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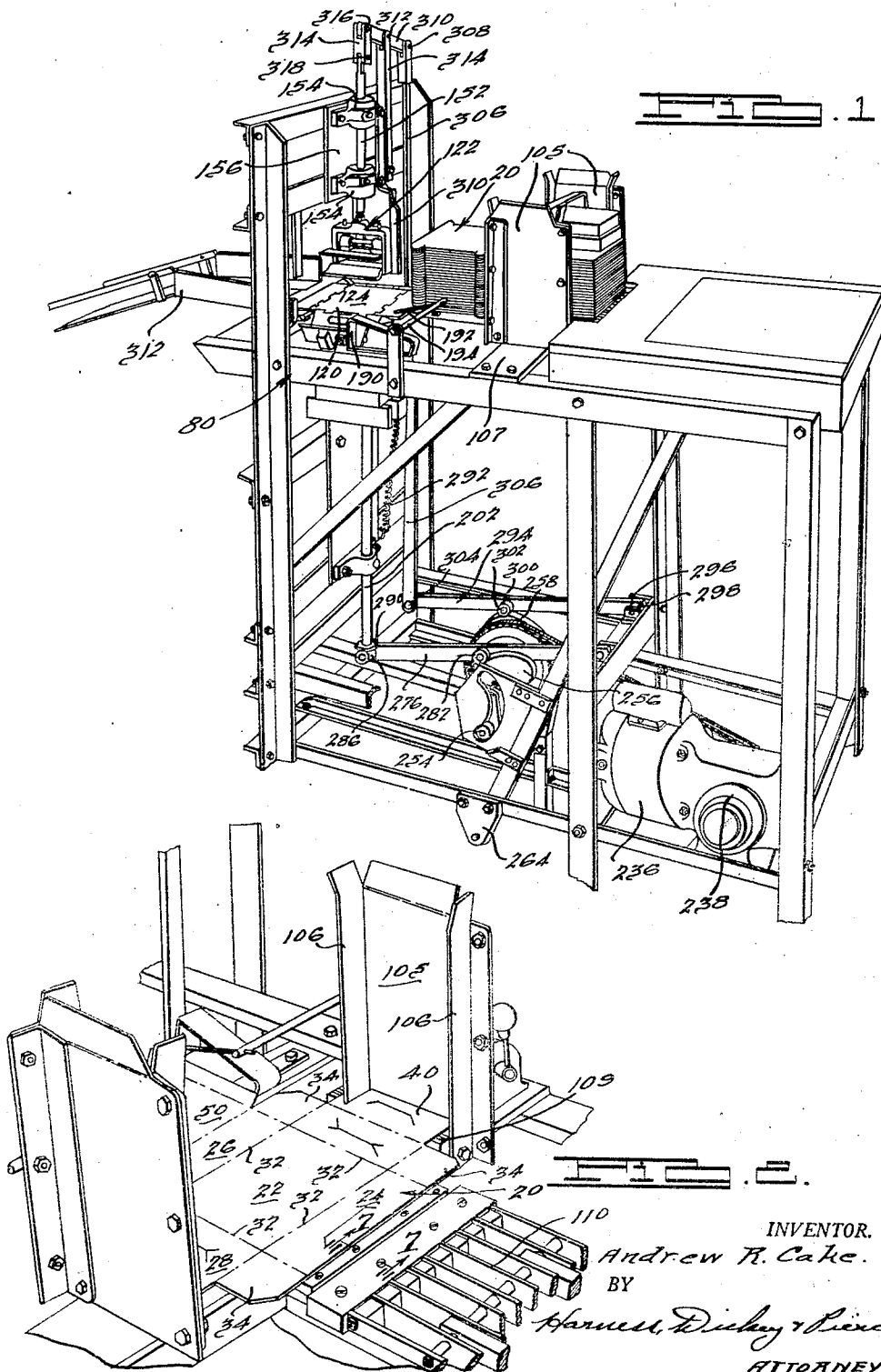
A. R. CAKE

2,458,341

CARTON FOLDING MACHINE

Filed Aug. 3, 1944

7 Sheets-Sheet 1



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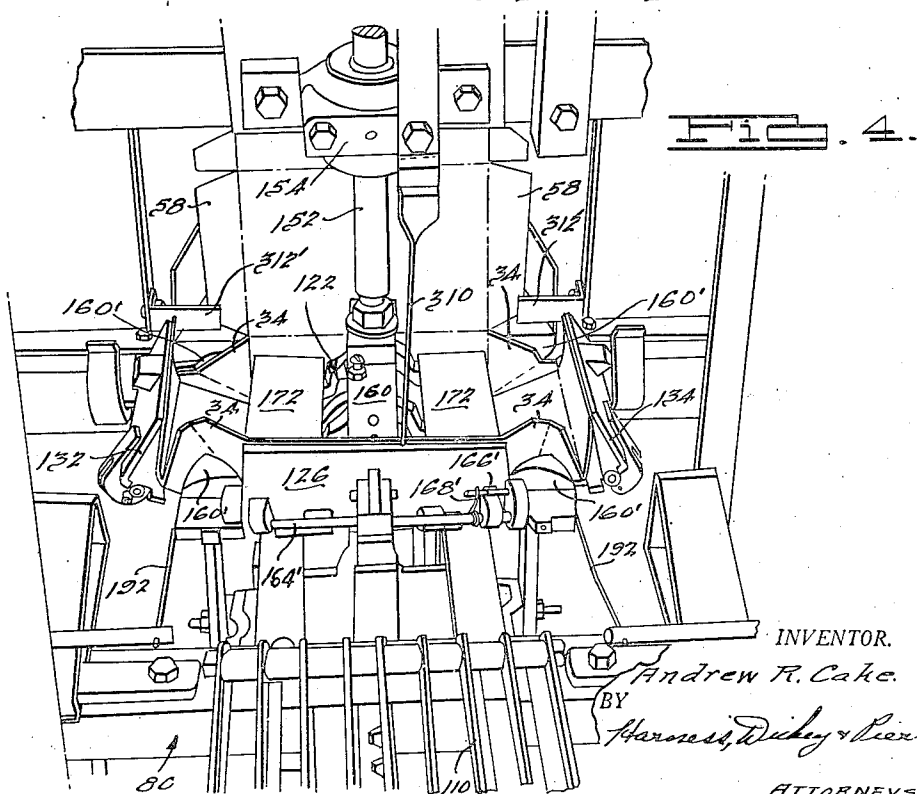
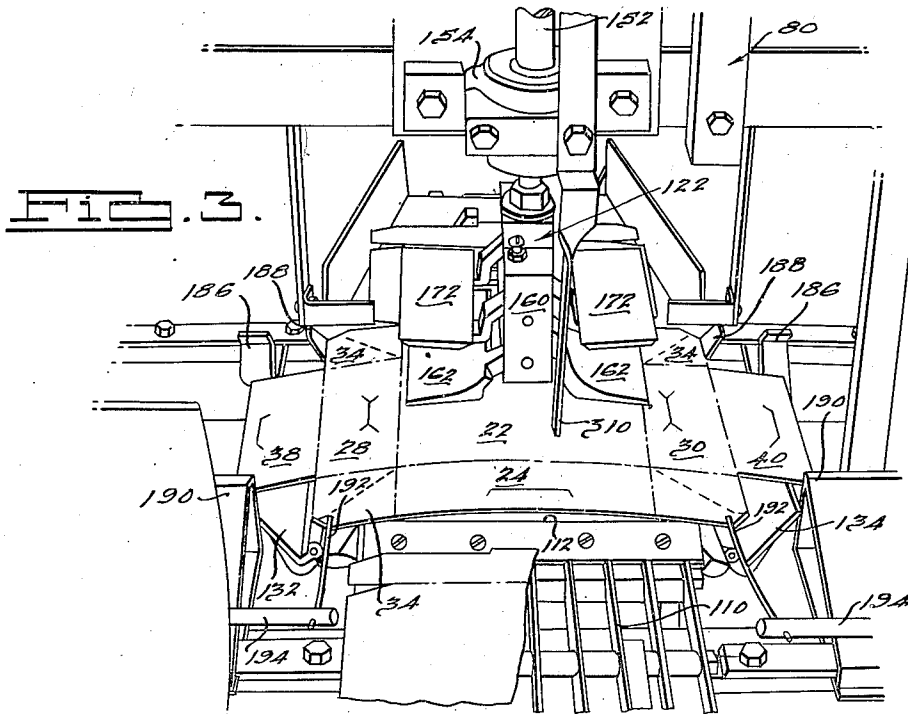
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CARTON FOLDING MACHINE

