Jan. 3, 1967 R. K. GALLOWAY 3,295,294

CARTON HANDLING MACHINE

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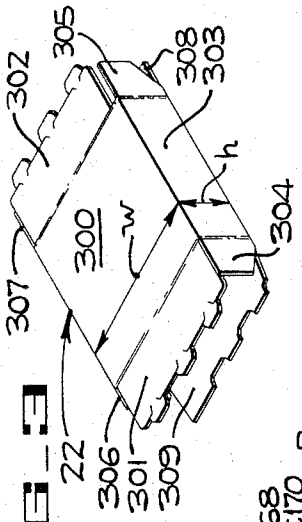


FIG_3

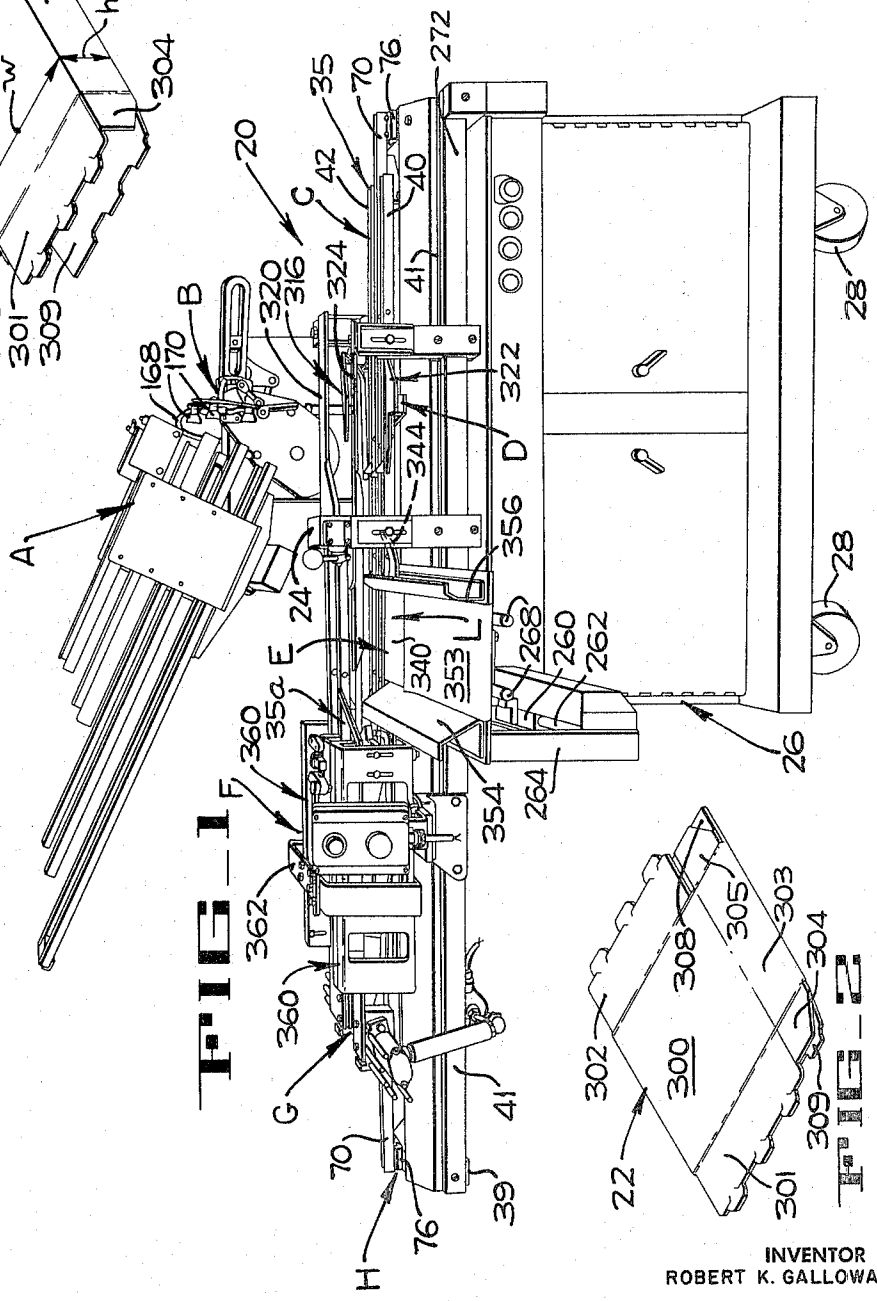


FIG_1

FIG_2

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CARTON HANDLING MACHINE

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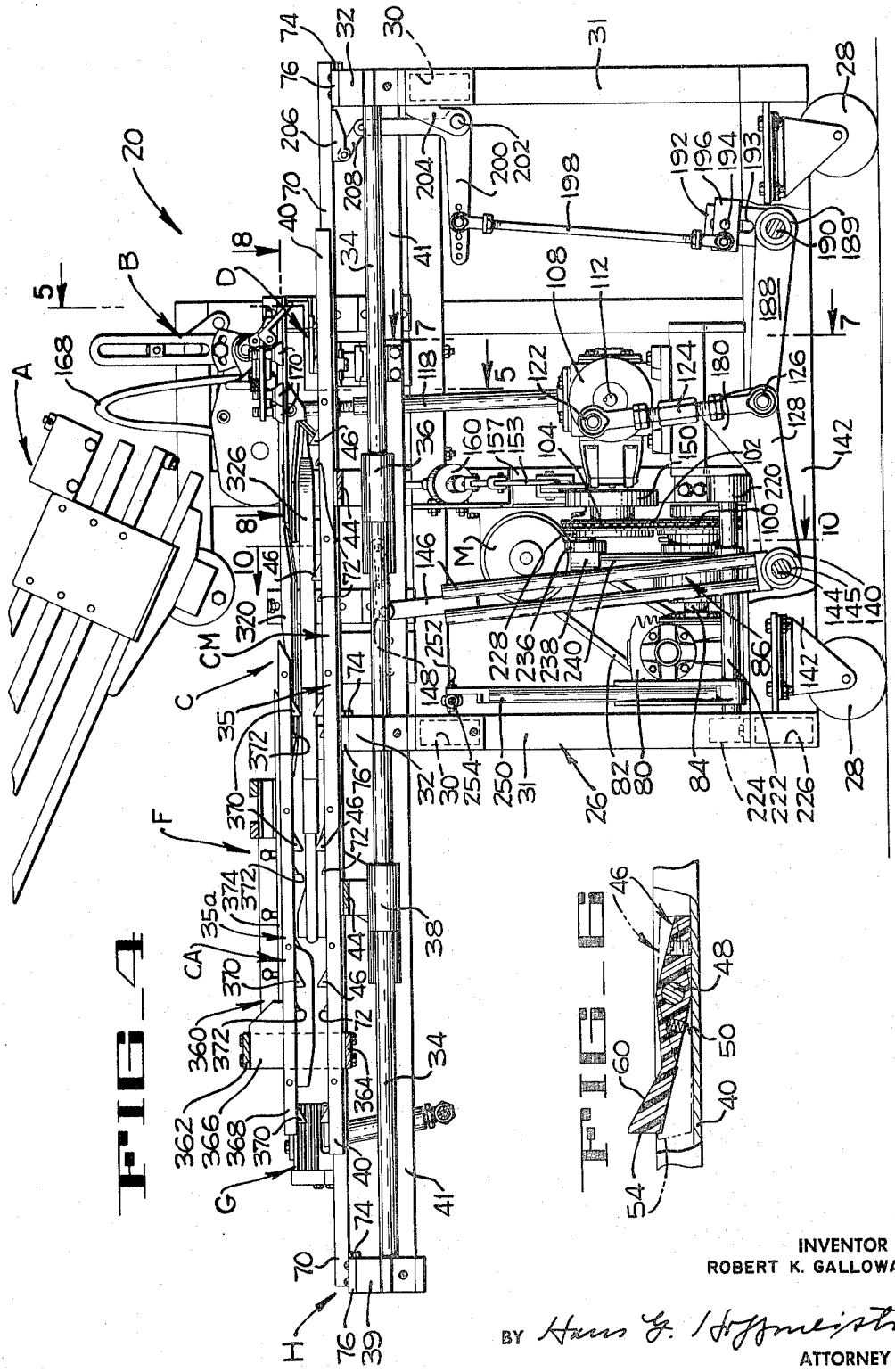


FIG. 4

FIG. 5

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CARTON HANDLING MACHINE

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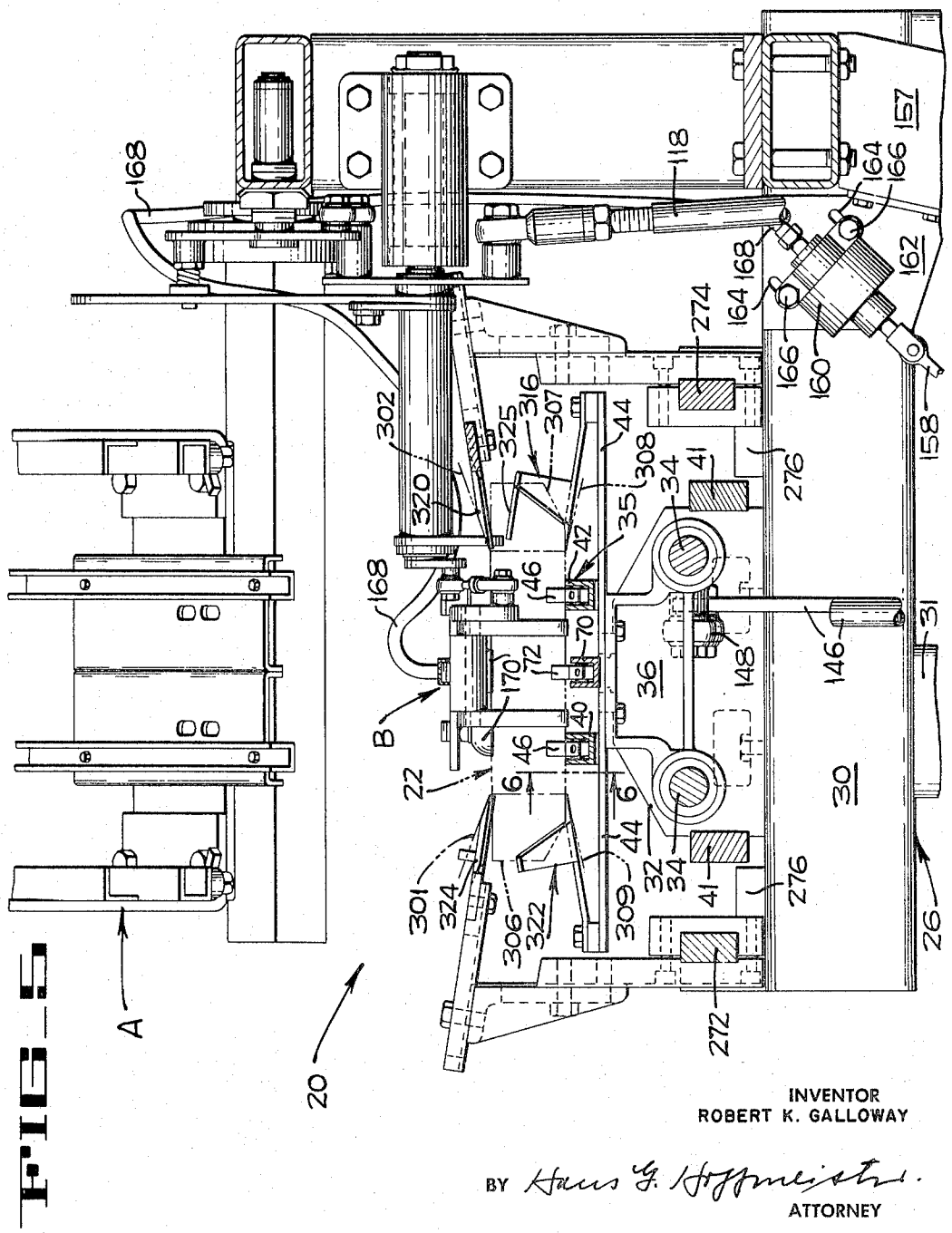


