

Jan. 14, 1958

A. JOHNSON

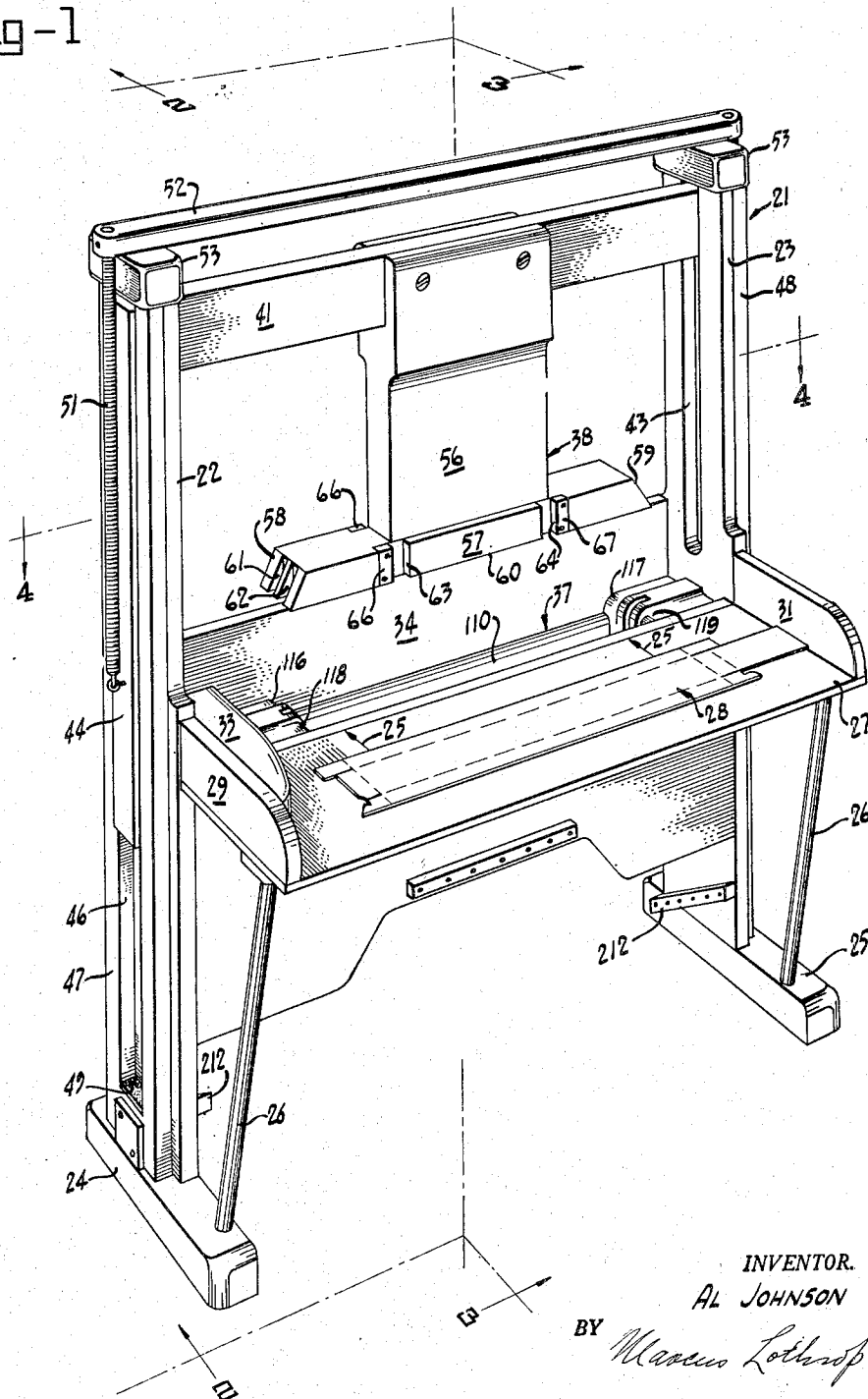
2,819,660

CARTON FOLDING AND LOCKING MACHINE

Filed Oct. 7, 1954

5 Sheets-Sheet 1

Fig-1



Jan. 14, 1958

A. JOHNSON

2,819,660

CARTON FOLDING AND LOCKING MACHINE

Filed Oct. 7, 1954

5 Sheets-Sheet 2

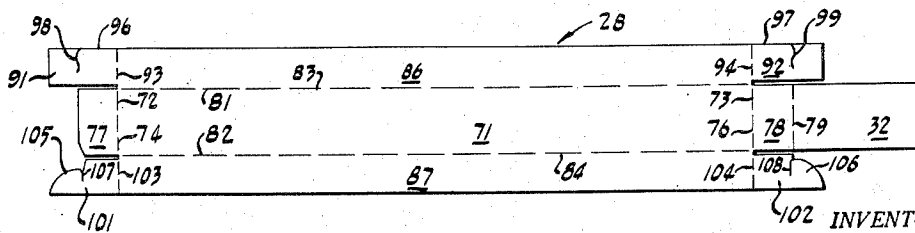
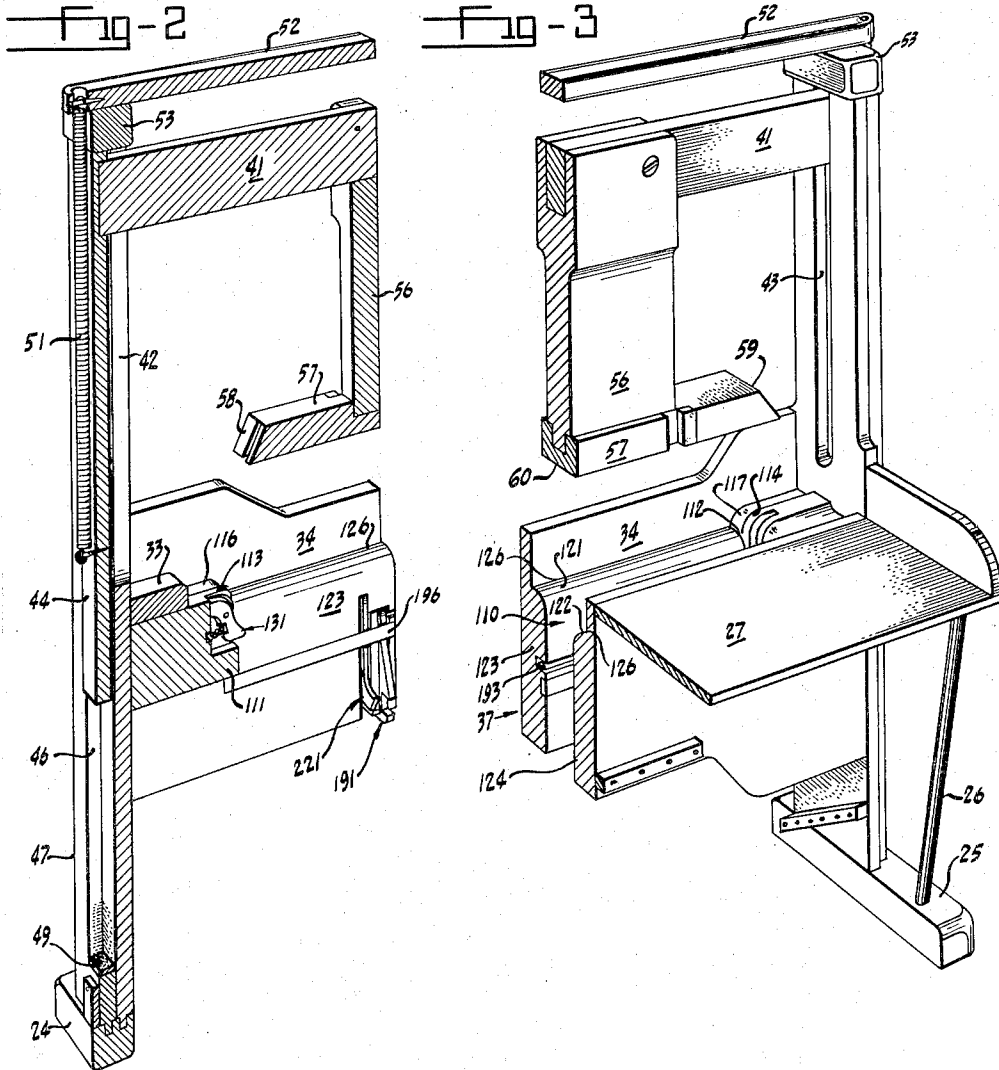


