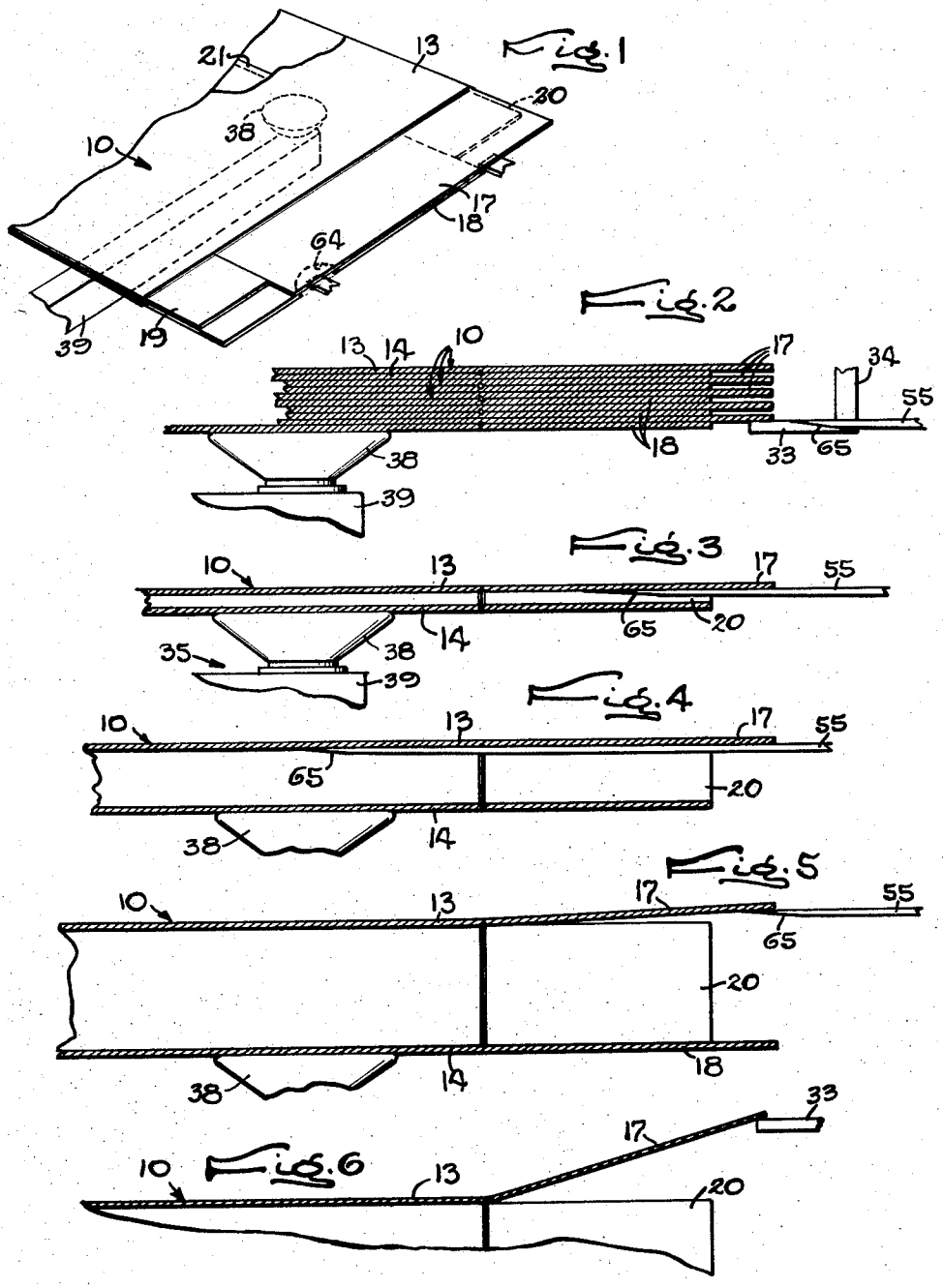
Aug. 11, 1964 LE ROY L. MARTIN 3,143,937

MACHINE FOR ERECTING CARTONS

Filed July 20, 1962 8 Sheets-Sheet 1



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MACHINE FOR ERECTING CARTONS

