably retained on the annular body 62 by a suitable ring nut 233. The cams 230 and 231 have identical peripheral contours which consist of diametrically opposed concentric sections 238, arcuate faces 239, extremities 240, and backs 241. Provided on the under side of the lower cam 216 are a concentrically disposed ring gear 246 and a pair of stop lugs 247, the latter being secured to the cam 231 at points adjacent the points of greatest radius 240 thereof.

Bolted to the transverse bar 32 of the base 25 is a bearing 250 in which a short driven shaft 251 is journaled. Keyed on opposite ends of the shaft 251 are a castellated clutch collar 252 and a pinion 253, the latter being positioned to mesh with the ring gear 246. Supported by the auxiliary frame 35 in close proximity with the right-hand transverse frame member 30 is a bearing 256 positioned in axial alignment with the bearing 250. Also supported by the auxiliary frame 35 is an electric motor 257 having a conventional built-in speed reduction unit 258 thereon.

Rotatably mounted in the bearing 256 is a drive shaft 260, one end of which is coupled to the speed reduction unit 258 of the motor 257 by a coupling 261. The opposite end of the shaft 260 is splined to receive a sliding companion clutch collar 263, the latter being grooved to receive a split floating collar 264, as shown in Fig. 4. The sliding clutch collar 263 is urged toward the clutch collar 252 by a compression spring 265, the latter bearing against a collar 266 which is fixed on the shaft 260, the clutch collars 252 and 263 constituting a clutch 267.

The motor 257 is adapted to drive the aforementioned pump 78 by means of a belt 268, the latter being trained about suitable pulleys, as shown in Figs. 1 and 6.

The control mechanism 155

Rotation of the driven shaft 251 by the drive shaft 260 is controlled by the control mechanism

155, clearly shown in Fig. 4, this mechanism including a bell crank 271 which is pivotally secured to the lower end of the aforementioned depending post 65 on the bottom 43 of the box 27. The bell crank 271 has horizontally extending arms 272 and 273, the latter having a bifurcated end 274 which is operatively connected to the floating collar 264 of the clutch collar 263 as shown. The arm 272 of the bell crank 271 is downwardly bent at its extremity, the latter being bifurcated and provided with a pin 275. Formed in the arm 272 of the bell crank 271 is a bore 276 and a rectangular opening 277. Slidable vertically in the bore 276 is a plunger 278 having a head 279 on the upper end thereof, and a collar 280 on the lower end as shown. The plunger 278 is normally urged upwardly to the position shown in Fig. 4 by a compression spring 281. Hinged to the pin 275 of the arm 272 is a lever 285, the free end of which is disposed directly below the rectangular opening 277 of the arm 272. The lever 285 has a central opening 286 which loosely receives the collar 280 of the plunger 278, the lever 285 being operatively connected to the plunger 278 by means of screws 287 as shown. It will be noted in Figs. 2 and 4 that the head 279 of the plunger 278 is normally disposed in the path of the aforementioned stop lugs 247 on the under side of the lower cam 231.

Slidably mounted in the vertical bearing 67 on the bottom 43 of the box 27 is a plunger 290, the lower end of which passes through the rectangular opening 277 of the bell crank 271, as shown in Fig. 4, it being noted that the free end of the lever 285 is disposed directly below the plunger 290. Provided on the upper end of the plunger 290 is a head 291, this being engaged by a compression spring 292 to hold the plunger 290 upward, this movement of the plunger being limited by a collar 293. The plunger 290 is provided at its center with a knuckle joint 294, the latter allowing the lower half of the plunger to swing in only one direction from the vertical position in which it is shown in Fig. 4, the plunger being yieldably retained in this position by a contractile spring 295.

Operation

In agricultural produce packing houses a suitable conveyor is usually provided for conveying packed crates from the packing tables to a crate lidding machine. The crate liner flap folding machine 10 of my invention is adapted to be positioned in line with the aforementioned packed crate conveyor at a point just preceding the lidding machine.

