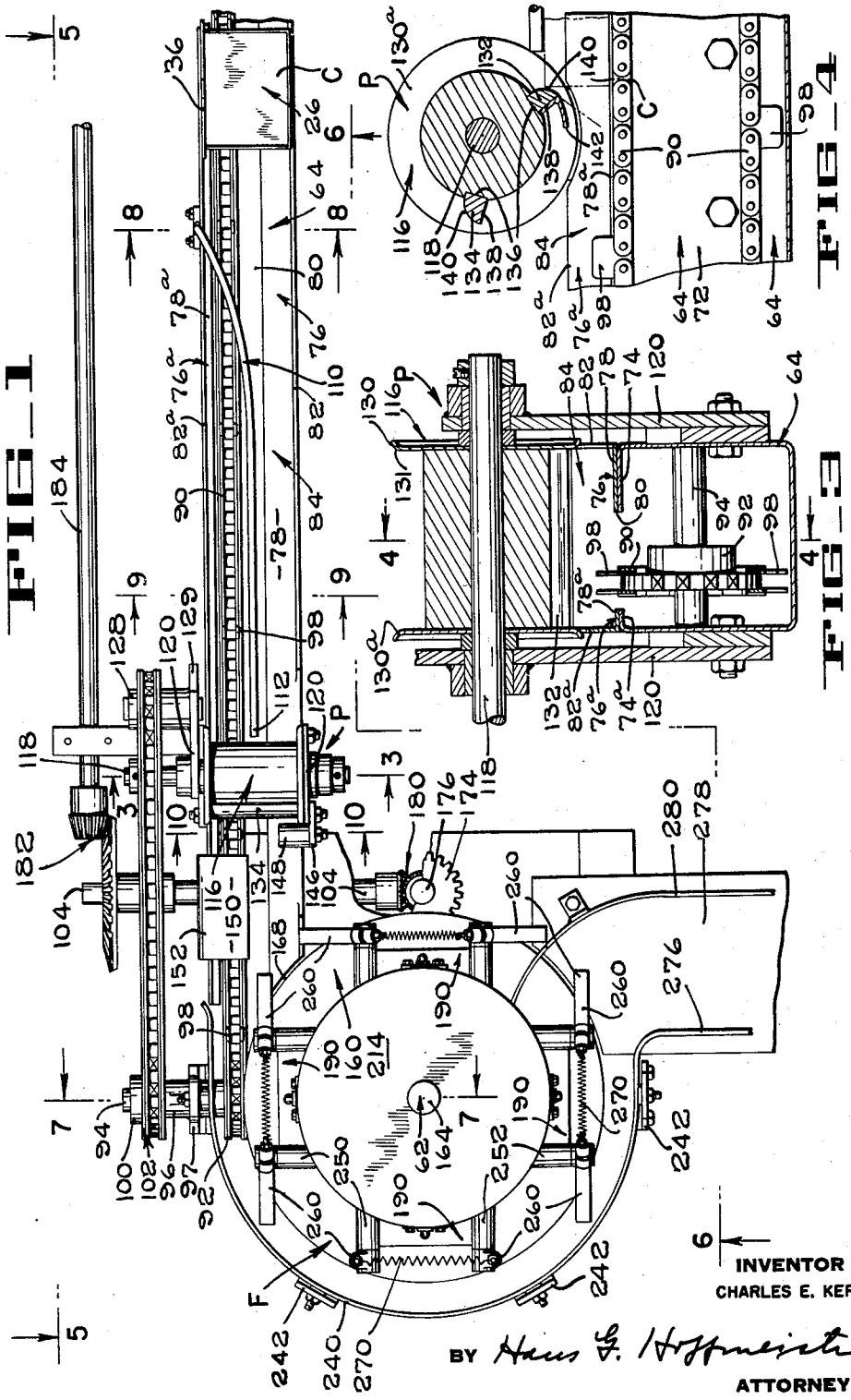
March 8, 1960 C. E. KERR 2,927,411

CARTON CLOSING MACHINE

Filed Oct. 22, 1954 8 Sheets-Sheet 1



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CARTON CLOSING MACHINE

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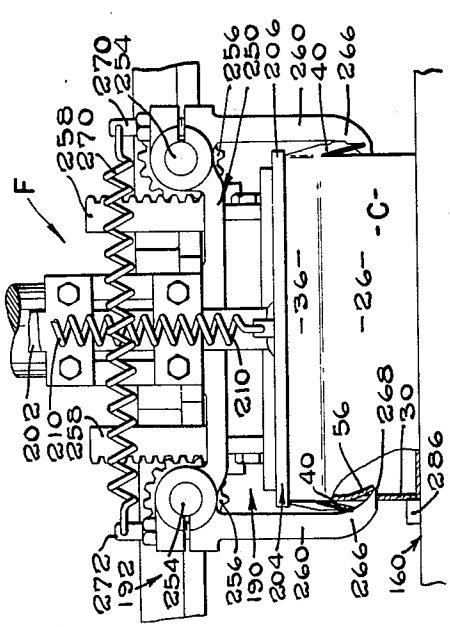


