United States Patent

[11] **3,580,144**

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[45] Patented **May 25, 1971**

[54] **APPARATUS FOR ERECTING AND FORMING INITIALLY COLLAPSED CARTONS INTO CONTAINERS**
7 Claims, 13 Drawing Figs.

[52] **U.S. Cl.** **93/53AC,** 93/84TW, 93/94PS
[51] **Int. Cl.** **B31b 1/78,** B31b 5/26, B31b 1/94
[50] **Field of Search** ..... 93/53, 84 (TW), 94 (PX), 49 (AC)

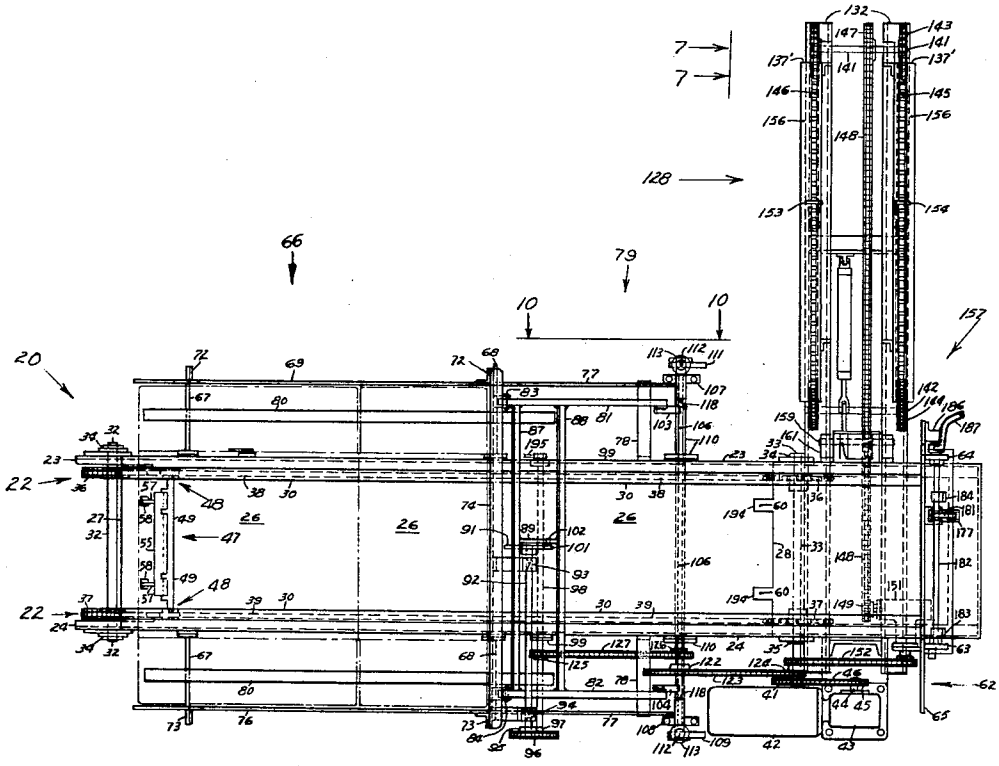
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ABSTRACT: A folded case opener apparatus including a flap depressor periodically actuated downwardly to allow a cooperating pivotal hooked arm to engage the advancing laterally disposed edge of an adjacent nondepressed flap thereby to raise said flap and erect such advancing folded case.