For illustration purposes I have shown diagrammatically in Fig. 1 a delivery conveyor 300 having suitable rollers 301 thereon, the latter being disposed in horizontal alignment with the rollers 126 on the platform 17 of the machine 10. The conveyor 300 is adapted to convey packed crates from packing tables (not shown) to the machine 10. Positioned adjacent the machine 10 opposite to and in horizontal alignment with the conveyor 300 is a discharge conveyor 305 having suitable rollers 306 thereon, this discharge conveyor being adapted to deliver packed crates from the machine 10 to a crate lidding machine (not shown). The machine 10 is made ready for operation by starting the motor 257, the motor and pump running continuously. The crate receiving and supporting platform 17 is normally held up in the position shown in Fig. 1 by the elevator 16, it being noted that the cylinder 75 of the elevator is filled with fluid under pressure from the pump 78, the excess fluid discharged from the pump being returned to the intake side of the pump through the by-pass circuit 110 and pressure relief valve 111, the latter relieving the pressure at the discharge end of the pump when this pressure reaches a given maximum.

Referring particularly to Fig. 1, I have shown therein a crate 310 having a paper liner 311 provided therein, the loose ends of the liner 311 hanging over the sides and ends of the crate to form end flaps 312 and front and rear side flaps 313 and 314, respectively. Packed in the crate 310 is a typical crown pack of produce, such as lettuce or the like. The crate 310 is being delivered onto the platform 17 of the machine 10 by the delivery conveyor 300, it being noted that the left-hand crate stop 136 is depressed while the right-hand stop 137 remains up in contact with the bar 129. As the crate 310 rolls onto the platform 17 the end of the crate strikes the right-hand stop 137, the latter being carried rightwardly by the inertia of the crate to the position shown in Fig. 5. The lateral outward movement of the stop 137 is checked by the stop lug 141 on the bar 135, the lug contacting the bar 129. This movement of the stop 137 is transmitted through the levers 130, 131, and rod 134 to the left-hand stop 136 so that both stops move outwardly. The bars 135 are forced inwardly and upwardly by the springs 146 so that the stops 136 and 137 firmly embrace opposite ends of the crate 310, thus aligning the crate centrally with respect to the platform 17. A more detailed description of the operation of the crate stop mechanism 115 can be found in a somewhat similar disclosure in the copending application of Hale Paxton, Serial No. 468,680, filed July 17, 1930, on Automatic box stops for lidding machines.

As the crate 310 carries the stop 137 rightwardly, the stop passes through the slot 119 in the member 118 and contacts the adjustable stop 102, as shown in Fig. 5. Thus, the shaft 100 is rotated and the slide 95 of the control valve 77 is thrown to the position shown in this figure through the medium of the arm 101 and link 104. This downward movement of the slide 95 swings the bell crank 105 by means of the link 106 so that the horizontal rod 107 slides inwardly to the position shown in Figs. 5 and 7, in which the inner end of the rod 107 is disposed in the path of the extremities 240 of the lower cam 231.

With the slide 95 of the control valve 77 in the lowermost position shown in Figs. 5 and 6, the ports 93 and 94 of the valve are allowed to communicate, and the liquid contained within the cylinder 75 passes through the pipes 109 and 112 to the valve 77 and through the pipe 113 into the reservoir 76, thus allowing the platform 17 to descend within the box 27 while the pump 78 by-passes through the circuit 110.

As the platform 17 descends within the box 27 the air, displaced from the box by the platform and the crate carried thereon, is forced rapidly upward along the sides and ends of the crate 310 under the end and side flaps 312, 313, and 314 of the paper liner 311, causing these flaps to be blown into a substantially vertical position.

As the platform 17 approaches the bottom 43

of the box 27 the rollers 140 on the ends of the inclined portions 139 of the stop bars 135 contact the bottom 43, thus pivoting the bars 135 so that the stops 136 and 137 are drawn downward below the bottom of the crate 310. As soon as the stops clear the crate they are forced inward by the spring-pressed rods 143 to the positions shown in Fig. 6.