FIG_19

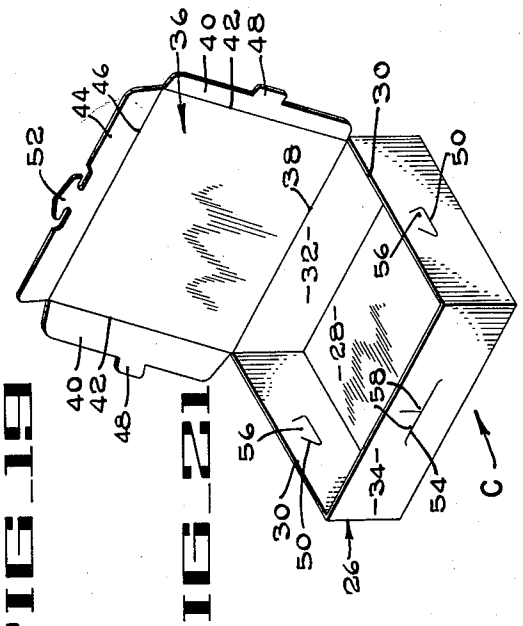


FIG_21

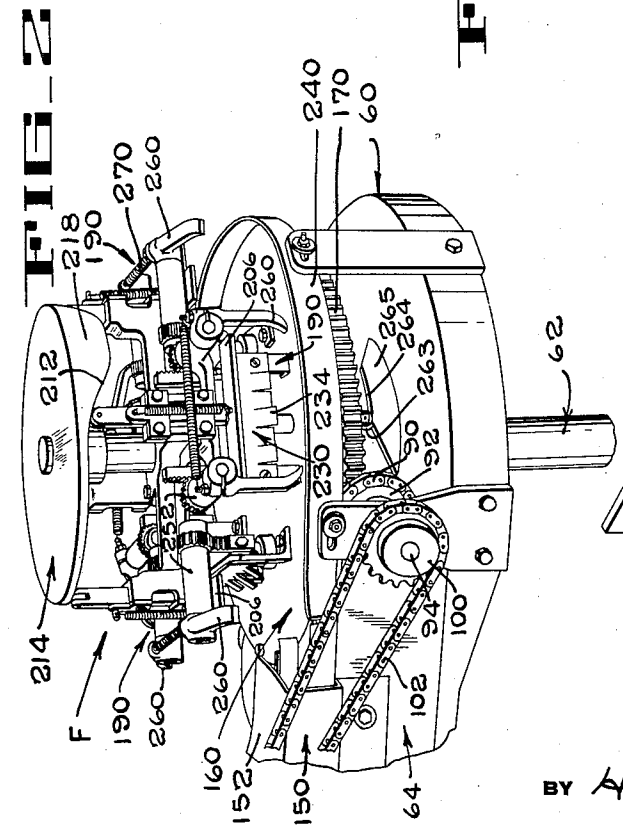


FIG_2

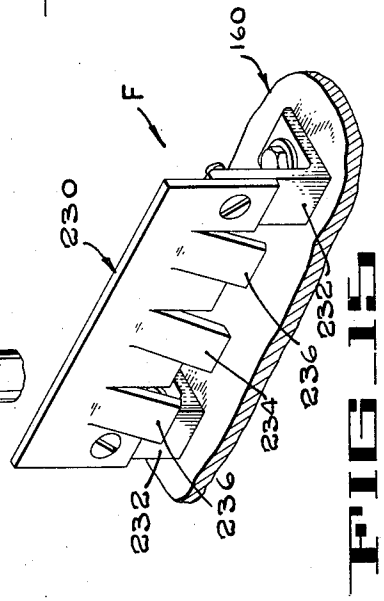


FIG_15

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CARTON CLOSING MACHINE

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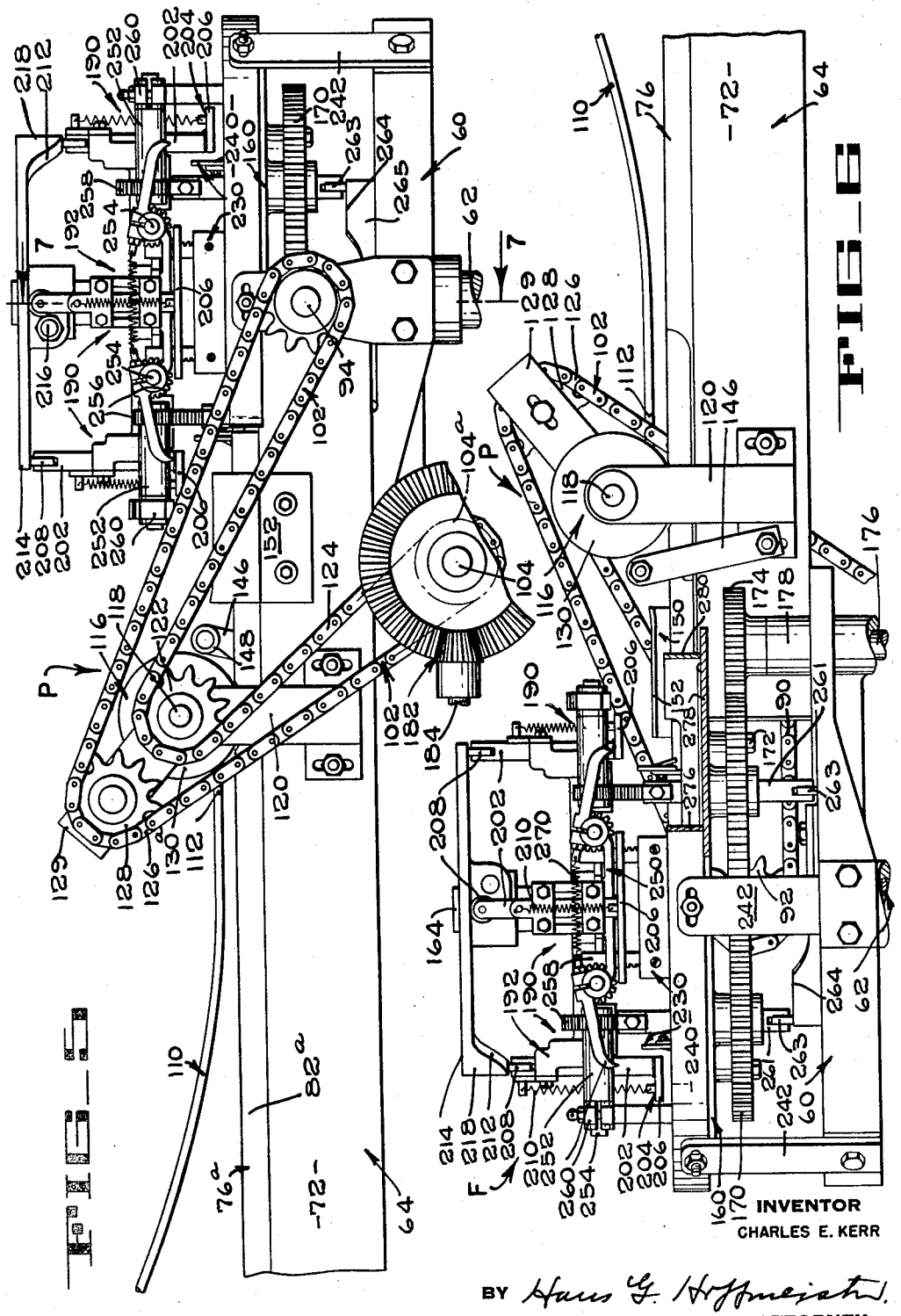


FIG. 5

FIG. 6

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CARTON CLOSING MACHINE

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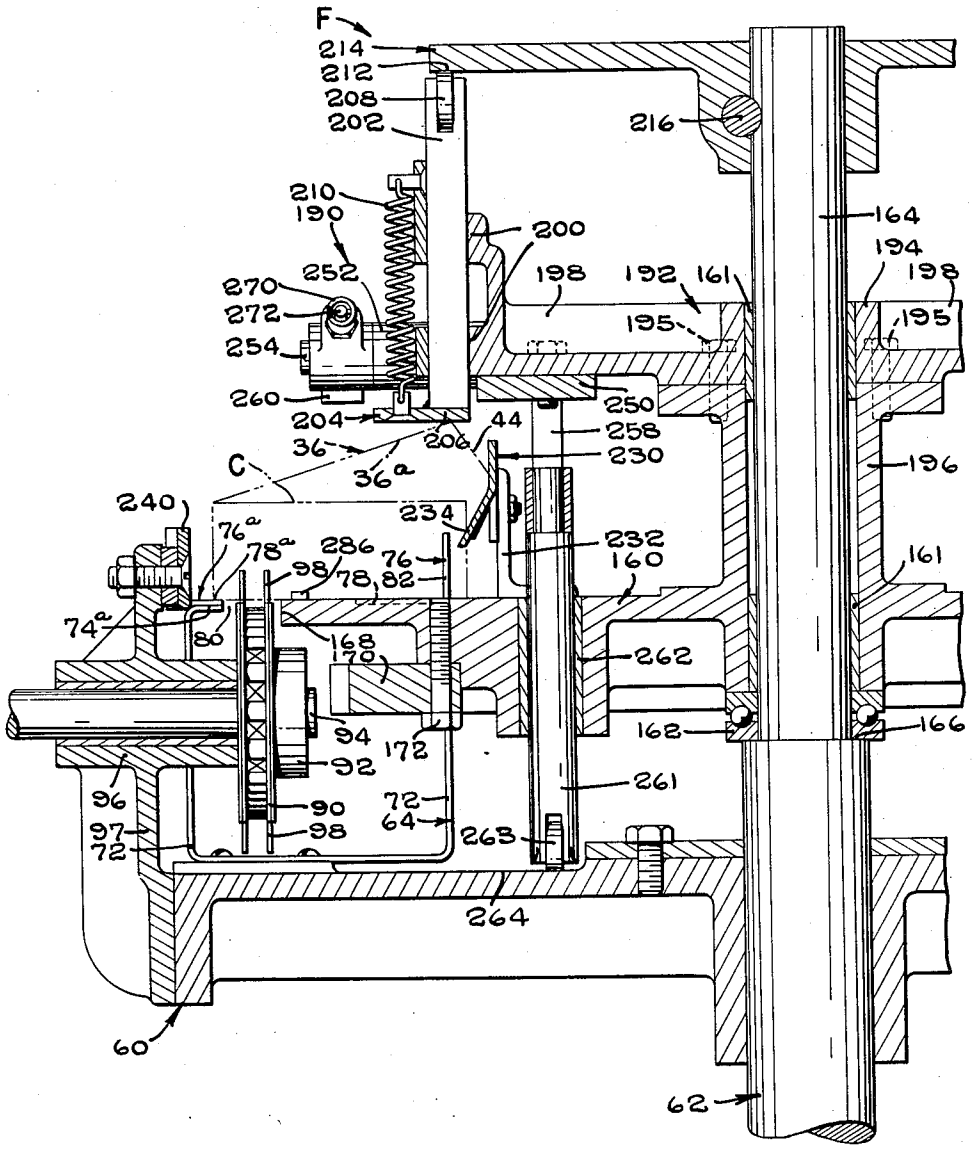


FIG_7

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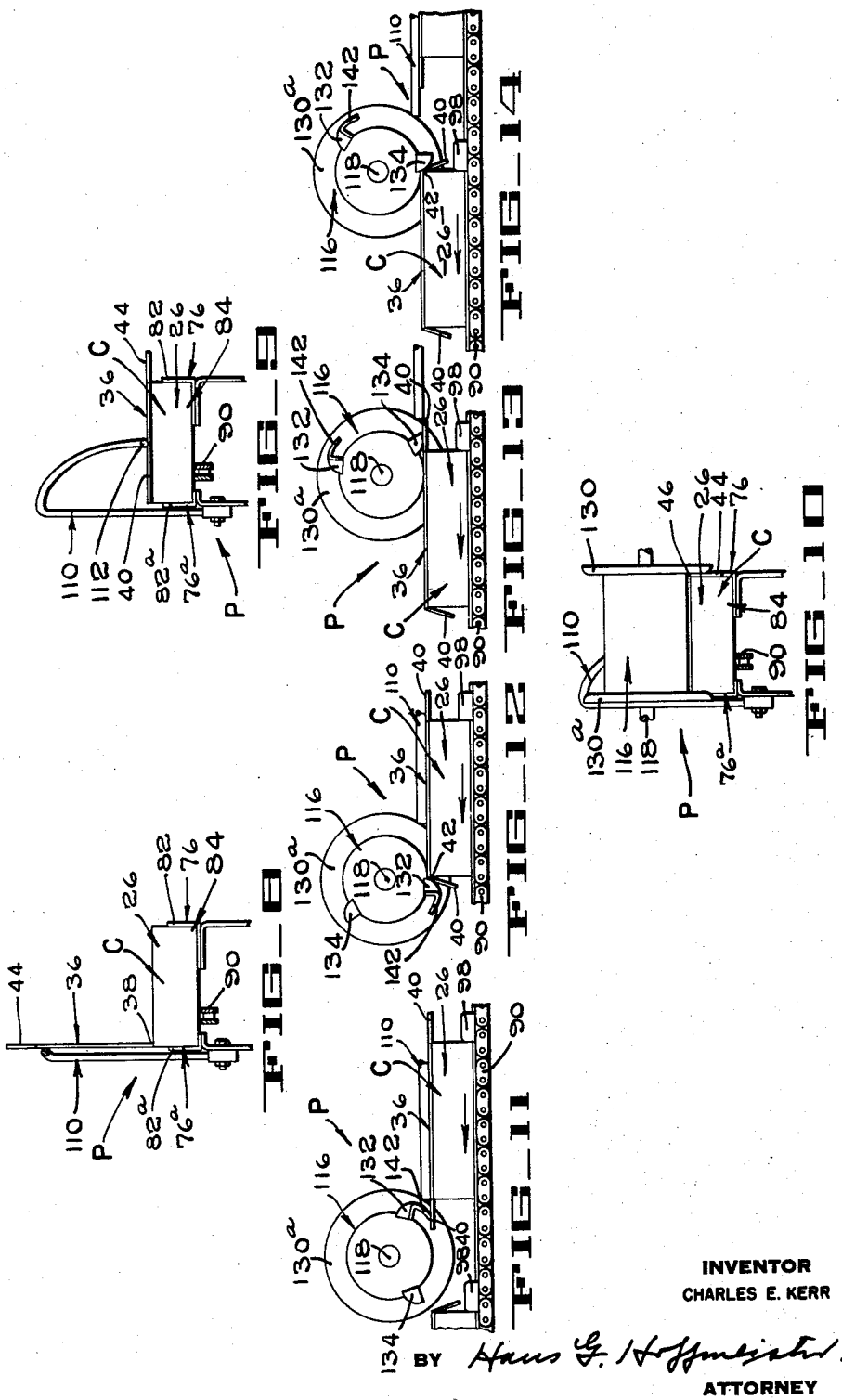