FIG. 5

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CARTON HANDLING MACHINE

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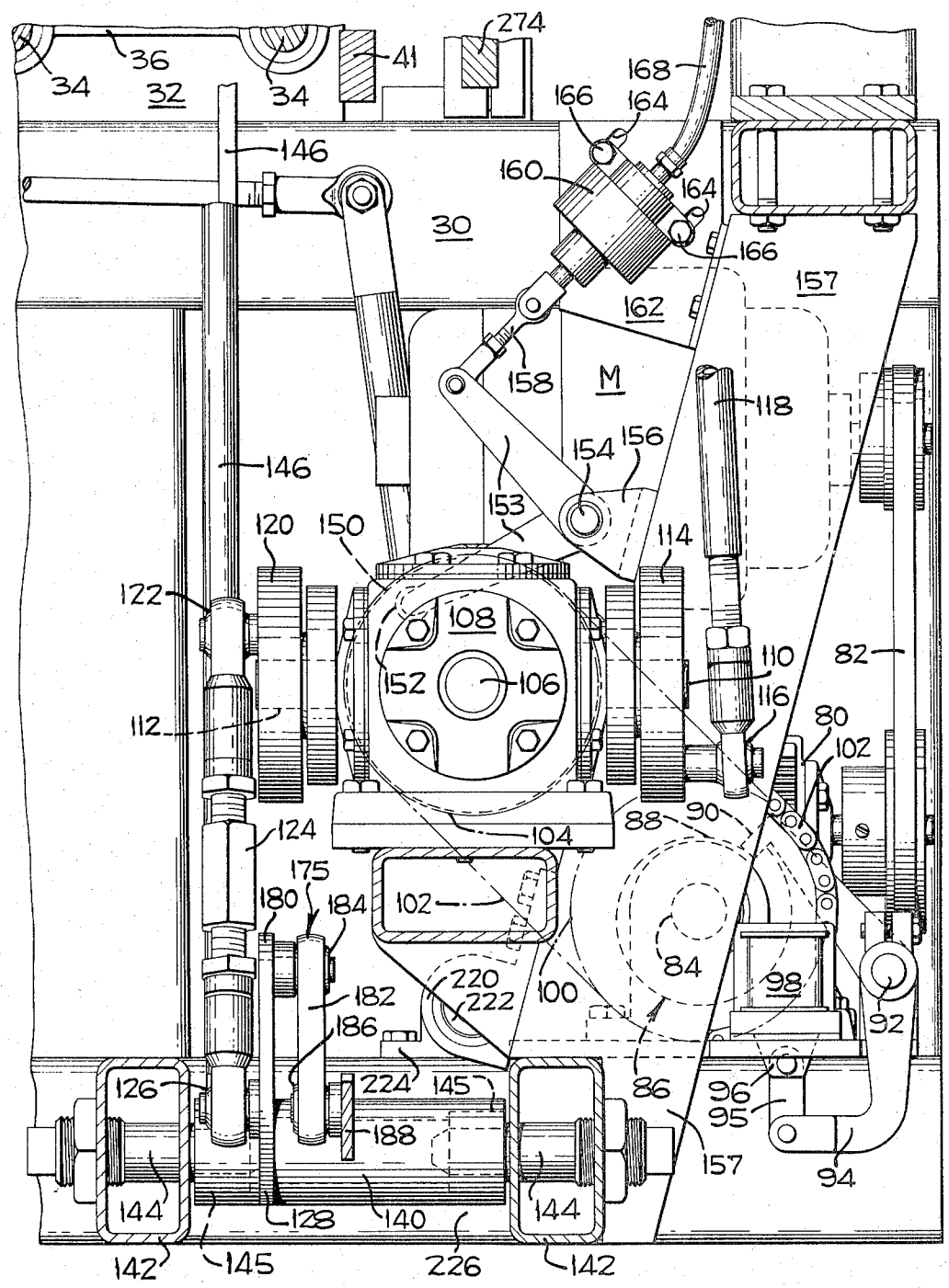


FIG_7

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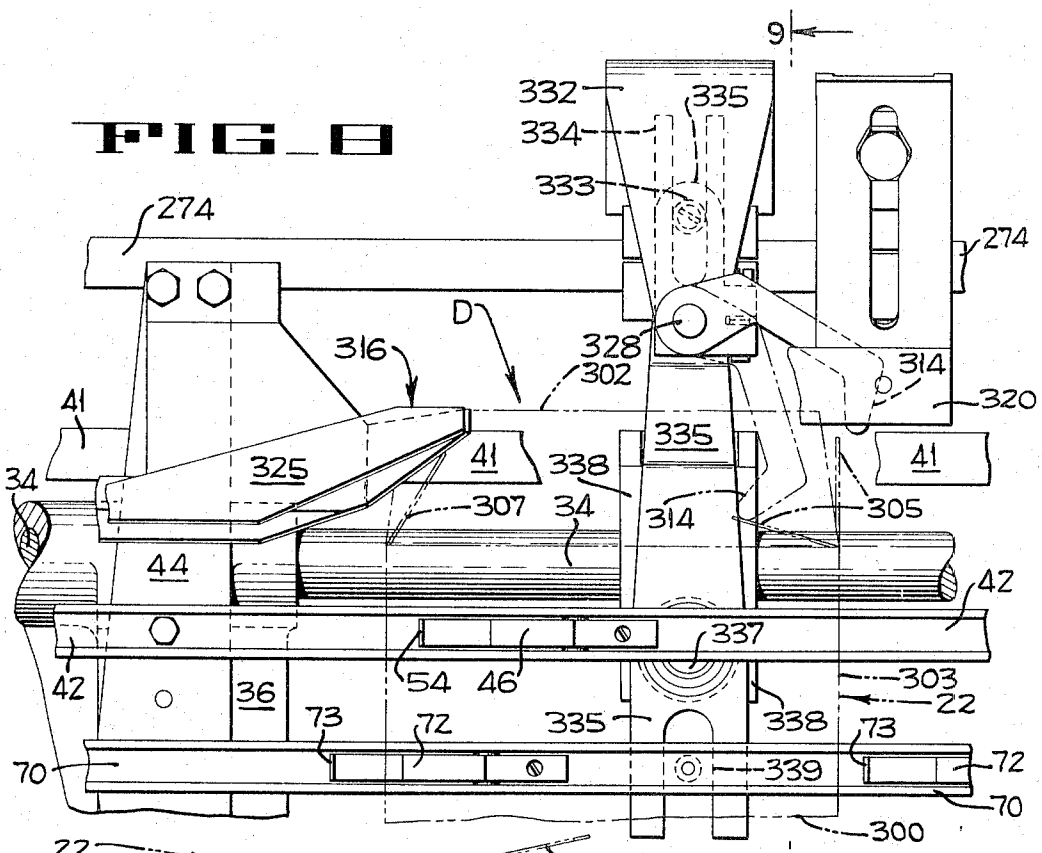
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CARTON HANDLING MACHINE

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FIG_8



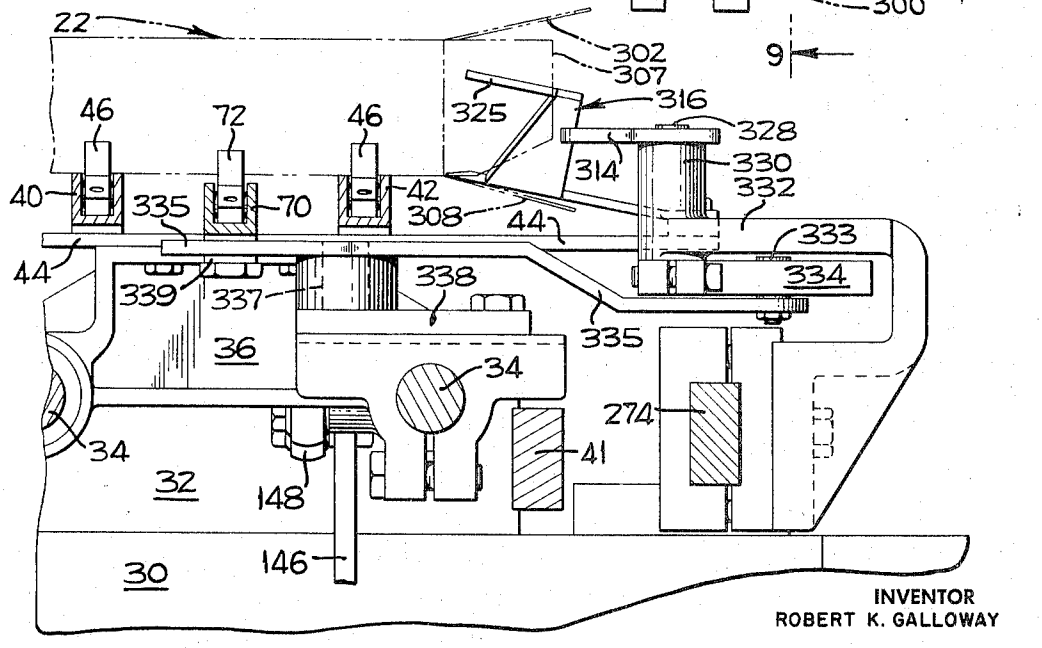


FIG_9

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CARTON HANDLING MACHINE

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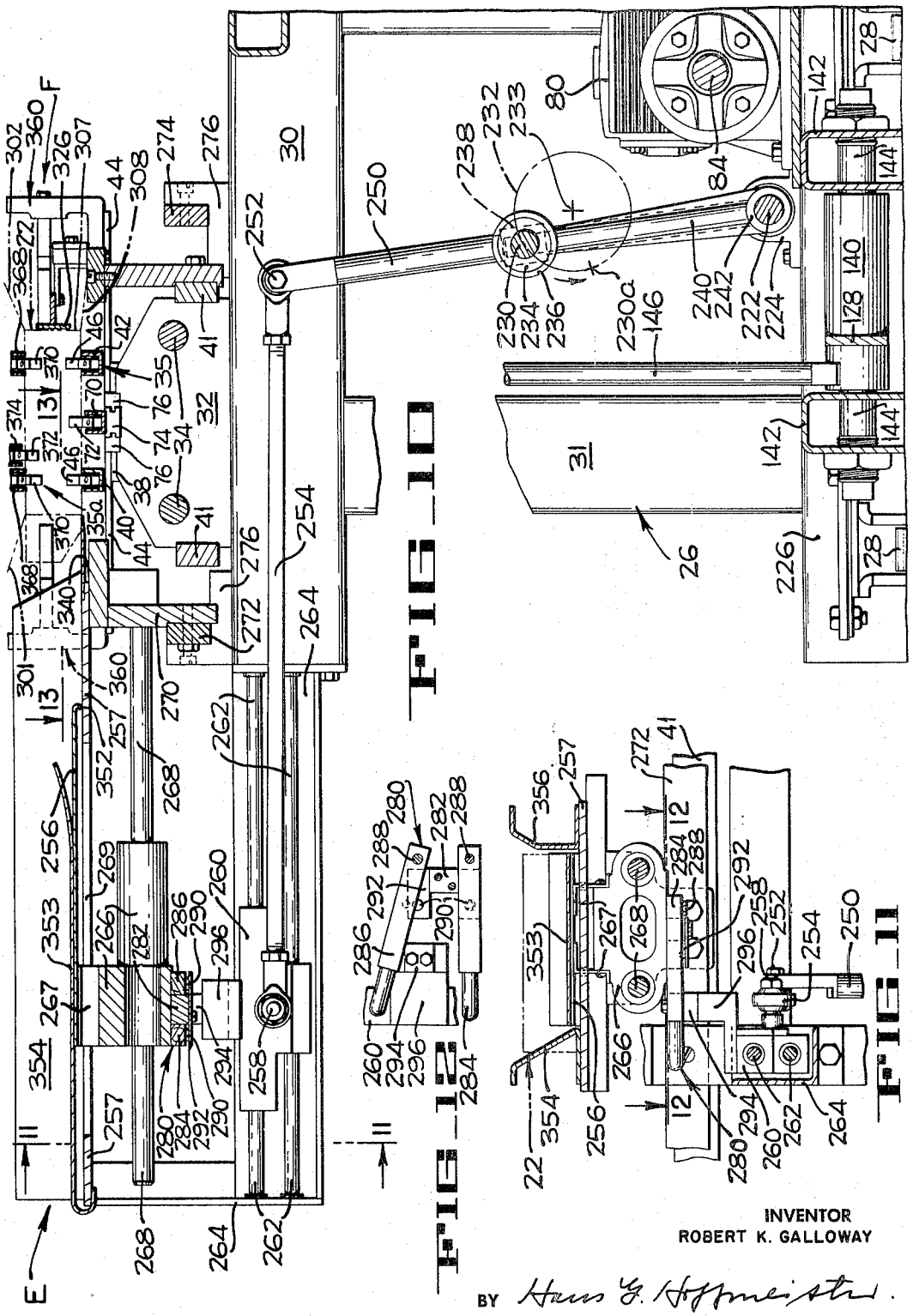