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7 Sheets-Sheet 2



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CARTON FOLDING MACHINE

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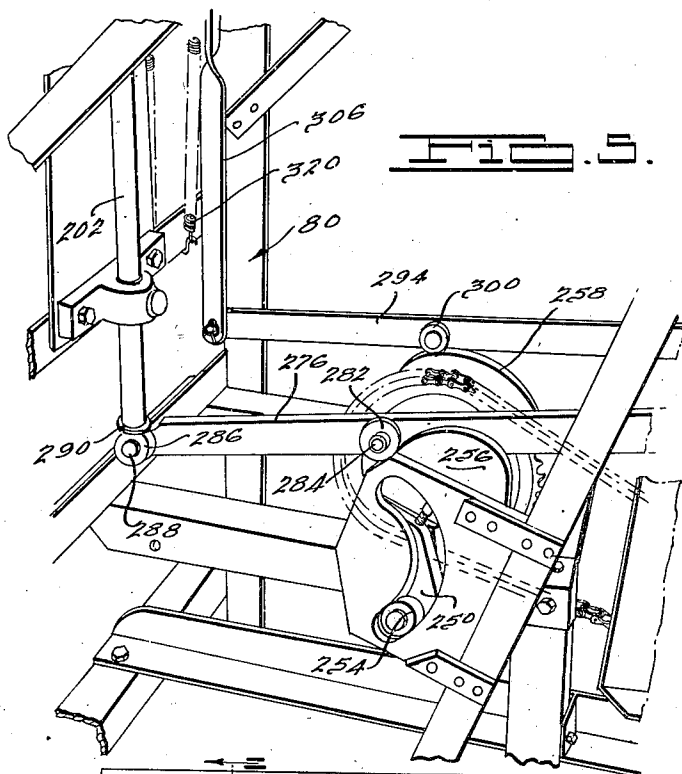


FIG. 5.

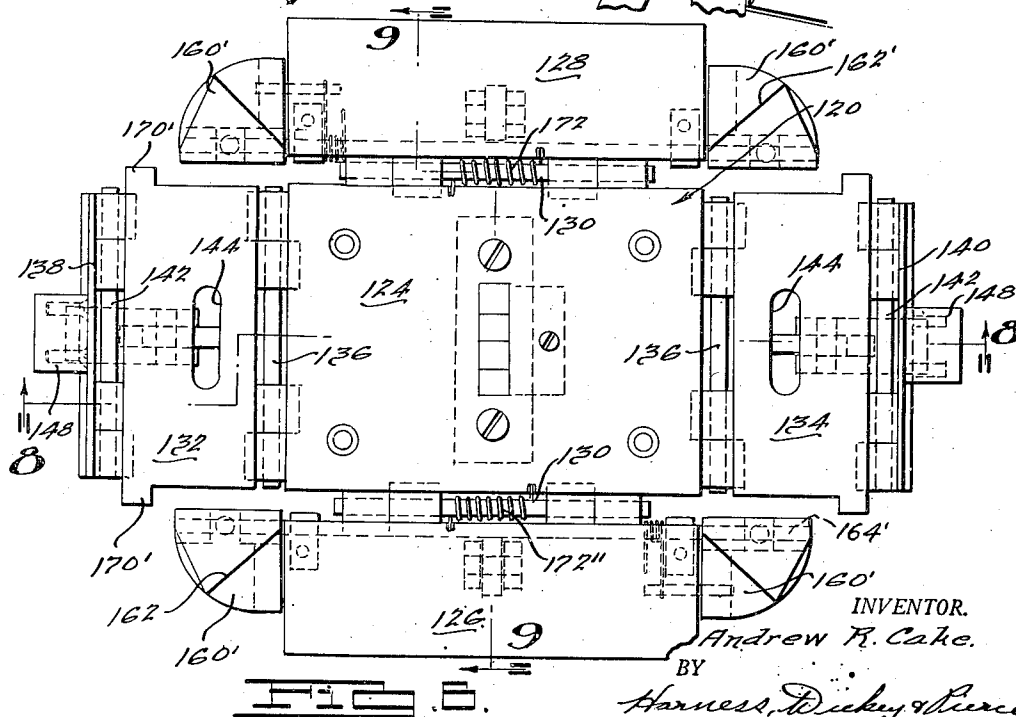


FIG. 6.

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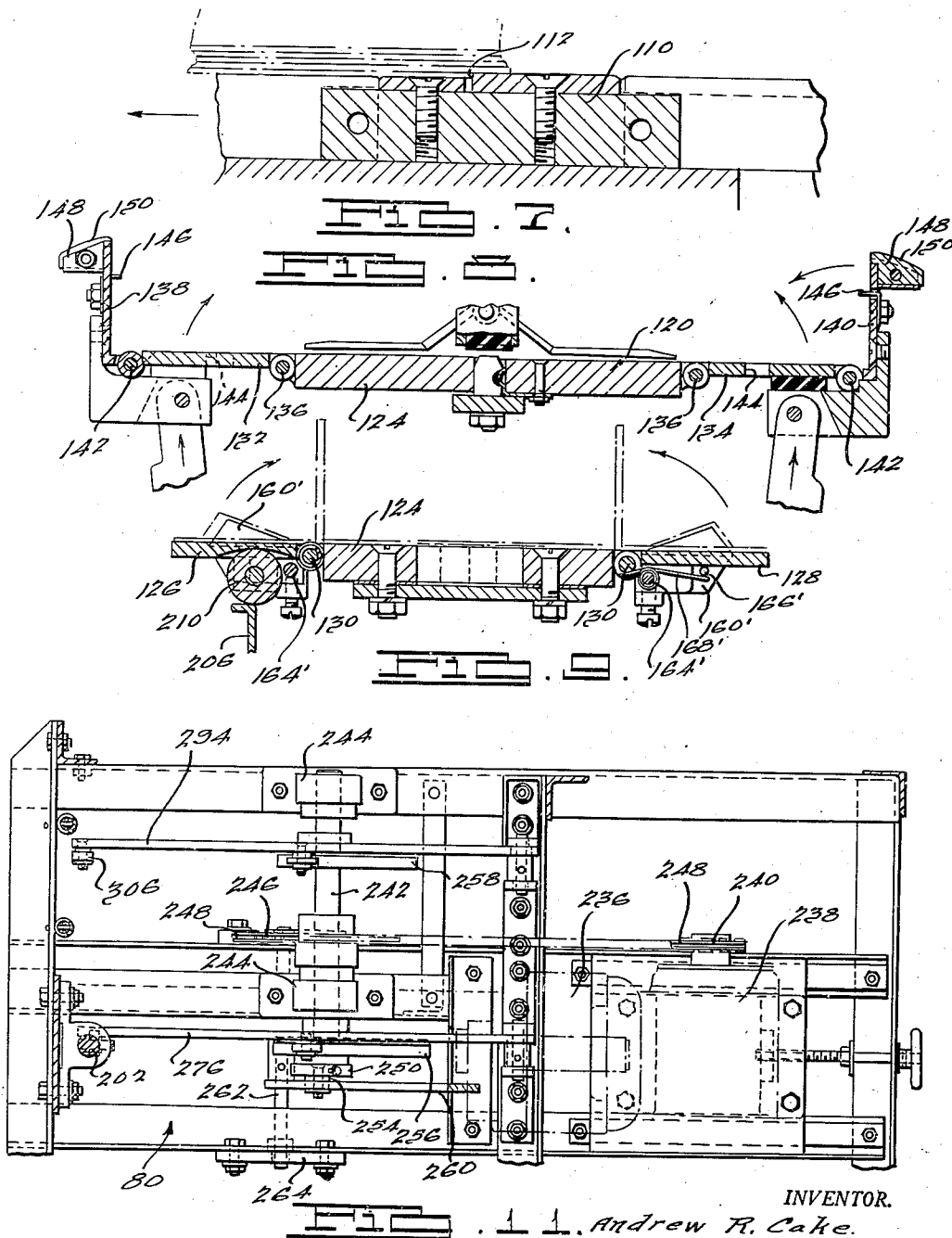
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CARTON FOLDING MACHINE