FIG. 7

FIG. 8

FIG. 9

FIG. 10

FIG. 11

FIG. 12

FIG. 13

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CARTON CLOSING MACHINE

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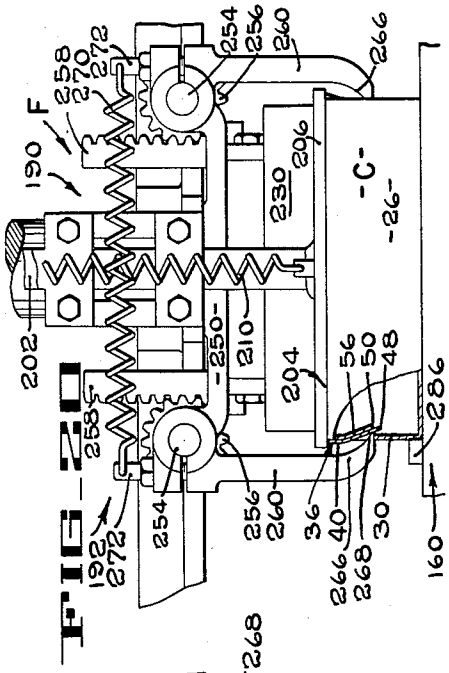


FIG. 20

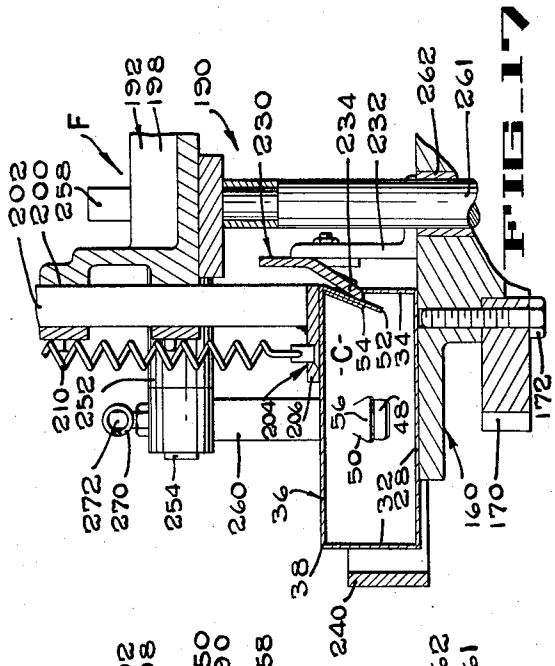


FIG. 17

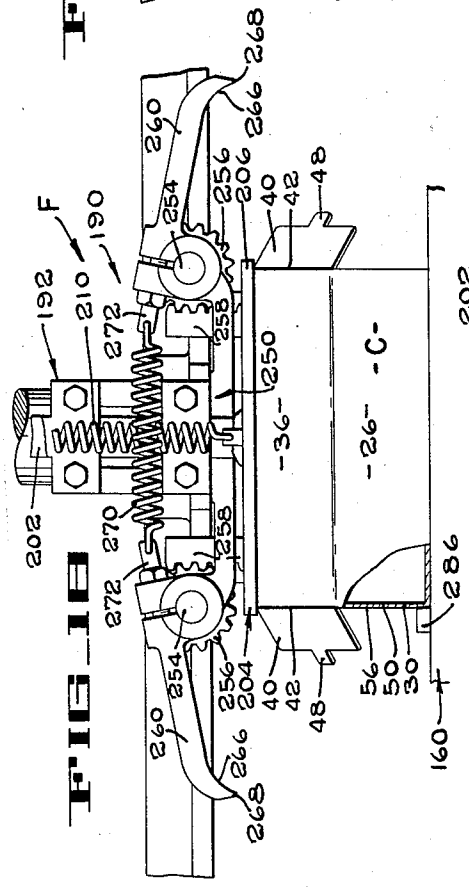


FIG. 18

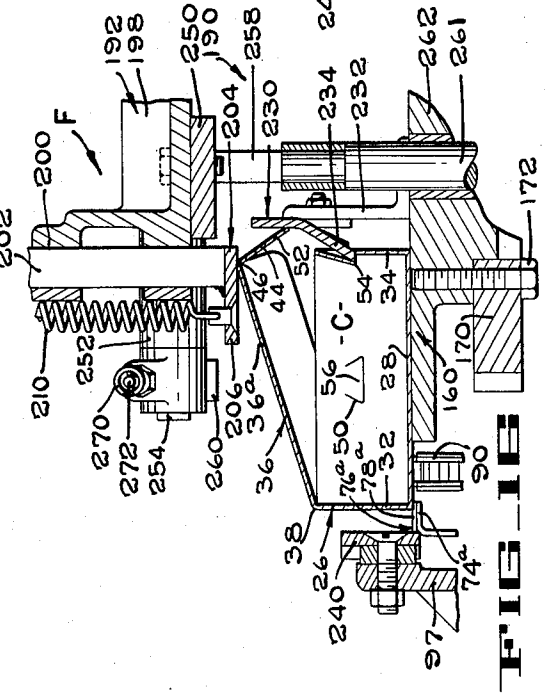


FIG. 16

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CARTON CLOSING MACHINE

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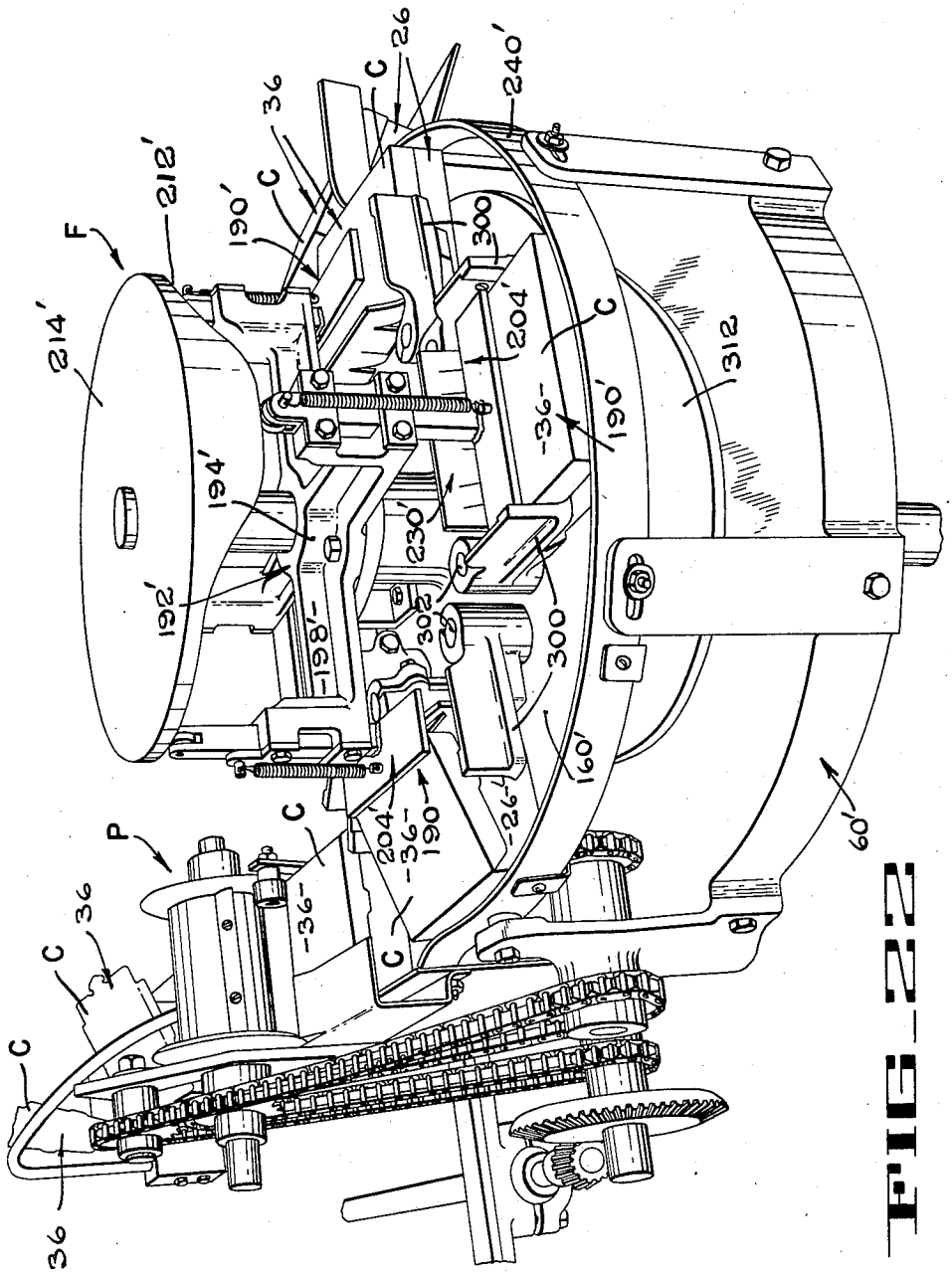