Filed July 20, 1962 8 Sheets-Sheet 2

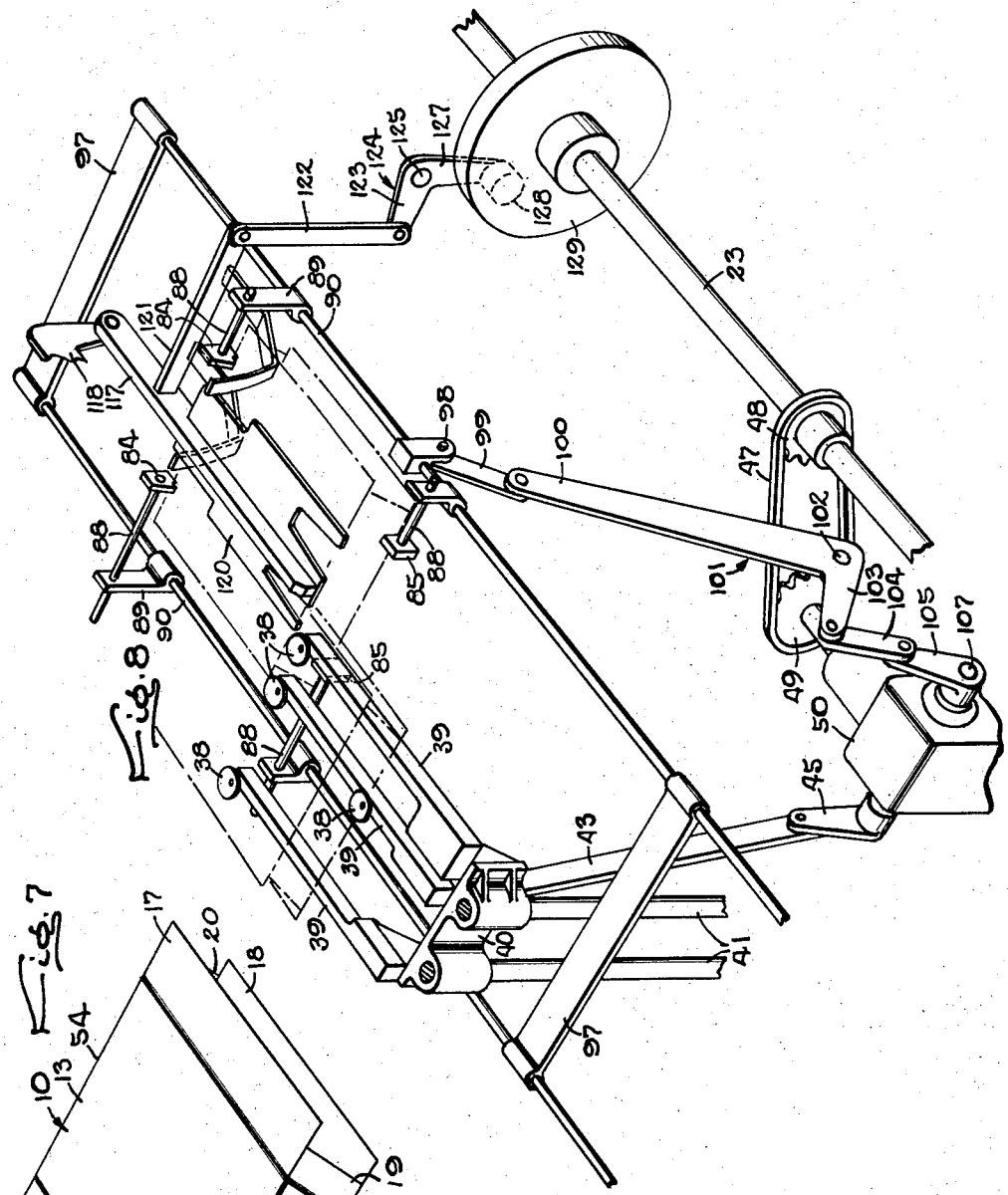

Fig. 8

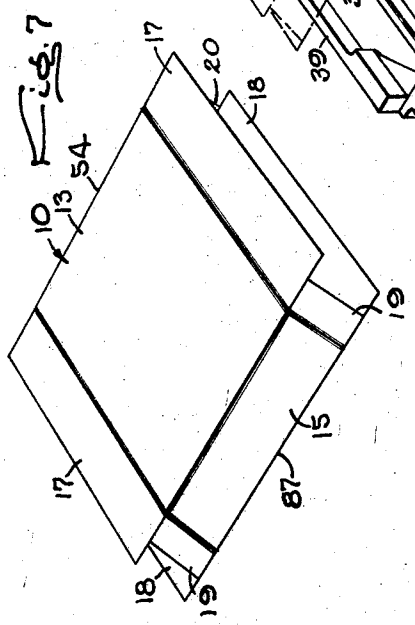

Fig. 7

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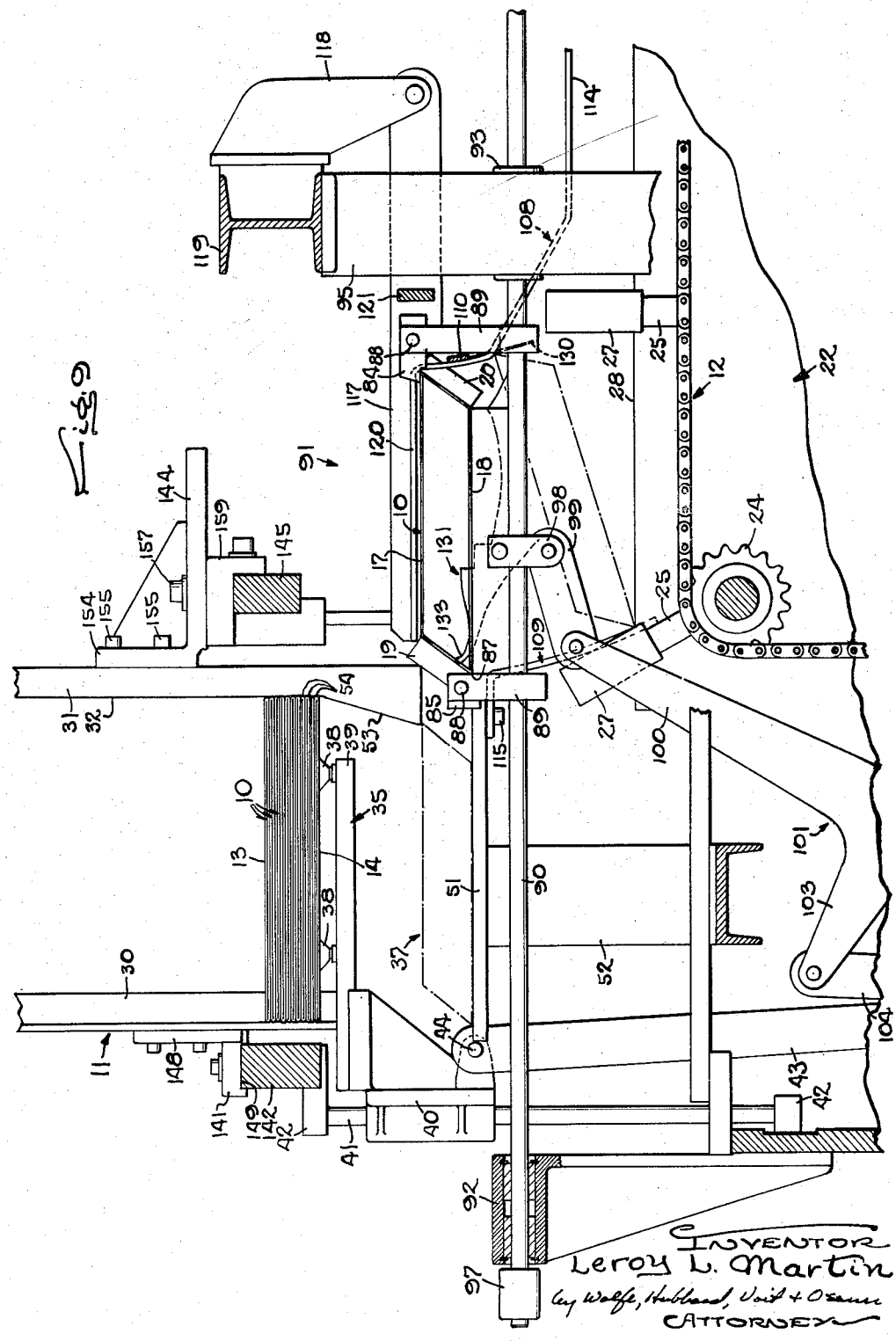

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MACHINE FOR ERECTING CARTONS