FIG. 10

FIG. 11

FIG. 12

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CARTON HANDLING MACHINE

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FIG_13

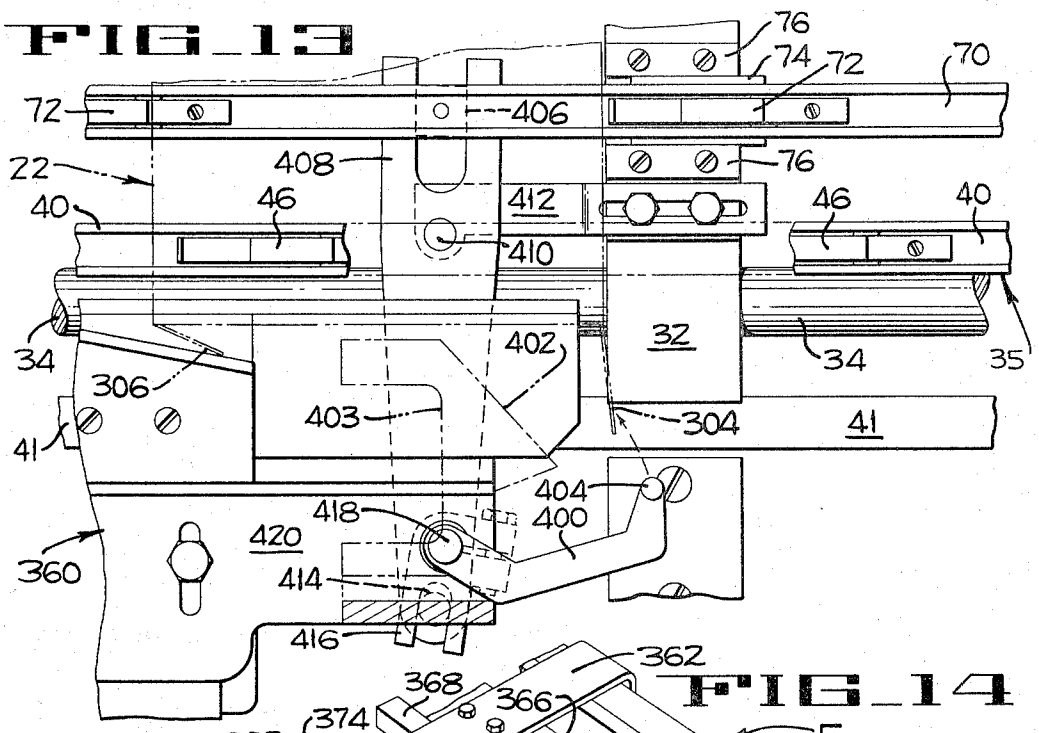
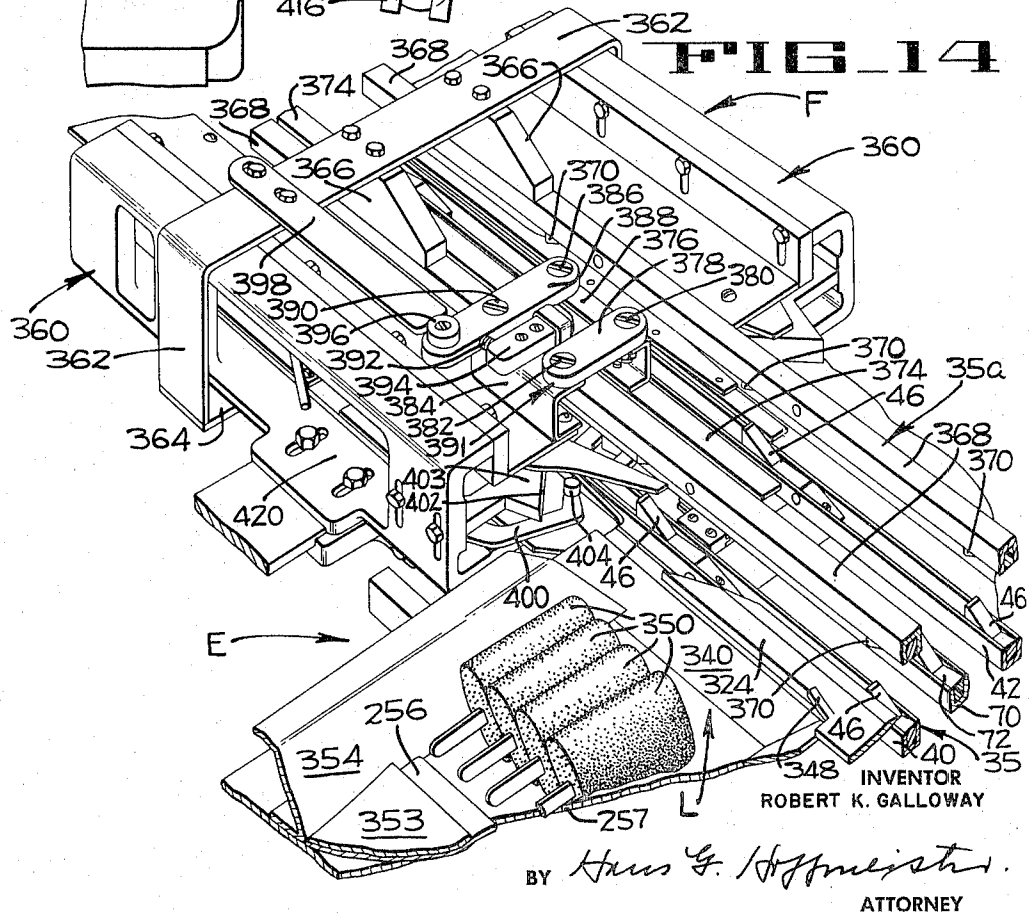


FIG_14



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CARTON HANDLING MACHINE

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FIG_15

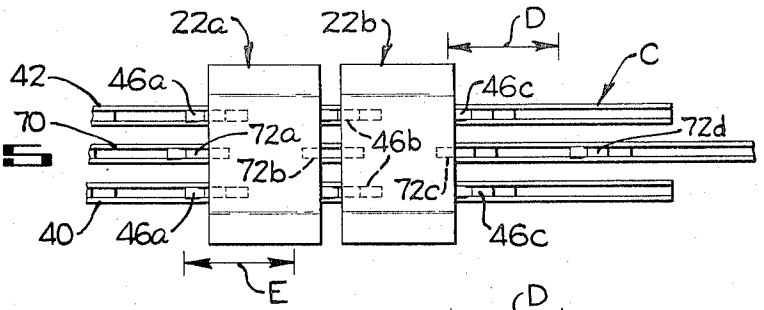


FIG_16

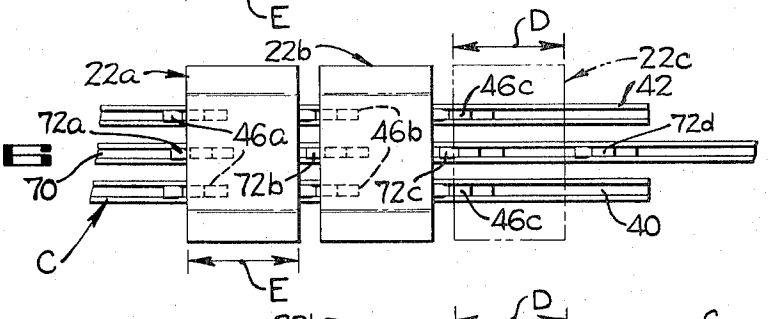


FIG_17

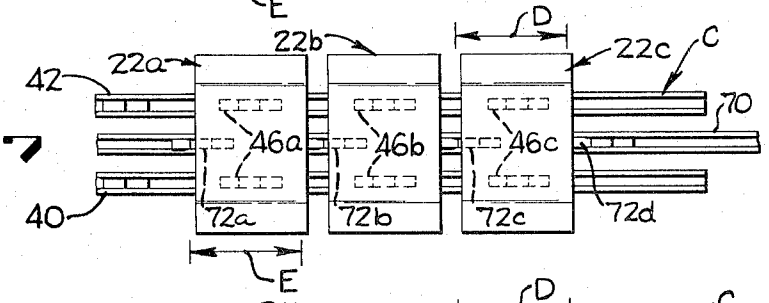


FIG_18

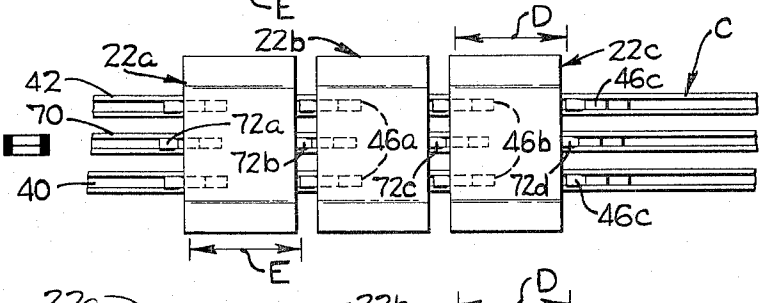
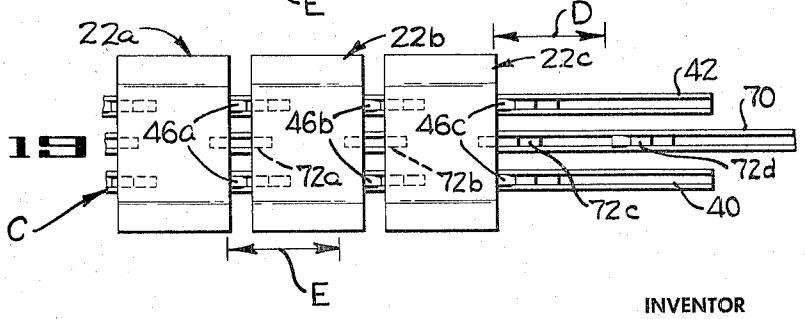