FIG. 2

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CARTON CLOSING MACHINE

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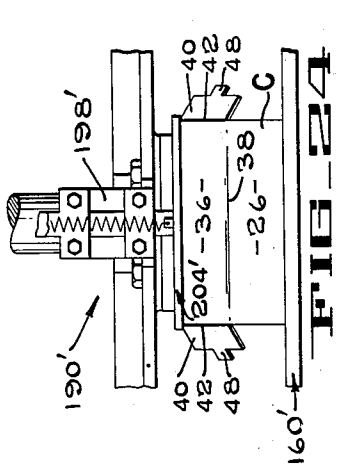


FIG. 24

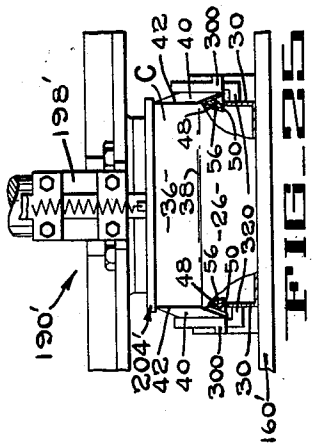


FIG. 25

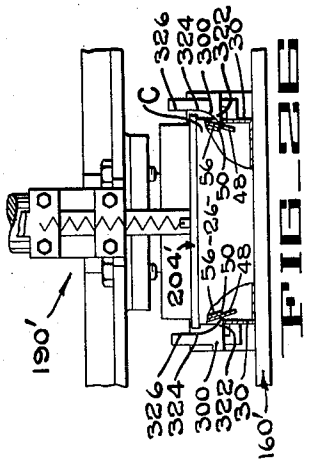


FIG. 26

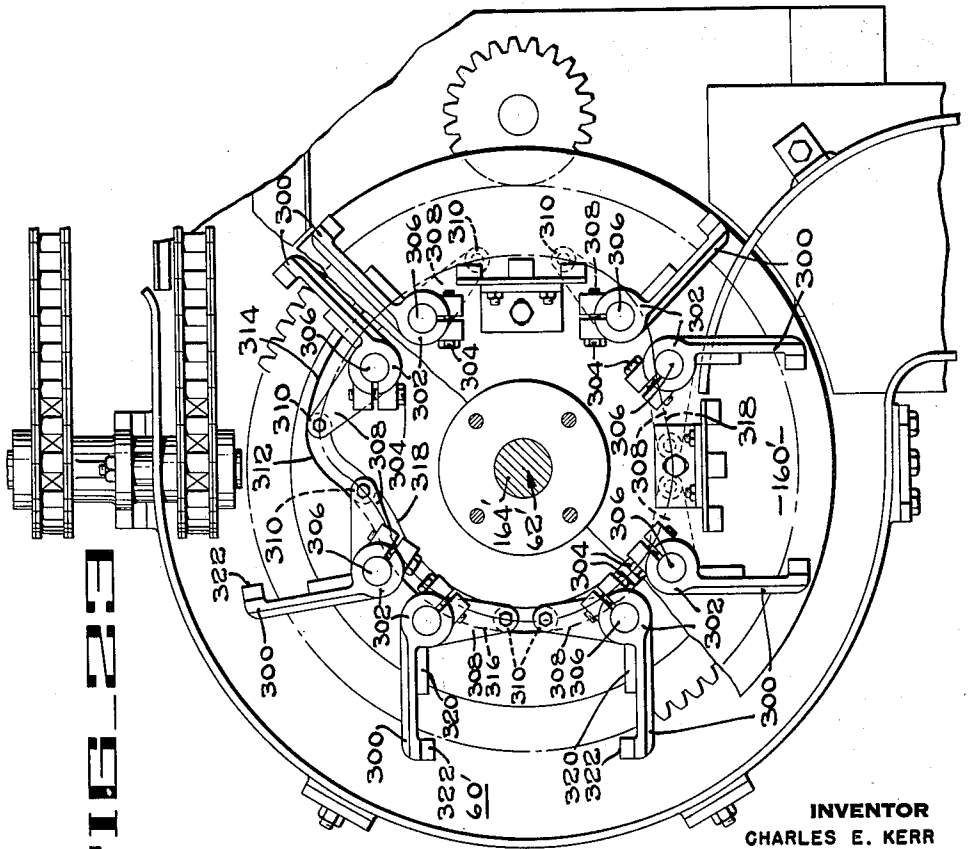


FIG. 23

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United States Patent Office 2,927,411 Patented Mar. 8, 1960

2,927,411

CARTON CLOSING MACHINE

Charles E. Kerr, Hoopeston, Ill., assignor to Food Machinery and Chemical Corporation, San Jose, Calif., a corporation of Delaware

Application October 22, 1954, Serial No. 463,926

19 Claims. (Cl. 53—376)

This invention relates to apparatus for handling paper cartons, and more particularly to carton closing machines.

An object of the invention is to provide an improved carton closing machine.

Another object is to provide a carton closing machine particularly adapted for use in connection with cartons having hinged covers and locking tabs extending from flap extensions of the covers, which tabs are adapted to seat within slits in walls of the carton to secure the covers in closing relation.

Another object is to incorporate within a carton closing machine, apparatus for folding a carton along certain previously scored fold lines to "pre-break" or crease the material of which the carton is made, as a step preliminary to final closing of the cover and securing the same in closed position.

Another object is to provide means for opening the slits of a carton characterized by locking tabs insertable into slits in the carton walls to secure the cover in closed position and for guiding the approaching tabs into the slits to ensure proper seating of the tabs within the slits.

Another object is to provide a machine adapted to receive a continuous, rapidly advancing procession of filled cartons with their covers in open, erect position, and to automatically perform on each carton the operations of preliminarily folding the cover to pre-break the material of which the carton is formed, along the fold line between the cover and the body of the carton, similarly pre-breaking the carton material along the fold lines between the cover and the flap extensions, permitting the cover to spring back away from its fully closed position until the locking tabs clear the slits in the carton walls, and thereafter pressing the cover closed and effecting insertion of the locking tabs into the slits in the carton walls.

Other objects and advantages of the invention will become apparent from the following description and the drawings, in which:

Figure 1 is a plan view of the carton folding machine of the invention.

Figure 2 is a fragmentary perspective of the carton folding machine.

Figure 3 is a section taken along lines 3—3 of Fig. 1.

Figure 4 is a section taken along lines 4—4 of Fig. 3.

Figure 5 is an elevation taken along lines 5—5 of Fig. 1.

Figure 6 is an elevation taken along lines 6—6 of Fig. 1.

Figure 7 is a section taken along lines 7—7 of Figs. 1 and 5.

Figures 8, 9, and 10 are sectional views, taken, respectively, along lines 8—8, 9—9, and 10—10 of Fig. 1, and illustrating successive preliminary folding operations.

Figures 11 to 14, inclusive, illustrate another series of successive preliminary folding operations.

Figure 15 is a fragmentary perspective showing the front slit-opening and tab-guiding means of the machine of the invention.

Figure 16 is a fragmentary section taken along lines 16—16 of Fig. 5, showing the cover closing means of the machine performing the operation of closing a carton cover.

Figure 17 is a view similar to Fig. 16, showing the carton cover in fully closed position.

Figures 18, 19 and 20 illustrate successive steps of the operations of folding the end flap extensions of the cover and inserting their locking tabs into the slits of the carton end walls.

Figure 21 is a perspective of a typical carton of the type upon which the closing machine of the invention is designed to operate.

Figure 22 is a perspective of a modified form of the carton closing machine of the invention.

Figure 23 is a fragmentary plan of the carton closing machine of Fig. 22.

Figures 24, 25 and 26 illustrate successive operative positions of the slit opening and tab inserting means of the machine of Figs. 22 and 23.

A carton C typical of those adapted to be closed by the machine of the present invention is illustrated in Fig. 21 and comprises a body 26 having a bottom 28, two opposed side walls 30, a back wall 32, and a front wall 34. A cover 36 is hinged to the back wall 32 along a scored fold line 38. The cover 36 is extended at each side to provide two opposed side flaps 40 hinged to the cover 36 along scored fold lines 42. The front of the cover 36 is also extended to provide a front flap 44 hinged to the cover 36 along a scored fold line 46. Each of the side flaps 40 has a tab 48 extending beyond its distal edge and receivable within a slit 50 in the associated side wall 30 of the carton body when the cover 36 is closed; and the front flap 44 is provided with a locking tab 52 extending from its distal edge and receivable within a slit 54 in the carton's front wall 34 when the cover 36 is closed. Each of the slits 50 is of substantially U-shaped configuration defining a tongue 56 severed from the associated side wall 30 throughout its entire periphery except at its upper end, so that the tongue may readily be flexed inward to open the slit 50 for the reception of the associated tab 48. For the same purpose the slit 54 is of inverted T-shaped configuration, defining two opposed corners 58 capable of being readily flexed inward to facilitate reception of the tab 52 within the slit 54.