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7 Sheets-Sheet 4



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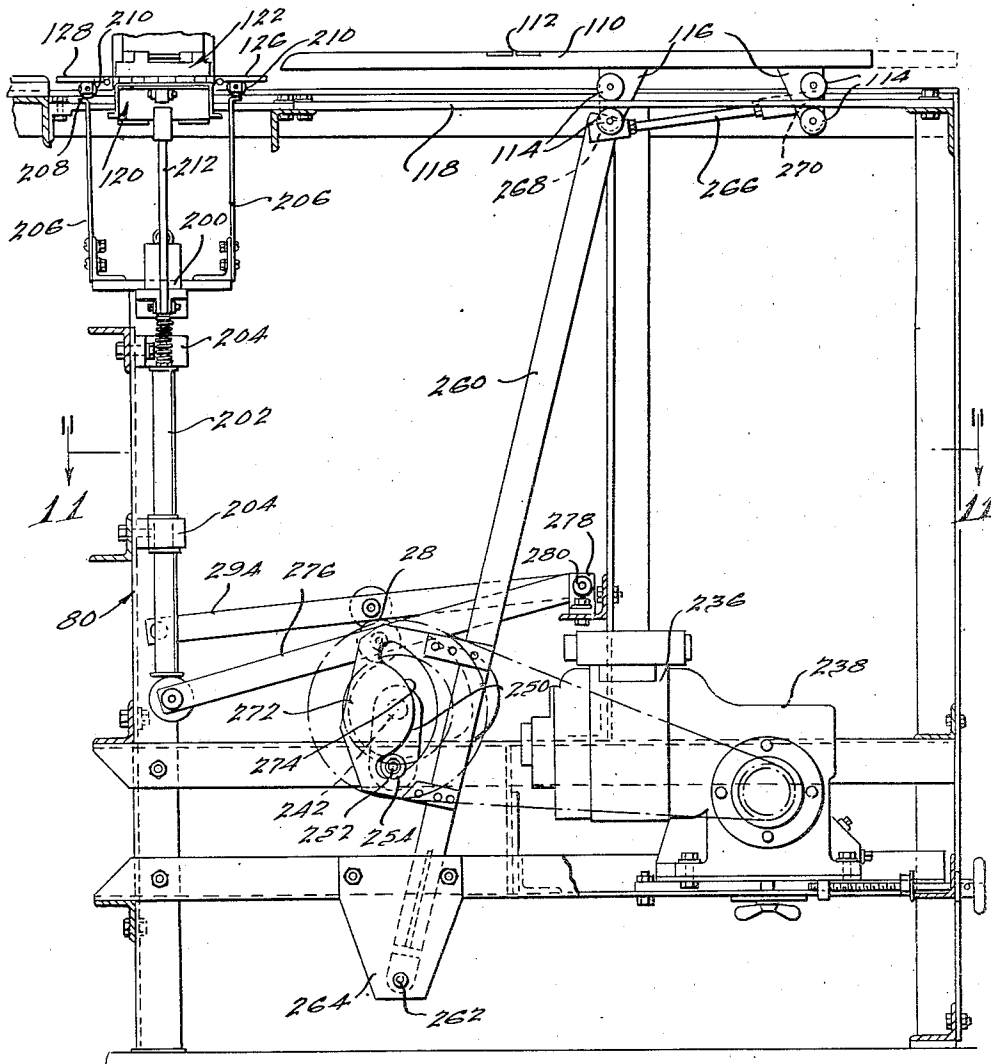


FIG. 10.

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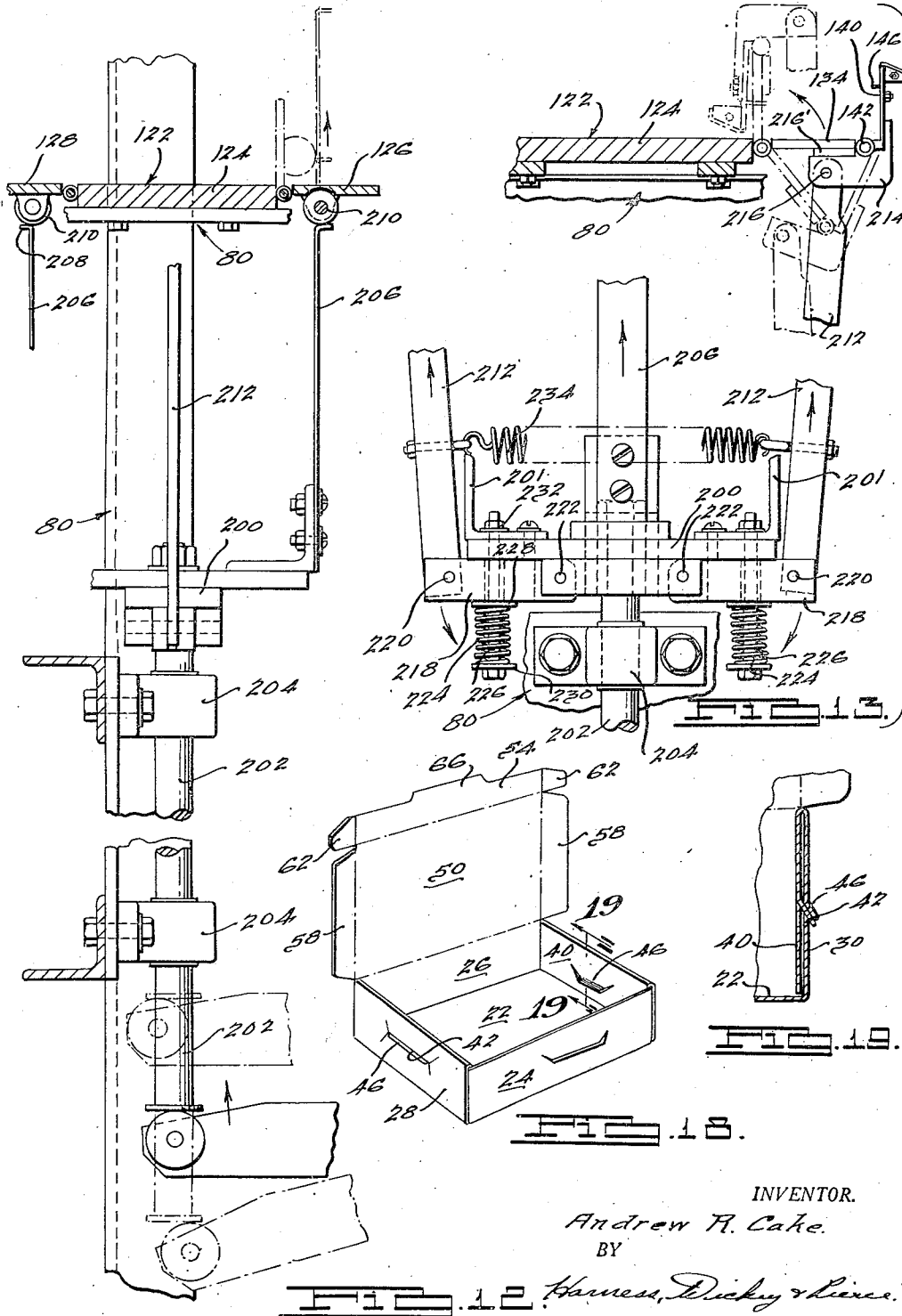
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CARTON FOLDING MACHINE