FIG_19



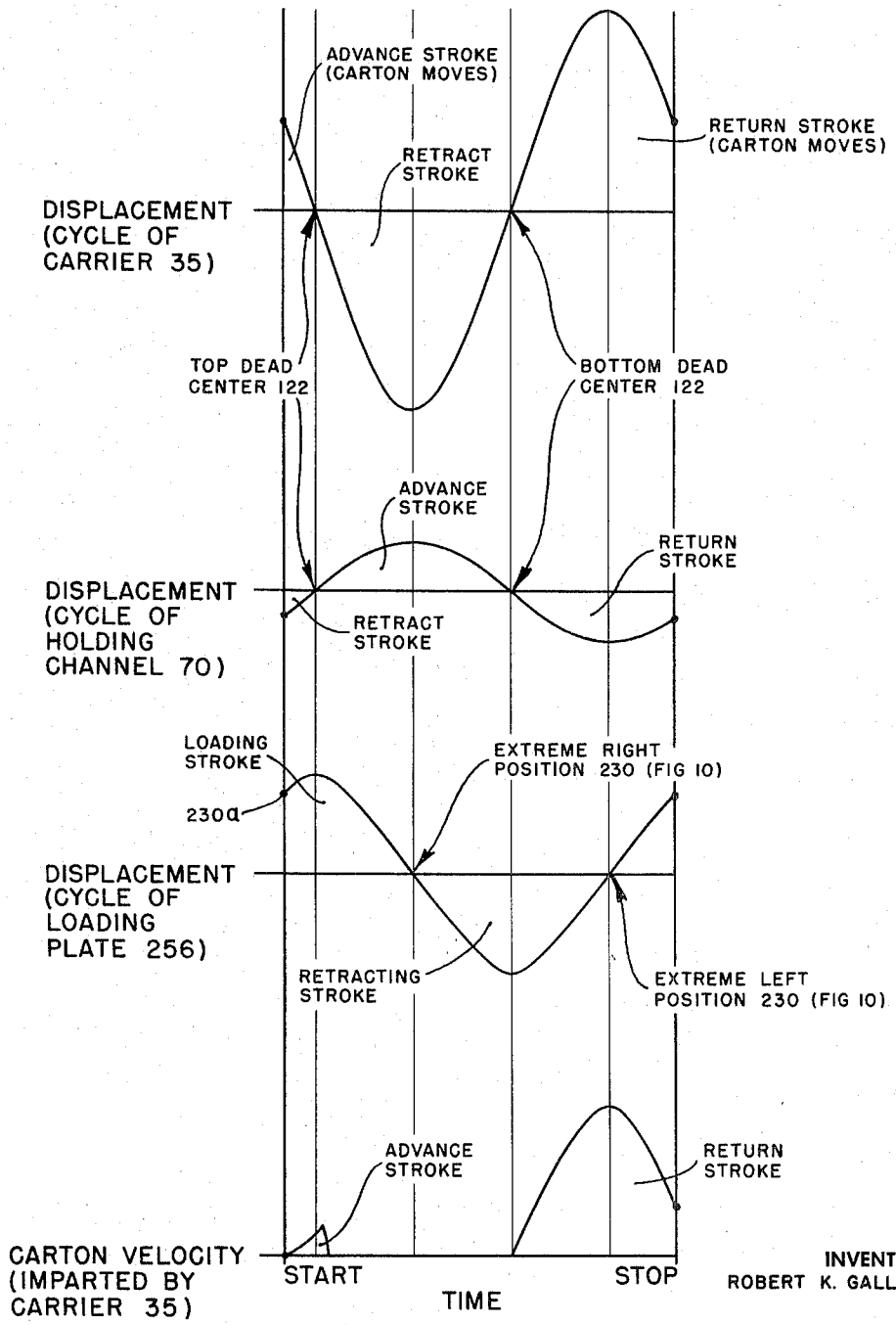
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FIG_20



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United States Patent Office 3,295,294 Patented Jan. 3, 1967

3,295,294

CARTON HANDLING MACHINE

Robert K. Galloway, Hoopeston, Ill., assignor to FMC Corporation, San Jose, Calif., a corporation of Delaware

Filed Aug. 29, 1963, Ser. No. 305,354
19 Claims. (Cl. 53—252)

The present invention pertains to a carton handling machine and more particularly to a machine including an apparatus for intermittently conveying a procession of cartons past a plurality of processing stations.

In carton handling machines of prior art, it has been known to convey cartons continuously from a feeding station past loading and folding stations to a discharge station, and to load the cartons mechanically while they continue to move. In motion carton machinery of this type requires delicate timing and a relatively great length to accomplish its various functions. In contrast, a machine that moves the cartons intermittently through the processing stations, stopping each carton briefly to allow it to be loaded at a stationary loading station, is not as sensitive to timing, and the same functions can be accomplished in machinery that is shorter than the in-motion machinery.

However, intermittent carton handling machines are subject to certain problems that must be overcome for optimum results. One of these problems is the manner in which the machine moves each carton and the product being loaded in the carton. Since the carton and product are intermittently moved and stopped, impacts must be minimized or avoided while maintaining relatively high velocities.

The carton conveying apparatus of the present invention overcomes the above described problem as well as other problems inherent in conventional roller-chain and belt conveyors that are subject to stretching and wear and require relatively frequent timing adjustments, replacement or repair. Furthermore, the conveying apparatus of the present invention does not pinch the cartons as is common on lugged chains at the discharge end portion of the conveying apparatus.

It is an object of the present invention to provide an apparatus for intermittently conveying cartons.

Another object is to provide an apparatus for loading cartons being conveyed along a predetermined path.

Another object is to provide an apparatus for intermittently conveying cartons while minimizing impacts on the cartons or their contents each time they are started in motion or stopped.

Another object is to provide an apparatus for moving cartons in stepped progression along a path so that during each step of the movement, the velocity of each carton is gradually increased and then decreased whereby abrupt starts and stops are minimized while relatively high average velocity is maintained.

Another object is to provide an intermittent carton conveying apparatus that is capable of discharging erected, filled, closed, and sealed cartons at speeds above one hundred cartons per minute.

Another object is to minimize the overall length of a carton handling machine.

Another object is to provide a carton handling machine that avoids the timing problems of an in-motion carton handling machine.

Another object is to provide a carton conveying apparatus that does not pinch the cartons nor stretch or wear in the manner of conventional chain and belt conveyors.

Another object of the invention is to provide a carton filling machine wherein an operator manually loads a carton-filling charge of articles in the machine and then initiates one cycle of operations in which a carton is automatically filled and other cartons in the machine are advanced toward the filling and other stations, whereby the speed of the machine is dependent upon the speed of the operator.

Another object is to provide improved carton conveying apparatus adapted to accurately index cartons sequentially through a plurality of container processing stations.

Other objects and advantages of the present invention will become apparent from the following description and from the accompanying drawings disclosing one embodiment of the invention, and in which:

FIGURE 1 is a perspective of the carton erecting, filling and closing machine of the present invention.

FIGURE 2 is a perspective of a collapsed carton blank.

FIGURE 3 is a perspective of a partially erected carton blank.

FIGURE 4 is an enlarged side elevation of the carton handling machine shown in FIGURE 1, and in which certain parts have been broken away or omitted to illustrate mechanism which would otherwise be concealed.

FIGURE 5 is an enlarged transverse vertical section taken along line 5—5 on FIGURE 4.

FIGURE 6 is an enlarged elevation, partly broken away, as seen from a position indicated by line 6—6 on FIGURE 5 and illustrates a typical conveyor lug.

FIGURE 7 is an enlarged transverse vertical section taken along line 7—7 on FIGURE 4 and particularly illustrates part of the drive train of the machine.

FIGURE 8 is an enlarged, horizontal and fragmentary plan as seen from a position indicated by line 8—8 on FIGURE 4, and shows a flap tucking mechanism for folding in one of the trailing vertical end flaps of each carton.

FIGURE 9 is a transverse vertical section taken along line 9—9 on FIGURE 8.

FIGURE 10 is an enlarged transverse vertical section taken along line 10—10 on FIGURE 4 and illustrates the loading station of the machine at which articles are automatically inserted into the cartons.

FIGURE 11 is a longitudinal vertical section taken along line 11—11 on FIGURE 10.

FIGURE 12 is a horizontal section taken along line 12—12 on FIGURE 11.

FIGURE 13 is a horizontal section, partly broken away, taken along line 13—13 on FIGURE 10 and illustrates a flap tucking mechanism, similar to the tucker shown in FIGURE 5, for folding in the other trailing vertical end flap of each carton.

FIGURE 14 is a perspective of the flap tucking mechanism shown in FIGURE 13, and of an auxiliary overhead carton drive mechanism which assists in pushing the cartons into and through the illustrated flap folding plows at the next downstream station.

FIGURES 15–19 are diagrammatic operational plans showing the sequence of certain operations performed in one operational cycle of the carton machine.

FIGURE 20 shows curves which are helpful in understanding the action of the subject machine.

In brief, the carton handling machine 20 (FIG. 1) is provided with a conventional carton magazine A which is adapted to hold a stack of unerected or collapsed cartons 22 (FIG. 2) resting on edge. A carton feed mechanism B (FIG. 1) grips the outermost carton 22 and simultaneously erects it to the condition shown in FIGURE 3 while it transports the carton onto a ratcheting carton conveyor C at a carton feed station D. The carton conveyor C intermittently advances the cartons to a loading position opposite a manually filled carton loading mechanism L at a carton loading station E. The carton conveyor C and the loading mechanism L form important parts of the present invention, as will appear later in this description.

At the loading station E, an operator manually assembles a carton-filling charge of articles and acuates an

electrical start switch 24. The switch effects loading of the articles into an erected carton 22 at the loading station and causes the conveyor C to advance all of the cartons 22 thereon to the next downstream stations. For a carton just filled at loading station E, the next downstream station is a carton folding station F comprising a pair of folding plows 360 that interengage the various locking tabs and slits of the carton; thereafter the cartons are squared-up by a carton squaring mechanism G integral with the plows. From a carton discharge station H, the filled and closed cartons are conveyed by other means, not shown, to further carton processing machinery or handling stations as may be required.

The carton feed mechanism B is disclosed in my copending U.S. patent application Serial No. 192,833 filed May 7, 1962, now Patent No. 3,156,167 for "Carton Handling Apparatus," and the folding plows at station F and carton squaring unit G are disclosed in my U.S. Patent No. 3,049,847, reference to both of which disclosures may be had for a more detailed description of these units beyond the general description necessary to disclose the present invention.

The carton machine 20 (FIG. 4) includes a frame 26 supported by casters 28 and fabricated of various tubular members including transverse tubes 30 atop vertical tubular members 31 at each end of the frame 26. The frame supports the magazine A, the feed mechanism B, the conveyor C, the loading mechanism L, the plows 360 and the squaring mechanism G. A stationary guide block 32 is mounted on each tube 30, through both of which blocks extends a pair of transversely spaced guide shafts 34 (FIG. 5). The shafts 34 overhang the forward end of the support frame 26 and are interconnected near their forward ends by a block 39 which is similar to the blocks 32. Rigidity is imparted to the shafts 34 by flat bars 41 (FIGS. 4 and 5) which are bolted to the sides of the blocks 32 and 39. It will be noted that the near bar 41 in FIGURE 4 and the loading mechanism L have been omitted to reveal structure which would otherwise be concealed.

The conveyor C includes a lower main unit CM (FIG. 4) and an upper auxiliary unit CA. The main unit is provided with a reciprocable main carrier 35, including front and rear bosses 36 and 38 slidably mounted on the shafts 34, and two longitudinally extending transversely spaced left and right carton support channels 40 and 42 (FIG. 5), both of which are secured to bars 44 that are individually mounted on and extend across the bosses 36 and 38. The main carrier 35 further includes a plurality of carrier lugs 46 pivotally mounted in the support channels 40 and 42 (FIGS. 5 and 6) in equally spaced relation therealong. Each lug 46 is mounted on a pivot pin 48 that extends through the upright flanges of the associated support channel and is preferably formed of a material characterized by a low coefficent of friction, such as nylon, Teflon or other plastic. A compression spring 50 (FIG. 6) projects downward from a recess, in the under surface of the lug and downstream of the pivot pin 48, and contacts the base of the support channel. Each lug is thus yieldably urged upward in a carton conveying position wherein its carton-engaging downstream end surface 54 is above the upper edge of its carton support channel and its rear end portion is abutting the base of the channel. When a lug 46 is depressed, it is positioned entirely below the upper edges of its associated channel, as is indicated by the phantom line position shown in FIG. 6. Each lug also has an inclined upper camming surface 60 that extends upstream from the end surface 54 of the lug; under certain operating conditions, the camming surface of each lug is engaged by a carton and cams the lug into its depressed position. It is to be noted that each lug has a corresponding transversely aligned lug on the other channel and that longitudinally adjacent lugs are spaced apart farther than the width *w* (FIG. 3) of an erected carton 22.