In general, the carton folding machine of the present invention (Fig. 1) comprises a conveyor for receiving a continuous procession of filled cartons C having open, erect covers 36 and for advancing the cartons C uninterruptedly in a continuous flow to and through a preliminary folding station P where the cover 36 of each carton C is folded to, or almost to, closing position to pre-break, or crease the carton material at the fold line 38 along which the cover 36 is hinged to the body 26. While the cover 36 is thus at or adjacent its closed position, the side flaps 40 and the front flap 44 are folded downward to crease the fold lines 42 and 46. As the carton C moves beyond the preliminary folding station P, its cover 36 springs back away from its closed position, far enough for the ends of the locking tabs 48 and 52 to clear the slits 50 and 54. The carton then enters a final closing station F, where, without interrupting the advance of the carton, a plate 206 descends onto the cover 36 and presses it to closed relation on the carton body 26. At the same time, fingers 260 and 234 press inward portions of the side walls 30 and front wall 34 to open the slits 50 and 54, and in so doing the fingers assume positions wherein they adapted to guide the tabs 48 and 52 into the slits 50 and 54 as the cover 36 descends. The plate and fingers then retract, releasing the closed carton which is then delivered to a discharge chute 278, thus completing

the rapid and uninterrupted passage of the carton through the closing machine.

More specifically described, the carton closing machine of the present invention (Figs. 1 and 7) comprises a horizontal frame 60 generally circular in form and rigidly mounted on a supporting pedestal 62 (Figs. 2 and 7). A rectilinear conveyor frame 64 (Figs. 3, 5 and 6) extends substantially tangentially from the circular frame 60. Inturned flanges 74 and 74*a* of the side walls 72 of the conveyor frame support opposed guide members 76 and 76*a*, the coplanar horizontal flanges 78 and 78*a* of which are arranged with their inner edges spaced apart to define a longitudinally extending slot 80 therebetween. Upstanding parallel flanges 82 and 82*a* of the guide members 76 and 76*a* define a rectilinear guideway 84 of only slightly greater width than the length, i.e., the front-to-back dimension, of one of the cartons C which are supplied to the guideway 84 in a continuous procession from any suitable source of supply (e.g. from a carton filling machine). Each carton C is received on the guideway 84 with its cover 36 extending substantially vertically upward from the back wall 32, and with the flaps 40 and 44 substantially in planar alignment with the cover. Moreover, each carton C is placed on the guideway 84 with its back wall 32 facing the outer flange 82*a*, the plane of which is at a greater distance from the center of the circular frame 60 than the plane of the inner flange 82.

The cartons are advanced sideways along the guideway 84 by a conveyor chain 90 (Fig. 1) trained around spaced sprockets 92 (Fig. 7) one of which is rigidly mounted on a shaft 94 journalled in a bearing 96 formed in a bracket 97 which is mounted on the circular frame 60. Spaced flights 98 carried by the chain 90 are adapted to extend upward through the slot 80 into position to engage cartons C on the guideway 84 and to advance the cartons C therealong. The conveyor 90 is driven by a sprocket 100 (Figs. 1 and 5) rigid with an extension of the shaft 94 and connected by a roller chain 102 with a driving sprocket 104*a* (Fig. 5) mounted on a shaft 104 rotatably supported from the circular frame 60 and adapted to be rotated at suitable speed by gearing 106.

The preliminary folding station P is arranged in cooperative association with the rectilinear guideway 84 and comprises an inwardly and downwardly curved camming rod 110 (Figs. 1, 5, 8, 9 and 10) sloping inward from a point above the outer guideway flange 82*a*, at an elevation slightly less than that of the upper edge of an erect cover 36 of a carton C (Fig. 8). The rod 110 slopes inward and then downward to dispose its lower end 112 at such elevation that as a carton C is advanced under the rod 110, the rod folds the cover 36 downward about the fold line 38 until the cover 36 is substantially in closing relation on the carton body 26 (Fig. 9).

A cylindrical flap-folding drum 116 (Figs. 1, 3, 4, and 10–14, inclusive) is disposed above the guideway 84 in position for each carton C to pass thereunder with its cover 36 making tangential contact therewith immediately after leaving the camming rod 110. The drum 116 is carried by a shaft 118 which is journalled in brackets 120 upstanding from the conveyor frame 64 (Figs. 3, 5, and 6) and is rotated so that its circumference moves at a linear speed corresponding to that of the conveyor chain 84 and with the lower side of the drum moving in the same direction as the adjacent, upper run of the conveyor chain 90. This is accomplished by means of a sprocket 122 (Fig. 5) rigid with the shaft 118 and engaged with the lower run 124 of the driving chain 102 which is looped upward and around the sprockets 122 so as to rotate the same in the direction opposite that in which the sprocket 100 turns. The upper run 126 of the chain 102 is looped upward and around an idler sprocket 128 which is journalled upon a bracket extension 129 and which supports the sprocket 128 in such a position that the upper and lower runs 124 and 126 are held clear of each other.

The drum 116 corresponds in length to the length of a carton C, and is provided with flanges 130 and 130*a* (Fig. 10) at its ends, above the guideway flanges 82 and 82*a*, respectively. The flanges 130 and 130*a* extend radially beyond the circumference of the drum 116, so that when a carton C passes under the drum 116, the flanges 130*a* engages the back wall 32 of the carton, ,and the flange 130 engages the front flap 44. As clearly shown in Figs. 3 and 10, the inner faces of the flanges 130 and 130*a* are marginally rounded as indicated at 131. When the flap 44 engages the flange 130, the rounded surface 131 thereof functions as a cam surface that gradually bends the flap 44 downward as the carton is pushed between the two flanges 130 and 130*a*. In this manner, the material of the carton is creased, or prebroken along the fold line 46 at which the flap 44 is joined to the cover 36, with the result that the flap 44 will remain in an angular position with relation to the cover 36 after the carton has passed beyond the drum 116.

The drum 116 is provided with two cleats 132 and 134 (Figs. 11 to 14) extending longitudinally of the drum and, consequently, transversally with respect to the path of carton C. The cleats 132 and 134 are of quarter-round cross sectional form and are mounted on the drum with one flat side 136 embedded slightly in the circumferential surface of the drum and the other flat side 138 extending substantially radially therefrom. The cleats 132 and 134 are spaced apart about the circumference of the drum by a distance corresponding to the width of a carton C, with the round sides 140 facing each other. Thed rum 116 is rotated by the drive chain 102 (Fig. 5) in timed relation to the conveyor chain 90 (Fig. 1) to effect engagement of the leading side flap 40 of the cover of the carton with the round surface 140 of the cleat 132 (Fig. 12) and engagement of the trailing side flap 40 of the cover of the carton with the round surface of the cleat 134 (Figs. 13 and 14).

The leading cleat 132 is provided with an arcuate flange 142 extending forward from the cleat. The function of the flange is to engage the leading flap 40 of the cover (Fig. 11) in a line of contact in advance of the line where the cleat 132 would initially engage the flap 40 were the flange 142 not present. Consequently, the flange 142 compensates for bulging of the leading side wall of the carton which frequently is caused by the contents of the carton. Such bulging of the leading side wall 30 might place the upper edge of the leading side wall 30 directly under the cleat 132, and thus, in the absence of the flange 142, be conducive to crushing the wall 30. But the flange 142 eliminates this hazard, by contacting the leading flap 40 in advance of the point where the flap is supported by a bulging wall 30, with the result that as the flap is forced downward by the flange 142, the bulging wall 30 is straightened sufficiently to permit uniform bending of the flap 40 along its hinge line 42. Initial bending of the flap is quickly followed by engagement of the flap by the round face 140 (Fig. 4) of the cleat 132, which occurs in a line which advances toward the hinge line 42 of the flap as the bending of the flap progresses, until the line of contact is closely adjacent the hinge line, and the flap is bent so sharply around the upper edge of the associated side wall 30 that the carton material is pre-broken along the hinge line, causing the flap 40 to remain in an angular position with relation to the cover 36 after the flap passes beyond the range of operation of the cleat 132.

In its engagement with the trailing side flap 40 of the carton cover, the cleat 134 (Fig. 13) does not require an extension such as that provided on the cleat 132. Since initial engagement between the cleat 134 and the trailing end flap 40 occurs in a line spaced behind the plane of the trailing end wall 30, and the rounded surface 140 makes rolling contact with the flap 40 in a line which approaches the hinge line 42, a moderate

amount of bulging of the side wall 30 is satisfactorily overcome. This action is completed while the carton travels through a shorter distance than that needed for folding the leading flap.

A bracket 146 (Figs. 1, 5, and 6) extending upward from the inner side wall 72 of the conveyor frame 64, rotatably supports a roller 148 above the guideway 84 closely adjacent the discharge side of the drum 116. Its function is to prevent cartons from being lifted off the guideway 84 by the flanges 130 and 130*a* between which each carton is compressed slightly as the carton passes out of the operative range of the drum 116. A bracket 150 (Figs. 2, 5, and 6) extends rigidly upward from the outer side wall 72 of the conveyor frame 64 and is formed with a horizontal flange 152 overlying the outer side of the guideway in position to limit the distance that the cover 36 of each carton springs upward upon release from the roller 148. It is important to observe, however, that the flange 152 is at sufficient elevation to permit each cover 36 to spring upward far enough for the lower ends of the angularly downwardly extending locking tabs 48 and 52 to clear the slits 50 and 54, respectively.