As the platform 17 reaches bottom the head 291 of the plunger 290, shown in Fig. 4, is contacted by the platform 17 and the plunger 290 depressed, causing the lever 285 to draw the plunger 278 downward so that the head 279 of the plunger 278 clears the stop lug 247 on the under side of the lower cam 231. When the head 279 is drawn out of contact with the stop lug 247 the bell crank 271 is free to pivot, thus allowing the spring 265 on the drive shaft 260 to slide the clutch collar 263 into engagement with the clutch collar 252, so that the drive shaft 260 is operatively joined to the driven shaft 251, and the cam member 229 is rotated by the pinion 253 and gear 246 in the direction of the arrow 320 of Fig, 2.

As the bell crank 271 pivots about its center the lever 285 on the arm 272 of the bell crank is slid from under the plunger 290 and the plunger 278 is spring-pressed up to its normal position, being again disposed in the path of the stop lugs 247 on the cam 231.

When the cam member 229 begins to rotate the arcuate faces 239 of the cam 231 immediately contact the rollers 224 on the links 222 forcing these outwardly, and when the approximate center of the arcuate faces 239 of the cam 231 are in contact with the rollers 224 of the links 222 the rollers 224 on the side links 223 begin to ride on the arcuate surfaces 239 of the upper cam 231. As the links 222 and 223 are pushed outward by the cams 230 and 231 the end levers 215 and side levers 216 pivot about the pins 217, thus swinging the arms 150, 151, 152, and 153 upward into contact with the liner flaps 312, 313, and 314, as shown in Fig. 8. The cams 230 and 231 are timed so that when the extremities 240 of the lower cam are in contact with the rollers 224 on the links 222, as shown in Fig. 7, the rollers 224 on the links 223 are disposed approximately in the center of the arcuate faces 239 of the upper cam 230. When the end links 222 are pushed to their extreme outward positions, as shown in Fig. 7, the end folding arms 150 and 151 are carried to the position shown in Fig. 6, it being noted that the end flaps 312 of the liner 311 are pressed firmly against the contents 315 of the crate 310.

When the end folding arms 150 and 151 are in the positions shown in Fig. 6 the side folding arms 152 and 153 are in the positions shown in Fig. 8, and as the side arms 152 and 153 continue inwardly from the position shown in Fig. 8 the end folding arms 150 and 151 begin to return to their normal position as the rollers 224 of the end links 222 ride inwardly on the backs 241 of the lower cam 230, it being noted that the links 222 and 223 are continually urged inwardly against the cams 230 and 231 by the torsion springs 218 which contact the levers 215 and 216, as shown in Fig. 3. The end flap folding arms 150 and 151 are caused to lead the side arms 152 and 153 in operation so that the side flaps 313 and 314 will overlap the end flaps 312, and the arms are properly timed so that the end arms do not return to normal position until the end flaps 312 are partially overlapped by the side flaps 313 and 314.

As shown in Fig. 8, the space between the secondary plate 168 and the plate 160 of the arm 152 is greater than the space between the secondary plate 169 and the plate 160 of the arm 153. This causes the front side flap 313 to lead the flap 314, and the flap 314 accordingly overlaps the flap 313 when the two flaps contact the pack 315 in the crate 310, as shown in Fig. 9.