Fig -17

INVENTOR.
AL JOHNSON
BY *Manuel Lotz*
ATTORNEY

Jan. 14, 1958

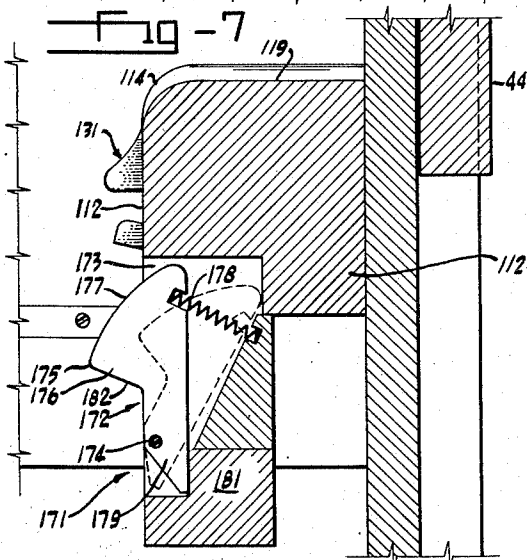
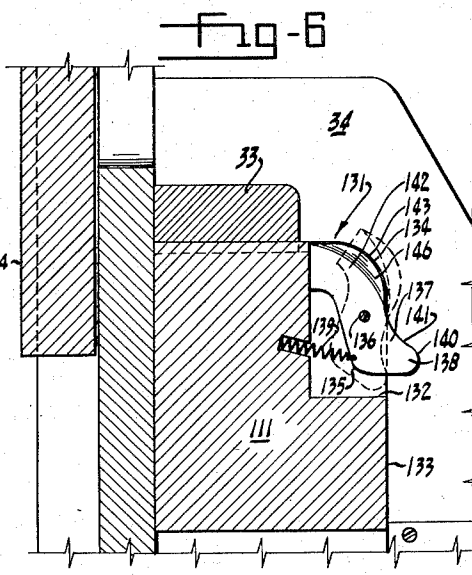
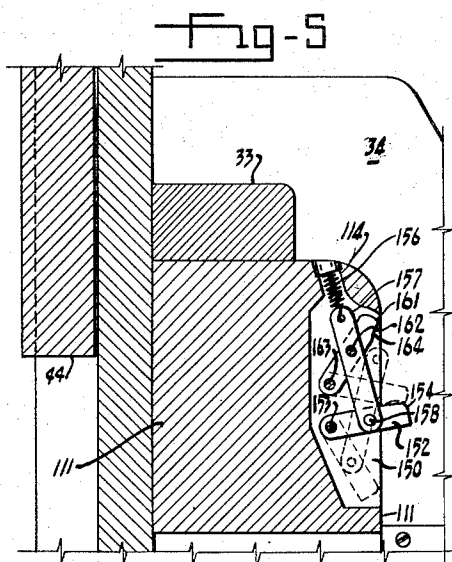
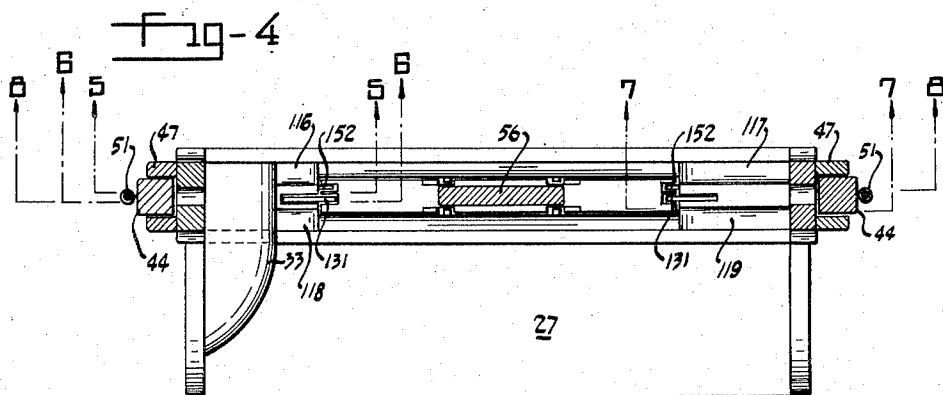
A. JOHNSON

2,819,660

CARTON FOLDING AND LOCKING MACHINE

Filed Oct. 7, 1954

5 Sheets-Sheet 3



INVENTOR.
AL JOHNSON
BY *Maxwell Lottrop*
ATTORNEY

Jan. 14, 1958

A. JOHNSON

2,819,660

CARTON FOLDING AND LOCKING MACHINE

Filed Oct. 7, 1954

5 Sheets-Sheet 4

Fig-8

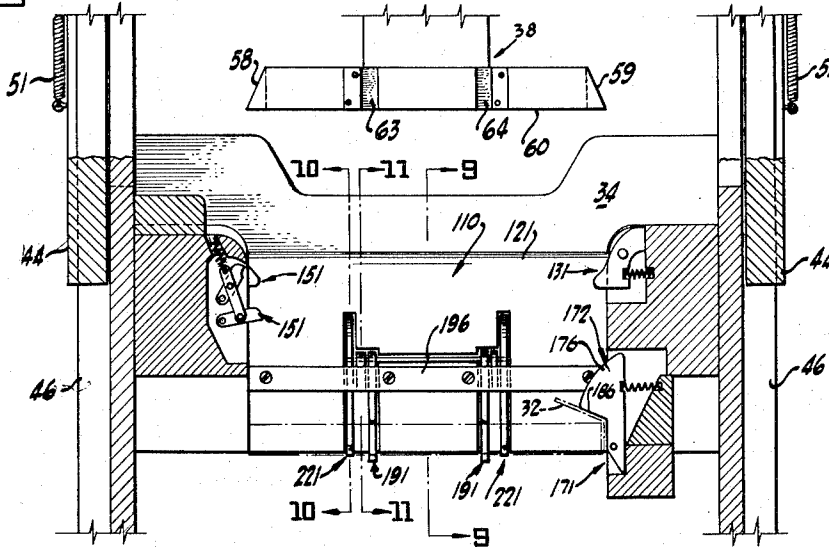


Fig-9

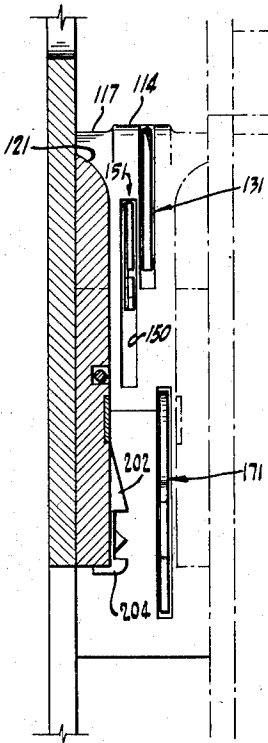


Fig-10

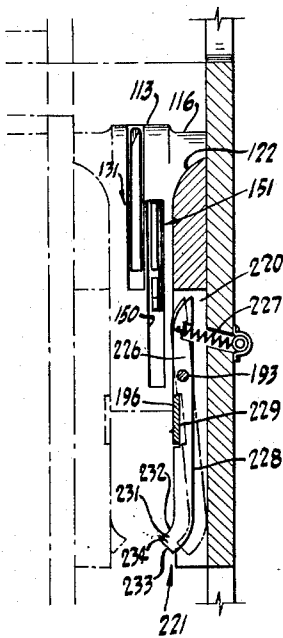
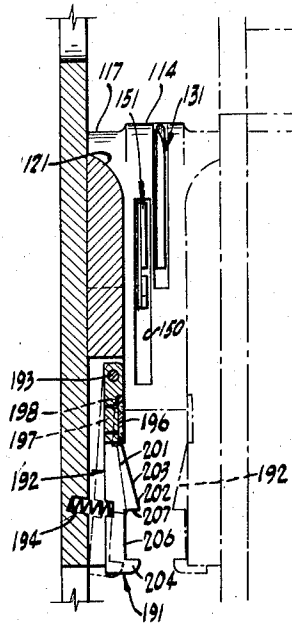


Fig-11



INVENTOR.