As shown in FIGURES 4 and 5, the main unit CM of the conveyor C also has a reciprocable U-shaped holding channel 70, positioned between and slightly below the carton support channels 40 and 42, and provided with a plurality of equi-spaced carton holding lugs 72. Adjacent holding lugs (FIG. 4) are spaced farther apart than the width *w* of an erected carton, each holding lug being positioned slightly in advance of a corresponding pair of transversely aligned carrier lugs 46 in the stopped position of the carrier 35, as shown in FIG. 4. Lugs 72 have forward carton-engaging end surfaces 73 (FIG. 8) and are otherwise identical to the carrier lugs 46. The end portions and mid-portion of the channel 70 (FIG. 4) are individually secured to front, intermediate and rear grooved blocks 74 (FIGS. 4 and 10) that are slidable a short distance longitudinally of the machine in tongued receiver blocks 76 which are in turn individually secured to the adjacent stationary blocks 32 and 39. It will be observed in FIG. 4 that the main conveyor unit CM extends nearly the full length of the machine and thus conveys cartons from the feeding station D to the discharge station H; the holding channel projects endwardly of the main conveyor unit, as will also be seen in FIG. 4.

For driving the feed mechanism B, the conveyor C and the loading mechanism I, an electric motor M (FIGS. 4 and 7) is mounted on the frame 26 and is continuously energized during operation of the machine 20. The motor M is connected to a speed reducer 80 by a V-belt 82, and the output shaft 84 of the speed reducer is coupled to an electrically-controlled single revolution clutch 86. The clutch 86 includes a shouldered clutch disc 88 (FIG. 7), and a clutch dog 90 is adapted to interrupt rotation of the clutch disc by engaging the shoulder of the disc.

The clutch dog 90 is secured to a shaft 92 which is rotated by a lever arm 94 secured to the shaft. The lever arm is also pivoted to an extension link 95 of the armature 96 of a solenoid 98. Solenoid 98 is momentarily energized to disengage the clutch dog from the clutch disc when the start switch 24 (FIG. 1) is actuated by the operator of the machine to initiate one revolution of the clutch disc 88; after completing its single revolution, it is stopped by the dog 90 and does not rotate again until the switch 24 is once again actuated.

Each time the clutch disc 88 is rotated for a single revolution, a driven sprocket 100 (shown by a pitch line in FIG. 7) integral with the clutch 86 is rotated. A chain 102 (also indicated by a pitch line), is trained around the sprocket 100 and around a similar sprocket 104 shown by a pitch line. Sprocket 104 is secured to the input shaft 106 (FIG. 7) of a gear type speed reducer 108.

Two oppositely projecting output shafts 110 and 112 (FIG. 7) are driven by the speed reducer 108. Both shafts rotate for one revolution when the speed reducer drive sprocket 104 rotates one revolution. The shaft 110 is connected to a driven disc 114 that is provided with an eccentrically positioned ball joint 116. The ball joint 116 is connected to an upwardly extending rod 118 that drives the carton feed mechanism B (FIG. 1).

The shaft 112 effects reciprocation of the main carrier 35 and holding channel 70 and is provided with a driven disc 120 (FIG. 7) that has an eccentrically mounted ball joint 122 secured thereto. The upper end portion of an adjustable upright link 124 is secured to the ball joint 122, and the lower end portion of the link is connected to a ball joint 126 which is secured to a lever 128. Lever 128 (FIG. 7) is secured to a tubular rockshaft 140 which is rotatably mounted between two longitudinal frame tubes 142 by adjustable cone-head studs 144 that are threaded into the tubes 142 and project into bearings 145. The lower end of a fabricated lever arm 146 (FIGS. 4 and 7) is welded to the rockshaft 140, and this arm is pivotally connected to the rear sliding boss 36 by an adjustable link 148.

Before continuing with the description of the drive train, it should be mentioned that means for controlling the vacuum source required by the carton erecting mechanism B (FIGS. 4, 5 and 7) includes a face cam **150** (FIGS. 4 and 7) which is mounted on the driven or input shaft **106** of the speed reducer **108**. A cam roller **152** (FIG. 7) is disposed within a camming groove, not shown, in cam **150** and is rotatably mounted on one free end of a bellcrank **153**. Bellcrank **153** is mounted on a pivot stud **154** which is supported by a fixed bracket **156** that is bolted to a diagonal frame tube **157**. The other free end of the bellcrank **153** is pivoted to a link **158** that is in turn connected to an air valve **160**. A fixed bracket **162** adjustably supports the valve **160** by means of slots **164** that receive the valve mounting bolts **165**. Conventional means, not shown, are provided to adjust the rotative position of the face cam **150** on the shaft **106** for purposes of timing, and a vacuum pump, not shown, is connected to the valve **160**. A hose **168** is connected to the valve **160** and communicates with a plurality of vacuum cups **170** (FIG. 1) of the carton erecting mechanism B in order to periodically evacuate the vacuum cups as required to transfer one of the carbon blanks **22** from the magazine A onto the conveyor C.

Returning now to a description of how the holding channel **70** is reciprocated, a linkage **175** is connected to an enlarged free end portion **180** of the lever **128**. The linkage includes a short link **182** that is connected to a ball joint **184** on the end portion **180**, and to a ball joint **186** which is secured to the free end of a lever **188**. Lever **188** is welded to a rockshaft **189** (FIG. 4) which is similar to the rockshaft **140** already described, and which is mounted between the same two frame tubes **142** by similar bearing means including a bearing support stud **190**.

An upstanding plate **192** (FIG. 4) is welded to the rockshaft **189** and is provided with a slot **193** which receives a bolt **194** that adjustably clamps a pivot block **196** to the plate **192**. A linearly adjustable actuating rod **198** is pivoted to the block **196** and to a bellcrank **200**, the bellcrank being mounted upon a pivot stud **202** which is held in a bifurcated frame bracket **204** and underlies the channel **70**. The holding channel **70** is provided with a depending block **206** which is pivotally connected to the bellcrank by a short connecting link **208**.

With reference to FIGS. 4 and 15–20, each time the shaft **112** and thus the ball joint **122** rotates one revolution, the main carrier **35** and holding channel **70** are reciprocated through one cycle. In FIG. 4, the ball joint **122**, the main carrier and the holding channel are in their stopped positions (that is, the one revolution clutch **86** is held against movement by the dog **90**). The carrier lugs **46***a*, *b*, *c* and the holding lugs **72***a*, *b*, *c*, and *d* in FIG. 15 are also in their stopped positions. When the operator actuates the switch **24**, the ball joint rotates in a clockwise direction (FIG. 4). As the ball joint travels from its stopped position to top dead center, the main carrier moves forwardly in an advance stroke to a forward position (FIG. 16) and the holding channel moves rearwardly in its retract stroke to its rear position; as the ball joint travels from top dead center to bottom dead center, the main carrier moves rearwardly in a retract stroke to a rear position (FIG. 18) and the holding channel moves forwardly in its advance stroke to its forward position (FIG. 18); and as the ball joint travels from bottom dead center to its stopped position (where it stops moving because of the clutch **86** and dog **90**), the main carrier moves forwardly in a return stroke to its stopped position (FIGS. 19 and 15) and the holding channel moves rearwardly in a return stroke to its stopped position (FIGS. 19 and 15). In working embodiments of the subject invention, the advance, retract and return strokes of the main carrier are respectively about 1½, 8 and 6½ inches and the retract, advance and return strokes of the holding channel are respectively about 3/16, ¾ and 9/16 of an inch, and the cartons **22** used are about 6¾ inches wide (dimension *w*) when erected; these dimensions are given by way of example only since the principles of the invention are applicable to various other dimensions, as will be evident.

It should be again noted that the movements of the carton support channels **40** and **42** are in an opposite direction to the movement of the central channel **70**, so that when the carrier lugs **46** move forwardly or downstream, the carton holding lugs **72** move rearwardly or upstream, and vice versa.

It will be understood, therefore, that an erected carton **22** placed on the support channels **40** and **42** at the feeding station D (represented by carton **22***c* in FIG. 16) is moved in increments lengthwise of the conveyor C into the loading station E and thence through the folding and squaring stations F and G to the discharge station H. More specifically, each carton is placed on the support channels in front of the rearwardmost holding lug **72***d* during the advance stroke of the main carrier **35**; and it is held against rearward movement, and in fact is stepped forward slightly to the position of carton **22***c* in FIG. 18 by the rearwardmost lug **72***d*, on the retract stroke of the main carrier during which time the main carrier lugs **46***c* slide under carton **22***c* and into their rear positions behind this cartion. On the return stroke of the main carrier, this carton is stepped forward again by the carrier lugs into the position illustrated by carton **22***c* in FIG. 19. The carton remains in this latter position until switch **24** is again actuated to cycle the carrier and channel whereupon the carton moves to the position of carton **22***b* in FIG. 19 (or carton **22***a* in FIG. 15) in three steps effected respectively by the advance strokes of the main carrier lugs and holding lugs and by the return stroke of the carrier lugs. On the third cycle, the carton is moved into the loading station during the advance stroke of the carrier (visualized by the relative positions of carton **22***a* in FIGS. 15 and 16); it remains substantially in the loading station, where it is loaded in a manner to be described, during the retract stroke of the main carrier and is thereafter moved forwardly out of the loading station (as indicated in FIG. 19) during the return stroke of the main carrier on the third cycle. Thus, each carton moves in six forward steps from the feeding station to a position past the loading station during three cycles of the main carrier. Of course, after the first three cycles, cartons are delivered to the loading station each time the switch is actuated assuming that cartons continue to be delivered to the feeding station. The loaded cartons are then moved by the carrier through the plow **360** but before describing such action, attention is directed to the loading mechanism L.

The loading mechanism L (FIG. 7) includes a bearing **220** bolted to the tube **157** and supporting one end of a rockshaft **222**. The other end portion of the rockshaft **222** is mounted in a bearing **224** (FIG. 4) that is bolted atop a transverse frame tube **226**. As shown in FIGURE 4, the end portion of the input shaft **106** of the speed reducer **108** is provided with a driven disc **228** adjacent the sprocket **104** over which the chain **102** is trained. The disc **228** is provided with a projecting stud **230** (FIG. 10) which is carried by the disc **228** in a counterclockwise direction on a circular path **232** about the axis **233** of shaft **106** as the ball joint **122** (FIG. 4) rotates clockwise.

Mounted on the outer end of the stud **230** (FIG. 10) is a circular bearing **234** which is nested within a cup **236**. The cup is secured to an apertured block **238** that is slidable upon a round shaft **240** which has an integral hub **242** keyed onto the rockshaft **222**. The rockshaft **222** is thus oscillated back and forth when the drive disc **228** is rotated. The timing of the rockshaft **222** relative to the reciprocation of the carton support channels **40** and **42** is such that after the carrier lugs **46** have moved a carton into the loading station E, the rockshaft **222** (FIG.

10) rotates to its clockwise limit of movement to effect the automatic loading of articles into the carton in a manner to be described.

An elongate upright rocker arm 250 (FIGS. 4 and 10) is keyed to the rockshaft 222 and has an upper end portion pivoted at 252 to the inner end portion of a generally horizontal, transversely extending shaft 254. The shaft 254 effects reciprocatory movement of a superposed loading plate (FIGS. 10 and 11) in response to the swinging movement of the rocker arm 250. Loading plate 256 is aligned with the loading station E (FIG. 1) and is adapted to thrust a manually assembled charge of articles 350 (FIG. 14) into the erected carton 22 that is momentarily at rest in the loading station where it is in alignment with the plate. The loading plate 256 is slidable upon the upper surface of a stationary plate 257.