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Fig. 10

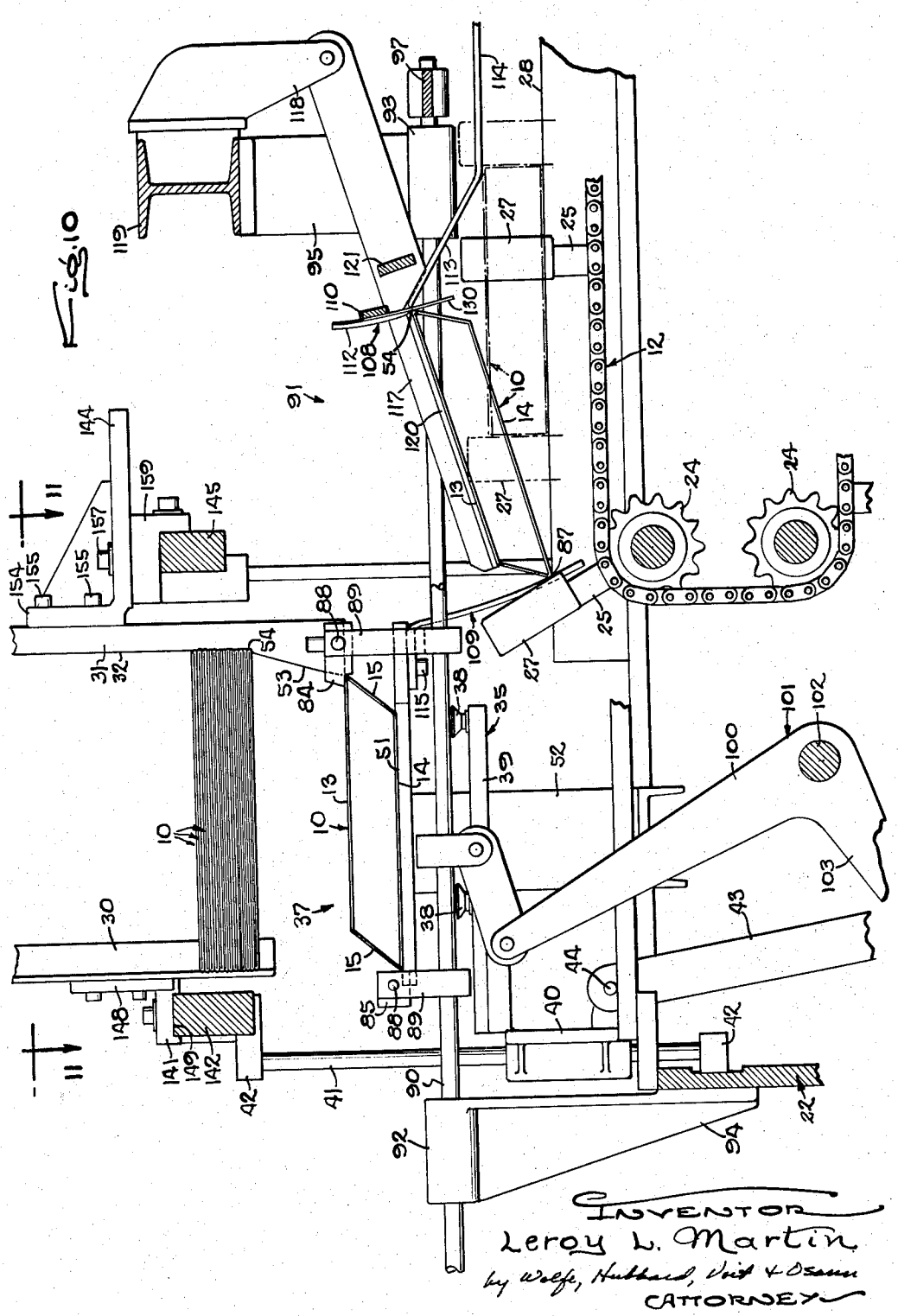

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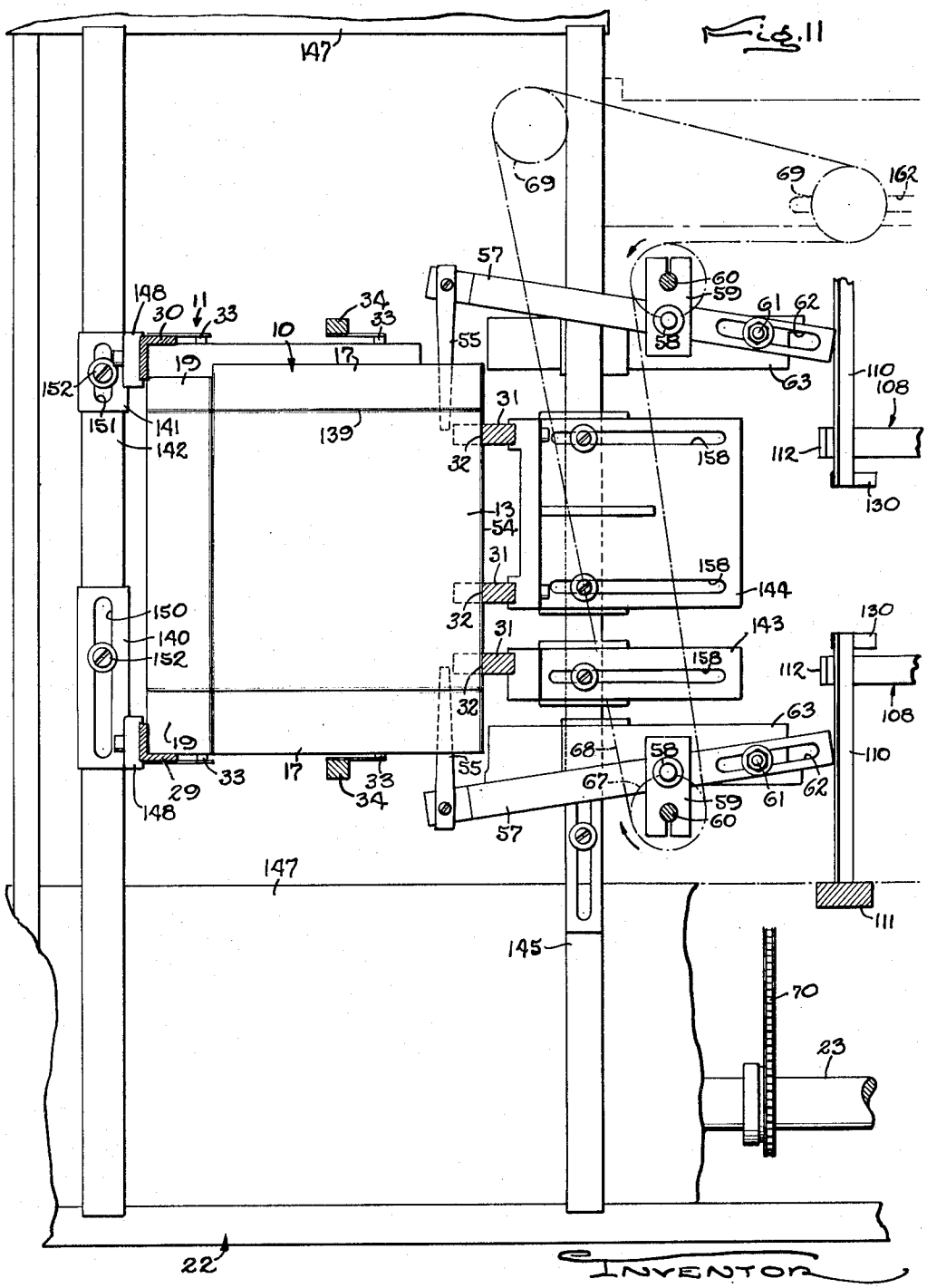
Fig. 11



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MACHINE FOR ERECTING CARTONS

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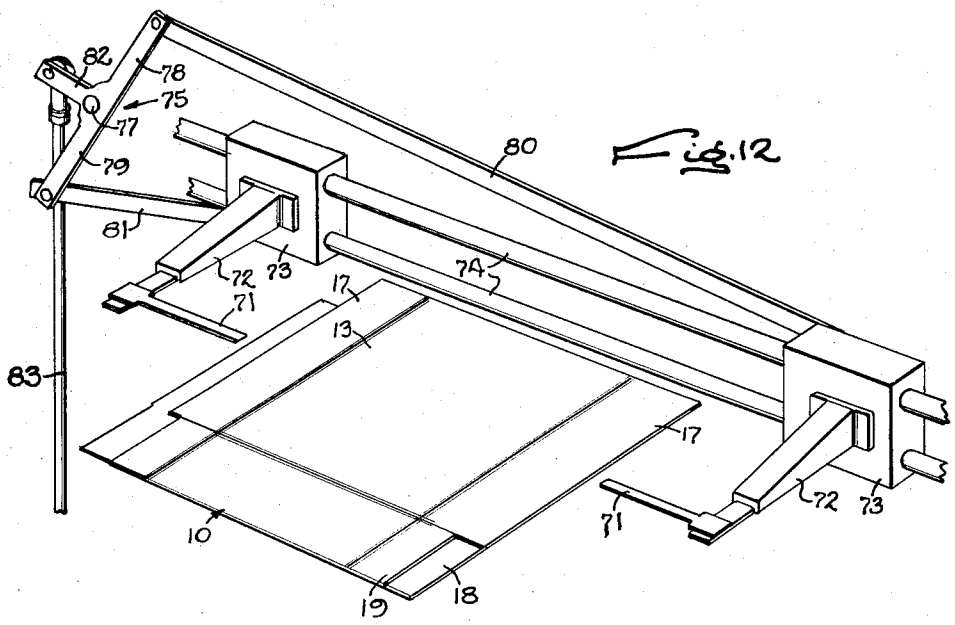