The final folding station F comprises a rotary table 160 (Figs. 1, 2, 5, 6, and 7) of substantially circular form, arranged above the frame 60, and rotatably mounted by bushings 161 and a thrust bearing 162 on an upward extension 164 of the pedestal 62 (Fig. 7). The thrust bearing 162 supports the table 160 upon a shoulder 166 of the pedestal 62 so as to maintain the table 160 in horizontal alignment with the flanges 78 and 78*a* of the guideway 84. The parts are so arranged that the peripheral edge 168 of the table 160 intersects the flange 78 and extends to a position of substantial tangency with the conveyor chain 90 which is outwardly offset from the longitudinal center line of the guideway 84. Consequently, the cartons C are delivered onto the table 160 in a position of stable equilibrium, wherein more than one-half of the carton rests upon the table 160 while less than half the carton overhangs the peripheral edge of the table.

A ring gear 170 (Figs. 2, 5, 6, and 7) is affixed by a plurality of cap screws 172 to the lower side of the table 160 in axial alignment therewith. A spur gear 174 (Figs. 1 and 6) meshing with the ring gear 170, is rigid with a vertical shaft 176 which is journalled in suitable bearings 178 (Fig. 6) carried by the frame 60, and the shaft 176 is connected to the aforesaid shaft 104 to be rotated thereby, by bevel gears 180 (Fig. 1). The shaft 104 is connected by another set of bevel gears 182 to a drive shaft 184, driven by any suitable source of power (not shown). Since the shaft 104 constitutes the drive for the conveyor chain 90, the conveyor chain 90 and the rotary table are synchronized with respect to each other, and the gears 170, 174, and 180 are appropriately proportioned to effect rotation of the table 160 at such a rate that one of four individual cover-closing and tab-inserting stations 190 (Figs. 1, 2, 5, 6 and 7) carried by the table 160, is presented to the delivery end of the guideway 84 each time one of the flights 98 of the conveyor chain pushes a carton C onto the table 160.

Carried by a head 192 (Fig. 7) and the table 160 are four cover-closing and tab-inserting stations 190. The head 192 comprises a hub 194 supported on and rigidly affixed by bolts 195 to the hub 196 of the table 160, and four spokes, or arms 198 extend radially from the hub 194, ninety degrees apart. Each arm 198 is provided at its outer end with vertically aligned bearings 200 within which the rod 202 of a plunger 204 is mounted for vertical reciprocation. The rod 202 is of non-circular cross section, and the bearings 200 are fitted to the rod, with the result that the plunger 204 is prevented from rotary motion with respect to the bearings. The lower end of the rod 202 is provided with a horizontal presser plate 206, and the upper end of the rod 202 carries a cam follower roller 208. A spring 210 constantly urges the plunger 204 upward and thereby presses the roller 208 against a cam surface 212 (Figs. 1, 2, 5, 6 and 7) on the underside of a circular plate 214 rigidly affixed to the extension 164 of the stationary pedestal 62 by a clamping dowel pin 216 (Fig. 7). The cam 212 includes a downwardly projecting lobe 218 (Figs. 2, 5, and 6) so positioned and so proportioned that after each cover-folding and tab-inserting station 190 arrives in position for the guideway 84 to discharge a carton C onto the table and into the station 190, the plunger 204 of the station 190 is pushed downward by the cooperating lobe 218 and follower roller 208, until the plate 206 is spaced from the table 160 by a distance coinciding with the height of the carton C.

As already stated, the function of the horizontal flange 152 (Figs. 1, 2 and 6) is to limit the height to which the cover 36 of each carton C can spring back after its hinge line 38 has been creased; and the flange 152 is disposed so closely adjacent the area where the cartons C pass from the conveyor guideway 84 onto the rotating table 160 that the trailing end of a carton does not pass out from under the flange 152 until at least the leading end of the carton is underneath the presser plate 206 of the station 190 into which the carton is being delivered. Hence, the flange 152 guides each partly closed cover 36 to the position indicated at 36*a* in Figs. 7 and 16, wherein the presser plate is directly above the hinge line 46 between the cover 36 and the front flap 44. Therefore, the downward thrust of the plunger 204 induced by the cam lobe 218 pushes the cover 36 to its fully closed position on the carton body 26, as illustrated in Fig. 17.

Each of the stations 190 is provided with a vertical guide plate 230 (Fig. 15) rigidly supported from the table 160 by angle brackets 232 (Figs. 7, 15, 16, and 17) in a position opposite and spaced radially inward from the front wall 34 of a carton C in the associated station 190. The guide plate 230 is provided with an intermediate downwardly and outwardly inclined finger 234, and two similarly inclined fingers 236 spaced laterally from the intermediate finger 234 at either side thereof.

A guide strap 240 of semi-circular form (Fig. 1) is arranged substantially concentrically with respect to the table 160, and is adjustably supported in position outwardly spaced therefrom and extending above the plane thereof, by brackets 97 and 242 (Figs. 2, 5, 6, and 7) rigid with and extending upward from the frame 60. The strap 240 is so arranged that as a carton C is carried in a circular path by the table 160, the strap 240 engages the back wall 32 of the carton and resists any tendency for the carton C to move radially outward. Therefore, as a guide plate 230 approaches the point of tangency between its circular path with the rectilinear path of the front wall 34 of a carton about to be deposited in a station 190, the lower ends of the fingers 234 and 236 are caused to press firmly against the front wall 34 of the carton.

As clearly shown in Figs. 15, 16, and 17, the intermediate finger 234 protrudes further from the plane of the plate 230 than do the fingers 236, and its lower end is at an elevation slightly above that of the slit 54 in the front wall 34 of the carton. Therefore, while the two fingers 236 engage the carton at either side the slit 54 and thereby hold the carton with both rear corners in sliding engagement with the guide strap 240, the lower end of the intermediate finger 234 presses inward the portion of the front wall 34 immediately above the slit 54, as illustrated in Fig. 16. This not only opens the slit 54, preparing it for subsequent entry of the front locking tab 52 thereinto, but also disposes the finger 234 in a position sloping upward from within the carton, just inside the slit, to a higher point in front of the carton. The sloping finger 234 when so disposed lies in

the path of the tab 52 as the tab is being carried downward by the descending cover 36, with the result that as the cover nears its fully closed position, the finger 234 intercepts the tab 52 and guides it into and through the slit 54, as illustrated in Fig. 17.

Each of the cover-closing and tab-inserting stations 190 includes means for opening the slits 50 in the side walls 30 of a carton substantially simultaneously with the above described operation of the finger 234. A crosshead 250 (Figs. 2, 5, 6, 18, 19 and 20) is provided at the outer end of each arm 198, preferably integral therewith. Bearings 252 (Figs. 1, 2, 16, and 17) at the outer ends of each crosshead 250 rotatably support parallel horizontal shafts 254, to the inner end of each of which a pinion gear 256 (Figs. 2, 18, 19, and 20) is secured. A vertically extending rack 258 engages each pinion gear 256, at the side thereof nearer the associated arm 198, so that upon upward motion of the racks 258, the shafts 254 are rotated in such a manner that fingers 260 secured to the outer ends of the shafts 254, are turned from a retracted, diverging position (Fig. 18) to a contracted arrangement wherein each finger 260 extends substantially vertically downward (Fig. 20). Each of the racks 258 is rigidly secured to the upper end of a vertical push rod 261 which is reciprocable within and extends through a vertical bearing 262 (Figs. 7, 16 and 17) in the table 160. The lower end of each push rod 261 is provided with a follower roller 263 in operative engagement with a cam surface 264 on the frame 60, as best shown in Figs. 5 and 6. A high lobe 265 of the cam 264 is so positioned that it moves the push rods 261 of each station 190 upward immediately after a carton C is received upon the table 160 below the associated plunger 204. The lobe 265 is so related to the lobe 213 of the cam 212 that the fingers 260 assume their vertical positions (Fig. 20) in engagement with the side walls of a carton, before the cover 36 is lowered beyond the point at which the side tabs 48 reach the elevation of the slits 50 in the walls 30 of the carton.

The distal end 266 of each finger 260 is of arcuate form, and slopes downward and inward toward a carton C engaged between two of the fingers 260. Moreover, the end 266 of each finger 260 is tapered to a relatively thin edge 268, and the fingers 260 are of such length that the end edges 268 of the fingers 260 engage the portions of the sidewalls immediately above the slits 50 and press these portions inward, opening the slits 50 and preparing the same for reception of the side locking tabs 48. When the fingers 260 arrive at their final, contracted position (Figs. 19 and 20), the ends 266 of the fingers occupy positions wherein they slope upward from inside the carton, just inside the slits 50, to locations at higher elevations outside the carton. Accordingly, the arcuate ends 266 lie in the paths of the downwardly approaching tabs 48, and are thus adapted to intercept the tabs 48 and guide them into the slits.

The high lobe 265 is of such length, measured circumferentially of the cam 264, that shortly after arrival of a cover-closing plunger 204 in its lowest position, the associated rollers 263 pass off the high lobe, permitting the push rods 261 to move to lower positions and the fingers 260 to retract to their raised, expanded positions (Fig. 18). Such motion of the rollers 263 and fingers 260 is induced by a coil spring 270 under tension between extensions 272 of the fingers 260. This withdraws the end edges 268 of the fingers from engagement with the carton, permitting the sidewalls 30 to spring back toward their original flat configuration, and causing the tabs 48 to be gripped between the edges of the slits 50, and thereby securing the cover 36 closed.