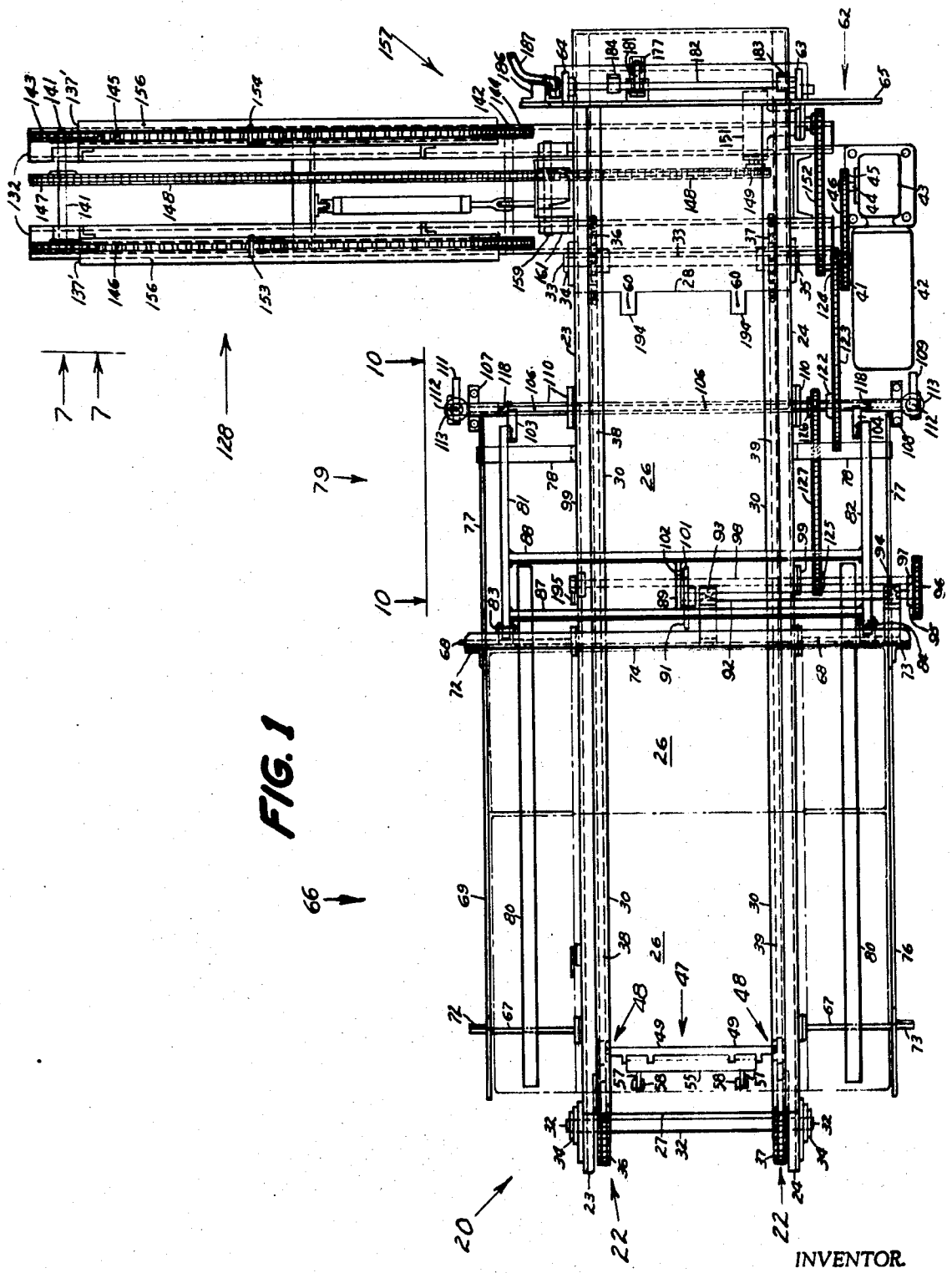


FIG. 1

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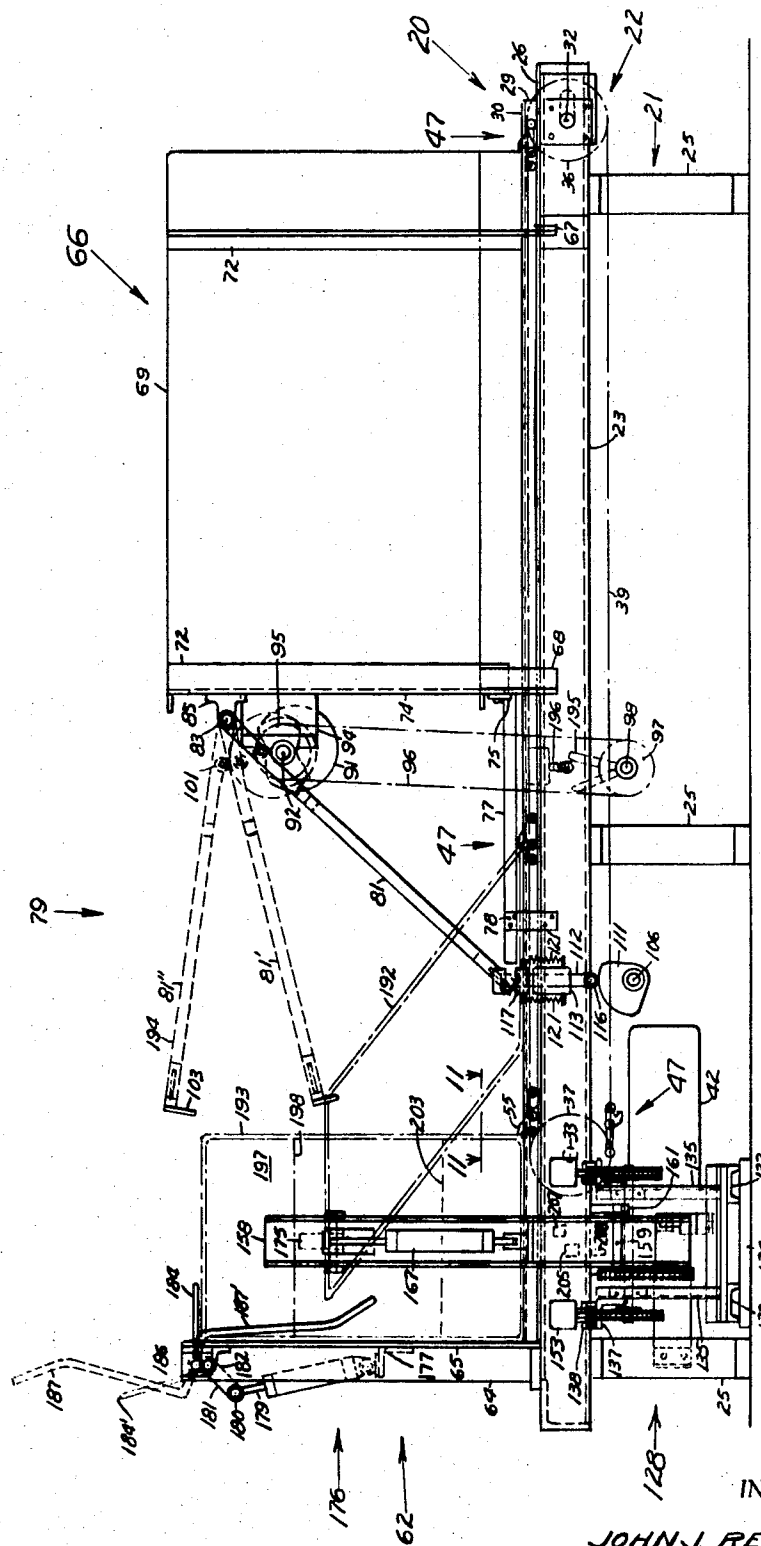