Fig. 12

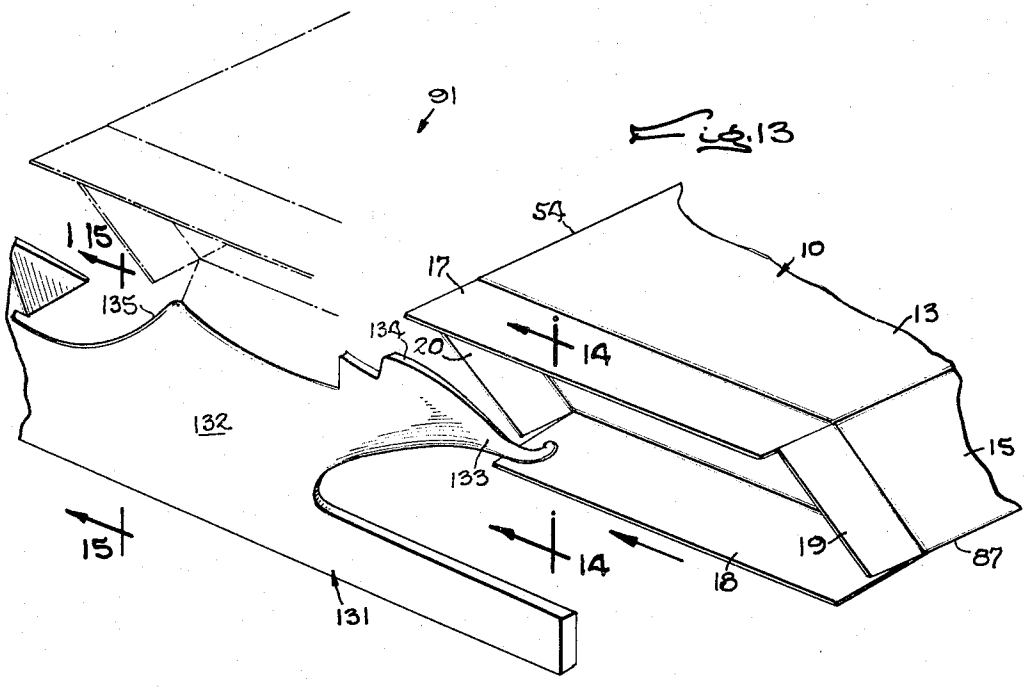

Fig. 13

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Fig. 14

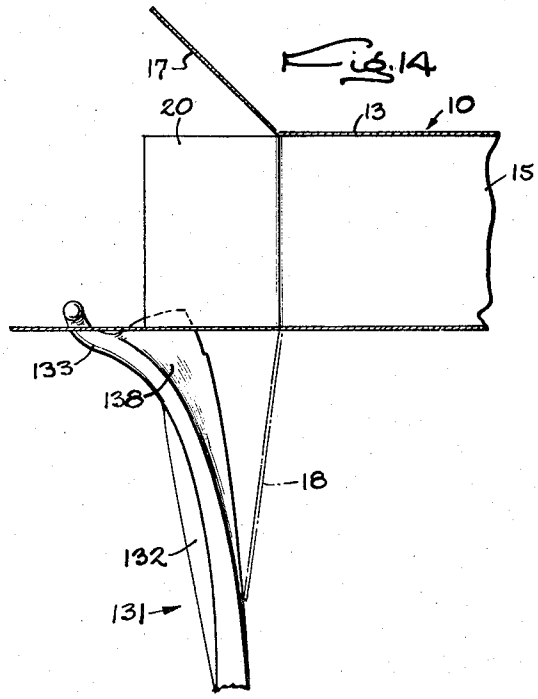


Fig. 15

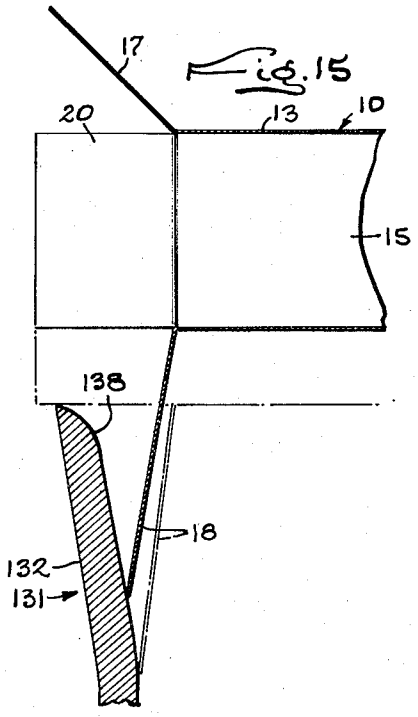
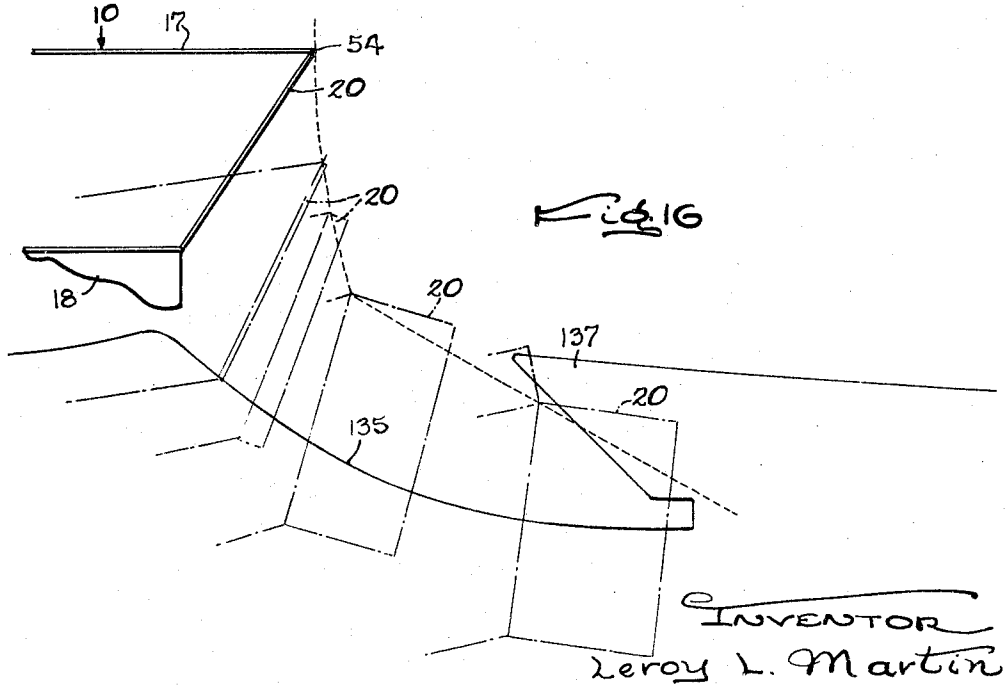


Fig. 16



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MACHINE FOR ERECTING CARTONS

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Fig. 17

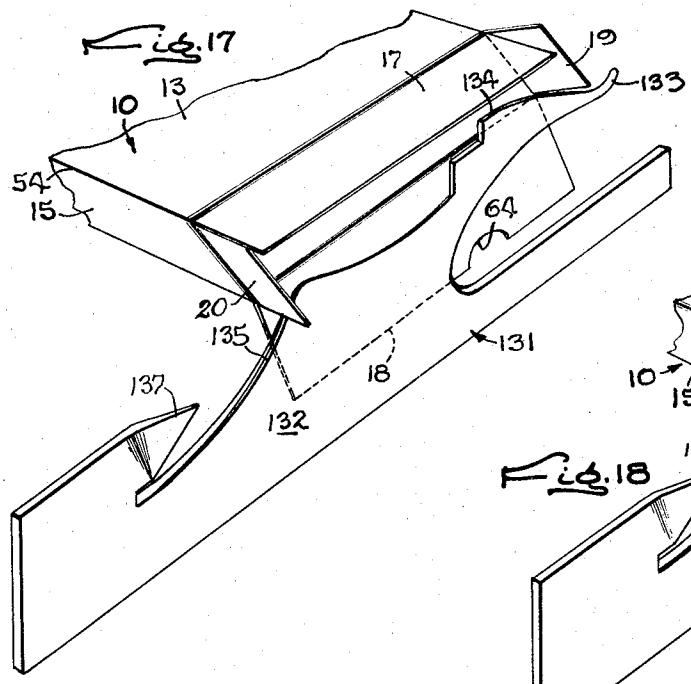


Fig. 18

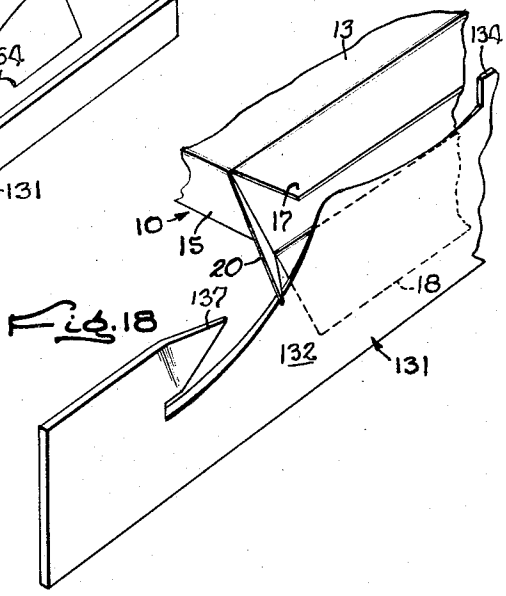


Fig. 19

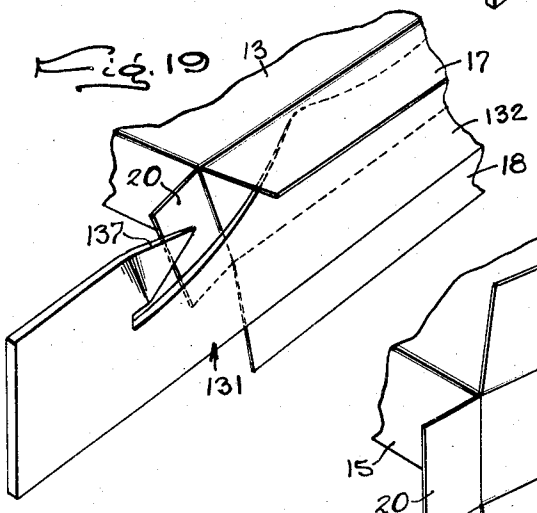
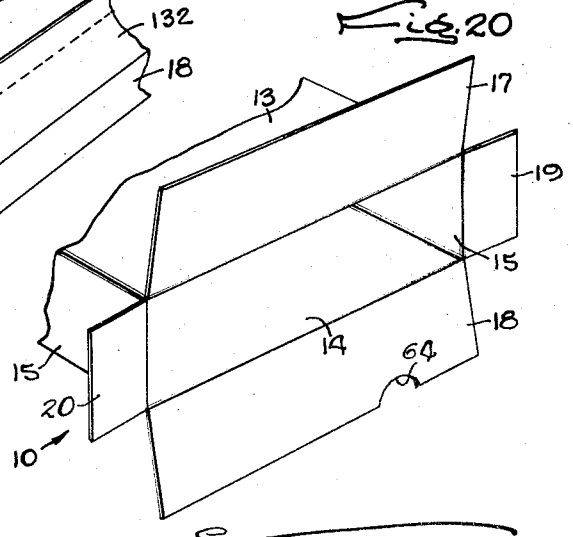


Fig. 20



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United States Patent Office 3,143,937 Patented Aug. 11, 1964

3,143,937

MACHINE FOR ERECTING CARTONS

Le Roy L. Martin, Dixon, Ill., assignor to Bartelt Engineering Company, Inc., Rockford, Ill., a corporation of Delaware

Filed July 20, 1962, Ser. No. 211,222
8 Claims. (Cl. 93—53)

This invention relates to a machine for erecting collapsed cartons while transferring the cartons to a conveyor from a stack in a magazine. Such cartons usually comprise a sheet of paperboard folded and glued to form two side panels hingedly joined by two edge panels with flaps projecting from each end of each panel to be folded over the ends of the carton to close the latter, the panels and the flaps being joined together along fold lines weakened as by scoring the paperboard. The cartons are stored in flattened condition in the magazine with the side panels disposed side by side and offset laterally relative to each other, and are removed one at a time from one end of the magazine by a transfer device which grips the exposed panel of the terminal carton in the stack and pulls the carton from the magazine.