As best shown in Fig. 1, the guide strip 240 terminates in a portion 276 which is deflected outward, away from the table 160, and over a discharge chute 278. A cooperating guide strip 280 is mounted on the chute 278 and curves inward over the table 160 in position to intercept each carton C after completion of the operation of closing the same, and to guide the closed carton onto the discharge chute 278. In this manner, each carton is pulled away from the associated guide plate 230, removing the finger 234 from the slit 54, and thereby permitting the front wall 34 to spring back toward its original, flat configuration. This causes the edges of the slit 54 to grip the tab 52, and thus cooperate with the tabs 48 and slits 50 in securing the cover closed.

It is believed that the manner in which each carton C is closed and its cover 36 secured, is readily understandable from the hereinabove description, throughout which the operation of each group of parts has been explained in conjunction with the description of their construction. It might be well at this point, however, to emphasize that in practical operation of the carton closing machine of the invention, filled open cartons are supplied to the machine in a rapidly moving, continuous procession, and the cartons pass in closely spaced relation and at sustained high speed along the rectilinear conveyor guideway 84, and through the preliminary folding station P, where the camming rod 110 bends the covers 36 down to, or nearly to, their closed position, and where the drum 116 bends first the front flap 44, and then the side flaps 40, down to, or nearly to, the positions which they ultimately will occupy when the closing operation is completed. As the cartons pass from the preliminary folding station P into the final folding station F, the covers 36 spring upward slightly, since the carton material, although pre-broken along the fold lines 38, 42, and 46, retains sufficient inherent resiliency to return the covers 36 and the flaps 40 and 44 partially to their starting positions. This disposes the tabs 48 and 52 at a higher elevation than the slits 50 and 54, in proper position for subsequent guided movement into the slits.

Without interruption of their rapid rate of advance, the cartons pass successively onto the rotating table 160, where each carton, with its cover 36 in an inclined position, is accurately located in one of the individual folding stations 190 by an indexing stop 286 (Figs. 2, 7, 18, and 19) on the table 160. While the carton is carried in an arcuate path on the table 160, the finger 234 enters and opens the slit 54 in the front wall of the carton, and the fingers 260 turn downward and inward, inserting their end eges 268 into the side wall slits 50 and thereby opening the same. The cover 36 is then pressed closed by the descending plunger 204, and as this occurs, the tabs 48 and 52 are guided into the slits 50 and 54, by the fingers 260 and 234, respectively. The fingers 260 then retract, and briefly thereafter, the advancing carton engages the guide strip 280, which pulls the carton away from the finger 234 and deflects the completely closed and secured carton onto the chute 278, which may convey the rapid succession of cartons thus delivered to it, to any suitable point of discharge.

Figs. 22 to 26, inclusive, illustrate a modified form of carton closing machine embodying the present invention. In this embodiment, all operating parts are constructed similarly to and operate in substantially the same manner as in the first described form of the machine, with the exception of the mechanism for opening the slits 50 in the side walls 30 (Figs. 25 and 26) of the carton C, and for guiding the side tabs 48 into the open slits.

In the modified form of the apparatus, the arms 198' (Fig. 22) which radiate from the hub 194' of the head 192' provide support for only the cover-closing plungers 204' which are actuated by an overhead cam 212' in the same manner as are the plungers 204 of the first described form of the machine. As illustrated in Figs. 22 and 23, however, the side embracing members comprise arms 300, a pair of which is provided for each of the four cover-closing and tab-inserting stations 190'. Each of the arms 300 is provided with a split hub 302 and clamping screw 304 whereby the arm is secured to the upper end of a vertical shaft 306 journalled in and extending through

the rotary table 160' whereby the cartons C are transported in an arcuate path, one under each of the plungers 204' as in the first described form of the invention. A lever 308 is affixed to the lower end of each shaft 306 and each lever 308 carries a cam following roller 310 (Fig. 23). All of the rollers 310 are engaged within an endless camming groove 312 in the upper surface of the frame 60' above which the table 160' rotates.

The groove 312 includes a portion 314 (Fig. 23) at relatively great radial distance from the vertical axis of rotation of the table 160', and a portion 316 at lesser radial distance from the said vertical axis, the two portions 314 and 316 of the groove being interconnected by appropriately configured portions 318 so that the camming groove 312 is endless. The portion 314 of the camming groove 312 is so spaced from the axis of the rotation of table 160' that when the camming rollers 310 associated with one of the pairs of arms 300 are disposed in the portion 314, the arms are spread apart as indicated at the right hand side of Fig. 23. The radial spacing of the portion 316 of the groove 312 from the axis of the table's rotation, however, is such that when the rollers 310 associated with one of the pairs of arms 300 are disposed in the portion 316, the arms are disposed in a contracted position wherein they extend parallel to each other as shown at the left hand side of Fig. 23. The spacing between the arms 300 of each pair is such that when the arms are in their said contacted, parallel position, bosses 320 on the inner faces of the arms 300 are adapted to engage the two side walls 30 of a carton C with just sufficient force to center the carton between the arms 300 and under the associated plunger 204' without any appreciable distortion of the carton.

At the outer end of each arm 300, a finger 322 is provided at a slightly higher elevation than the associated boss 320 and protruding inward a slightly greater disatnce from the arm 300 than does the boss 320, as best shown in Fig. 26. The parts are so proportioned and arranged that when the arms 300 occupy positions wherein they embrace a carton C, the fingers 322 engage the portions of the carton side walls 30 immediately above the slits 50 therein and press these portions inward to open the slits 50 as indicated in Fig. 25. The upper surface 324 of each finger 322 is of arcuate form and slopes upward and outward so that it merges gradually with the vertical inner face 326.

At the time that a carton C is deposited on the rotating table 60' beneath one of the plungers 204, the arms 300 associated with that plunger 204' are in their retracted, separated position which permits entry of the carton between the arms without interference. Immediately after such disposition of the carton between the arms 300, the cam follower rollers 310 associated with these arms enter the portion 312 of the camming groove causing the shafts 306 to turn and the arms 300 to move to their retracted position. This effectually centers the carton C below the plunger 204' and in relation to the finger 234' of guide plate 230' because of the engagement of the bosses 320 with the side walls 30 of the carton. At the same time, the fingers 322 open the slits 50 as hereinabove described and assume positions wherein their arcuate upper surfaces 324 slope upward and outward from within the carton C just inside the opened slits 50 and to a location of higher elevation outside the carton. Consequently, the sloping upper surfaces 324 lie in the path of the side flaps 48 as they are carried downward by the cover 36 as the cover is moved to its closed position. It is readily apparent therefore that the arms 320 and their fingers 322 having upwardly and outwardly inclined upper surfaces 324 operate to guide the descending tabs 48 into and through the open slits 50 in the same manner as do the fingers 260 of the first described form of the invention.

While I have illustrated and described a particular embodiment and a modification of the present invention, it will be understood that various changes may be made in the details thereof without departing from the scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent is:

1. A machine for closing a carton having a body including a slitted wall, a cover hinged to the body, and a locking tab carried by the cover and disposed perpendicularly with respect thereto, said closing machine comprising means for advancing the carton in a predetermined path, means mounted adjacent said path for folding the cover to closing position on the body, means cooperatively associated with said folding means for opening the slit and for guiding the locking tab into the opened slit including a plate disposed in opposed relation to the slitted wall and having a finger sloping downward and toward the slotted panel, and means for deflecting the carton from said path to thrust the carton against the finger, said finger being disposed in an oblique position sloping upward and away from the carton in the path of the tab on the closing cover, the lower end of the finger being in alignment with a portion of the slitted wall above the slit whereby the lower end of the finger opens the slit and the finger guides the tab into the slit as the cover closes.

2. Flap folding apparatus for a carton having side walls, a cover on the body, and a flap hinged to the side of the cover along a fold line adjacent the upper edge of one of the side walls, said apparatus comprising a rotatably mounted drum, means for moving the carton sideways past the drum with the flap leading, a transverse cleat on the drum, means for rotating the drum in timed relation with the carton advancing means, carton locating means on the advancing means for registering the flap with said cleat and thereby effecting engagement of the flap by the cleat at a predetermined distance from the hinge line of the flap, and an extension carried by the cleat and engageable with the flap in advance of the cleat and at a greater distance from the hinge line to initiate folding of the flap prior to engagement of the cleat with the flap.

3. In a carton handling apparatus, a conveying mechanism comprising a straight line conveyor including a rectilinear guide track and means for propelling a carton longitudinally thereof, and a rotatably mounted table in planar alignment with the discharge end of said guide track and arranged with its peripheral edge intersecting said track through more than half but less than all of the track's transverse extent whereby a carton delivered onto the table from the track is disposed in stable equilibrium on the table but with one edge of the carton overhanging the edge of the table, said propelling means being offset outwardly of the peripheral edge of said table and extending to a position wherein a radius of the table is perpendicular to the propelling means.

4. In carton handling apparatus, a conveyor mechanism comprising a guide track, a rotatably mounted table in position to receive cartons from said guide track, the peripheral edge of the table intersecting the track through more than half but less than all of the transverse extent of the track whereby a carton delivered onto the table from the track is disposed in stable equilibrium on the table but with part of the carton protruding beyond the edge of the table, a drive chain movable longitudinally of the guide track and extending to a position of tangency with the table, and a carton engaging lug carried by said chain.

5. In carton handling apparatus, a conveyor mechanism comprising a guide track, a rotatably mounted table in position to receive cartons from said guide track, the peripheral edge of the table intersecting one side edge of the track and extending to a position between the longitudinal center line and the opposite side edge of the track whereby the table is adapted to receive a carton from the track with more than half the carton inward of

the peripheral edge of the table and with less than half of the carton overhanging the edge of the table, a guide chain movable longitudinally of the track, and a carton engaging lug carried by the chain, said chain being offset from the longitudinal center line of the track to dispose said lug in position to engage said overhanging portion of the carton.