AL JOHNSON

BY

Marcus Lott

ATTORNEY

Jan. 14, 1958

A. JOHNSON

2,819,660

CARTON FOLDING AND LOCKING MACHINE

Filed Oct. 7, 1954

5 Sheets-Sheet 5

Fig-12

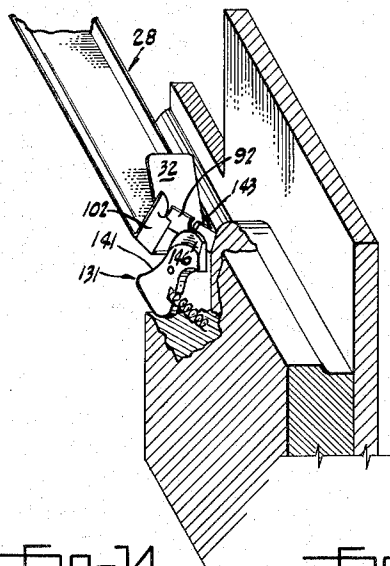


Fig-13

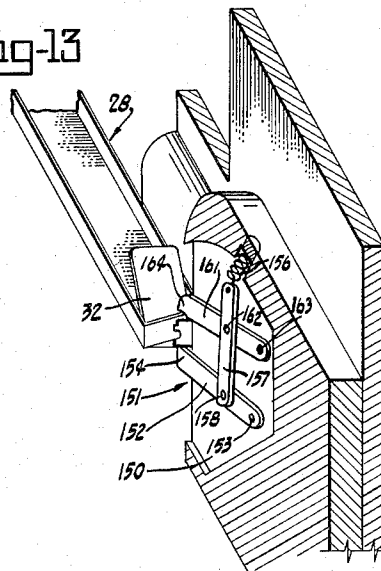


Fig-14

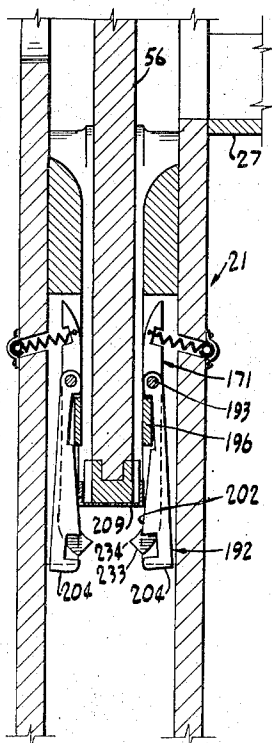


Fig-15

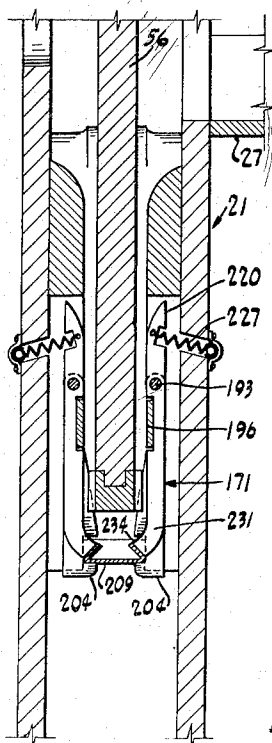
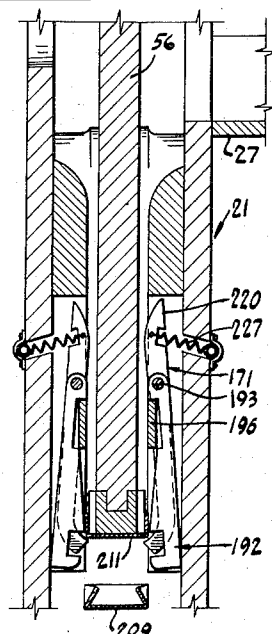


Fig-16



INVENTOR.

AL JOHNSON

BY *Maxim Lothrop*

ATTORNEY

1

2,819,660

CARTON FOLDING AND LOCKING MACHINE

At Johnson, Stockton, Calif.

Application October 7, 1954, Serial No. 460,815

13 Claims. (Cl. 93—51)

The invention relates to machines for converting carton blanks into carton form and especially to machines for folding and locking elongated carton blanks into cartons of the kind used, for example, to package elongated objects such as tapers and other varieties of wax candles.

Large manufacturers ordinarily employ automatic, high-speed carton-forming machines to convert carton blanks into the cartons used to package their product. Small producers, such as specialty shops, on the other hand, resort to hand-folding of the blanks because the large output of high-speed machines is not adapted to their size of operation. Between the small and the large manufacturer is an extensive group of intermediate-sized operators who seek to avoid the expenses attendant upon the purchase or rental of the high-speed machines, but who often require a substantial number of cartons (for example, during rush or peak seasons) and find that the cost of hand-folding a large number of carton blanks becomes competitively prohibitive, owing to present-day wages.

It is therefore an object of the invention to provide a carton folding and locking machine which is hand-actuated but which greatly increases the production of cartons over that obtainable by hand-folding.

It is another object of the invention to provide a machine which is economical in price, and cheap in operation and upkeep, yet which is capable of producing sufficient cartons to satisfy the needs of most intermediate-sized manufacturers who package their product in such cartons.

It is still another object of the invention to provide a machine which requires but a small amount of floor space and which does not need for its operation any electrical energy source or electrical connections.

It is a further object of the invention to provide a machine which not only converts a blank into a fully formed and interlocked carton but which also pre-sets the elongated side panels of the carton in an inwardly inclined attitude to assist in packaging the product in the carton.

It is yet another object of the invention to provide a generally improved carton folding and locking machine.

Other objects, together with the foregoing, are attained in the embodiment hereinafter described and illustrated in the accompanying drawings in which:

Figure 1 is a left front perspective view of the machine embodiment and showing in outline, a typical carton blank, located on the carton storage tray preparatory to being moved onto the top of the carton forming die.

Figure 2 is a sectionalized perspective view of the left-hand portion of the machine shown in Figure 1, the section being taken along the vertical, transverse, substantially median plane indicated by the line 2—2 of Figure 1.

Figure 3 is a sectionalized perspective view of the right-

2

hand portion of the machine shown in Figure 1, the section being taken along the vertical longitudinal, substantially median plane indicated by the line 3—3 of Figure 1.

Figure 4 is a sectional view of the machine looking downwardly on the die, the plane of section being indicated by the line 4—4 of Figure 1.

Figure 5 is an enlarged sectional view of the lock panel clamping mechanism, the plane of section being indicated by the line 5—5 of Figure 4.

Figure 6 is an enlarged sectional view of the lock panel flexing and biasing mechanism, the plane of section being indicated by the line 6—6 of Figure 4.

Figure 7 is an enlarged sectional view of the carton tongue deflecting mechanism, the plane of section being indicated by the line 7—7 of Figure 4.

Figure 8 is a sectional view of the die and an elevational view of the bottom portion of the plunger, the plane of section being substantially indicated by the line 8—8 of Figure 4.

Figure 9 is a sectional view looking toward the right-hand end of the die, the plane of section being indicated by the line 9—9 of Figure 8.

Figure 10 is a sectional view looking toward the left-hand end of the die, the plane of section being indicated by the line 10—10 of Figure 8, and showing in outline a carton side panel pre-setting finger in fully retracted position in the rearward side wall of the die.

Figure 11 is a sectional view looking toward the right-hand end of the die, the plane of section being indicated by the line 11—11 of Figure 8, and showing, in outline, a carton retaining jaw in fully retracted position in the rearward side wall of the die.