When the side flaps 313 and 314 are brought into contact with the pack 315 in the crate 310 by the secondary plates 168 and 169 the arms 152 and 153 continue their downward movement and the plates 168 and 169 pivot about the pins 170 until the plates are in the position shown in Fig. 9. During the final downward movement of the arm 153 against the pack 315 in the crate 310 the crimping tool 182 which is attached to the plate 160 of the arm 153 functions to crimp the side flaps together in the following manner:

Upon contacting the overlapped portions of the side flaps 313 and 314 the blades 196 of the crimping tool 182 cut V-shaped flaps 321 from the paper, and when the plate 207 contacts the upper flap 314 the plunger 201 is forced upward, causing the bell cranks 200 to rotate about their centers. This rotation of the bell cranks folds the V-shaped flaps 321, as shown in Fig. 12, thus crimping the side flaps 312 and 313 of the crate liner 311 together. As the crimping tool 182 is withdrawn from the flaps 313 and 314, the bell cranks 200 are forced to the position shown in Fig. 10 by the spring 203, thus allowing the tool 182 to be withdrawn from the paper without causing damage thereto.

As shown in Fig. 6, the end flaps 312 of the liner 311 do not overlap when folded over the top of the pack 315 of the crate 310. However, it is common practice to provide longer end flaps than those shown so that the end flaps as well as the side flaps overlap when folded over the contents of a crate. It is understood that the crimping tool 182, shown in Fig. 10, will function properly when all four flaps of a crate liner are overlapped as well as when only the two side flaps are overlapped as shown.

When the end flap folding arms 150 and 151 return to normal position they remain inoperative for a period due to the rollers 224 thereof riding on the concentric portions 238 of the cam 231.

The complete folding of the end and side flaps of the crate liner 311 is accomplished during a half revolution of the cam member 229, and at the completion of a flap folding operation one of the extremities 240 of the cam 231 contacts the inner end of the horizontal rod 107 and forces the latter outwardly from its position shown in Figs. 6 and 7 to the position in which it is shown in Fig. 2. Outward movement of the rod 107 rocks the bell crank 105 and raises the slide 95 of the control valve 77 to its uppermost position, thus bringing the ports 92 and 94 of the valve 77 into communication. It will be noted that when the slide 95 of the valve 77 is returned to its uppermost position the shaft 100 above the valve is rotated by means of the link 104 and arm 101, and the adjustable stop 102 which is fixed to the shaft 100 is returned to its normal position as shown in Fig. 1. With the slide 95 of the valve 77 in its upper or normal

position, fluid passes from the pump 78 through the pipe 108, the valve 77, and the pipe 113 to the hydraulic cylinder 75.

Just after the extremity 240 of the lower cam 231 comes in contact with the horizontal slide rod 107, the stop lug 247 on the under side of the extremity 240 strikes the head 279 of the plunger 278, causing the bell crank 271 to return to its normal position so that the forked arm 273 of the bell crank 271 disengages the clutch 267, whereupon rotation of the cam member 229 ceases with the cams 230 and 231 positioned as shown in Fig. 2.

It can be seen from Fig. 4 that when the bell crank 271 is in operative position the plunger 290 is depressed by the platform 17 (not shown in Fig. 4), and it is obvious that the lower end of the plunger 290 is disposed in the path of the lever 285; consequently, when the bell crank 271 is forced to its normal position the lever 285 strikes the plunger 290, causing the lower half of the plunger to rock about the joint 294 against the tension of the spring 295. It is also obvious that when the platform begins to rise the plunger 290 is lifted to its normal position by the spring 292, and as soon as the lower end of the plunger is free from the end of the lever 285, the contractile spring 295 returns the lower half of the plunger 290 to its normal vertical position.

As the cam member 229 stops following a folding operation the pump 78 continues to force fluid into the cylinder 75 from the reservoir 76 until the platform 17 is returned to its uppermost position, as shown in Fig. 1, the platform being held in this position by the fluid pressure in the cylinder 75 while the pump 78 continues to run, pumping through the by-pass circuit 110.

After the flaps 312, 313, and 314 of the crate liner 311 have been properly folded and crimped, and the crate 310 has been elevated, the crate stops 136 and 137 remain inoperatively disposed below the crate in the position shown in Fig. 6, and the crate 310 is free to be discharged onto the discharge conveyor section 305 by any suitable means. As the crate 310 is discharged from the machine 10 onto the conveyor 305 the crate stops 136 and 137 are spring-pressed upwardly to their normal positions in readiness for receiving the next crate (not shown). The aforementioned rollers 138 on the crate stops 136 and 137 are provided to prevent lateral movement of these stops incidental to the discharge of a crate from the platform 17 of the machine 10, the rollers reducing friction between the bottom of the crate and the stops 136 and 137.