The primary object of the present invention is to open the cartons as an incident to their removal from the magazine in a novel manner which insures the rapid separation of the side panels even of difficult-to-open cartons such as square cartons, cartons in which the fold lines have not been pre-broken, and cartons in which the panels are sealed together by excess glue applied to the paperboard during the fabrication of the carton.

A more specific object is to provide a novel splitter needle which temporarily holds the inner panel in place as the transfer device pulls the exposed panel away from the stack and thereby cooperates with the transfer device in positively separating the panels and breaking the fold lines and accidental glue seals.

Another object is to provide a splitter needle which passes edgewise between the panels to slice across at least part of the glued seam.

A further object is to transfer the cartons from the magazine to the conveyor in a novel manner which insures positive control of the cartons and prevents premature release of the cartons into the conveyor.

Still another object is to provide novel and simple means operable to fold all four flaps at one end of the carton away from the end preparatory to insertion of the product.

Another object is to provide a highly versatile magazine which is adjustable to accommodate a wide range of carton sizes while holding one end of each carton, regardless of its size, on a fixed reference line to facilitate operations on the cartons during the transfer and on the conveyor.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

FIGURE 1 is a fragmentary perspective view of a portion of a carton and a transfer device in a machine embodying the novel features of the present invention.

FIG. 2 is a fragmentary sectional view taken in a vertical plane through a stack of cartons and showing the beginning of the removal of a carton from the stack.

FIG. 3 is a view similar to a portion of FIG. 2 with the parts in different positions.

FIG. 4 is a view similar to FIG. 3 showing another step in the carton removal.

FIG. 5 is a view similar to FIG. 4 with the parts in another condition.

FIG. 6 is a view similar to FIG. 5 showing still another condition of the parts.

FIG. 7 is a perspective view of a carton after removal from the stack.

FIG. 8 is a fragmentary perspective view of the transfer mechanism of the machine.

FIG. 9 is a fragmentary sectional view taken in a vertical plane extending longitudinally of a machine embodying the novel features of the present invention.

FIG. 10 is a view similar to FIG. 9 with the machine in a different condition.

FIG. 11 is a fragmentary sectional view taken along the line 11—11 of FIG. 10.

FIG. 12 is a fragmentary perspective view showing a flattened carton and an alternative form of the actuating mechanism for the splitter needles.

FIG. 13 is an enlarged fragmentary perspective view of a portion of FIG. 9.

FIG. 14 is a fragmentary sectional view taken along the line 14—14 of FIG. 13 with the carton in a slightly different position.

FIG. 15 is a fragmentary sectional view taken along the line 15—15 of FIG. 13.

FIG. 16 is a diagrammatic view illustrating successive positions of the carton in passing along the flap opening means.

FIG. 17 is a fragmentary perspective view of a carton and the flap opening means.

FIG. 18 is a fragmentary view similar to a portion of FIG. 17 with the carton in a different position.

FIG. 19 is a fragmentary view similar to FIG. 18 showing another position of the carton.

FIG. 20 is a fragmentary perspective view of a carton with the flaps folded into the open positions.

As shown in the drawings for purposes of illustration, the invention is embodied in a packaging machine (see FIGS. 9 and 10) in which cartons **10** stored in flattened condition in a magazine **11** are removed one at a time from the magazine and transferred to a continuously moving carrier or conveyor **12**, the cartons being opened during this transfer to receive a product to be packaged. On the conveyor, the cartons pass through successive stations to be filled, glued, and closed in a manner well known to those skilled in the art.

Each of the cartons shown herein comprises two rectangular side panels **13** and **14** (see FIG. 3) hingedly connected along opposite side margins by two narrow rectangular edge panels **15**. To close the open ends of the carton, side flaps **17** and **18** and edge flaps **19** and **20** projecting outwardly at each end are folded across the open ends. Usually, such cartons are made of one sheet of suitable material such as paperboard which is slitted on opposite sides to form the flaps and is scored or otherwise weakened along the fold lines. The free ends of the sheet are glued together along a seam **21** (FIG. 1).

Preferably, the various mechanisms for opening, advancing, filling, and closing the cartons **10** are mounted on an elongated horizontal frame **22** and are operated in timed relation with each other by a single, continuously rotating horizontal camshaft **23** (FIG. 8) journaled on the frame and generally paralleling the path of the opened cartons. The conveyor **12** is in the form of a pair of endless chains disposed in parallel vertical planes and wound around two horizontally spaced pairs of sprocket wheels **24** (FIGS. 9 and 10) with the upper horizontal runs of the chains defining the path of the cartons. Spaced apart along and secured to the chains are a plurality of arms **25** carrying lugs **27** arranged in pairs which project upwardly on each side of a fixed bed **28** when on the horizontal runs to form the leading and trailing walls of a plurality of pockets along the conveyor, the distance between the adjacent pairs of lugs being substantially equal to the width of the cartons. Thus, each carton is held in a pocket between the leading sides of one pair of

lugs and the trailing sides of the preceding pair so that the lugs slide the cartons along the bed and through the machine while holding them evenly spaced to position each of the cartons properly at the various operating stations.

Preparatory to being transferred to the conveyor 12, the cartons are stored in a stack in the magazine 11 in flattened or collapsed condition, that is, with the side panels 13 and 14 lying side by side and offset laterally from each other by the width of the edge panels 15 and with each edge panel lying flat against one of the side panels. In the present instance, the magazine 11 comprises an upright open frame including two bars 29 and 30 of right angle cross-section opening inwardly and spaced apart to receive the corners of the stack on one side, the left-hand side as viewed in FIGS. 9 and 10, and with three upright bars 31 spaced apart along the opposite side of the stack with one edge 32 of each bar bearing against the right-hand side of the stack as shown most clearly in FIGS. 9, 10 and 11. The cartons are supported releasably in the magazine by suitable means which herein comprise four fingers 33 mounted at the lower end of the magazine and projecting a short distance in under the flaps of the bottom carton in the stack. Two of the fingers are supported on vertical bars 34 (FIGS. 2 and 11) adjacent the remaining two sides of the stack and the other two fingers are mounted on the angle bars 29 and 30. The cartons are pulled one by one from the stack through the open bottom of the magazine, the flaps bending up slightly during removal to pass around the supporting fingers.

To effect the transfer of cartons 10 from the magazine 11 to the conveyor 12, the machine includes a transfer device 35 movable up and down beneath the magazine and toward and away from the bottom carton therein to engage the underside of the bottom carton, grip the latter, and pull the carton past the fingers 33 and into a transfer station 37 below the magazine. In this instance, the transfer device takes the form of a plurality of upwardly opening suction cups 38 carried on three parallel horizontal arms 39 each fast at one end on a yoke 40 and extending under the magazine. The yoke is guided for up and down sliding on vertical guide rods 41 which are secured at their ends to brackets 42 on the frame. To slide the yoke up and down along the rods, a link 43 (FIGS. 8, 9 and 10) is fulcrumed at 44 adjacent its upper end on the yoke and its lower end is pivoted on a crank 45 rotated with the camshaft 23 through an endless chain 47, sprockets 48 and 49, and a gear box 50 (FIG. 8). The suction cups 38 first are raised into engagement with the bottom of the stack and then lowered to pull the bottom carton downwardly out of the magazine, suction being applied to the cups and released in timed relation with the movements of the arms 39 in a well-known manner so that the cups grip the carton at the upper end of their stroke and release the carton when the latter is in the transfer station 47.

In order that the transfer may be effected by a simple reciprocating motion of the arms 39, the carton is deposited in the transfer station on a platform 51 (FIGS. 9 and 10) comprising a plate supported below the magazine on posts 52 and slotted to allow the arms 39 to pass through the platform into positions below the latter (see FIG. 10). The suction is released as the carton reaches the platform which, therefore, prevents further lowering of the carton and thereby assists in breaking the grip of the suction cups on the carton.