Figure 12 is a sectionalized perspective view of a portion of the right-hand lock panel flexing and biasing mechanism and showing the folded condition of the carton just prior to the lock panel flexing and biasing operation of the mechanism.

Figure 13 is a sectionalized perspective view of a portion of the right-hand lock panel clamping mechanism, and showing the interposed lock panels being clamped into full interlocking engagement.

Figure 14 is a median vertical sectional view of the die looking toward the right-hand end of the die in the machine appearing in Figure 1, and showing the plunger and carton in descending operation, the carton retaining jaws having been cammed outwardly into partially retracted position preparatory to receiving the carton formed about the plunger.

Figure 15 is a view similar to Figure 14 but showing the plunger in ascending position, the carton having been stripped from the plunger and being held by the carton retaining jaws, the deflecting fingers pressing inwardly on the carton side panels to deform and pre-set the side panels.

Figure 16 is a view similar to Figures 14 and 15 but showing the plunger descending with the next carton, the carton-holding jaws having been cammed outwardly to fully retracted position and releasing the previously held carton shown falling downwardly through the die.

Figure 17 is a plan view of a typical carton blank of the kind used in the machine embodiment illustrated in Figure 1.

While the carton folding and locking machine of my invention is susceptible of numerous embodiments depending upon the particular environmental situation to be met, a number of the herein-described and illustrated embodiments have been made and used, and have performed in an eminently satisfactory fashion.

The machine's frame, generally designated as 21, comprises a pair of vertical standards 22 and 23 supported on a pair of horizontally extending feet 24 and 25, respectively. Projecting horizontally outwardly from the standards at a convenient height for the operator, and supported by a pair of legs 26, is a tray 27 for holding a stack of carton blanks such as the blank 28, the topmost one of the blanks being slid toward the rear of the machine, in the direction indicated by the arrows 25, by the machine operator at the beginning of each carton-forming cycle. The tray is bounded on each side by upstanding guide rails 29 and 31, the right-hand rail 31 being abutted by the end of an elongated tongue 32 on the right-hand end of the particular blank 28 illustrated, and serving as one transverse bench mark to assist the operator in guiding the blank into proper location between the standards and over the die for proper engagement with the carton-forming elements therein. A smoothly faired block 33 located against the inner side of the left-hand guide rail 29 is appropriately dimensioned to suit the maximum length of the particular blank used and likewise assists in transversely positioning the blank between the standards. A vertical stop plate 34 at the rear of the frame serves to locate the blank in the proper longitudinal position, the blank being slid rearwardly until it abuts the plate.

With the carton blank placed in proper transverse and longitudinal position, the carton forming and locking operation itself is ready to be undertaken, the blank at this juncture being located on top of the carton forming die, generally designated as 37, and underneath a plunger, generally designated by the numeral 38.

The plunger 38 comprises a horizontal transverse bar 41 extending at each end through a pair of corresponding vertically elongated apertures 42 and 43 in the standards 22 and 23, the apertures being slightly wider than the bar thickness to permit vertical translation of the bar ends in the apertures. The outer ends of the bar are secured to a pair of vertical rods 44 reciprocably movable in corresponding slots 46 formed in a pair of cheek members 47 and 48 mounted on the outer sides of the standards 22 and 23. The vertical rods 44 and attached plunger cross bar 41 are movable downwardly from an uppermost position, shown most clearly in Figure 2, to a lowermost position determined by abutment of the lower ends of the vertical rods 44 with a corresponding pair of sound-deadening and shock-absorbing pads 49 located at the bottom of the slots 46. Urging the plunger into uppermost position, and resisting downward motion thereof, is a pair of resilient members 51 such as springs, the upper ends of the springs being mounted on the ends of a transverse frame bracing bar 52 supported on a pair of fixed blocks 53 surmounting the co-extensive cheek members and standards, and the lower ends of the springs being secured to the rods 44 in a position such that the spring 51 is under some tension even when the plunger is in its uppermost location. Depending from the transverse vertically reciprocable plunger bar 41 is a block 56 having mounted on the bottom end thereof an elongated, transversely disposed plunger shoe 57.

The plunger shoe includes an elongated body generally rectangular in cross-section but with an upwardly and inwardly inclined taper or bevel on its ends 58 and 59, and with a flat base 60. Vertical slots 61 and 62 are formed in each of the tapered end portions to avoid interference with certain projecting and carton forming elements in the die and to provide a relief or recess to inward bending of the carton ends in a fashion to be hereinafter described. Vertical slots 63 and 64 are also provided on each side of the plunger shoe to avoid interference with certain other projecting elements on the die side walls, as will be later described. Mounted on the shoe adjacent the outer sides of each of the slots 63 and 64 are inserts 66 and 67, or wearing members adapted

to engage still other projecting die elements, to be later described.

With the carton blank in proper position on top of the die 37, the plunger structure is caused to descend from its uppermost position into engagement with the carton blank. While this motion is ordinarily produced by the operator pressing downwardly on the plunger bar 41, it is to be understood that mechanical force or other force such as that obtained from a hydraulic or pneumatic plunger-cylinder mechanism may be used if desired, the force in such case preferably being exerted on the plunger bar.

The plunger descends so that the base 60 of the plunger shoe 57 comes into engagement or abutment with the elongated carton blank 28 and more especially into engagement with that elongated portion of the blank called a bottom panel 71, as appears most clearly in Figure 17, the bottom panel forming the center or main panel to which other foldable panels are attached. Connected to each end 72 and 73 of the bottom panel, along score lines 74 and 76 is a pair of end panels 77 and 78, respectively, the end panels being foldable upwardly with respect to the bottom panel into a position substantially normal thereto. For some purposes, it is desirable that one end of the carton be provided with an end panel which is lengthened to form the tongue 32, heretofore mentioned, and which is connected to the end panel, for example, the right-hand end panel 78, along a score line 79, the tongue being inwardly foldable about the score line 79 to overlie a portion of the bottom panel and being spaced therefrom in final carton form so as to overlie and protect the corresponding end of the packaged product.

Connected to opposite sides 81 and 82 of the bottom panel, along score lines 83 and 84, respectively, is a pair of side panels 86 and 87 upwardly foldable to a position substantially normal to the bottom panel 71.

While there are numerous kinds of carton locking panel constructions, a very satisfactory type is illustrated most clearly in Figure 17. One portion of the lock panel construction comprises a pair of lock flaps 91 and 92 connected along respective score lines 93 and 94 to opposite ends of the side panel 86. Generally parallel to the score lines 93 and 94 and extending inwardly from the outer sides 96 and 97, respectively, of the lock flaps 91 and 92, to a position approximately half way across the flaps, is a pair of cuts 98 and 99, preferably sinuous and disposed in mirror symmetry with respect to each other. The other portion of the lock construction comprises a pair of lock tabs 101 and 102 connected along respective score lines 103 and 104 to opposite ends of the side panel 87. For greater ease in inserting the tab ends 105 and 106 into corresponding interlocking relation with the lock flaps 91 and 92, the tab ends 105 and 106 are arcuately formed or curved. Continuing the general shape of the curves as they enter the lock tabs is a pair of cuts 107 and 108, respectively, the cuts stopping at a point approximately half way across the width of the lock tabs and terminating in a slope substantially parallel with the corresponding score lines 103 and 104.

Upon coming into engagement with the bottom or main panel 71, the base 60 of the plunger urges the bottom panel and thus the entire carton in a downward direction and into a central vertical aperture, designated by the numeral 110, in the die 37, the aperture being bounded at each end by die end walls 111 and 112 and at each side by die side walls 123 and 124.

In order first to fold the end panels 77 and 78 into a position substantially normal to the bottom panel 71, there is provided on top of each end wall 111 and 112 of the die a pair of first shoulder members 113 and 114, respectively, each of the first shoulder members being substantially the width of the carton end panels 77 and 78. The first shoulder members are arcuately formed or rounded on their inner or facing ends, the curved portion of the

shoulders acting in co-operation with the adjacent descending bottom ends of the plunger shoe to fold upwardly, about the shoe ends, the interposed end panels, folding taking place about the weakened score lines 74 and 76 as hinges.