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7 Sheets-Sheet 6



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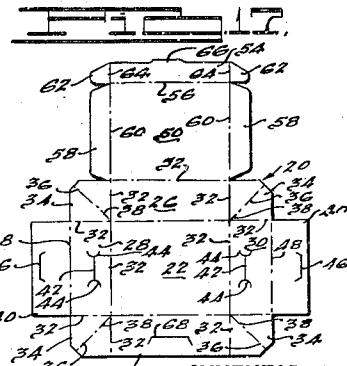
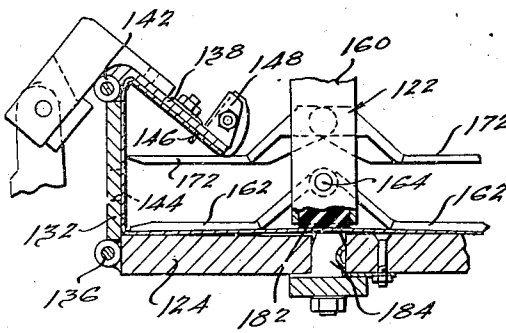
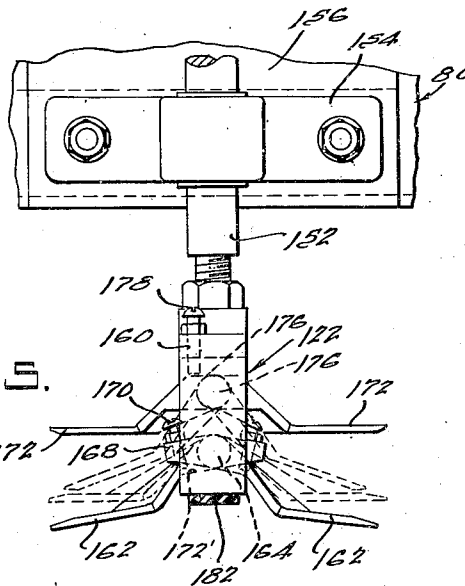
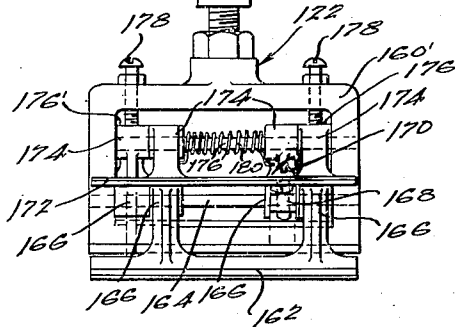
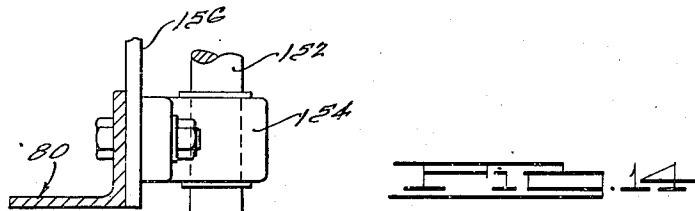
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CARTON FOLDING MACHINE

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7 Sheets-Sheet 7



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UNITED STATES PATENT OFFICE

2,458,341

CARTON FOLDING MACHINE

Andrew R. Cake, Norfolk, Va.

Application August 3, 1944, Serial No. 547,821

19 Claims. (Cl. 93—49)

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The present invention relates to folding machines and particularly relates to machines for folding cardboard or paper cartons or boxes.

The primary object of the present invention is to provide improvements in machines of the type mentioned whereby carton or box blanks may be accurately and quickly folded and assembled into condition for filling.

The particular improvements to which the present invention is directed include improvements in the blank feeding mechanism; improvements in the hold-down mechanism; improvements in the means for engaging and folding and securing the carton walls; and improvements in the combined operation of the feeding, hold-down, and folding mechanism.

Other objects of the invention will become apparent from the following specification, the drawings relating thereto and from the claims hereinafter set forth.

In the drawings, in which like numerals are used to designate like parts in the several different views throughout:

Figure 1 is a perspective view of a folding mechanism embodying features of the present invention;

Fig. 2 is a perspective view of a portion of the structure shown in Fig. 1, particularly the hopper and feed mechanism;

Fig. 3 is a perspective view of a portion of the structure shown in Fig. 1 showing one blank in folding position and prior to the operation of the hold-down and wall folding mechanisms;

Fig. 4 is a view similar to Fig. 3 showing the same elements in a different period of operation;

Fig. 5 is a perspective view of a portion of the operating means;

Fig. 6 is a top plan view of the blank support and wall folding mechanism;

Fig. 7 is an enlarged cross-sectional view taken substantially along the line 7—7 of Fig. 2;

Fig. 8 is a cross-sectional view taken substantially along the line 8—8 of Fig. 6;

Fig. 9 is a cross-sectional view taken substantially along the line 9—9 of Fig. 6;

Fig. 10 is a side elevational view of the structure shown in Fig. 1, but with certain parts removed for the purpose of clarity;

Fig. 11 is a cross-sectional view taken substantially along the line 11—11 of Fig. 10;

Fig. 12 is an enlarged, broken, elevational view of the side folding operating mechanism shown in Fig. 10;

Fig. 13 is a broken view of a portion of the

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structure shown in Fig. 12 and substantially at a right angle thereto;

Fig. 14 is a side elevational view of the hold-down mechanism;

Fig. 15 is a view similar to Fig. 14 taken at a right angle thereto;

Fig. 16 is a partial cross-sectional view taken through the hold-down mechanism and side folding mechanism showing the relationship of such mechanism in one stage of the operation;

Fig. 17 is a plan view of a blank adapted to be folded by the mechanism of the present invention;

Fig. 18 is a perspective view of the folded carton and

Fig. 19 is an enlarged cross-sectional view taken substantially along the line 19—19 of Fig. 18.

The machine of the present invention is particularly adapted for folding the cartons disclosed in the copending application of A. R. Cake, Serial No. 483,150, filed April 15, 1943 (which has been abandoned).

Referring to Figs. 17, 18 and 19, a flat blank is generally indicated at 20 and is formed from a sheet of paper or cardboard of single thickness. The blank is suitably cut or scored to form the various portions of the container which comprises a bottom 22, a front side wall 24, a rear side wall 26, and end walls 28 and 30, all of which are joined to the bottom 22 along the scored lines 32. The end walls 28 and 30 are joined to the side walls 24 and 26 by corner gussets 34. Such corner gussets 34 are formed with diagonal perforations 36 over a portion of the length thereof, which perforations are joined with score lines 38 at the inner corners thereof.

The gussets 34 are joined to the adjacent sides and end walls by score lines 32.

The end walls 28 and 30 are formed with integral extensions 40, which are substantially the same area as the ends 28 and 30 so that when they are folded inwardly, they overlie the ends 28 and 30 and are substantially coextensive therewith.

The ends 28 and 30 are formed with longitudinally extending slots 42 therethrough which are located in the central regions thereof. Diverging slots 44 are also formed in the end members 28 and 30 at the ends of the slots 42 and joined therewith.

Tongues 46 are struck out of the end extensions 40 and are positioned to be received through slots 42 when the carton is folded. The extensions 40 are joined to the ends 28 and 30 by score lines 48.

If an open top carton or tray is desired, the structure so far described will be sufficient. How-

ever, where an enclosed carton is desired, as in the frozen food industry, a top portion 50 is provided which is integral with the side wall 26. The top portion 50 is of substantially the same area as the bottom 22 and is formed with a front flap extension 54 which is integral with the top portion 50 and joined thereto along score line 56. Side flanges or flaps 58 are formed integral with the top portion 50 and are joined thereto along score lines 60.

The top extension 54 is formed with tabs 62 at the ends thereof, which are joined with the extension 54 along score lines 64. The extension 54 is formed with a tongue projection 66, which is adapted to be received within longitudinal slot 68 formed in the end wall 24 when the top is closed.

The machine of the present invention does not fold the top, but merely folds the carton to the stage shown in Figs. 18 and 19.

In general, in the machine of the present invention, a hopper is provided which is adapted to contain a plurality of stacked flat blanks 20. A reciprocating feed table is provided which moves between the hopper and the folding station or folding table so that it moves one of the blanks at a time from the hopper to the folding position and returns to the hopper for the next blank. The flat blank is disposed on the folding table and a hold-down plunger then acts to engage the bottom of the flat blank and hold it while the walls thereof are bent upwardly to a position at 90° to the bottom. During the folding of the end and side walls upwardly, the corner gussets are bent so that they are folded inwardly and against the end walls. Such gussets are held in this position against the end walls while the extensions on the end walls are folded over the gussets and, as the extensions are folded downwardly and forwardly, the means holding the gussets against the side walls are moved out of the way. The means which fold the end walls and extensions are formed with complementary recesses and projections so that the tabs 46 are pressed outwardly through slots 42 to lock the extensions 40 to the end walls 28 and to furthermore lock the gussets in position. After the folding operation, the folding means and the hold-down plunger are retracted and as the next succeeding blank is fed to the folding position, it engages and pushes the folded carton out of the way and onto a collection chute.