To assist in erecting the cartons 10 during the transfer from the magazine 11 to the transfer station 37, the lower portions 53 of the bar edges 32 are inclined downwardly and across the path followed by the adjacent edges 54 of the cartons as shown in FIGS. 9 and 10. With the bottom panels 14 gripped by the cups 38 and moved sidewise downwardly thereby, these inclined edges engage the right-hand carton edge and cam the top panel 13 toward the left relative to the bottom panel thereby at least partially erecting the carton.

In accordance with the present invention, the flattened cartons 10 are opened as an incident to their removal from the magazine 11 in a novel manner which insures separation of the panels of difficult-to-open cartons such as square cartons, cartons with fold lines that have not been pre-broken, or cartons in which excess glue has been applied to the seam 21 and has sealed the panels together. For these purposes, the upper panel 13 of the terminal carton is held positively in place as the lower panel 14 is pulled away from the stack so that the force of the transfer device 35 breaks the carton folds and also breaks any accidental glue seals between the panels. Thus, prebreaking or overbending of the cartons to soften the joints is unnecessary.

To these ends, at least one splitter needle 55 (FIGS. 2 through 5 and 11) is mounted alongside the magazine 11 in a plane extending between the panels 13 and 14 of the terminal carton in the stack, and mechanism is provided to support the needle for back and forth movement into and out of the terminal carton in timed relation with the movement of the transfer device 35. The needle is inserted in the carton as the suction cups 38 pull the bottom panel 14 away from the stack and is withdrawn after the panels have been separated a predetermined distance. Accordingly, the splitter needle holds the upper panel 13 in place during the initial downward movement of the bottom panel under the pull of the suction cups so that separation of the panels and opening of the carton are assured.

In the form shown in FIG. 11, the splitter needle 55 is supported for gyratory or revolving movement in the plane extending between the side panels of the terminal carton, this movement carrying the needle first endwise into the carton, then edgewise between the panels, and finally endwise out of the carton. This is accomplished by mounting the needle on one end of an elongated horizontal arm 57 disposed on one side of the magazine and pivoted intermediate its ends on a pin 58 defining a vertical axis, the pin being carried on the free end of a horizontal crank 59 fast adjacent its other end on a vertical shaft 60 journaled on the machine frame. The free end portion of the arm extends along the side of the magazine at the level of the bottom carton, while the other end portion of the arm is both slidably and pivotally connected to the frame by means of a bolt 61 projected through an elongated slot 62 in the arm and threaded into a frame plate 63 below the arm.

With this arrangement, turning of the shaft 60 rotates the crank 59 which swings the arm 57 bodily about the crank axis while the arm slides generally endwise along the bolt 61, as permitted by the length of the slot 62, and simultaneously pivots about the bolt. Accordingly, the free end of the arm gyrates or revolves along an oval-shaped path. The needle 55, which herein comprises an elongated flat blade, is fastened adjacent one end to the free end of the arm by means of a screw 63 and projects toward the magazine at a predetermined angle with the arm so that the tip of the needle follows a similarly shaped path which extends into and out of the bottom carton between the flaps on the adjacent end of the carton.

To facilitate insertion of the needle between the panels, either the lower flaps 18 and 20 are made shorter than the upper flaps 17 and 19 or portions of the lower flaps are cut out as indicated at 64 (FIGS. 1, 13 and 20) so that the fingers 33 engage the underside of an upper flap (see FIG. 2) thereby permitting the lower flaps to hang slightly below the upper flaps. Further, the free end of the needle 55 preferably tapers at 65 to a knife edge disposed at or slightly below the level of the supporting fingers as shown most clearly in FIG. 2.

Successive positions of the needle 55 relative to the bottom carton are illustrated in FIGS. 2 through 6. As the suction cups 38 approach and engage the bottom panel

14 (FIG. 2), the needle moves toward and into the carton, the beginning of the downward motion of the cups (FIG. 3) and the full insertion of the needle being practically simultaneous in a high-speed machine so that the needle is within the carton before the upper flaps yield around the fixed fingers 33. In the fully inserted position of the needle (FIG. 4), the free end extends beyond the score lines forming the flap folds and supports the upper panel 13 and the associated flaps independently of the fixed fingers.

With the actuating mechanism shown in FIG. 11, the needle 55 is inserted and withdrawn rapidly and moves generally edgewise between the panels at the inner end of its stroke thus, in effect, dwelling momentarily in the inserted position. Accordingly, this form is especially well suited for use with relatively large cartons in which a greater separation of the panels may be necessary to insure adequate breaking of the fold lines. In addition, this form has the advantage of a positive edgewise slicing motion which may be utilized to cut across part of the glued seam 21 and slice any accidental glue seal in the path of the needle.

After a predetermined amount of separation of the panels 13 and 14, the needle 55 is withdrawn from the carton (FIG. 5) and the upper flaps yield to pass around the fingers 33 as shown in FIG. 6. The cups 38 then carry the carton in at least partially opened condition downwardly past the cam edges 53 and into the transfer station 37.

Herein, a second splitter needle 55 is mounted on the opposite side of the magazine to be inserted in and withdrawn from the cartons in unison with the first needle, the elements for actuating the second needle being the same as the elements actuating the first needle and being indicated in the drawings by the same reference numbers. To swing the arms 57 in unison toward and away from the magazine 11, sprockets 67 shown in phantom in FIG. 11 are mounted above the cranks 59 on the shafts 60 and an endless chain 68 is wound around the sprockets 67 and also around two idler sprockets 69 which direct the chain around the sprockets 67 in opposite directions. Thus, when the chain is driven in the direction indicated by the arrows in FIG. 11, the arms swing in unison toward and away from the magazine. Herein, the chain is driven from the camshaft 23 by an endless chain 70 driving one of the shafts 60 through a suitable gear box (not shown). By using two needles, the stroke of each one may be shortened with a resulting saving in the time required to insert the needles far enough to support the upper panel.

An alternative form of the needle-supporting mechanism is shown in FIG. 12. In this instance, needles 71 similar to the needles 55 are disposed on opposite sides of the magazine 11 in a plane extending between the panels of the bottom carton and are supported on horizontal arms 72 each rigid with a slide block 73 guided on parallel horizontal guide bars 74 extending across one side of the magazine. The blocks are slid back and forth toward and away from each other along the bars to carry the needles 71 into and out of the carton by a T-shaped crank 75 pivoted on a horizontal pin 77 fast on the frame. Two legs 78 and 79 of the crank project generally upwardly and downwardly from the pin 77 and are pivotally connected to the blocks by links 80 and 81. The remaining crank leg 82 preferably is perpendicular to the legs 78 and 79 and is pivotally connected at its free end to an upright rod 83 which is reciprocated endwise up and down by a suitable eccentric connection (not shown) with the camshaft 23.

This up and down movement of the rod 83 rocks the crank 75 about the pivot pin 77 to slide the blocks 73 alternately together and apart, thus inserting and withdrawing the needles 71. As before, the timing of this movement is such that the needles remain within the carton long enough to hold the upper panel 13 of the bottom carton in place until the bottom panel 14 has been pulled a predetermined distance from the upper panel in the manner shown in FIGS. 2 through 6.

In the transfer station 37, the carton on the platform 51 is held in the partially open condition by means of pairs of blocks 84 and 85 spaced apart to engage the leading and trailing edges 54 and 87 of the carton as shown in FIGS. 9 and 10, preventing elongation and collapse of the carton after it is released by cups 38. Herein, the blocks are mounted on horizontal rods 88 carried by upright fingers 89 fast on horizontal rods 90 disposed on opposite sides of and paralleling the path of the cartons. The trailing pair of blocks 85 project upwardly on opposite sides of the platform 51 to engage the trailing carton edge 87 and the leading pair of blocks 84 are formed with notches in their lower rear corners to receive the leading edge 54 of the carton.

In order to transfer the cartons 10 from the platform 51 onto the conveyor 12, each carton first is shifted edgewise and horizontally into a station 91 above one end of the conveyor where the carton is clear of the transfer device, and then is transferred generally sidewise downwardly onto the conveyor by a novel loading unit which maintains positive control of the carton at all times. Also, the erection of the carton is completed during this transfer. This two-step transfer makes it possible to overlap the motions of the transfer device and the loading unit, the arms swinging up toward the magazine to engage another collapsed carton as soon as the preceding carton has been shifted from the platform into the station 91.