The first shoulder members 113 and 114 are at a somewhat higher elevation than a second pair of rounded shoulders 116 and 117 adjacent thereto and which are located rearwardly therefrom, that is, toward the stop plate 34. The second pair of shoulders are provided to act upon the lock flaps 91 and 92 and to cause the lock flaps to fold upwardly about score lines 93 and 94, respectively, the side panel 86 remaining substantially co-planar with the bottom panel 71 during upward folding of the lock flaps.

At an elevation slightly below the second pair of shoulders 116 and 117 is a third pair of shoulders 118 and 119 adjacent the first pair of shoulders and located forwardly therefrom. The second pair of shoulders acts upon the corresponding lock tabs 101 and 102 in a fashion very similar to that effected by the second pair of shoulders on the lock flaps, but in a slightly retarded sequence with respect to the lock flaps owing to the lower elevation and slightly less steeply rounded contour of the third pair of shoulders, the side panel 87 remaining substantially coplanar with the bottom panel 71 while the lock tabs are being folded upwardly.

As the plunger continues to descend into the die aperture, the still outstretched side panels 86 and 87 are urged into abutment with a pair of arcuately flared side shoulders 121 and 122 at the upper ends of the die side walls 123 and 124. The outer edges of the side panels impinge first, against the upper and outermost margins 126 of the side shoulders. Then, as the side panels continue to move downwardly under urgency of the plunger, each of the inwardly curved shoulder surfaces acts or pushes upwardly and inwardly against the abutting side panel along a line of tangency, the line of tangency or contact moving inwardly across the abutting side panel as downward motion proceeds. The upward and inward force exerted by the rounded shoulders thus effects a folding action on each side panel, about the respective side panel score line and about the lower side edge of the plunger shoe as a hinge.

At this juncture, the previously folded lock flaps and lock tabs, folded in that order, have commenced to swing inwardly toward each other along with the side panels to which they are connected, the lock flaps beginning to overlap the adjacent previously folded end panels and the lock tabs beginning to overlap the adjacent lock flaps, the flap and tab folding shoulders being shaped so that the flaps underlie the tabs as explained above. The farther the plunger urges the side panels through the side shoulders, the greater the amount of fold imparted to the side panels and the greater the amount of overlap between the lock flaps and lock tabs.

Shortly before the arcuate portion of the lock tab overlaps the cut in the adjacent lock flap, mechanism is placed in operation for engaging and flexing the portion of the lock flap adjacent the lock tab, flexing taking place about the weakened part of the lock flap in a line with the flap cut, and for opening the cut to provide a clear passageway therethrough for the approaching lock tab. Mechanism is also provided for engaging and biasing the leading or arcuate portion of the lock tab through the opened cut in the lock flap so that at least partial interlocking of the lock flap and lock tab is effected.

The mechanism provided to accomplish the foregoing purposes comprises a pair of flexing and biasing leg-shaped elements, generally designated as 131, and which are most clearly illustrated in Figures 6 and 12. The elements 131 are located on each end wall of the die, and are constructed in substantially mirror symmetry, so that a description of one serves equally to describe the other. Each of the flexing elements 131 is located sub-

stantially centrally between the die sides in a recess 132 in the corresponding die end wall and is rockably mounted on a pivot pin 136 extending between the sides of the recess 132. The leg-shaped element 131 includes a lower

5 portion 137, or foot, having a toe 138 which is urged toward a projected position wherein the toe extends inwardly into the die aperture from a vertical face 133 of the die end wall, urgency being effected by a compression spring 139 bearing against a heel portion 135 of the foot. 10 The upper margin 141 of the toe is arcuately formed to provide a curved camming face, 140 so that as the descending plunger end, covered by the carton panels folded about the plunger end, comes into engagement with the toe upper margin 141 and the cam face 140 the 15 foot is rocked backwardly into the recess about the pivot pin 136 as an axis, the flexing element 131 then assuming the position shown in outline in Figure 6.

The flexing element 131 also includes an upper portion 142, or knee having an upper or top margin 143 arcuately 20 formed in general conformity to the arcuate shape of the adjacent first or uppermost shoulder member. The arcuately formed upper margin 143 on the knee 142 does not extend all the way across the width of the knee. Instead, on the side of the knee 142 adjacent the carton 25 lock tab, the knee margin 143 is carved away, as most clearly is shown in Figure 12, to form an inclined surface or biasing face 146. As the knee 142 is tilted forwardly into the position shown in outline in Figure 6 in response to the force exerted on the toe 137 causing the toe to 30 move into retracted position, the knee margin 143 and biasing face 146 are likewise moved forwardly or inwardly into projected position, pivoting taking place about the pin 136. As the knee moves inwardly into the die aperture, the leading knee margin 143 comes into en- 35 gagement with the inner portion of the lock flap, that is to say, with that portion of the lock flap on the side of the lock flap cut adjacent the approaching lock tab, and cams or urges or deflects that portion of lock flap inwardly toward the plunger end, and thus opens the cut to 40 permit ready entry of the lock tab. Concurrently, the leading or curved portion of the lock tab is urged into abutment with the biasing face 146 and, since the lock tab continues to be urged from behind by the closing side panel, the curved portion of the lock tab is slid 45 or cammed or biased by the face 146 into the opened cut in the lock flap, the rounded portion of the lock tab being moved into underlying relation behind the right half of the lock flap shown in Figure 12, with the generally rectangular portion of the lock tab overlying the left half of the lock flap. Owing to the inwardly in- 50 clined shape of the ends of the plunger shoe the knee 142, in effecting its flexing and biasing actions, can freely push inwardly on the locking panels (lock flap and lock tab) and in turn, on the previously folded adjacent and underlying end panel, the flexed panels bending or bow- 55 ing inwardly into the relief space provided by the inward taper of the shoe ends. The results obtained from folding the end panel inwardly and beyond a 90° attitude are highly beneficial, since a pre-set condition of the end 60 panel is effected by the slight over-bending, the panel returning to its correct vertical position as the resiliency of the carton material comes into play upon cessation of force exerted by the knee. In quite a similar fashion, the slight over-folding or pre-set of the lock panels causes 65 them to return, when the knee pressure is relieved, to their correct 90° position with respect to the side panels, and not to bulge or protrude outwardly as would be the case were they not slightly over-folded.

The flexing and biasing element not only effectively 70 urges the lock tab through the opened cut in the lock flap but also opens, at least to some extent, the co-operating cut on the lock tab, thereby permitting the lock tab and lock flap to interengage or interlock at least partially along their co-operating or mutually disposed 75 cuts. Owing to occasional imperfections in the manu-

facture of the carton blanks, however, the lock panels are not always biased into full interlocking engagement as a result of the flexing and biasing knuckle mechanism 131. In order to accomplish complete interengagement and in order to move the lock tab and lock flap into full interlocking position, a lock panel clamping mechanism 151 is provided, the mechanism and its operation being shown very clearly in Figures 5 and 13. One of the clamping mechanisms is located at each end of the die in a recess 150 in the die end wall and is spaced slightly below and rearwardly from the adjacent flexing and biasing mechanism, as illustrated, for example, in Figures 9 and 10. Each of the clamping mechanisms is substantially identical, and a description of one serves equally to describe the other.