Referring to Figs. 1 to 16, an embodiment of the present invention for folding the carton blank 20 is illustrated. The carton folding machine comprises a base or standard generally indicated at 80 which is generally in the form of a table. Such standard is in the form of a frame composed of a plurality of vertical, horizontal and transverse elements arranged and connected to provide the supporting elements for the various forming and operating mechanisms which are mounted thereon. The forming and operating elements, which are described in detail hereinafter, are merely described as being mounted on the frame, the particular arrangement and relationship being clearly illustrated in the drawings.

A plurality of stacked, flat blanks 20 are positioned on the table surface of the frame 80 within a hopper formed by upstanding members 105 having inwardly directed sides 106. The upper ends of the members 105 and 106 may be turned outwardly to assist in positioning the carton blanks therein. Such hopper members are attached to grooved bars 109. These grooved bars

are each supported on an overhanging plate 107 which may be bolted to the frame 80. The lower edges of sides 106 nearest the folding mechanism terminate above the top surfaces of plates 107 in spaced relation thereto a distance slightly greater than the thickness of one of the carton blanks so that such blanks may be slid thereunder so that the lower edges thereof will serve as a stop to prevent the feed of the next succeeding blank. A weight is disposed on the top of the carton stock to control this feed. The major portion of the blanks is supported upon a reciprocating feed table 110. The feed table 110 has a forward portion which is at a slightly lower level than the rear portion thereof, as best shown in Figs. 7 and 10. The juncture of the two portions provides a shoulder 112 (Fig. 7) which is substantially the thickness of one of the blanks, but which may be slightly less than the actual thickness thereof so that as the feed table is moved in the feeding direction, the shoulder 112 abuts against the rear edge of one of the blanks and pushes it out from under the stack and into folding position on the forming table. When the feed table 110 is in its retracted position, the next succeeding blank will drop down onto the top surface thereof forwardly of the shoulder 112 and as that particular blank is moved to the forming table, the remaining blanks are supported upon the rear raised portion of the feed table.

The table 110 is movably supported by means of pairs of rollers 114 which are supported upon depending brackets 116 on opposite sides of the table with the rollers 114 running on trackways 118 which are mounted to the frame 80 on opposite sides of the table.

The means for reciprocating the table 110 in timed relation to the other operation will be described in detail hereinafter.

The folding means is generally indicated at 120 and is particularly shown in Figs. 1, 3, 4, 6, 8, 9, and 16. The hold-down means is generally indicated at 122 and is particularly shown in Figs. 1, 3, 4, 14, 15, and 16.

The folding means includes a bottom 124 having side folding members 126 and 128 pivotally connected thereto by means of pivot pins 130 which pass through cooperating hinge lugs provided on members 124, 126, and 128.

End members 132 and 134 are pivotally connected to the end edges of bottom member 124 by means of pivot pins 136 which are passed through cooperating hinge lugs provided on adjacent members 124, 132, and 134. Extension members 138 and 140 are pivotally connected to members 132 and 134, respectively, by means of pivot pins 142 which are received through cooperating hinge lugs formed on the adjacent edges of members 132 and 138, and 134 and 140.

The members 124, 126, 128, 132, 134, 138, and 140 are substantially co-extensive in area with the corresponding portions of the carton blank so that when the blank is positioned on the forming means, the score lines on the blank lie substantially at the pivot junctures of these folding elements.

The members 132 and 134 are provided with central recesses or apertures 144 therethrough and members 138 and 140 are provided with inwardly extending projections 146 which are located to project within recesses 144 when extensions 138 and 140 are folded inwardly over their adjacent end members so as to engage the tongues

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46 and force them outwardly through slots 42 to lock the carton portions as shown in Fig. 19.

Each of the extensions 138 and 140 has a fiber block 148 mounted on the leading edge thereof; and such block has a curved surface 150 which serves to move flippers 172 of the hold-down mechanism out of the way as shown in Fig. 16 and which is for a purpose that will become more apparent from the later description.

The folding means also include gusset-breaking elements 160' disposed adjacent each of the ends of front and rear side wall members 126 and 128. Such members 160' have inwardly directed, curved surfaces joined by diagonal ridge lines 162' which are adapted to engage the score lines 36 of the gussets 34 in Fig. 17 as sides 126 and 128 move upwardly so as to break the gusset along those score lines to cause them to fold inwardly. The members 160' for each of the sides 126 and 128 are fixed to a pivot shaft 164', by means of a set screw, or the like, which is pivotally mounted on suitable bearing lugs on members 126 and 128. One of the members 160' for each of the pairs of arms 126 and 128 has a pin 166' (Fig. 4) connected thereto against which one end of a spring 168' resiliently bears. The spring 168' is wound about shaft 164' and the opposite end of the spring bears against shaft 130. Thus, the members 160' will move upwardly with walls 126 and 128, but may be pivoted with respect thereto; that is, when the arms 126 and 128 reach vertical positions, as arms 132 and 134 move upwardly they will cause the members 160' to move outwardly so that walls 132 and 134 may abut against walls 126 and 128 when all of these walls are in a vertical position.

Walls 132 and 134 are formed with projecting shoulders 170' which are adapted to overlies the adjacent edges of members 126 and 128 when the walls are in vertical positions.

The walls 126 and 128 are normally urged to horizontal positions by means of coil springs 172' which embrace shafts 130 and have the opposite ends thereof bearing against the top surfaces of wall 126 and bottom 124 and wall 128 and bottom 124. The ends of the spring may be received within recesses so that they will be flush with the surfaces.

The hold-down mechanism 122 includes a vertically-reciprocating rod 152 which is mounted in spaced bearing brackets 154. Such bearing brackets 154 may be supported on a mounting plate 156 which in turn may be supported on frame 80. The brackets are so positioned that the hold-down mechanism is disposed above the bottom 124 of the folding means 120.

The hold-down mechanism 122 may, in general, be considered as a plunger mechanism, which includes a rectangular, open frame member 160 which is adjustably threaded to the lower end of rod 152. A pair of lower, outwardly directed flipper members 162 is pivotally connected to a pivot rod 164 which extends across the opening in member 160, with the ends thereof received in the upstanding sides of such frame member. The members 162 have outwardly-extending, generally flat surface portions which are adapted to bear against the major portion of the top surface of the carton bottom substantially coextensive therewith, as shown in Fig. 16, and with the end edges of the members 162 extending along the junctures of the bottom and end walls of the carton so that the carton is held down against the bottom folding member 124 and the side and end walls of the carton may be accurately bent along their

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score lines as the wall members of the folding means move to their vertical positions. The members 162 are formed with arms terminating in bearing portions 166 through which the shaft 164 extends. One of the bearing members 166 for each of the flippers 162 is formed with a projection 168 which extends on the opposite side of the shaft from the main portion of the flipper; and a set screw 170, having a lock nut, is threaded through a tapped opening in the projection 168. The lower end of the set screw is adapted to adjustably bear against the top tapered surface 172' of the lower horizontal portion of frame 160 so as to limit the upward pivotal movement of the flippers 162. By setting the screw 170 the flippers 162 may be adjusted so that the major portions thereof lie flat against the carton bottom. When the hold-down mechanism 122 is moved upwardly the outer ends of the flippers 162 may drop downwardly, as shown in Fig. 15, so that there will be ample clearance in withdrawing the hold-down mechanism from the folded carton.