The outer end portion of the shaft 254 (FIGS. 10 and 11) is provided with a pivotal connection at 258 to a lower slidable boss 260 which is mounted for reciprocatory movement on two fixed parallel guide rods 262. The guide rods 262 are supported by a bracket 264 that is bolted to the frame 26 and projects outward therefrom adjacent to the downstream end of the loading station E, as best shown in FIGURES 1 and 10.

Normally in a predetermined position above the slidable boss 260 (FIGS. 10–11) is a similar boss 266 which is connected to the loading plate 256 by two angle clips 267, that extend through slots 269 in the plate 257, and is slidably mounted upon two parallel shafts 268 that project laterally outward from an integral base plate 270 (FIG. 10). The base plate 270 is bolted to a longitudinal support rail 272 extending along the left side of the machine, as viewed in FIG. 10. A similar rail 274 (FIGS. 5 and 10) extends along the right side of the machine. The rails 272 and 274 are supported by a plurality of angle brackets 276 which are bolted to the transverse frame tubes 30.

A disengageable drive connection 280 (FIGS. 10–12) interconnects the slidable bosses 260 and 266 so that in the event of a malfunction that tends to jam the loading plate 256, the drive connection 280 is disengaged. The drive connection comprises a block 282 which depends from the upper slide 266 and which is normally engaged with pivotally mounted release bars 284 and 286. Each release bar is mounted on an associated pivot screw 288 that is threaded into the underside of the slide 266. The release bars 284 and 286 are normally retained in parallelism by detent projections 290 that are fixed on a flat leaf spring 292. The spring 292 is secured to the bottom of the block 282 and each detent is adapted to seat within a mating depression, not shown, in the corresponding release bar 284 or 286.

The free end portions of the release bars 284 and 286, when the bars are parallel, engage the leading and trailing vertical surfaces of a block 294 which, by means of an angle bracket 296, is secured to the lower slide 260. If a jam occurs that interferes with the free sliding movement of the upper boss 266, the release bar 284 or 286 (FIG. 12), depending upon the direction in which the lower boss 260 happens to be moving, will be forced out of engagement with the detent 290 in the manner shown for the release bar 286. If the jam is such that the upper slide 266 will not move in the other direction, the release bar 284 will also be pivoted aside. Accordingly, no motion of the upper boss 266 can occur until the jam is corrected and the release bars 284 and 286 are returned to their former condition of parallelism in engagement with the block 294.

It will be helpful, in describing the action of the machine on the cartons 22, to further identify the cartons. Thus, with reference to FIGURES 2 and 3 each erected carton 22 includes a top panel 300 with laterally projecting left and right top end flaps 301 and 302. The carton 22 has a rear or trailing panel 303 having left and right end flaps 304 and 305 and a front or leading panel, not shown, which is provided with left and right end flaps 306 and 307. It is also to be noted that the bottom panel of the carton is provided with a left end flap 309.

During the carton loading operation at the loading station E, the leading and trailing end flaps 307 and 305, respectively, at the right end of the carton are in a folded inward condition while the top end flap 302 and a corresponding bottom end flap 308 remain unfolded. At the time the rearmost carton holding lug 72 (FIG. 8) moves forward into contact with the rear panel 303 of a carton 22 thereby to move it out of the feeding station D, a pivotally mounted tucking shoe 314 swings downstream into contact with the rear end flap 305 and folds it into closed position. Also, during the retract stroke of the carrier lugs 46, a plow 316 moves rearward with the lugs 46 and into contact with both the lower end flap 308 (FIG. 9) and the front end flap 307 thereby closing the front end flap 307 and depressing the lower end flap 308, as illustrated in FIG. 10. The upper end flap 302, beginning at the time the carton feed mechanism B deposits the erected carton on the carton support channels 40 and 42, is supported upon a fixed rail 320 (FIGS. 1 and 5). Both the movable plow 316 and the rail 320 have counterparts 322 and 324, respectively, at the left side of the machine, as shown in FIGURE 5. However, whereas the plow 316 is provided with an upper rail 325 that strikes the front end flap 307 to accomplish the described folding of the flap and to retain both front and rear flaps 307 and 305 folded in against the carton, the plow 322 is for the sole purpose of camming down the adjacent bottom flap 309 (FIG. 5).

The movable plows 316 and 322 (FIGS. 5, 8 and 9) are mounted on the bar 44 of the carrier 35 and reciprocate therewith adjacent to the feeding station D. Furthermore, the rail 320, as best shown in FIGURE 4, extends forward to the folding plow 360 so that the top right end flap 302 of each carton (FIG. 9) is held up until the carton enters the plow 360. The front and rear right end flaps 307 and 305, after being folded into closed positions by the plow 316 and the tucking shoe 314 and held there by the rail 325 as described, are maintained in such positions downstream of the rail 325 by a fixed rail 326 (FIGS. 4 and 10) which extends along the right side of the machine from within the plow 316 into the plow 360.

The tucking shoe 314 (FIGS. 8 and 9) is secured to a vertical pivot stud 328 that projects through a hub 330 of a mounting bracket 332 which is adjustably clamped on the rail 274. A bifurcated arm 334 is secured to the lower end of the stud 328 and embraces a roller 333. Roller 333 is mounted on one end of a lever 335 that is pivotally mounted intermediate its ends on a shaft 337, the shaft being supported by a fixed bracket 338 which is adjustably clamped on the right hand guide shaft 34.

The other end of the lever 335 is bifurcated and straddles a block 339, preferably of nylon, that is pivoted to and depends from the holding channel 70. Since the channel 70 is positively driven and is coupled as described to the tucking shoe 314, forward movement of the channel 70 causes the tucking shoe 314 to pivot in a clockwise direction (FIG. 8) whereby the rear end flap 305 is folded into closed position in the manner indicated by the phantom line position of the shoe 314 (FIG. 8).

As the cartons 22 advance from the carton feed station D (FIG. 8), the bottom left end flap 309 (FIG. 3) moves beyond the forward end of the movable plow 322 (FIGS. 1 and 5) and slides under a guide plate 340 (FIGS. 1 and 10). The plate 340 is flush with the inner end portion of the stationary plate 257, which supports the loading plate 256, and has an upturned rear end portion 344 (FIG. 1) for guiding the lower end flap 309 thereunder.

The upper end flap 301 (FIG. 3) is supported by the rail 324 (FIGS. 1 and 14) immediately upon being de-

posited upon the carton support rails 40 and 42 since the rail 324 extends from the carton feed station D to the carton filling station E. The lower end flap 309 merely flexes aside and snaps in place under the rail 324 during depositing of the carton on the support rails. Similarly, the end flap 308 at the other end of the carton flexes and snaps in under the rail 320. As shown in FIGURE 14, the upper end flap 301 rides up over an upturned tab 348 on the rail 342 as it approaches the loading station E, whereby the flap 301 is lifted away from the entrance throat of the carton for the loading operation. The adjacent front and rear end flaps 306 and 304, respectively, remain substantially coplanar with their associated front and rear panels due to the inherent resiliency of the carton.

As indicated by the phantom outline of the carton 22 (FIG. 11), the carton is wider than the loading plate 256 and is slightly misaligned therewith in the loading position. Such misalignment accommodates certain articles, such as frozen confections 350 of the type having integral handles; machines embodying the subject invention are not limited to use with frozen confections, as will be evident. For example, however, one carton-filling charge comprising six frozen confections (FIG. 14) is manually assembled on edge upon the support plate 257 (FIG. 10), the loading plate 256 being withdrawn to a position under the upturned end of a stationary shield 353 before a machine cycle is started. Due to the instability of the confections 350 (FIG. 14), they tend to tilt sidewise. Accordingly, a tilted sidewall 354 is provided at one side of the loading plate 256 to support the assembled group of confections between the wall 354 and a similar wall 356 at the other side of the loading plate. Subsequently, after one cycle has been initiated by depressing the start button 24 (FIG. 1), the loading plate 256 (FIG. 10) advances toward the conveyor C, as an open carton approaches its loading position. The carton arrives at the loading station in time to receive the charge of confections which are pushed entirely within the carton by the end portion 352 of the loading plate 256 during the retract stroke of the main carrier 35.

It is to be noted that the driving arm 250 (FIG. 10) for the loading plate 256 will, at the beginning of the loading stroke, have its driving stud 230 positioned on an axis indicated by the cross 230*a*. As shown in FIG. 10, the stud 230 is just completing its cycle and is moving counterclockwise toward the position 230*a*. In other words, when the stud 230 is at position 230*a* it is at its rest or stop position corresponding to the position of the ball joint 122 illustrated in FIG. 4. As the stud is moved counterclockwise about the axis 233 from stop position 230*a*, the loading plate 256 and thus its charge of confections 350 gradually increase in velocity, as the stud 230 approaches bottom dead center and then gradually decrease in velocity as the stud moves away from bottom dead center. It is thus evident that the more or less fragile confections are not forcibly struck by the loading plate, are not violently thrust against the rail 326 (FIG. 10) that abuts the partially closed right end of the carton 22, and yet are rapidly moved into the carton.

The loaded cartons 22, which are conveyed downstream past the loading station E (FIG. 14) by the main carrier 35, pass under an upper auxiliary carrier 35*a* and holding channel 374 which are part of the conveyor C. The auxiliary carrier and channel have carrier holding lugs 372 which assure positive advance of the cartons through the pair of folding plows 360 which straddle the conveyor C at the carton folding station F. The auxiliary carrier includes an inverted U-shaped strap 362 (FIGS. 4 and 14) positioned over the folding plows 360 and connected to a bar 364 which is bolted to the undersurfaces of the carton support channels 40 and 42, as shown in FIGURE 4 for the support channel 40. The straps 362 and 364 are thus reciprocated in synchronism with the support channels as they convey the cartons through the various stations D, E, F and G along the length of the conveyor C.

The auxiliary carrier 35*a* also includes a mounting block 366 bolted to the underside of the strap 362 in vertical alignment with each of the carton support channels 40 and 42, each block 366 having an upper inverted lug mounting channel 368 secured thereto. Four upper carrier lugs 370 (FIG. 4) are mounted in each of the channels 368 in positions vertically aligned with the lower carrier lugs 46. The lugs 370 have the same shape and are mounted in the same manner shown in FIGURE 6 for the lugs 46, and the distance between the channels 40 or 42 and the corresponding channel 368 is slightly greater than the height *h* of the cartons whereby only the upper lugs 370 engage the upper portions of the rear panels 303 of the cartons 22. It will be understood that the auxiliary carrier reciprocates with the main carrier 35 and has the same advance, retract and return strokes as the main carrier.

Three upper holding lugs 372 (FIG. 4) are mounted in the inverted channel 374 (FIG. 14) which has a channel bracket 376 secured thereto near the inlet ends of the plows 360. A link 378 is pivoted at 380 to the upstream end portion of the upper flange of bracket 376 and at 382 to the upper flange of a similar bracket 384 which is fixed to the left-hand plow 360. The other end portion of bracket 376 is pivoted at 386 to a link 388 which, in turn, is pivoted at 390 to the bracket 384. Links 378 and 388 and brackets 376 and 384 form a parallelogram linkage 391 for the upper holding channel 374, the channel being positively driven in a downstream direction against the force of a compression spring 392 which has end portions mounted in recesses, not shown, in a block 394 rigidly fastened to the bracket 384 and in the upstream edge of the link 388. The link 388 has a free end portion on which is mounted an abutment roller 396 that lies in the path of a striker bar 398 bolted on top of the strap 362. When the main and auxiliary carriers 35 and 35*a* move forwardly in their advance stroke, the striker bar moves away from the roller 396 whereupon the compression spring 392 urges the bracket 376 and the upper holding channel rearwardly; thus, the upper holding channel and lugs experience a retract stroke similar to and at the same time as the retract stroke of the lower holding channel 70 and lugs 72. When the main and auxiliary carriers travel rearwardly in the retract strokes thereof, the striker bar engages the roller 396, compressing the spring 392 and moving the bracket 376 and upper holding channel forwardly in an advance stroke which is comparable to the advance stroke of the lower holding channel 70. Finally, during the return stroke of the carriers, the striker bar once again moves forwardly allowing the compression spring to move the upper holding channel rearwardly in its return stroke to the stop position. It will be understood, therefore, that the upper carrier and holding channels operate just like the lower carrier and holding channels and in synchronism therewith. That is, when the cartons are moved under the upper carrier, vertically aligned pairs of upper and lower carrier lugs 370 and 46 simultaneously engage the rear panel 303 of each carton during the advance stroke of the carrier; further, during the retract stroke of the carriers, vertically aligned pairs of upper and lower holding lugs 372 and 72 simultaneously engage the rear panel 303 of each carton and thereby resist rearward movement of the cartons on the conveyor C. The upper and lower carriers and holding lugs thus function together to ensure positive advance of the cartons through the folding plows 360.