The clamping mechanism comprises a lower finger 152, or backing finger, pivotally mounted in the recess 150 to swing about a pin 153, the free end 154 of the finger projecting normally into the die aperture and being swung downwardly by the force exerted by the descending carton formed about the plunger shoe and coming into engagement with the finger. The backing finger 152 is urged upwardly and toward its projected position by a tension spring 156 connected to a cross-lever 157 pivotally mounted on the backing finger 152 by a pivot pin 158 substantially centrally located on the finger. The cross-lever 157 is also pivotally connected to an upper finger 161 by a pivot pin 162, the upper finger 161 being mounted to swing about a pin 163. The spring 156 thus serves, not only to keep the lower finger in a normally projected position but also to keep the upper finger in a normally retracted position, and when the spring 156 and the lever 157 are in alignment, as shown in Figure 5, the fingers are located in their base or normal position. Upon abutment of the carton lower edge with the lower finger 152, the lower finger is swung downwardly by the descending carton (backed by the adjacent plunger shoe) to the lower or retracted position shown in outline in Figure 5. Concurrently, the upper finger 161 is swung by the connecting lever 157 into projected position, the positions of the pivot mountings being adjusted so that the free end 164 of the upper finger 161 swings downwardly more quickly, over the first portion of its arc, than does the lower or backing finger 152, the result being that the lower edge of the free end 164 of the upper finger 161 swings downwardly into contact with the upper edges of the already at least partly interlocked lock tab and lock flap and urges or pushes those lock panels downwardly into full interlocking engagement, the lower or backing finger 152 serving concurrently to back or support the lower edges of the lock panels during interlocking and serving as well to limit or stop or position the lock panels when they have been pushed downwardly into their fully interlocked condition. As soon as the lower finger moves into retracted position the descending carton is free to continue its downward motion, the lock panels at this juncture being in fully interengaged or interlocked position owing to the operation of the clamping fingers.

Some cartons, as, for example, the one shown in Figure 12, and formed from the blank illustrated in Figure 17, preferably include one end panel which is elongated, as heretofore explained, to form the tongue 32, the tongue helping to protect the packaged product at one end thereof. The end panel 78 adjacent the tongue 32 is folded to its vertical position by the first shoulder 113 early in the carton forming operation and, as a consequence, the attached tongue 32 protrudes upwardly from the upper edge of the end panel 78 and in a generally vertical attitude. To avoid interference between the tongue and the following carton, were the tongue permitted to remain in its vertical attitude, and to fold the tongue inwardly about the fold line 79 to its proper ultimate position, the carton converting device of my in-

vention includes a tongue-folding and hold-down mechanism 171, shown most clearly in Figures 7 and 8. The tongue folding mechanism comprises a rocker-arm 172 pivotally mounted in a recess 173, at the end of the die corresponding to the position of the tongue, to rock about a pin 174, the rocker-arm having an upper portion 176, or head, surmounted by an arcuate smoothly-faired camming surface 177, or margin terminating at its lower end in a point 175, the head 176 being urged inwardly toward the die aperture by a compression spring 178. The rocker-arm also includes a lower portion 179, or shank, abutting a shoulder 181 formed in the die wall to position the finger in the attitude shown in full line in Figure 7. The descending carton, and in particular, the adjacent end lower edge thereof, comes into engagement with the camming surface 177, tilting or rocking the head 176 backwardly into the recess 173 and into the retracted position shown in outline in Figure 7, the spring 178 undergoing compression. The head remains in retracted position as the carton continues its descent until the top edge of the adjacent interlocked lock flap and lock tab moves to a location just below the point 175 of the head 176. At this juncture, the point 175 is urged, by force of the compressed spring 178, into engagement with the tongue 32, and bends the tongue 32 inwardly about the scored and weakened fold line 79, folding of the tongue continuing until the tongue assumes approximately the angular attitude of the linear lower margin 182 of the head 176, abutment between the margin 182 and the top of the folded tongue preventing the resiliency inherent in the tongue from returning the tongue to its original more nearly vertical attitude. The position of the folded carton at this juncture is substantially as shown in outline in Figure 8, the tongue 32 being held down by the lower sloping margin 182 of the head 176.

Upon reaching the location shown in outline in Figure 8, the folded carton is held or restrained temporarily so as to strip the carton from the plunger shoe, the plunger having reached the lowermost portion of its stroke and being ready to return to uppermost position. With especial reference to Figures 2 and 11, it will be seen that the carton holding and stripping mechanism, generally designated as 191, comprises a pair of stripping jaws 192 pivotally mounted on each side of the die, the jaws being rockable about a transverse rod 193 disposed within the die side walls, and being projectable into the die aperture by a suitable compression spring 194, the extent of the projection being limited by a transverse stop plate 196 mounted flush with the face of the die side wall. The stripping jaws 192 are substantially identical in construction and operation and a description of one serves equally to describe the other, the opposed pairs of jaws, in turn, differing only in their oppositely disposed direction of facing, each of the pairs being constructed in mirror symmetry.

The stripping jaws 192 include a shank 197 having a recess 198 on its inner edge to accommodate or fit around the stop plate 196, and a depending lower portion 201 including an inwardly sloping upper lip 202, having on its upper edge a camming surface 203, and a lower lip 204, the lips forming between them a mouth 206, or recess or pair of jaws, to receive and hold the carton, as appears in outline in Figure 9.

The steps by which the upper and lower edges of the carton side panels are interposed between the jaws are shown most clearly in Figures 11, 14 and 16. The descending plunger shoe, having the carton side panels folded into close engagement therewith, begins to engage the camming surface 203 of the jaws at a position just below the lower edge of the stop plate 196, downward movement of the plunger and carton effecting an outward camming action on the jaws, forcing the jaws into the retracted position shown in outline in Figure 11, against spring urgency. As soon as the carton fully enters the jaws or

mouth 206, with the upper edge of the carton side panel in a location below the overhanging portion 207 of the upper lip 202, spring force urges the jaws into projected position, the overhang 207 thereupon moving into an overlying position with respect to the upper edge of the carton side panel and the leading tip of the overhang moving into the corresponding one of the recesses in the side of the plunger shoe. The overlying or overhanging lip therefore holds or restrains the carton against upward carton motion as the plunger is withdrawn toward uppermost position, and in this fashion strips the carton from the plunger. It is especially to be noted that while the plunger shoe with the carton folded about it acts as a backing or stiffening member when descending, and thus enables the carton lower edges to act on the various mechanisms projecting into the die aperture, the plunger shoe during ascent does not interfere in any way with the projecting members owing to the vertical slots formed in the shoe ends and in the shoe sides, and as most clearly appears in Figure 4.

The formed and folded carton is held by the jaws, and is supported by the lower jaw lips until released, release being effected by the plunger descending with the next of subsequently-formed carton. Figure 16, for example, shows that as the jaws are cammed into open or retracted position by a subsequent stroke by the plunger, with its attendant folded carton 211, the previously formed carton 209 is allowed to fall from the jaws by gravity, the stripping and retaining jaws having been cammed into retracted position and being no longer operative to hold the prior formed carton 209. The falling carton 209 drops onto an inclined board (not shown), located below the die aperture and supported on a pair of inclined cleats 212 shown in Figure 1, thence rearwardly onto the floor or into suitable receptacles (not shown).

In the event the cartons to be folded are greatly elongated in shape, as for example, the cartons used to package long candles or tapers, it is found that if the side panels are formed so that they are pre-set to incline slightly inwardly toward each other, packaging is facilitated. It has been noted that where the side panels have not been pre-set to an inwardly inclined attitude, the natural resiliency of the carton material causes the upwardly folded side panels, and especially the upper edges thereof, to bow outwardly over the central portion between the opposite end panels. This bowing effect results in an unsightly carton and one which is ill-adapted to subsequent product packaging and covering, for example, by "cellophane."

For especial use, therefore, with greatly elongated cartons although not confined thereto, the device of my invention includes a carton panel presetting mechanism, 221, to deform and pre-set certain of the carton panels and particularly the side panels, by a predetermined amount. Referring to Figures 2, 10, 14 and 15, in particular, it will be seen that the pre-setting mechanism 221 comprises two pairs of vertically elongated fingers 222, each of the finger pairs being mounted in corresponding recesses 220 on each of the die side walls in mirror symmetry, and each finger in each pair being substantially identical for descriptive purposes. Each finger is pivotally mounted about the transverse rod 193 and includes an upper portion 226 urged or pulled toward a vertical attitude by a tension spring 227, and a lower portion 228 having a recess 229 for abutment with the stop plate 196 limiting the inward motion of the lower portion 228 to the position shown in full in Figure 10. At the bottom end of the lower portion 228, the finger is curved inwardly and forms a tip 231 having a cammed upper face 232, a linear lower face 233 and an interposed point 234.