6. In a machine for closing a carton including a body and a substantially horizontally extending flap disposed substantially in planar alignment with the uppermost portion of the body, apparatus for folding the flap downward comprising a rotatably mounted drum, means for advancing the carton past the drum substantially in tangential relation therewith, means connecting the drum to the advancing means for rotation in timed relation therewith, and a transverse cleat projecting from the circumference of the drum in a position clearing the body of the carton and in opposed relation to the flap whereby the cleat engages the flap and folds the same downward relatively to the carton as the carton advances past the drum, the surface of the cleat engageable with the flap being rounded and making rolling contact with the flap in a line that progresses toward the body of the carton.

7. A machine for closing a carton having a body including a slitted wall, a cover hinged thereto, a flap hinged to the cover, and a locking tab extending from the flap, said closing machine comprising a table mounted for rotation in a horizontal plane, means for rotating the table, means for placing onto the table a carton with its cover in an open position and its flap and locking tab extending substantially perpendicularly from the cover, a tab guide mounted on the table for rotation therewith in alignment with the slit in the slitted wall of the carton, means for effecting relative motion between the carton and the tab guide to press the guide against the slitted wall above the slit to open the slit and enter the guide into the slit, and means mounted on the table for rotation therewith for folding the cover to closed position and thereby sliding the tab along the guide and into the opened slit.

8. A machine for closing a carton having a body including a slitted wall, a cover hinged thereto, a flap hinged to the cover, and a locking tab extending from the flap, said closing machine comprising a table mounted for rotation in a horizontal plane, means for rotating the table, means for placing onto the table a carton with its cover in an open position and its flap and locking tab extending substantially perpendicularly from the cover, slit opening means supported by the table for rotation therewith and for movement relative thereto from a carton releasing position to a carton engaging position, means operative synchronously with rotation of the table to press the slit-opening means against the slitted wall above the slit to open the slit and enter the slit-opening means into the slit, and means mounted on the table for rotation therewith for folding the cover to closed position and sliding the tab into the opened slit.

9. A machine for closing a carton having a body including a rear wall and a slitted side wall, a cover hinged to the rear wall and a locking tab connected to the cover, said closing machine comprising conveying means constructed and arranged to advance the carton along a predetermined circular path with the cover of the carton in an open position and the locking tab extending substantially perpendicularly from the cover, an arm pivotally mounted on the conveying means for advancement therewith, a slit opening finger projecting from the arm in alignment with the slit in the side wall of the carton, means operative in timed relation with the conveying means to press the finger against the slitted wall above the slit to open the slit and enter the finger into the slit, and means mounted on the conveying means for advancement therewith for folding the cover to closed position and thereby sliding the tab along the finger and into the opened slit.

10. A machine for closing a carton having a body including a rear wall and a slitted side wall, a cover hinged to the rear wall, and a locking tab connected to the cover, said closing machine comprising conveying means arranged to advance the carton along a predetermined circular path with the cover of the carton in an open position and the locking tab extending angularly from the cover, slit opening and tab guiding means supported from the conveying means for advancement with the carton and for movement relative thereto from a withdrawn position to a carton engaging position, means operating in timed relation with advancement of the carton by the conveying means to enter the slit opening and tab guiding means into the slit, and means operating while the slit opening and tab guiding means is inserted into the slit for folding the cover to closed position and sliding the tab along the guiding means into the slit.

11. A machine for closing a carton having a body including opposed slitted walls, a cover hinged to the body, and a locking tab associated with each of the slitted walls and extending angularly from the cover, said closing machine comprising a table mounted for rotation about a vertical axis, means for rotating the table, two opposed arms, means carried by the table for rotation therewith and mounting said arms for rotary motion from a carton releasing arrangement to a carton engaging arrangement, means connected to the table for operation in timed relation therewith for placing onto the table adjacent the arms a carton with its cover in an open position, means operative in timed relation with the table for folding the cover to closing position, means operable during operation of said cover closing means for turning the arms to said carton engaging arrangement thereof, and fingers extending inward from the arms in position to engage the slitted walls of the cartons adjacent the slits therein to open the slits for entry of the tabs thereinto.

12. A machine for closing a carton having a body including opposed slitted walls, a cover hinged to the body, and a locking tab associated with each of the slitted walls and extending angularly from the cover, said closing machine comprising a table mounted for rotation about a vertical axis, means for rotating the table, two opposed arms mounted above the table for rotation therewith and for motion relative thereto from a carton releasing arrangement to a carton engaging arrangement, means connected to the table for operation in timed relation therewith for placing onto the table adjacent the arms a carton with its cover in an open position, means operative in timed relation with the table for folding the cover to closing position, means operable during operation of said cover closing means for moving the arms to said carton engaging arrangement thereof, and fingers extending inward from the arms in position to engage the slitted walls of the cartons adjacent the slits therein to open the slits for entry of the tabs thereinto.

13. A machine for closing a carton having a body including opposed slitted walls, a cover hinged to the body, and a locking tab associated with each of the slitted walls and extending angularly from the cover, said closing machine comprising a table mounted for rotation in a horizontal plane, means for rotating the table, two opposed arms, means carried by the table for rotation therewith and mounting said arms for rotary motion from a carton releasing arrangement to a carton engaging arrangement, means connected to the table for operation in timed relation therewith for placing onto the table adjacent the arms a carton with its cover in an open position, means operative in timed relation with the table for folding the cover to closing position, means operable during operation of said cover closing means for turning the arms to said carton engaging arrangement thereof, and fingers extending obliquely inward from the arms in position to engage the slitted walls of the cartons adjacent the slits therein to open the slits for entry of the tabs thereinto and to dispose the fingers in position to guide the tabs

into the opened slits as the cover approaches said closing position.

14. A machine for closing cartons comprising a rotatably mounted table, rotating means therefor, stationary circular cam means mounted in axial alignment with the table, plunger means mounted for rotation with the table and for reciprocation relative to the table and yieldably urged into operative engagement with the cam means, carton closing means mounted adjacent the table for rotation therewith and connected to the plunger means for actuation thereby to effect a carton closing operation and means for placing an open carton onto the table in position to be engaged by said closing means during advancement of the carton on the rotating table.

15. A machine for closing cartons comprising a rotatably mounted table, rotating means therefor, a plurality of stationary circular cams mounted in axial alignment with the table, a plunger associated with each cam and mounted for rotation with the table and for reciprocation relative to the table and yieldably urged into operative engagement with its associated cam, carton closing means connected to each plunger to perform a carton closing operation, and means for placing an open carton onto the table in position to be engaged by said closing means during advancement of the carton by the rotating table.

16. A machine for closing cartons of the type including a body and a cover hinged to the body, said carton closing machine comprising a rotatably mounted table, rotating means therefor, a stationary circular cam mounted in axial alignment with the table, a plunger mounted for rotation with the table and for reciprocation relative to the table and yieldably urged into operative engagement with the cam, a cover closing plate carried by the plunger and means for placing a partially closed carton onto the table in alignment with said plate.

17. A machine for closing cartons of the type including a body having a slitted wall, a cover hinged to the body and a locking tab hinged to the cover, said carton closing machine comprising a rotatably mounted table, rotating means therefor, a stationary circular cam mounted in axial alignment with the table, a plunger mounted for rotation with the table and for reciprocation relative to the table and yieldably urged into operative engagement with the cam, a rack carried by the plunger for reciprocation therewith, bearing means mounted in fixed position relative to the table for rotation therewith, a pinion gear journaled in the bearing means and enmeshed with said rack, an arm rigid with the pinion, a slit-opening finger projecting laterally from the arm, and means for placing an open carton onto the table in position for its slitted wall to be engaged adjacent the slit therein by said finger upon rotation of said pinion.

18. A machine for closing cartons of the type including a body having a slitted wall, a cover hinged to the body, and a locking tab hinged to the cover, said carton closing machine comprising a rotatably mounted table, rotating means therefor, a plurality of stationary circular cams mounted in axial alignment with the table, a plunger associated with each cam and mounted for rotation with the table and for reciprocation relative to the table and yieldably urged into operative engagement with its associated cam, a cover closing plate carried by one of said plungers, a rack connected to the other plunger for reciprocation therewith, a pinion in meshing engagement with the rack and rotatably mounted on the table for movement therewith and for rotation about its own axis relative to the table, an arm rigid with the pinion, a slit-opening and tab-guiding finger on the arm and means for placing an open carton onto the table in alignment with the cover closing plate and with the slit in its slitted wall in alignment with said finger, said cams being arranged to effect rotation of the pinion to advance the finger into engagement with the carton prior to movement of the cover closing plate to its fully advanced position.

19. A machine for closing cartons of the type including a body having a slitted front wall, a back wall, a cover hinged to the back wall and a locking tab hinged to the cover, said machine comprising a rotatably mounted table, rotating means therefor, a bracket rigid with the table, a slit-opening and tab-guiding finger supported by the bracket in position inclining downward and radially outward relatively to the table, means for placing an open carton onto the table with the slit in the slitted wall of the carton opposite said finger, means operative as the table turns for crowding the carton radially inward of the table to press the finger against the front wall of the carton adjacent and above the slit to open the slit and enter the lower end of the finger into the opened slit, a plunger mounted for rotation with the table and for reciprocation relative to the table, yieldable means urging the plunger upward, and a circular cam engaged by the plunger and mounted in fixed position thereabove to effect lowering the plunger while the slit-opening and tab-guiding finger is entered into the slit.

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