A pair of upper flipper members 172 is disposed above the flipper members 162, and such members are generally of the same form as members 162. Such members 172 have arms terminating in bearings 174 through which shaft 176 extends. The shaft 176 is disposed above shaft 164, and has the ends thereof mounted in the upstanding portions of frame 160. The bearing portions 174 have flat top surfaces 176'; and a set screw 178, for each of the flippers 172 is threaded through a tapped opening in the top horizontal portion of frame 160, with the lower end thereof abutting against the flat surface 176' of one of the bearings 174 for each of the flippers 172. The set screw 178, for its particular flipper 172, is disposed on the same side of the axis of shaft 176 as its particular flipper 172 extends. Thus the upward movement of each flipper 172 is limited. The flippers 172 are urged to this upper position by means of a coil spring 180 which is disposed around shaft 176 with one of the free ends engaging the inner surface of one of the arms for one of the flippers 172 and the opposite free edge engaging the inner surface of one of the arms of the other flipper 172. Thus the flippers 172 are resiliently urged upwardly so that the major portions thereof normally lie in a substantially horizontal plane, as shown in Fig. 15, but may be moved downwardly against the action of spring 180.

The purpose of the flippers 172 is that they engage the gussets 34 (see Fig. 17) and hold the gussets against the end walls 28 and 30 during a portion of the folding operation. The flippers 172 are then in the horizontal position; and as the extensions 138 and 140 are folded downwardly and inwardly to fold the extensions 40 (see Fig. 17) over the gussets 34 the fiber blocks 148 mounted on extensions 138 and 140 will engage the top surfaces of the major portions of the flippers 172 to pivot them downwardly, to the position shown by broken lines in Fig. 15. This relationship is also shown in Fig. 16, which illustrates the action of the extension in engaging and moving the flippers 172 downwardly. The extensions 40 on the carton at this time engage and hold the gussets 34, and they are then locked in position against the end walls 28 and 30 of the carton.

A rubber bumper member or pad 182 is cemented on the under surface of the lower horizontal portion of frame 160 and is adapted to engage a central portion of the bottom of the

carton. Marking dies 184, which may have numerals or other indicia formed thereon, are removably received through an opening in the bottom 124, and the pad 182 will force the carton bottom against the dies to impress such indicia on the carton.

As mentioned previously the feed table 110 is reciprocated between the hopper and the folding station. A single flat blank is moved to the folding station and is positioned over the folding mechanism 120 so that the bottom of the carton accurately overlies the bottom 124 of the folding mechanism. Stops 186 are mounted on frame 80 in such a position as to limit the movement of the carton blank, and other stops 188 engage the leading gussets so as to properly position the blank. Other stops 190 are mounted on the frame and are provided with upwardly inclined top surfaces over which the projections 40 pass as the carton is put in folding position. Such stops terminate in vertical walls which serve as stops and limiting means to further properly hold the carton blank in proper folding position.

One of the important details of the present invention includes the provision of resilient wires 192, which are mounted on inwardly directed rods 194, supported on the frame 80, and positioned so that the wires 192 extend longitudinally of the path of travel of the carton blank as such blank is moved to the folding position. The resilient members 192 extend downwardly toward the folding bed and are above the carton blank so that they engage the carton blank as it is moved toward the folding position, and urge it against the leading lower surface of table 110. They thus hold the carton blank in substantially the position shown in Fig. 3, at the folding station, so that the following edge of the carton blank is held against the corners of shoulder 142. The wires 192 thus urge the carton blank downwardly causing the carton to bow upwardly in the middle and causing extended ends 40 to be bent below the top edge of 190 so that the blank will remain within the guides 186, 188 and 190, respectively, as the table is withdrawn.

When the blank is positioned on the folding table the plunger mechanism 122 is depressed so that the flippers 162 engage the bottom of the carton, as mentioned above. The walls of the folding mechanism are then pivoted upwardly, walls 126 and 128 together with their gusset breaking members 160 moving upwardly first as shown in Fig. 4. The members 132 and 134, together with their extensions, then move upwardly to complete the folding operation with the extensions 138 and 140 folding downwardly and inwardly so that tabs 46 are passed through slots 42 to lock the carton walls in the form shown in Fig. 18.

The mechanism for causing the pivotal movement of the walls 126, 128, 132, 134, and extensions 138 and 140 is best shown in Figs. 10, 12, and 13. Such means include a vertically reciprocating frame 200, which is mounted upon a vertically reciprocating rod 202. The rod 202 is mounted in bearing brackets 204 which are supported on the frame 80 in such a position that the rod 202 and the frame 200 are supported directly under mechanism 120.

The means for pivoting walls 126 and 128 include a pair of upwardly directed flat springs 206, having their lower ends secured to the frame 200 and having their upper ends free and terminating in outwardly directed flanges 208. The

upper ends of spring members 206 are adapted to bear against rollers 210 which are rotatably mounted on brackets fixed to the back or outer sides of wall members 126 and 128. Thus, as frame 200 moves upwardly the members 206 resiliently bear against rollers 210, thereby forcing the walls 126 and 128 to pivot upwardly to a vertical position, as shown by the broken lines in Fig. 12.

The means for pivoting the walls 132 and 134, including the turning or downward and inward pivotal movement of the extensions 138 and 140, includes a pair of upwardly directed links 212 disposed on opposite sides of frame 200 and having their upper ends pivotally connected to one arm of a bell crank member 214 by means of a pivot pin 216. The upper surface of this arm bears against the under surface of its wall member 132 or 134 and is pivoted to the pivot shaft 142. A resilient bumper 216 may be interposed between the facing surfaces of wall members 132 and 134 and the bell crank member 214. The member 214 is then rigidly connected to its extension 138 or 140 so that upon the upward movement of links 212 the walls 132 and 134 are first moved to a vertical position and thereafter the extensions 138 and 140 are pivoted about pivot pins 142 to cause the extensions to pivot downwardly and inwardly to the positions shown in broken lines in Fig. 13. This causes the projection 146 to move through the recess or opening 144 for the purpose mentioned above.

The lower ends of links 212 are pivotally connected to outer ends of short links 218 by pivot pins 220, the inner ends of links 218 being pivotally connected to a bracket or supporting member fixed to the underside of frame 200 by means of pivot pins 222. The under edges of links 218 are resiliently supported and urged against the under sides of frames 200 by means of a coil spring 224 which embraces a bolt 226. The opposite ends of the spring may bear against washers 228 and 230, washers 223 bearing against links 218 and the bolt 226 extending through frame 200 and angle brackets 201 and being mounted thereon by means of a nut 232. The spring 224 and the mounting therefor thus serve as resilient bumpers to prevent injury to the parts when the folding means reaches the upper end of its stroke and permits adjusting of tension of same. The links 212 are further resiliently held together about their pivots 220 by means of a coil spring 234 having the opposite ends thereof connected to such links.

The table 110, the rod 152 of the hold-down mechanism 122, and the rod 202 of the folding mechanism 120 are caused to reciprocate in proper timed relationship by the means to be described. Such means includes a prime mover, which may be an electric motor 236, which is mounted on frame 80 under the table portion of the frame and which is operatively connected to a speed reducer 238. The motor and speed reducer are preferably mounted on longitudinal ways so that they can be adjustably moved for the use of different size sprockets.

The speed reducer 238 has a drive shaft projecting therefrom to which the hub of a driving sprocket 240 is keyed, or otherwise fixed. A main shaft 242 is rotatably mounted in bearing brackets 244, which in turn are mounted on longitudinal frame members. The shaft 242 extends transversely of the frame and has a driven sprocket 246 keyed, or otherwise fixed, thereto. A sprocket

chain 248 is trained about sprockets 240 and 246 for driving shaft 242.

A crank arm 250 (see Figs. 5, 10 and 11) is fixed to one end of the shaft 242 and has a crank pin 252 projecting outwardly therefrom at the outer end of the crank arm. A roller 254 is mounted on pin 252. A cam 256 is fixed to shaft 242 and another cam 258 is also fixed to shaft 242 for rotation therewith.

The crank 250 serves to operate the table 110; the cam 256 serves to operate the shaft 202 for pivoting the sides of the folding mechanism 120; and the cam 258 serves to operate the hold-down plunger 122 by reciprocating the shaft 152. The shaft 242 is turned so that it rotates in a counterclockwise direction, viewing Fig. 5.