As the plunger shoe and attendant formed carton descends into engagement with the cammed face 232, the finger tip 231 is cammed outwardly into the recess 229 in the die wall and assumes the retracted position shown in outline in Figure 10, the fingers remaining in retracted position until the plunger shoe is withdrawn and separated

from the carton by the previously explained holding action of the stripping jaws. Upon upward withdrawal of the plunger shoe, the backing or support theretofore given to the carton side panels by the shoe is removed and the force of the tension spring 227, as appears most clearly in Figure 15, is sufficient to force the point 234 of the finger into engagement with the adjacent carton side panel and to bend or deform the side panel inwardly until it assumes the angle of the linear lower face 233 of the finger.

The side panel deforming fingers continue to hold the side panels in the inwardly inclined attitude shown in Figure 15 until the carton is released as heretofore described, and as shown in Figure 16. Not only do the fingers effectively preset the side panels, but owing to the force exerted by the fingers against the side panels in opposition to the natural resiliency of the carton material the fingers constitute a very effective carton ejector, serving positively to urge or eject the carton downwardly and away from the holding jaws and thus to prevent jamming or interference with the subsequent, descending carton. As shown in Figure 16, the side walls of the ejected carton 209 are not inwardly inclined as steeply as the side walls are inclined when undergoing pre-setting, and illustrated in Figure 15, the resiliency inherent in the carton material causing some outward motion of the side walls upon release from the pre-setting fingers, but only to the predetermined amount of incline or preset desired for the finished carton, the slope of the lower face 233 being adjusted to suit the particular carton material being used and to obtain the optimum extent of final inclination of the side panels.

It may therefore be seen that the carton locking and folding machine of my invention enables an operator quickly and safely to feed a carton blank into the device and, by a single, rapid downward thrust on the plunger, properly to form, fold, interlock and pre-shape the blank into final desired carton configuration, each additional stroke of the plunger being effective, during operation of the device, to produce a finished carton. A relatively high rate of carton production and an eminently satisfactory carton product is thereby obtained.

What is claimed is:

1. An apparatus for converting into carton form elongated carton blanks substantially symmetrical about a transverse center line, each blank including a bottom panel, a pair of end panels each connected to said bottom panel along a score line, a pair of side panels each connected to said bottom panel along a score line, a first pair of lock flaps scoredly connected to the ends of one of said side panels, a second pair of lock flaps scoredly connected to the ends of the other of said side panels, each of said first pair of flaps and the corresponding one of said second pair of flaps being provided with registering cuts whereby said flaps are foldable into interlocking and face to face engagement, said apparatus comprising a die, a plunger movable through said die, said plunger having a shoe for engaging said bottom panel, said die having arcuately shaped shoulders for folding in sequence said end panels about said shoe, for folding said lock flaps inwardly, and for folding said side panels about said shoe whereby adjacent lock flaps are moved into overlapping relation, a pair of leg members rockably mounted on the ends of said die each adapted to engage and flex inwardly one portion of each of said first lock flaps about said cut therein and to engage and flex inwardly each of said second lock flaps whereby said cuts in said first and said second flaps are moved into interlocking relation and said lock flaps are placed in face to face engagement, a pair of lock flap clamping fingers rockably mounted on each end of said die, each of said fingers being interconnected so that the engagement by the descending lower edge of said lock flaps with the lower of said fingers effects a downward motion of the upper of said fingers to interpose said lock flaps between said fingers and urge said

lock flaps into full interlocking engagement, means for stripping the folded and interlocked carton from said plunger, and means for moving said plunger into and out of said die.

2. A carton locking machine comprising a frame, a plunger mounted on said frame for vertical reciprocation, an elongated die on said frame having a vertical aperture therethrough forming a pair of inwardly facing die ends and a pair of die sides, the dimensions of said die being slightly in excess of the corresponding dimensions of said plunger, a pivotally mounted leg on each end of said die and including an upper cam face and a lower cam face, said leg being rockable from a first position wherein said lower cam face extends into said aperture to a second position wherein said upper cam face extends into said aperture, a pair of clamping fingers pivotally mounted on each end of said die and including an upper and a lower finger, a crossbar pivotally interconnecting said fingers intermediate the ends thereof, said fingers being movable from a first position wherein said lower finger extends into said aperture to a second position wherein said upper finger extends into said aperture, a pair of pivotally mounted carton holding jaws on each side of said die and movable into and out of said aperture, and means for reciprocating said plunger in said die aperture.

3. An apparatus for converting into carton form carton blanks including a bottom panel, a pair of end panels connected to said bottom panel and foldable to a position normal thereto, a pair of side panels connected to said bottom panel and foldable to a position substantially normal thereto, a first pair of lock flaps each foldably connected along a score line to one of said side panels, each of said first pair of lock flaps having a sinuous cut, a second pair of lock flaps each foldably connected along a score line to the other of said side panels, each of said second pair of lock flaps having a cut therein to engage the corresponding one of said sinuous cuts, each of said lock flaps being foldable into overlapping and interlocking position, said apparatus comprising an elongated die and a plunger reciprocally movable through said die, said plunger having a shoe for engaging said bottom panel, a pair of shoulders on each side of said die for engaging and folding said side panels about the sides of said plunger shoe, a pair of shoulders on each end of said die for engaging and folding said end panels about the ends of said plunger shoe and for folding said lock flaps into overlapping relation, a pair of leg members each pivotally mounted in a recess on each end of said die, each of said leg members including a lower portion rockably movable into said recess by downward force of said shoe and an upper portion concurrently movable from said recess and into said die for engaging and flexing one end of each of said first pair of lock flaps about said sinuous cut and for urging the adjacent one of said second pair of lock flaps into interlocking relation with said first lock flap, means projecting into said die and movable by direct downward force of said shoe for urging said lock flaps into full overlapping and interlocking position, and means for moving said plunger through said die.

4. A machine for folding and locking in carton form elongated carton blanks each including a bottom panel, a pair of end panels, a pair of side panels, said end and said side panels being connected to said bottom panel and foldable into positions normal thereto, a pair of locking flaps connected to the ends of one of said side panels, a pair of locking tabs connected to the ends of the other of said side panels, said locking flaps and said locking tabs being foldable to a position normal to said side panels and movable with said side panels in a direction toward each other for interlocking engagement, each of said flaps and said tabs having registering lock cuts, said machine comprising: a die; a plunger movable through said die, said plunger including a shoe for engaging said bottom panel and urging said carton blank through said die; means for folding said end panels about said shoe; means

for folding said lock flaps and said lock tabs normal to said side panels; means for folding said side panels about said shoe whereby the adjacent ones of said lock flaps and said lock tabs are swung inwardly toward each other; a camming member pivotally mounted on the end of said die, said member being engageable at one with said bottom panel and rockable thereby into engagement at the other end with the inner portions of said locking flap and said locking tab for flexing said locking flap inner portion to open said lock cut therein and cammingly to urge said locking tab inner portion therethrough into a position behind said flap; clamping members on said die for urging together the upper and lower edges of said flap and said tab so that said flap and said tab are moved into full interlocking engagement as said carton moves continuously downwardly through said die; means for stripping the formed and locked carton from said shoe; means for deforming inwardly the central portions of said side panels whereby said formed carton is resiliently urged and moved in a downward direction away from said die as said plunger next descends; and means for moving said plunger into and out of said die.

5. A device for converting a carton blank into carton form, said blank including a bottom panel, end panels, side panels, a pair of lock flaps on the ends of one of said side panels, and a pair of lock tabs on the ends of the other of said side panels, said flaps and said tabs having co-operative cuts and being adapted to be engaged in interlocking relation on both sides of said cuts, said device comprising: a die; a plunger movable through said die; a shoe on said plunger engageable with said bottom panel; means on said die for folding said end panels and said side panels about said plunger; projectable members on said die for flexing each of said lock flaps on one side of said cuts to open said cuts to permit the entry therethrough of a portion of each of said lock tabs and for engaging and biasing said lock tab portions through said cuts to a position behind said lock flaps; means for projecting said projectable members in dependence on the position of said plunger in said die; elements mounted on said die movable into clamping engagement with the upper and lower edges of said flaps and said tabs to urge said flaps and said tabs into complete interlocking position, said elements being operable by passage of said plunger through said die; means for positively holding the formed and locked carton in position adjacent the bottom of said die as said plunger shoe is withdrawn therefrom, said holding means being rendered inoperative further to hold the carton as said plunger next re-enters said die and approaches the carton; and means for moving said plunger into and out of said die.