The horizontal portion of the transfer is accomplished by moving the blocks 84, 85 in unison edgewise of the carton into a position over the end of the conveyor while maintaining the spacing of the blocks. For this purpose, the rods 90 are slidable in guides 92 and 93 mounted on brackets 94 and 95 on the frame and are connected together by yokes 97 spanning their ends. Fast on one of the rods is a block 98 on which a link 99 is fulcrumed at one end, the other end of the link being pivoted on the upright arm 100 of a bell crank 101 (FIGS. 8, 9 10) pivoted on a horizontal shaft 102 extending transversely of the frame. The other arm 103 of the bell crank is connected by means of a link 104 (FIG. 8) to a crank 105 on a shaft 107 journaled in the gear box 50 and continuously rotated by the gearing in the box. Thus, the bell crank 101 is rocked back and forth to reciprocate the rods 90 endwise back and forth on the frame and carry successive cartons from the transfer station 37 to the station 91 above the conveyor.

The loading unit includes a chute formed by forward and rear guide bars 108 and 109 which are spaced apart to receive the cartons in the partially opened condition and engage the leading and trailing edges 54 and 87 of the cartons, the bars converging downwardly toward the conveyor to a spacing less than the spacing of the leading and trailing edges of the carton. Herein, the forward guide bars 108 are supported adjacent their upper ends on horizontal bars 110 (FIGS. 10, 11 and 12) extending toward each other from upright posts 111 (FIG. 11) on the frame, the guide bars being spaced apart a distance less than the length of the cartons.

The upper portions 112 of the bars 108 curve downwardly and forwardly as shown in FIGS. 9 and 10 and the intermediate portions 113 are straight and inclined downwardly and forwardly to a point above the conveyor where the forwardly extending lower end portions 114 parallel the bed 28 and are spaced above the latter a distance approximately equal to the erected thickness of the cartons. The rear guide bars 109 are bolted at 115 to the underside of the platform 51 and curve downwardly and forwardly to a point below the bed while converging slightly relative to the curved portions 112.

To shift successive cartons down the chute, an arm

117 constituting part of the loading unit is fulcrumed at one end on a bracket 118 supported on a transverse beam 119 disposed beyond the station 91 and extends rearwardly and normally horizontally from the bracket with the free end of the arm carrying a flat plate 120 above the station. Projecting laterally from the arm 117 is a bar 121 which is connected by a link 122 to one arm 123 of a bell crank 124 (FIG. 8) pivoted on a horizontal shaft 125 on the frame above the camshaft 23, the arm being horizontal in the position shown in FIG. 8. The other arm 127 of the crank extends downwardly and carries a follower roller 128 which rides in an annular track (not shown) recessed into one side of a cam 129 which rotates with the camshaft.

As the cam turns, the track shifts the roller radially inwardly and outwardly to rock the crank 124 about the shaft 125 and thereby swing the free end of the arm 117 into and out of the upper end of the chute. The two positions of the arm are shown in FIGS. 9 and 10. Each downward stroke of the arm is timed to occur immediately after a carton is delivered to the station 91 so that the plate 120 engages the top of the carton and presses the latter downwardly into the chute.

Due to the convergence of the guide bars 108 and 109, each carton is compressed laterally in passing down the chute, the bottom panel 14 being shifted to the right (FIGS. 9 and 10) relative to the top panel 13 thus further opening the carton. More importantly, this compression of the cartons insures frictional engagement at all times between the curved guide bars and the carton edges 54 and 87 whereby the cartons are held in place in the chute in case it is necessary to turn off the machine during operation. The arm 117 continues to swing downwardly when operation is resumed and the carton is moved onto the conveyor 12 as if there had been no stoppage.

It will be seen that the arm swings the trailing edge 87 of each carton downwardly along the chute until it comes to rest on the bed 28 between two sets of conveyor lugs 27. In this position, the leading carton edge 54 is positioned at the lower end of the curved bar portions 112. As the next pair of lugs 27 pass around the upper sprockets 24, they engage the trailing edge 87 of the carton and begin to move the carton forwardly along the conveyor.

Means is provided to resist sliding of the leading carton edge 54 down the inclined portions 113 until the carton is almost completely expanded thereby preventing premature sliding of cartons onto the conveyor and possible flattening and jamming of cartons between the bars 108 and the lugs 27. This means herein takes the form of flat springs 130 (FIGS. 9, 10 and 11) fastened to the bars 110 and depending therefrom to form a yieldable stop engageable with the leading carton edge to hold the latter momentarily in place as the lugs 27 advance the trailing edge along the conveyor. At a predetermined instant determined by the stiffness of the springs, the latter swing forwardly, to the right as viewed in FIGS. 9 and 10, far enough to release the leading edge which then slides along the guide bars and into the pocket between two sets of lugs 27. When the leading sides of the trailing lugs are vertical, the carton is held in the fully expanded condition with the edge panels 15 held in vertical positions by the lugs. Thus, the loading unit at all times positively grips the cartons. Further, the two-step motion speeds up the transfer of cartons to the conveyor.

Advantage is taken of the two-step movement of the cartons into the station 91 and down the chute to the conveyor to fold all the flaps at one end of each carton away from the end in a novel manner preparatory to insertion of a product into the carton through this end. For this purpose, a plow 131 which may be a single, simple piece is disposed along the path followed by the cartons to engage all four flaps, fold them away from the open end, and subsequently hold them away from the end.

Herein, the plow 131 is a generally flat plate shown in full in FIG. 17 and including a body portion 132 disposed alongside the plane of the end of the carton in the station 91 with most of the plow below the level of the carton (see FIG. 9). Projecting rearwardly from the plow body is a finger 133 which is inclined upwardly and away from the carton end so that the tip of the finger overlies the leading edge of the bottom flap 18 (see FIGS. 13 and 14) as each carton moves edge wise into the station 91 in the direction of the arrow in FIG. 13. Thus, the bottom flap moves under the finger 133 and slides along thte inclined underside thereof, being cammed downwardly and folded by the finger toward the plane of the carton end and into the broken line position in FIG. 14 as the carton comes to rest above the plow.

As the carton is shifted downwardly and generally sidewise between the guide bars 108 and 109, the top flap 17 engages an upwardly facing surface 134 extending along the top of the plow and in the downward path followed by the top flap. Thus, the surface 134 folds the top flap upwardly toward the plane of the carton end. Also during the side wise motion, the edge flap 20 engages an inclined surface 135 disposed beneath the flap and inclined downwardly and forwardly to the left across the path as viewed in FIGS. 16 through 19. Thus, the surface 135 cams the flap 20 to the left and behind a finger 137 as the lower edge of the flap slides along the surface and thereby folds the flap 20 away from the open carton end and toward the plane of the end.

The remaining edge flap 19 which trails the carton during the edgewise motion into the station 91 may be cammed into an open position in various ways. Herein, it engages the adjacent side 138 (FIGS. 14 and 15) of the finger 133 as the carton is lowered into the chute as indicated in broken lines in FIG. 15, the flap being cammed rearwardly by this surface which is inclined rearwardly and away from the plane of the carton end. As each carton passes the plow 131, therefore, all four flaps are folded by the various surfaces of the plow into out-of-the-way positions shown in FIG. 20 and are held in these positions by the body of the plow. Below the plow and along the conveyor 12, the flaps are held open by fixed elements (not shown) in a manner well known in the art.

The invention also contemplates a novel construction and mounting of the magazine 11 such that the latter is highly versatile, being adjustable to handle a wide range of sizes of cartons while holding one end of each carton, regardless of its size, on a fixed reference line indicated at 139 in FIG. 11. For this purpose, the angle bars 29 and 30 are mounted on brackets 140 and 141 slidable longitudinally of the cartons along a rail 142 on one side of the stack and the bars 31 are mounted on plates 143 and 144 slidable transversely of the cartons on a parallel rail 145 on the other side of the stack, the two rails 142 and 145 extending transversely of the machine frame and being supported at their ends on the frame on side rails 147 (FIG. 11). The brackets 140 and 141 are in the form of blocks fast on plates 148 bolted to the sides of the angle bars, and are grooved at 149 to fit over the top of the rails as shown in FIG. 10. Slots 150, 151 through the brackets receive screws 152 which are threaded into the rail 142.

Thus, the angle bars 29 and 30 may be adjusted toward and away from each other along the rail 142 to accommodate different lengths of cartons, and are held in place by the screws 152. To hold one end of the cartons on a reference line, the bracket 141 is adjusted for the difference in the length of the flaps at one end only, while the bracket 140 is adjusted to accommodate the rest of the change in carton length. Accordingly, one end of each carton always lies along the reference line 139 both before and after the flaps are folded into open positions.