Referring particularly to Figs. 13, 14, and 15, I have shown therein a modified form of crimping tool 325 which might be used in the machine 10 in place of the aforedescribed crimping tool 182 shown in Fig. 10.

The tool 325 has a tubular body 330 which is closed at its upper end and provided with an attaching arm 331, the latter being adapted to be secured to the plate 160 of the rear side folding arm 153 in the same aforedescribed manner that the tool 182 is attached to the plate 160. Mounted concentrically within the body 330 by means of a screw 332 is a cylindrical plunger 333, the lower portion of the latter having a flattened portion 334, as shown in Figs. 13 and 14. The lower end of the plunger is beveled as shown in Fig. 13. Threadedly mounted on the lower end of the body 330 is a ring nut 336 which has an annular flange 337 integral therewith, it being noted that a portion of the flange 337 extends inwardly as shown.

Slidable vertically about the plunger 333 is a tubular member 340 which has an annular shoulder 341 disposed concentrically about the upper end thereof. The shoulder 341 is normally urged against the flange 337 of the nut 336 by a compression spring 342. Fixed onto the lower end of the tubular member 340 is an annular plate 343.

The operation of the crimping tool 325 is shown in Fig. 15, it being noted that the end flaps 312, as well as the side flaps 313 and 314, are disposed in overlapping relation over the contents 315 of the crate. When the crimping tool 325 is brought into contact with the folded flaps 312, 313, and 314 of the packed crate liner 311, as shown in Fig. 15, the flaps are held firmly by the plate 343 while the plunger 333 is forced through the flaps and into the pack 315 of the crate 310. As the sharp beveled end of the plunger 333 pierces the flaps 313, 314, and 315, an opening 344 is cut through the flaps providing a tab 345, the latter being forced down into the pack 315 as shown. As the tool 325 is raised the spring 342 expands, causing the plate 343 to exert a pressure on the flaps while the plunger 333 is withdrawn from the flaps. The tab 345 remains downwardly disposed in the position shown in Fig. 15 after the plunger 333 is withdrawn.

In Fig. 15 I have shown fragments of the overlapped portions of the flaps 312, 313, and 314 after these have been crimped together by the tool 325. The arrows on each of the flaps in this figure indicate the tension exerted on the flaps by the tendency of the pack 315 to expand after this pack has been tucked and slightly compressed by the flap folding arms 150, 151, 152, and 153 of the machine 10. It is clear in Fig. 15 that the tension of the flaps 313 and 314 tends to draw the tab 345 up through the opening 344, but the tension of the flaps 312 tends to close the opening 344, thus preventing the tab 345 from being withdrawn through the opening 344. It is thus seen that the crimping tool 325 is very simple in operation and that it is very effective in securing the flaps of the crate liner 311 over the contents 315 of the crate.

It is seen that the machine 10 of my invention is entirely automatic in its operation, and although I have not shown means for automatically feeding crates to the machine 10 or discharging these crates from the machine 10, it is understood that such means may be readily provided, or in lieu of such means packed crates may be fed to and discharged from the machine 10 manually.

It may also be seen that in addition to efficiently folding and crimping crate liner flaps the machine 10 of my invention has a gathering and tucking action on any portion of the pack that might project over the sides or ends of the crates.

I claim as my invention:

1. In a machine of the character described, the combination of: a frame; a crate receiving and supporting platform slidable vertically in said frame; crate stop means provided on said platform; means for raising and lowering said platform, said means being responsive to said crate stop means to lower said platform; crate liner flap folding means mounted on said frame; means for actuating said flap folding means

automatically following lowering of said platform; and means for automatically causing said platform handling means to raise said platform following operation of said flap folding means.