A flap tucking arm 400 (FIG. 14) is mounted between the loading plate 256 and the plow 360 at the left hand side of the machine for folding the rear left end flap 304 (FIG. 3) forwardly, or downstream, into closed position before this flap enters the plow. The left front end flap 306, upon entering the plow 360, strikes a fixed cam-

ming surface 402 (FIGS. 13 and 14) of a block 403 which folds the flap of each advancing carton rearwardly into closed position.

The rear left end flap 304 of a filled carton 22 (in phantom lines in FIGURE 13), after the carrier lugs 46 have completed their advance stroke, will be positioned slightly downstream of a flap-engaging peg 404 on the free end of the tucking arm 400. As the lugs 46 reverse direction for the retract stroke, the carton holding lugs 72 and channel 70 move downstream. This downstream movement of the channel 70 is transmitted to the flap tucking arm 400 to cause the peg 404 to rapidly fold the flap 304 toward the carton body. This motion is transmitted as follows: A block 406 (FIG. 13), prefereably of nylon, is pivoted to the underside of the lower holding channel 70 and is engaged by the bifurcated end of a lever 40. A pivot pin 410 mounts the lever 408 to an arm 412 that is adjustably bolted to the forward guide blocks 32 (FIGS. 4, 5, 13). The other end of lever 408 (FIG. 13) carries a roller 414 which is straddled by the bifurcated end of a clamp arm 416. The clamp arm is secured to a pivot shaft 418 which extends through, and is rotatably journalled in, a wall 420 of the plow 360, the upper end portion of the pivot shaft being attached to the flap tucking arm 400. During the advance stroke of the holding channel 70, the flap tucking arm 400 swings rapidly downstream and effects the described flap tucking operation before the camming surface 402 can interfere when, during the next return stroke of the carrier, the carton is carried farther into the plow 360.

In the manner previously mentioned, and by means of structure disclosed in the aforementioned patent, the erected, filled and closed cartons advance beyond the closing plows 360, and are squared by the carton squaring unit G prior to being discharged at station H for subsequent processing or handling.

By way of summarizing the carton conveying operations, reference is made to FIGURES 15–19 which diagrammatically illustrate the step by step progress of the cartons from the feeding station D to just past the loading station E.

It is assumed in FIGURE 15 that cartons, identified as 22*a* and 22*b*, in order of their delivery onto the conveyor C by the carton feed mechanism B (FIG. 1), have already been placed on conveyor C during previous operational cycles of the machine. As is true in each machine cycle, the carton pushing lugs 46*a*, 46*b* and 46*c* have come to rest at the end of the return stroke and the carton holding lugs 72*a*, 72*b*, 72*c* and 72*d* are at rest at the end of their return stroke.

After assembling one carton-filling charge of articles 350 upon the loading plate 256 (FIG. 14) at the loading station E, the operator actuates the start switch 24 thereby energizing the motor M. Thus, the carton support channels 40 and 42 with their lugs 46*a*, *b* and *c* are moved downstream in their advance stroke and convey the cartons 22*a* and 22*b* to their FIGURE 16 positions. At the same time, the carton holding lugs 72*a*, *b*, *c* and *d* which were in depressed positions under cartons 22*a* and *b*, are moved upstream in their retract strokes, the lubs 72*b* and *c* rising behind cartons 22*a* and *b*. It is noted that the lug 72*c* is behind the feed station D in both FIG. 15 and FIG. 16. During these movements, the carton feed mechanism B (FIG. 1) deposits carton 22*c* (FIG. 16) upon the support channels 40 and 42.

The advance stroke of the lugs 46*b* positions carton 22*a* (FIG. 16) in its loading position opposite the loading station E. During the retract stroke of the lugs 46*a*, *b*, *c* the loading plate 256 (FIG. 10) pushes the charge of articles 350 into the carton 22*a*. The carton holding lugs, 72*b*, *c* and *d* (FIG. 17) simultaneously move downstream into engagement with the cartons 22*a*, *b* and *c*, respectively, whereby the carrier lugs 46, which are moving upstream, cannot displace the cartons. It should be particularly noted that when the carrier lugs 46 (FIG. 17) begin moving upstream, they may move the cartons rearwardly into engagement wtih the holding lugs 72. However, the holding lugs 72 are simultaneously moving downstream so that at the end of the respective retract and advance strokes of both sets of lugs, the holding lugs 72 (FIGURE 18) have advanced the cartons downstream of their FIGURE 17 positions in order that the carrier lugs 46 are free to rise without being obstructed by the cartons. Attention is directed to the fact that the relatively long time interval during the carrier's retract stroke enables an operator to have time to assemble a new carton-filling charge of articles upon the loading plate.

The completion of the carrier's retract stroke, as shown in FIGURE 18, places the rearwardmost carrier lugs 46*c* clear of the trailing panel 303 of the carton 22*c*, and the other pusher lugs 46*a* and *b* in similar positions back of their adjacent cartons. The lugs 46 and 72 (FIG. 18) reverse their directions of movement and respectively move forwardly and rearwardly to their stop positions as shown in FIGURE 19, these being the same lug positions shown in FIG. 15. Thus, one operational cycle is completed wherein one carton is fed onto the conveyor C, all of the cartons on the conveyor in advance of the one fed are moved forward a predetermined distance in two steps, one of the cartons is moved into the loading station and loaded, loaded cartons are advanced through the folding plows 360 and squaring mechanism G, and a completely squared carton is moved into the discharge station H.

An important feature of the invention is the smooth yet rapid motion of the carriers 35 and 35*a* and holding channels 70 and 374 effected by the ball joint 122 travelling about the axis of shaft 112. All the lugs 46, 72, 370 and 372 gradually accelerate from their stop positions to a maximum velocity and then smoothly decelerate to their stop positions, following generally sinusoidal patterns as illustrated in FIG. 20. In this manner impacts on the cartons are minimized, and yet the indexing movements of the cartons from station to station are accomplished rapidly because of the relatively high average velocity of the lugs, whereby the cartons can be handled at speeds higher than one hundred cartons per minute. As previously noted, abrupt impacts are also minimized by the loading mechanism L.

Due to the particular conveyor structure and drive train herein disclosed, the advance of the cartons through the machine may be higher than one hundred cartons per minute if the operator can load and cycle the machine fast enough since the carton loading speed is governed by the speed of the operator. Another important feature is that the timing of the carton-advancing movements, unless breakage occurs, will not vary to the extent found in the ordinary carton handling machine having a roller chain or belt carton conveyor. Belt or chain conveyors inevitably stretch in use and thus necessitate frequent timing adjustments, which disadvantage is avoided by the conveyor C. In short, the conveyor C is a relatively simple apparatus for achieving intermittent, yet smooth, motion at high speeds.

While a particular embodiment of the present invention has been shown and described, it will be understood that the disclosed carton handling machine is capable of modification and variation without departing from the principles of the invention and that the scope of the invention should be limited only by the scope and proper interpretation of the claims appended hereto.

The invention having thus been described, that which is believed to be new, and for which protection by Letters Patent is desired, is:

1. An apparatus for intermittently conveying a procession of cartons along a predetermined path past a loading station comprising a support, carrier means engageable with said cartons and mounted on said support for movement lengthwise of said path thereby to move the cartons

along the path, powered means for intermittently advancing said carrier means along said path so that on each advance, the velocity of said carrier means, and thus each carton, is gradually increased from zero to a maximum and then gradually decreased before the carrier means is brought to a stop, said carrier means being adapted to position the cartons successively at said loading station, and loading means mounted on said support at said loading station for reciprocation toward and away from said path, said powered means also being connected to said loading means and moving the same toward said path with gradually increasing and then decreasing velocity.

2. A carton handling machine comprising carton conveying means extending longitudinally through the machine and arranged to intermittently advance erected cartons with common open ends of the cartons disposed laterally of the conveying path, said conveying means including a plurality of carton pushing lugs biased by spring means to engage the cartons only when moved in a downstream direction, and drive means connected to said conveying means for imparting a downstream stroke to said carton conveying means which is less than the dimension of a carton measured lengthwise of the conveying means followed by an upstream stroke of said conveying means which is greater than said dimension, and then followed by another downstream stroke of said conveying means which is equal to the dimensional difference between the initial and following strokes.

3. A carton handling machine comprising carton conveying means extending longitudinally through the machine and arranged to intermittently advance erected cartons with common open ends of the cartons disposed laterally of the conveying path, a plurality of carton pushing lugs carried by said conveying means and biased by spring means to engage the cartons only when moved in a downstream direction, drive means connected to said conveying means for imparting a limited number of reciprocatory movements thereto, the initial and downstream movement of said carton conveying means being less than the corresponding dimension of a carton, the next following and upstream movement of said conveying means being larger than the corresponding dimension of a carton, the final and downstream stroke of said conveying means being equal to the dimensional difference between the initial and following strokes, and a loading plate connected to said drive means and arranged to thrust laterally of the conveyor into and out of the open end of a carton after said initial downstream movement of said carton conveying means.

4. A carton machine for handling erected cartons conveyed sequentially through upstream to downstream carton stations comprising two parallel channels adapted to support erected cartons mounted for endwise reciprocatory movement and advanced through said stations, a plurality of equally spaced carrier lugs pivoted to said channels in transverse alignment, said lugs being resiliently urged upward into the path of cartons supported by said channels and having forward carton engaging pushing surfaces merging into upper camming surfaces declining rearwardly whereby forward movement of the cartons relative to said lugs pivots the lugs downward out of the path of the cartons, means interconnecting said channels for unitary movement in a linear path, drive means for reciprocating said channels along said path, the length of the initial downstream first stroke of said rails being a fraction of the corresponding width of a carton, the next following and upstream second stroke of the channels being larger than the corresponding width of a carton, the following third stroke of said channels being the dimensional difference between said first and second strokes, means for feeding a carton onto said channels upstream from the farthest upstream carrier lug at a time interval between said first and second strokes and at a location wherein completion of said second strokes positions a pair of carrier lugs upstream of the carton, and means for preventing upstream movement of the carton when said carrier lugs move upstream under the carton.

5. A carton handling machine adapted to advance cartons through carton handling stations step-by-step comprising three longitudinally movable elongate channels extending through an upstream carton feed station and through a carton station at a subsequent downstream location, the outer channels having upper surfaces adapted to support an erected carton, a plurality of equally spaced carrier lugs mounted on each outside channel in transverse alignment with the lugs on the other channel, a plurality of equally spaced carton holding lugs mounted on the center channel, each adjacent pair of said holding lugs being spaced apart substantially the same distance as the corresponding pair of said carrier lugs, said carrier and holding lugs having carton engaging downstream surfaces and upper surfaces sloping downward in an upstream direction, each of said lugs being depressible to a position below the upper surface of its associated channel against resilient means biasing the lug toward said carton engaging position, means for depositing an erected carton onto said outer channel support surfaces in a position upstream of a transversely aligned pair of said carrier lugs and downstream of one of said carton holding lugs, and drive means connected to said channels for longitudinally reciprocating said outer channels together in one direction and said center channel in the opposite direction, the upstream stroke of said outer channels and the simultaneous downstream stroke of said center channel being effective to cause said one carton holding lug to advance the carton downstream and then immobilize the carton against upstream movement while said pair of carrier lugs pass upstream under the carton and are depressed thereby until they are clear of the trailing edge of the carton.