To accommodate increases or decreases in the collapsed width of the cartons, the plates 143 and 144, which are

formed with upturned ends **153** and **154** bolted at **155** to the bars **31**, are held on the rail **145** by screws **157** inserted through slots **158** (FIG. 11) in the plates and threaded into plates **159** fast on the rail. Thus, when the screws **157** are loose, the plates **143** and **144** slide endwise to carry the bars **31** toward and away from the angle bars **29** and **30**. The screws hold the plates and, hence, the bars any selected distance from the angle bars. Adjustment of the bars **31** longitudinally of the rail **145** may be accomplished by mounting the plates **159** for sliding on the rail in a manner similar to the mounting of the brackets **140** and **141**.

With the form of actuator shown in FIG. 11, adjustment of the positions of the needles **55** is accomplished simply by adjusting the frame plates **63** toward or away from the adjacent sides of the magazine. Herein, the plates also are held on the rail **145** by screws **160** which project through slots **161** extending longitudinally of the rail, the screws being threaded into portions of the plates below the rail. To provide or take up slack in the chain **68** during adjustment of the positions of one or both of the plates, one of the idler sprockets **69** is adjustable along a slot **162** in the frame. Adjustments in the stroke of the needles shown in FIG. 12 may be made simply by changing the crank **75** and the links **81** and **82**.

I claim as my invention:

1. In a machine for erecting cartons including two panels disposed side by side, the combination of, a frame, a magazine having an open end and mounted on said frame to hold a plurality of flattened cartons in a stack, means supporting said cartons releasably in said magazine, a pair of needles disposed on opposite sides of said magazine in a plane extending between the panels of the terminal carton in said stack, mechanism supporting said needles for gyratory movement in said plane to carry one end portion of each needle generally endwise in between the panels of the terminal carton, then edgewise in said plane between the panels, and finally endwise out of the carton, a transfer device supported on said frame for movement transversely of said plane toward and away from said open magazine end and engageable with the exposed side of the terminal carton to withdraw the latter from said magazine, and mechanism for moving said needles along said paths in timed relation with the movements of said device to insert the needles in the terminal carton as said device pulls the exposed panel away from the stack whereby said needles hold the inner panel of the terminal carton temporarily in place and cooperate with said device in erecting the carton.

2. In a machine for erecting collapsed cartons including two panels disposed side by side, the combination of, a frame, a magazine having an open end and mounted on said frame to hold a plurality of cartons side by side in a stack, means on said magazine at said open end holding said cartons releasably in said stack, a pair of elongated needles disposed on opposite sides of said magazine in a plane extending between the panels of the terminal carton in said stack, and mechanism supporting said needles for gyratory movement in said plane to carry the blades first generally endwise toward each other and into said terminal carton, then edgewise in said plane between said panels, and fiinally endwise out of the carton.

3. In a machine for erecting at least partially collapsed cartons including two separable side panels disposed face to face with one panel offset laterally relative to the other and with the offset edges hingedly joined together by two edge panels, the combination of, a frame, a chute on said frame formed by two guides spaced apartt at one end of said chute to receive said cartons sidewise in the collapsed condition, said guides being arcuately curved and converging toward each other from said one end toward the other end to a spacing less than the collapsed width of the cartons, an arm fulcrumed at one end on said frame with its free end extending across said one end and swingable inwardly along said chute, mechanism on said frame for delivering cartons one by one to a position between said arm and said one chute end, and means for swinging said arm into and along said chute in timed relation with the delivery of cartons to said position whereby the arm engages the carton in said position and shifts the carton sidewise down the chute to compress the carton laterally between said guides and thereby further separate the side panels while at the same time frictionally engaging the cartons.

4. In a machine for erecting at least partially collapsed cartons including two side panels disposed face to face with one panel offset laterally from the other and with the offset edges hingedly joined together by two edge panels, the combination of, a frame, a conveyor on said frame having a plurality of spaced pockets thereon each including a trailing wall and a leading wall for holding an open carton between them and advancing the carton along a predetermined path, means for delivering successive cartons to a station above said conveyor, a first guide extending from a point adjacent the trailing edge of the carton in said station to a point below said conveyor to guide said trailing edge into one of said pockets, a second guide spaced forwardly from said first guide and inclined downwardly and forwardly to engage the leading edge of said carton and guide the leading edge downwardly into said pocket, mechanism on said frame for shifting said cartons downwardly and generally sidewise between said guides and seating said trailing edge in said pocket, and a spring mounted on said frame to engage said leading edge and hold the latter yieldably against sliding along said second guide and into said pocket whereby said trailing pocket wall engages said trailing edge and advances the latter relative to said leading edge until the carton is compressed an amount sufficient to overcome the spring force, said spring then releasing said leading edge to slide along said second guide and into said pocket.

5. In a machine for erecting at least partially collapsed cartons including two side panels disposed face to face with one panel offset laterally from the other and with the offset edges hingedly joined together by two edge panels, the combination of, a frame, a conveyor on said frame having a plurality of spaced pockets thereon each including a trailing wall and a leading wall for holding an open carton between them and advancing the carton along a predetermined path, a guide mounted on said frame above said conveyor and inclined downwardly and forwardly toward a loading station on the conveyor, means for delivering successive cartons to said loading station and seating the trailing edges thereof in successive pockets with the leading edges engaging said guide above said station, and means yieldably engaging said leading edges to hold the latter against moving along said guide as said trailing walls move said trailing edges along said path whereby said trailing walls compress each carton laterally, said means releasing said leading edges to slide down said guide and into said pockets in response to predetermined amounts of compression of said cartons.

6. In a machine for opening cartons having open ends surrounded by top, bottom and two edge flaps, the combination of, a frame, mechanism on said frame for supporting cartons with said ends in a predetermined plane and for edgewise movement one by one along a first generally horizontal path into a predetermined position and then generally sidewise movement downwardly along a second path, a plow disposed along said paths and having a body disposed alongside said plane, a finger on said plow disposed along said first path and inclined upwardly and rearwardly from a point below the level of said bottom flap to a point above the latter to engage the leading edge of the bottom flap during said edgewise movement and fold it downwardly as the carton moves into said position, a surface on said plow disposed below the leading edge flap of the carton in said position and inclined downwardly and forwardly across the path followed by said leading edge flap during said sidewise movement whereby the leading edge flap is cammed forwardly away from said

open end and into said plane during such movement, an upwardly facing surface on said plow positioned along the path followed by said top flap during said sidewise movement to engage the upper flap and fold the latter upwardly away from said open end and into said plane, and a rearwardly facing surface on said plow positioned along the path followed by the other edge flap to engage the latter and fold it rearwardly away from said open end and into said plane, said body subsequently holding said flaps in said plane.

7. In a machine for opening cartons having open ends surrounded by two side flaps and two edge flaps, the combination of, a frame, mechanism on said frame for supporting cartons with said ends in a predetermined plane and for edgewise movement one by one along a first path into a predetermined position and then generally sidewise movement from said position along a second path, a plow disposed along said paths and having a body disposed alongside said plane, a surface on said plow inclined forwardly and across said second path to engage the leading edge of one of said edge flaps during said sidewise movement and fold said one edge flap forwardly away from said open end and into said plane, a surface on said plow disposed along said second path to engage the leading side of the side flap which trails during said sidewise movement and fold the side flap away from said open end and into said plane, a finger on said plow projecting rearwardly and inclined across said first path to engage the leading edge of the other side flap during said edgewise movement and fold said other side flap away from said open end and into said plane, and a rearwardly facing surface on said plow positioned along the path followed by the other edge flap to fold the latter rearwardly and into said plane, said body subsequently holding said flaps in said plane.

8. In a machine for erecting rectangular collapsed cartons held side by side in a stack and including side panels with flaps at each end, the combination of, a frame, a pair of upright elongated members spaced apart to engage adjacent corners of said stack on one side of the latter, means mounting one of said members in a fixed plane on said frame for selective adjustment in said plane toward and away from the other member and along one side of said stack to accommodate changes in the length of the carton flaps at one end, means mounting the other member on said frame for selective adjustment in said plane toward and away from said one member to accommodate changes in the length of the remainder of the collapsed carton whereby one side and one end of said carton are held on predetermined reference lines regardless of variations in the length and width of the carton, at least one elongated element on the other side of said stack and intermediate the ends of the stack having an edge for engaging said other side, and means mounting said element for selective adjustment toward and away from the plane of said members to accommodate cartons of different widths.

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