2. In a device for preparing a crown packed crate for lidding, the combination of: an elevator having a platform for receiving a crown packed crate; stop means on said platform for automatically positioning a crate thereon; control means actuated by said stop means and causing said elevator to move said crate vertically; and means automatically operative in conjunction with said vertical movement to gather an overflow portion of the contents of said crate inwardly over said crate.

3. In a device for preparing a crown packed crate for lidding, the combination of: a platform for receiving a crown packed crate; stop means on said platform for automatically positioning a crate thereon; and means automatically set in motion in response to said positioning of said crate to gather an overflow portion of the contents of said crate inwardly over said crate.

4. In a device for preparing a crown packed crate for lidding, the combination of: a platform for receiving a crown packed crate; stop means on said platform for automatically positioning a crate thereon; and means automatically set in motion in response to said positioning of said crate to fold paper liners of said crate over the contents thereof.

5. In a device for handling crates in preparing these for shipment, the combination of: an elevator having a platform for receiving a crate travelling along a given path; means to operate said elevator to move said crate vertically out of said path to perform an operation on said crate and then return said crate to said path; stop means on said platform for automatically positioning a crate on said platform in said path; and control means actuated by said stop means for causing said elevator operating means to perform as aforesaid.

6. In a device for preparing a crown packed crate for lidding, the combination of: a frame; a platform on said frame for receiving a crate lined with relatively flexible paper and packed with fresh farm produce so that the latter is heaped up in said crate above the upper edges thereof, flaps of said liner hanging down over said edges; means for lifting said liner flaps from downward to upwardly extending positions; means for folding said upwardly extending liner flaps inwardly over said crate and tucking outer portions of the upper layer of said produce inwardly from over said crate edges; and means carried by said folding means for securing said flaps together when said folding has been accomplished.

7. In a device for preparing a crown packed crate for lidding, the combination of: a frame; a platform on said frame for receiving a crate lined with relatively flexible paper and packed with fresh farm produce so that the latter is heaped up in said crate above the upper edges thereof, flaps of said liner hanging down over said edges; stop means on said platform for automatically positioning said crate thereon; and means controlled by said stop means for directing blasts of air upwardly beneath said flaps to lift the latter into upwardly extending positions and thus facilitate the inward folding of said flaps.

8. In a device for preparing a crown packed crate for lidding, the combination of: a frame; a platform on said frame for receiving and supporting a crown packed crate; a conveyor in substantially horizontal alignment with said platform for delivering said crate to said platform; stop means on said platform for automatically positioning said crate thereon; and means controlled by said stop means for causing said platform to drop below the level of said conveyor to perform an operation on said crate.

9. In a device for preparing a crown packed crate for lidding, the combination of: a frame; a platform on said frame for receiving a crate lined with relatively flexible paper and packed with fresh farm produce so that the latter is heaped up in said crate above the upper edges thereof, flaps of said liner hanging down over said edges; a conveyor in substantial horizontal alignment with said table for delivering said crate to said platform; stop means on said platform for automatically positioning said crate thereon; means controlled by said stop means for causing said platform to drop below the level of said conveyor; and means operated by the dropping of said platform to direct blasts of air up beneath said flaps to lift the latter into upwardly extending positions and thus facilitate the inward folding of said flaps.

10. In a device for preparing a crown packed crate for lidding, the combination of: a frame; a platform on said frame for receiving a crate lined with relatively flexible paper and packed with fresh farm produce so that the latter is heaped up in said crate above the upper edges thereof, flaps of said liner hanging down over said edges; a conveyor in substantially horizontal alignment with said platform for delivering said crate thereto; means for causing said platform, while carrying said crate, to drop below the level of said conveyor; and means for directing blasts of air beneath said flaps as said platform descends to lift said flaps into upwardly extended positions and facilitate inward folding of said flaps.

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