The table 110 is caused to reciprocate through a lever 260, the lower end of which is pivotally connected by means of a pivot pin 262 to depending brackets 264 mounted to the frame 80. The upper end of the lever 260 is connected through a link 266 with the table 110, being pivotally connected to one end of the link 266 by means of a pivot pin 268.

The link 266 is adjustable in length, and the opposite or rear end thereof is pivotally connected to one of the depending brackets 116 of the table 210 by means of a pivot pin 270. A plate 272 having a cam slot 274 formed therein is fixedly mounted to one edge of the lever 260 intermediate the ends thereof. The roller 254 is rotatably received within the cam slot 274 so that as the crank 250 is turned in a counterclockwise direction, viewing Fig. 10, the lever 260 is caused to pivot about pivot 262, causing the table 110 to advance and retract in carrying a carton blank to the folding position and return therefrom.

The cam 256 is operatively connected to the shaft 202 by means of a lever 276, the rear end of which is pivotally connected to a bracket 278 by means of a pivot pin 280. The bracket 278 is mounted on a transverse frame member of the main frame 80. A follower roller 282 is pivotally mounted on pivot pin 284 intermediate the ends of lever 276 and so located that the roller 282 is adapted to engage and follow the edge of cam 256 to cause the lever 276 to pivot about the pivot 280. The free end of lever 276 has a roller 286 mounted thereon by means of pivot pin 288 on which roller 286 is positioned to engage the undersurface of a disc 290 fixed to the lower end of shaft 202. It will be evident that as the cam 256 rotates the lever 276 is caused to pivot so that as it pivots upwardly the shaft 202 is moved upwardly to cause the folding of the sides of the folding mechanism 120, as disclosed above.

The shaft 202 may be permitted to return by gravity or, if a more positive action is desired, a coil spring 292 may be provided having the lower end thereof fixed to frame and having the upper end thereof suitably connected to the frame 200. The spring 292 would thus always hold the disc 290 in engagement with roller 286.

The cam 258 is operatively connected to shaft 152 for operating the hold-down mechanism 122 through a lever 294 and has the return end thereof pivotally connected to brackets 296 by means of a pivot pin 298 (see Fig. 1). The brackets 296 may be mounted on the same transverse frame member as brackets 278. A follower roller 300 is pivotally mounted on lever 294 by means of a pivot pin 302 intermediate the ends of the lever, such roller 300 being adapted to engage and follow the edge of cam 258. The forward end of lever 294 is pivotally connected by means of a

pivot pin 304 with the lower end of an upright link 306. The upper end of link 306 is pivotally connected by a pivot pin 308 with one end of a walking beam 310. Such walking beam 310 is pivotally connected intermediate its ends by means of a pivot pin 312 with an upright mounting member 314 which may be fixedly mounted to the frame 80 as shown in Fig. 1. The opposite end of pin 310 has a link 314 pivotally connected thereto by means of a pivot pin 316, the opposite end of the link 314 being pivotally connected to the upper end of shaft 152 by means of a pivot pin 318. As the cam 258 rotates it causes an upward pivotal movement of lever 294 which in turn causes an upward movement of link 306 to thereby depress shaft 152 and move the hold-down mechanism 122 downwardly to its hold-down position. A coil spring 320 (Fig. 5) may be provided having the lower end thereof connected to the frame 80 and having the upper end thereof connected to the link 306 so that the roller 300 will be held against the edge of cam 258 and the link 306 will be pulled downwardly to raise the hold-down mechanism 122 to its upper position.

The cam slot 274 of plate 272, and cams 256 and 258, are so designed and positioned on the shaft that the reciprocation of the table, the operation of the hold-down mechanism 122, and the operation of the folding mechanism are accomplished in proper sequence and timed relationship. Thus as the main shaft 242 is driven, at the initial stages of operation the table 110 is in its retracted position, the hold-down mechanism 122 is raised, and the shaft 202 is lowered so that the sides of the folding mechanism lie substantially horizontal. The table 110 moves under the hopper to engage the lower-most blank and move it to the folding position. The table is returned to its original position and the hold-down mechanism 122 is depressed to engage the bottom of the blank. The shaft 202 is then moved upwardly so that the sides of the folding mechanism are pivoted to fold the carton sides, as discussed above. After the completion of the folding operation the shaft 202 returns to its lower-most position at which time the sides of the folding mechanism return to their original positions and the hold-down mechanism 122 moves upwardly. So that the folded carton will not follow the hold-down mechanism as it moves upwardly a depending finger 310 is mounted on frame 80 (Figs. 1, 3, and 4) and is so positioned to engage one edge of the folded carton, as shown in Fig. 4. The carton will thus be held down as the hold-down mechanism moves up. As the next succeeding carton blank is moved to the folding position the leading edge of the blank engages the folding carton and pushes it onto a disposal chute 312 where the folded cartons may be collected and removed.

Brackets 312' (Fig. 4) are mounted on the frame and engage flaps 58 to hold them out of the way while extended ends 138 and 140 move upward and over as they fold ends 28 and 30 and extended ends 40 upward and over.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit and substance of the invention, the scope of which is commensurate with the appended claims.

What is claimed is:

1. In a machine for folding carton blanks having a bottom, side walls, and end walls and in which said end walls are provided with extensions adapted to fold over corner gussets, means for supporting said blank, means to engage and

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turn the side and end walls perpendicular to the plane of said bottom, means to engage the corner gussets and cause them to fold inwardly as said walls move, means to fold said extensions inwardly and downwardly over said corner gussets, and movable means engageable with said gussets during the folding of said extensions to hold said gussets in their inwardly folded position.

2. In a machine for folding carton blanks having a bottom, side walls, and end walls and in which said end walls are provided with extensions adapted to fold over corner gussets, means for supporting said blank, means to engage and turn the side and end walls perpendicular to the plane of said bottom, means to engage the corner gussets and cause them to fold inwardly as said walls move, means to fold said extensions inwardly and downwardly over said corner gussets, and a plunger movable into engagement with said bottom before the folding of the blanks, said plunger having a movable means thereon engageable with said gussets during the folding of said extensions to hold said gussets in their inwardly folded position.

3. In a machine for folding carton blanks having a bottom, side walls, and end walls, means for supporting said blanks, means to engage and turn the side and end walls perpendicular to the plane of said bottom, a plunger movable into engagement with said bottom before the folding of the blanks, and elements movably mounted on said plunger and movable into engagement with said bottom along the lines of juncture between the bottom and end walls before the folding of the blanks.

4. In a machine for folding carton blanks having a bottom, side walls, and end walls, means for supporting said blanks, means to engage and turn the side and end walls perpendicular to the plane of said bottom, a plunger movable into engagement with said bottom before the folding of the blanks, a pair of elements substantially coextensive with the area of said bottom movably mounted on said plunger and movable into engagement with said bottom along the lines of juncture between the bottom and end walls before the folding of the blanks.

5. In a machine for folding carton blanks having a bottom, side walls, and end walls, means for supporting said blanks, means to engage and turn the side and end walls perpendicular to the plane of said bottom, and a plunger means movable into engagement with said bottom before the folding of the blanks, said plunger means including elements movably mounted on said plunger and movable into engagement with said bottom along the lines of juncture between the bottom and end walls before the folding of the blanks.

6. In a machine for folding carton blanks having a bottom, side walls, and end walls, means for supporting said blanks, means to engage and turn the side and end walls perpendicular to the plane of said bottom, a plunger movable into engagement with said bottom before the folding of the blanks, and a pair of laterally extending elements pivotally mounted on said plunger and pivotally movable into engagement with said bottom along the lines of juncture between the bottom and end walls before the folding of the blanks.

7. In a machine for folding carton blanks having a bottom, side walls, and end walls, means for supporting said blanks, means to engage and turn the side and end walls perpendicular to the plane of said bottom, a plunger movable into engage-

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ment with said bottom before the folding of the blanks, a pair of laterally extending elements pivotally mounted on said plunger and pivotally movable into engagement with said bottom along the lines of juncture between the bottom and end walls before the folding of the blanks, and adjustable means to limit the extent of pivotal movement of said elements.