6. A carton handling machine adapted to advance cartons through carton handling stations step-by-step comprising longitudinally movable elongate outer and intermediate channels extending through an upstream carton feed station and through a carton loading station at a subsequent downstream location, the outer channels having upper surfaces adapted to support an erected carton, a plurality of equally spaced carrier lugs mounted on each outer channel in transverse alignment with the carrier lugs on the other channel, a plurality of equally spaced carton holding lugs mounted on the intermediate channel, adjacent holding lugs being spaced apart substantially the same distance as adjacent carrier lugs, said lugs having carton engaging downstream surfaces and upper surfaces sloping downward in an upstream direction, each of said lugs being depressible to a position below the upper surface of its associated channel against resilient means biasing the lug into a carton engaging position above the channel, means for depositing an erected carton onto said outer channel support surfaces at said feed station and in a position upstream of a transversely aligned pair of said carrier lugs and downstream of one of said holding lugs, drive means connected to said channels for longitudinally reciprocating said outer channels together in one direction and said intermediate channel in the opposite direction, the upstream stroke of said outer channels and the simultaneous downstream stroke of said intermediate channel being effective to cause said one carton holding lug to advance the carton downstream and then immobilize the carton against upstream movement while said pair of carrier lugs pass upstream under the carton and are depressed thereby until they are clear of the trailing edge of the carton, carton engaging means preventing upward movement of the cartons off said outer channel support surfaces, and control means for actuating said drive means, said control means including a limited revolution clutch to effect a single cycle of operation wherein each carton is advanced by said carrier lugs one step, said drive means being so arranged that the velocity of said outer chan-

nels and carrier lugs is successively gradually increased and gradually decreased.

7. A carton handling machine for intermittently advancing erected cartons sequentially through upstream to downstream carton feeding, loading and closing stations comprising three longitudinally slidable parallel channels extending through said station, the outer channels having coplanar upper carton supporting surfaces adapted to support cartons for transport through the machine, a plurality of transversely aligned carrier lugs carried by said outer channels, a plurality of carton holding lugs carried by said center channel, both sets of lugs having downstream carton engaging surfaces and capable of being depressed out of carton engaging positions against resilient means biasing the lugs toward said positions, drive means connected to said channels for longitudinally reciprocating said outer channels in one direction and said center channel in the opposite direction, means for depositing an erected carton upon said outer channels before the channels attain their downstream limit of movement and at the time said carrier lugs are downstream of the carton and one of said holding lugs is upstream of the carton, said outer channels being driven in one operational cycle downstream in a stroke shorter than the corresponding width of a carton, upstream in a stroke longer than the corresponding width of a carton, and downstream to their point of beginning, and means controlling said drive means to initiate said one operational cycle.

8. In a carton handling machine, carton conveying means comprising a plurality of equally spaced carrier lugs extending longitudinally of the machine through upstream to downstream stations, a support for said carrier lugs arranged for reciprocatory movement alternately carrying said lugs in upstream and downstream directions, a plurality of equally spaced carton holding lugs extending longitudinally through said stations, a support for said holding lugs arranged for reciprocatory movement alternately carrying said holding lugs in upstream and downstream directions, disengageable drive means connected to said supports for simultaneous movement of said supports in opposite directions, said lugs being spring urged from their respective supports into positions wherein carton engaging downstream surfaces of the lugs lie in the path of the cartons, said lugs having upper sloping surfaces engageable with a carton for camming the lugs out of the path of the carton upon downstream movement of a carton relative to the lugs, the arrangement of the lugs being such that prior to engagement of said drive means one carrier lug lies beneath the carton feeding station in the path of the next incoming carton and one holding lug lies upstream of the carton holding station, means for engaging said drive means, consecutive movements of the supports upon engagement of said drive means advancing said one carrier lug downstream of the carton feeding station while said one holding lug moves upstream and a carton is deposited at said feeding station, said holding lug moves downstream into contact with the trailing end of the deposited carton and advances the carton while said carrier lug moves upstream under and beyond the carton, said carrier lug moves downstream carrying the carton while said holding lug moves upstream until both lugs reach their initial position, and means for disengaging said drive means when said lugs reach their initial positions.

9. A carton handling machine comprising two parallel lower channels extending through upstream to downstream carton feeding, loading and closing stations of the machine and being adapted to support an erected carton, two parallel upper channels vertically aligned with said lower channels and extending from the loading station through said closing station, said upper and lower channels having confronting surfaces spaced apart approximately the height of an erected carton, a plurality of carrier lugs mounted on said upper and lower channels, all of said lugs having downstream carton engaging surfaces and capable of being depressed toward their respective channels out of carton engaging positions against resilient means biasing the lugs toward said positions, drive means connected to said lower channels for longitudinally reciprocating said channels, means interconnecting said upper channels and said lower channels for simultaneous reciprocatory movement, means for depositing an erected carton upon said lower channels before the channels attain their downstream limit of movement and at the time the adjacent carrier lugs are downstream of the carton, means for preventing upstream movement of the cartons, said upper and lower channels being consecutively driven in one operational cycle downstream in a stroke shorter than the corresponding width of a carton to advance one carton to the loading station, upstream in a stroke longer than the corresponding width of a carton to position one pair of pushing lugs behind said deposited carton, and downstream to their points of beginning to advance each carton in the machine one step downstream, and means controlling said drive means to initiate said one operational cycle.

10. A carton handling machine comprising conveyor means for transporting erected cartons sequentially through predetermined stations with the end flaps of the cartons unfolded and extending toward the sides of said conveyor means, an elongate longitudinally slidable channel extending through said stations, a plurality of depressible carton holding lugs projecting upward above said conveying surface from said channel into the path of the cartons, said lugs having forwardly facing carton engaging surfaces and rearwardly declining upper camming surfaces, means pivotally mounting said holding lugs to said channel, means resiliently urging said lugs to raised positions intersecting the path of the cartons, drive means for longitudinally reciprocating said channel in synchronism with said carton conveyor means such that said carton holding lugs are positioned rearwardly of the trailing walls of the cartons after the cartons come to rest and the lugs moved forward into engagement with said rear walls before the cartons resume motion, a flap tucking arm mounted adjacent one of said stations for pivotal movement in a horizontal plane intersecting the path of one rear end flap of a carton, said tucking arm having a free end portion adapted to strike the trailing surface of said rear end flap, and linkage means connected to said holding lug channel and to said flap tucking arm for swinging said tucking arm toward and beyond the trailing surface of the end flap to fold the flap against the body of the carton when said channel moves in a downstream direction.

11. A carton handling machine comprising reciprocable carton conveyor means extending longitudinally through the machine and arranged to intermittently transport erected cartons through certain stations with the end flaps of the cartons unfolded and extending toward the sides of said conveyor means, carton holding means adapted to prevent upstream movement of the cartons and including a longitudinally slidable channel extending through said stations, drive means for longitudinally reciprocating said channel between upstream and downstream positions in synchronism with said carton conveyor means, said channel being moved in a downstream direction when said conveyor means moves upstream into a carton engaging position, a flap tucking arm mounted adjacent one of said stations for pivotal movement in a horizontal plane intersecting the path of one rear end flap of a carton, said tucking arm having a free end portion adapted to strike the trailing surface of said rear end flap, and linkage means interconnecting said flap tucking arm and said channel for swinging said tucking arm toward and beyond the trailing surface of said end flap to fold the flap against the body

of the carton when said channel moves in a downstream direction.

12. A carton handling machine comprising three parallel channels movable endwise through upstream to downstream stations, the outer channels being adapted to support an erected carton with the unfolded end flaps of the carton projecting laterally of the machine, a plurality of carton engaging lugs mounted along each channel, said lugs having downstream carton engaging surfaces and upper sloping surfaces capable of being engaged by the bottom panel of a carton to depress the lugs toward their respective channels, spring means biasing said lugs toward said carton engaging positions, means for depositing an erected carton upon said outer channels, drive means for longitudinally and simultaneously reciprocating said outer channels in one direction and said center channel in the opposite direction, a movable plow mounted beside one of said outer channels and connected to said channel for reciprocatory movement therewith in the path of the adjacent leading and trailing end flaps of the cartons, a flap tucking arm mounted adjacent said channels for pivotal movement in a horizontal plane intersecting the path of the trailing end flap of a carton, said arm having a free end portion adapted to strike the trailing surface of said trailing end flap, linkage means interconnecting said center channel and said tucking arm for swinging said tucking arm in a downstream direction when said center channel moves in the same direction so that the trailing end flap is folded downstream against the body of the carton, the subsequent upstream movement of the plow and outer channels causing the leading end flap to be folded upstream and held against the body of the carton, said upstream movement of the plow thus positioning an edge of the plow against the outer surfaces of the folded leading and trailing end flaps, subsequent downstream movement of the plow and the outer channels thus causing both end flaps to be held in said folded positions against the body of the moving carton.

13. A carton handling machine adapted to advance erected cartons intermittently from an upstream carton feeding station to a downstream loading station comprising carton conveyor means including depressible carrier lugs mounted for upstream and downstream reciprocatory movement, means for depositing an erected carton on said carton conveyor means at said carton feeding station with the end flaps of the carton unfolded and extending laterally from said conveyor means, said carrier lugs being depressed by the carton when moving in an upstream direction, reciprocable loading means extending laterally of the machine at said loading station and having an inner end adapted to push a charge of articles into a carton aligned therewith, a motor, a limited revolution clutch for transmitting power in one operational cycle from said motor to said loading means and to said conveyor means, control means for actuating said clutch, and carton holding means effective to prevent upstream movement of the cartons when said carrier lugs move in the same direction, said motor and clutch, during one of said operational cycles being effective to operate said conveyor means to consecutively transport an empty carton to said loading station, move said loading means into and then out of the empty carton, retract said carrier lugs upstream under the cartons, and project said carrier lugs downstream a distance effective to transport the loaded cartons past said loading station and a following empty carton into a preliminary position back of said loading station.

14. Carton handling apparatus comprising means for intermittently conveying a procession of spaced cartons along a predetermined path, means for singularly feeding cartons from a stack to said conveying means, and means for feeding articles into said cartons on said conveying means at a position spaced downstream from said feeding means, said conveying means comprising a support, ratcheting conveyor means mounted in said support and extending lengthwise of said path, said conveyor means including a carrier portion movable lengthwise of said path and a holding portion, and powered means for reciprocating said carrier portion forwardly and rearwardly of said path, said carrier portion including means for advancing the cartons during forward movement of the carrier portion, said holding portion including means for restricting rearward movement of said cartons during rearward movement of said carrier portion, said feeding means being operative to feed articles into said cartons during the rearward movement of said carrier portion.

15. The apparatus of claim 14, wherein said holding portion is also movable lengthwise of said path, and wherein said powered means also reciprocates said holding portion but in an opposite direction from said carrier portion so that when the carrier portion moves forward, the holding portion moves rearward and vice versa.

16. The apparatus of claim 15 wherein each carton has foldable flaps thereon, wherein a tucking member is mounted on said support for movement between flap folding and retracted positions, and linkage means for moving said tucking member into its folding position in response to reciprocating movement of one of said portions of the conveyor means.

17. The apparatus of claim 14 wherein on each forward movement of said carrier portion, said powered means gradually increases and then decreases the velocity of said carrier portion so as to move the cartons intermittently and relatively smoothly along said path.

18. The apparatus of claim 14 wherein each carton has foldable parts thereon, and wherein carton folding means are mounted on said carrier portion for folding said parts of the cartons as the carrier portion moves rearwardly of said path.

19. The apparatus of claim 14 wherein said holding portion is mounted for movement along said predetermined path, and said powered means including means for moving said holding portion and said cartons forwardly by a small increment during the rearward movement of said carrier portion.

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