6. In a machine for folding and locking carton blanks into elongated cartons having a bottom panel, end panels, side panels, and lock panels overlying the end panels, said machine including a die, a plunger movable through said die and shoulders on said die for folding the blanks into carton form, the combination of means for urging the lock panels into at least partial interlocking engagement, a pair of clamping fingers on said die, means for interposing the upper and lower edges of the lock panels between said clamping fingers whereby the lock panels are urged into full interlocking engagement as said carton moves continuously through said die, means for stripping the formed and locked carton from said plunger, means for deforming inwardly said side panels whereby said formed and locked carton is urged and moved in a carton ejecting direction, means for deforming inwardly a portion of at least one of said end panels, and means for moving said plunger into and out of said die.

7. A machine for converting into carton form elongated carton blanks substantially symmetrical about a transverse axis, each blank including a bottom panel, a pair of opposite end panels on said bottom panel, a pair of opposite side panels on said bottom panel, a first pair

13

of lock flaps on one of said side panels, a second pair of lock flaps on the other of said side panels, the adjacent ones of said lock flaps being cut for interlocking engagement, said machine comprising an elongated die and a plunger movable through said die, said plunger having a shoe for engaging said bottom panel and urging said blank through said die, said die including members for engaging and folding said end panels and said side panels about said shoe and for folding said adjacent lock flaps toward face to face position, a pair of lock flap flexing members rockably mounted on each end of said die for engaging and flexing the portions of said adjacent lock flaps on the inner sides of the lock flap cuts and for urging said lock flaps into interengaging relation, a pair of interconnected fingers on each end of said die for engaging the lock flaps therebetween and urging said flaps into full interlocking relation, a pair of jaws rockably mounted on each side of said die for engaging said side panels, said jaws being effective to resist upward motion of the folded and interlocked carton blank in engagement therewith and ineffective to oppose upward motion of said plunger, a pair of rockably mounted side panel deforming members on each side of said die for engaging the outer sides of said side panels and deformingly urging said side panels inwardly, and means for moving said plunger through said die.

8. In a machine for converting carton blanks into elongated folded and locked cartons having a bottom panel, side panels and a pair of interlocking panels at each end, said machine including a die, a plunger movable through said die and shoulders on said die for folding the blanks into carton form about said plunger, the combination of a pair of vertical rocking legs pivotally mounted intermediate their ends and disposed in recesses at each end of said die, each of said legs including a lower toe portion normally projected into a position for abutment with said bottom panel and cammingly retractable thereby as said bottom panel descends through said die under urgency of said plunger, and an upper knee portion normally retracted into said recess and rockably projectable into engagement with said interlocking panels, said upper knee portion having an arcuate margin adapted to deflect in a longitudinal opening direction a portion of one of said pair of interlocking panels and having a biased camming face on the side of said knee portion adjacent the other of said pair of interlocking panels adapted to deflect and bias said other of said pair of interlocking panels into interlocking and face to face relation with respect to said one of said pair of interlocking panels, and means for moving said plunger downwardly through said die and to a location below said pair of legs.

9. In a machine for converting carton blanks into elongated folded and locked cartons having a bottom panel, side panels, and at each end a pair of interlocking panels, said machine including a die, a plunger movable through said die, shoulder means on said die for folding said side panels into carton form, and means for folding each of said pairs of interlocking panels into at least partially interlocked attitude, the combination of a pair of swingable clamping members each mounted at one end within a recess at each end of said die, each of said clamping members being vertically spaced from the other, a cross-lever interconnecting said members and pivotally mounted on said members for moving the free ends of said members in approaching relation as the lower of said members is swung downwardly by the bottom edge of said pair of interlocking panels and whereby the upper of said members is moved into engagement with the upper edge of said pair of interlocking panels and urges said pair of interlocking panels into fully interlocked attitude, and means for moving said plunger through said die.

10. In a machine for erecting cartons of the type having

14

at each end a pair of interlocking panels placed in interlocking attitude by angular rotation of each of said panels toward the other and into face to face and interlocking relation, first means in engagement with the lower edge of one of said panels for resisting rotation of said one of said panels beyond a predetermined angle, second means swingable into engagement with the upper edge of the other of said panels for increasing the rotation of said other of said panels until said panels are in fully interlocked relation and means interconnecting said first means and said second means for relatively swinging said second means toward said first means as said first means moves in a direction away from said second means.

11. In a die and plunger type of machine for converting carton blanks into formed cartons having a bottom panel, a pair of side panels, and at each end of said side panels a pair of mutually interlocking panels swingable into face to face and interlocking relation as said pair of side panels is folded into an attitude substantially normal to said bottom, a first finger pivotally mounted at each end of the die and engageable by the adjacent margin of said bottom panel and the lower edge of the adjacent one of said pair of interlocking panels, said first finger being pivoted thereby in a predetermined direction, a second finger pivotally mounted at each end of the die and spaced from said first finger, a cross-connecting lever pivotally mounted on said first and said second fingers at differing distances from the pivot axes of said fingers whereby said second finger rotates at a velocity greater than that of said first finger and whereby said second finger is pivoted into abutment with the upper edge of the other of said pair of interlocking panels.

12. In a plunger and die apparatus for converting carton blanks into formed cartons having a bottom panel and a pair of side panels upstanding from said bottom panel, the combination of a pair of spaced carton stripping and holding jaws pivotally mounted on each side of said die and retractable into recesses in said die as said plunger moves from a first position above said jaws to a second position intermediate the ends of said jaws, said jaws each comprising a recessed portion forming a lower lip adapted to support said bottom panel and an upper lip overlying the upper edge of said side panel, and a pair of deforming members pivotally mounted on each side of said die and retractable into recesses in said die as said plunger moves from said second position to a third position located adjacent to and below said second position, said jaws being projectable into said die as said plunger moves said carton into a fourth plunger position interposed between the opposite ones of said recessed portions of said jaws to retain said carton as said plunger is withdrawn, said deforming members being concurrently projectable into said die and against the adjacent of said side panels to stress the fibers thereof and exert a downward force on said carton whereby said carton is ejected from said die as the plunger next moves from said first to said second position.

13. In a plunger and die machine for converting elongated carton blanks into formed cartons each having a bottom panel, a pair of side panels, and on opposite ends a pair of interlocking panels each adapted to swing inwardly toward the other into face to face and interlocking relation, each of said pairs of interlocking panels comprising an outer portion and an inner portion separated by complementary cuts, a leg member rockably mounted in a recess in each end of said die, said leg member comprising a toe portion cammable by said plunger into retracted positions, and a knee portion concurrently rockable into said inner portion of one of said interlocking panels in a longitudinal direction to open the adjacent one of said cuts, said knee portion including an inclined margin adjacent the other of said interlocking panels adapted to engage and bias said inner portion of said other of said interlocking panels through said open cut, and a pair of clamping fingers pivotally mount-

ed in recesses at each end of said die, the lower of said fingers being normally projected into the throat of said die at a height substantially identical to the height of said toe portion as said toe portion is cammed into retracted position by said plunger, each of said pair of clamping 5 fingers being vertically spaced and interconnected, the upper of said fingers being projectable into said die and into said die and into engagement with the adjacent of said interlocking panels as said lower of said fingers is cammed into said retracted position.

10

References Cited in the file of this patent

UNITED STATES PATENTS

1,025,880	Peters -----	May 7, 1912
1,115,822	Inman -----	Nov. 3, 1914
1,212,182	Brooks -----	Jan. 16, 1917
1,906,283	Schulz -----	May 2, 1933
2,653,524	Hickin -----	Sept. 29, 1953
2,655,843	Baker et al. -----	Oct. 20, 1953