8. In a machine for folding carton blanks having a bottom, side walls, and end walls and in which said end walls are provided with extensions adapted to fold over corner gussets, means for supporting said blank, means to engage and turn the side and end walls perpendicular to the plane of said bottom, means to engage the corner gussets and cause them to fold inwardly as said walls move, means to fold said extensions inwardly and downwardly over said corner gussets, a plunger movable into engagement with said bottom before the folding of the blanks, elements movably mounted on said plunger and movable into engagement with said bottom along the lines of juncture between the bottom and end walls before the folding of the blanks, and other movable elements movably mounted on said plunger engageable with said gussets during the folding of said extensions to hold the gussets in their inwardly folded position.

9. In a machine for folding carton blanks having a bottom, side walls, and end walls and in which said end walls are provided with extensions adapted to fold over corner gussets, means for supporting said blank, means to engage and turn the side and end walls perpendicular to the plane of said bottom, means to engage the corner gussets and cause them to fold inwardly as said walls move, means to fold said extensions inwardly and downwardly of said corner gussets, a plunger movable into engagement with said bottom before the folding of the blanks, elements movably mounted on said plunger and movable into engagement with said bottom along the lines of juncture between the bottom and end walls before the folding of the blanks, and other movable elements movably mounted on said plunger above said first-named elements engageable with said gussets during the folding of said extensions to hold the gussets in their inwardly folded position.

10. In a machine for folding carton blanks having a bottom, side walls, and end walls and in which said end walls are provided with extensions adapted to fold over corner gussets, means for supporting said blank, means to engage and turn the side and end walls perpendicular to the plane of said bottom, means to engage the corner gussets and cause them to fold inwardly as said walls move, means to fold said extensions inwardly and downwardly over said corner gussets, a plunger movable into engagement with said bottom before the folding of the blanks, a pair of laterally extending elements movably mounted on said plunger and movable into engagement with said bottom along the lines of juncture between the bottom and end walls before the folding of the blanks, and another pair of laterally extending movable elements movably mounted on said plunger above said first named pair engageable with said gussets during the folding of said extensions to hold the gussets in their inwardly-folded position.

11. In a machine for folding carton blanks having a bottom, side walls, and end walls and

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in which said end walls are provided with extensions adapted to fold over corner gussets, means for supporting said blank, means to engage and turn the side and end walls perpendicular to the plane of said bottom, means to engage the corner gussets and cause them to fold inwardly as said walls move, means to fold said extensions inwardly and downwardly over said corner gussets, a plunger movable into engagement with said bottom before the folding of the blanks, a pair of laterally-extending elements pivotally mounted on said plunger and pivotally movable into engagement with said bottom along the lines of juncture between the bottom and end walls before the folding of the blanks, and another pair of laterally-extending elements pivotally mounted on said plunger above said first-named pair engageable with said gussets during the folding of said extensions to hold the gussets in their inwardly-folded position.

12. In a machine for folding carton blanks having a bottom, side walls, and end walls and in which said end walls are provided with extensions adapted to fold over corner gussets, means for supporting said blank, means to engage and turn the side and end walls perpendicular to the plane of said bottom, means to engage the corner gussets and cause them to fold inwardly as said walls move, means to fold said extensions inwardly and downwardly over said corner gussets, a plunger movable into engagement with said bottom before the folding of the blanks, a pair of laterally-extending elements pivotally mounted on said plunger and pivotally movable into engagement with said bottom along the lines of juncture between the bottom and end walls before the folding of the blanks, another pair of laterally-extending elements pivotally mounted on said plunger above said first-named pair engageable with said gussets during the folding of said extensions to hold the gussets in their inwardly-folded position, and adjustable means to limit the extent of pivotal movement of said elements.

13. In a machine for folding carton blanks having side walls and end walls provided with extensions, a support member for said blank, side members pivotally connected to said support member, end members pivotally connected to said support member, extension members pivotally connected to the free edges of said end members, each of said end members having an inwardly facing recess formed therein, each of said extension members having a projection formed thereon adapted to be received within the said recess, and means to pivot said side, end, and extension members to thereby fold the sides, ends, and extensions of said blank.

14. In a machine for folding carton blanks having side walls and end walls provided with extensions, a support member for said blank, side members pivotally connected to said support member, end members pivotally connected to said support member, extension members pivotally connected to the free edges of said end members, said end and extension members having complementary recesses and projections formed thereon so that said projections are adapted to be received within the said recesses, and means to pivot said side and end extension members to thereby fold the sides, ends, and extensions of said blank.

15. In a machine for folding carton blanks having side walls and end walls provided with

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extensions, a support member for said blank, side members pivotally connected to said support member, end members pivotally connected to said support member, extension members pivotally connected to the free edges of said end members, each of said end members having an inwardly facing central recess formed therein, each of said extension members having a central projection formed thereon adapted to be received within the said recess, and means to pivot said side and end extension members to thereby fold the sides, ends, and extensions of said blank.

16. In a machine for folding carton blanks having a bottom, side walls and end walls and in which said end walls are provided with extensions adapted to fold over corner gussets, in combination, a support member for said blank, side members pivotally connected to said support member, end members pivotally connected to said support member, extension members pivotally connected to the free edges of said end members, a plunger disposed above and movable toward said support, a pair of laterally extending elements pivotally mounted on said plunger and extending to a position to engage said gussets during the folding of the blanks, means to move said elements downwardly out of engagement with said gussets as said extensions are folded inwardly and downwardly over said gussets, means to pivot said side, end, and extension members to thereby fold the sides, ends, and extensions of said blank and means to move said plunger toward and from said support.

17. In a machine for folding carton blanks having a bottom, side walls and end walls and in which said end walls are provided with extensions adapted to fold over corner gussets, in combination, a support member for said blank, side members pivotally connected to said support member, end members pivotally connected to said support member, extension members pivotally connected to the free edges of said end members, a plunger disposed above and movable toward said support, a pair of laterally extending elements pivotally mounted on said plunger and extending to a position to engage said gussets during the folding of the blanks, means on said extension members engageable with said elements to move said elements downwardly out of engagement with said gussets as said extensions are folded inwardly and downwardly over said gussets, means to pivot said side, end, and extension members to thereby fold the sides, ends, and extensions of said blank, and means to move said plunger toward and from said support.

18. In a machine for folding carton blanks having a bottom, side walls and end walls and in which said end walls are provided with extensions adapted to fold over corner gussets, in combination, a support member for said blank, side members pivotally connected to said support member, end members pivotally connected to said support member, extension members pivotally connected to the free edges of said end members, a plunger disposed above and movable toward said support, a pair of laterally extending elements pivotally mounted on said plunger and extending to a position to engage said gussets during the folding of the blanks, means on said extension members engageable with said elements to move said elements downwardly out of engagement with said gussets as said extensions are folded inwardly and downwardly over said gussets, another pair of laterally extending elements pivotally mounted on said plunger below said

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first named pair and pivotally movable into engagement with said bottom along the lines of juncture between the bottom and end walls during the folding of the blank, means to pivot said side, end, and extension members to thereby fold the sides, ends, and extensions of said blank, and means to move the plunger toward and from the support.

19. In a machine for folding carton blanks having a bottom, side walls and end walls and in which said end walls are provided with extensions adapted to fold over corner gussets, in combination, a support member for said blank, side members pivotally connected to said support member, end members pivotally connected to said support member, extension members pivotally connected to the free edges of said end members, and reciprocable means resiliently connectible with said side, end, and extension members to pivot such members and thereby fold the sides, ends, and extensions of said blank.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

	Number	Name	Date
	413,323	Herberger et al.	Oct. 22, 1889
	1,000,991	Comings	Aug. 22, 1911
	1,257,988	Evers	Mar. 5, 1918
5	1,281,982	Labombarde	Oct. 15, 1918
	1,297,748	Streeper	Mar. 18, 1919
	1,915,921	Carle	June 27, 1933
	1,937,027	Low	Nov. 28, 1933
	2,017,583	Burrow	Oct. 15, 1935
10	2,042,719	Lindgren	June 2, 1936
	2,082,365	Straw et al.	June 1, 1937
	2,110,368	Lautzenheiser	Mar. 8, 1938
	2,132,859	Medick et al.	Oct. 11, 1938
	2,270,871	Felber	Jan. 27, 1942
15	2,289,010	Greenwood	July 7, 1942
20			