FIG. 2

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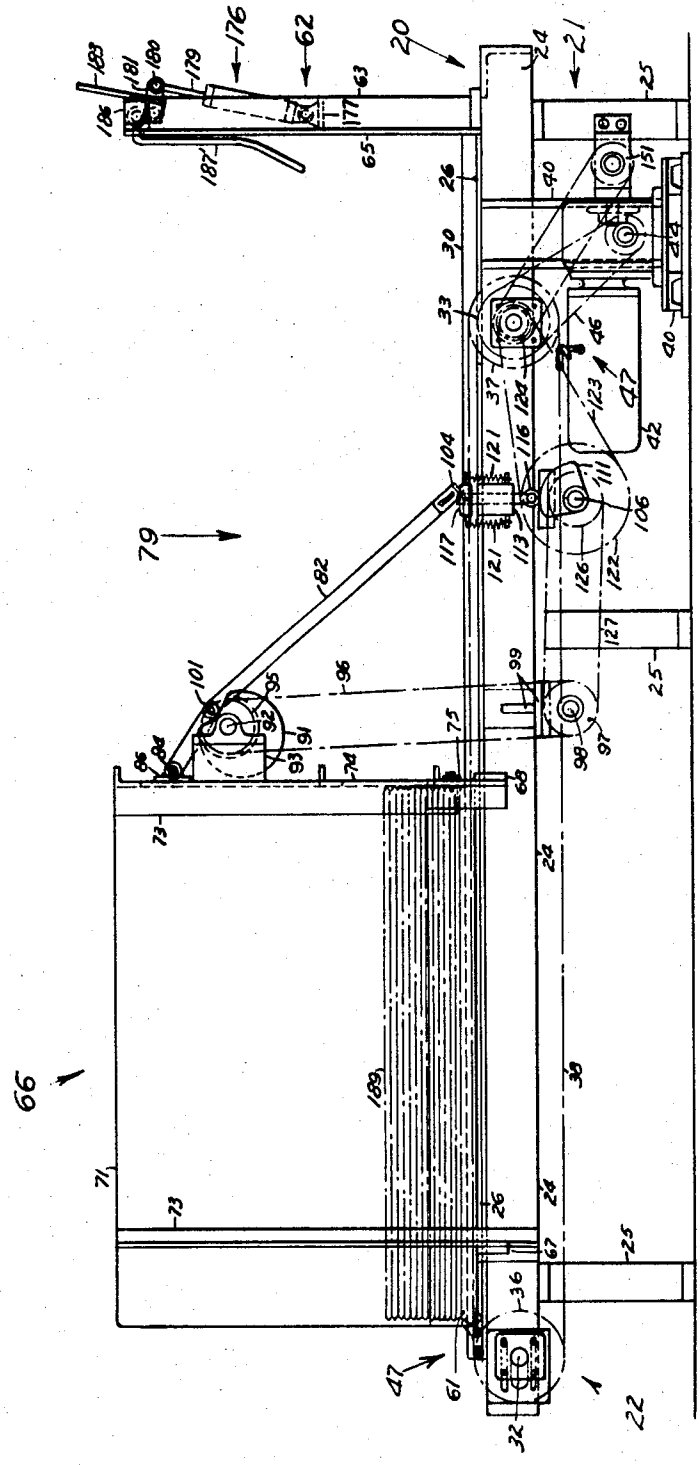


FIG.3

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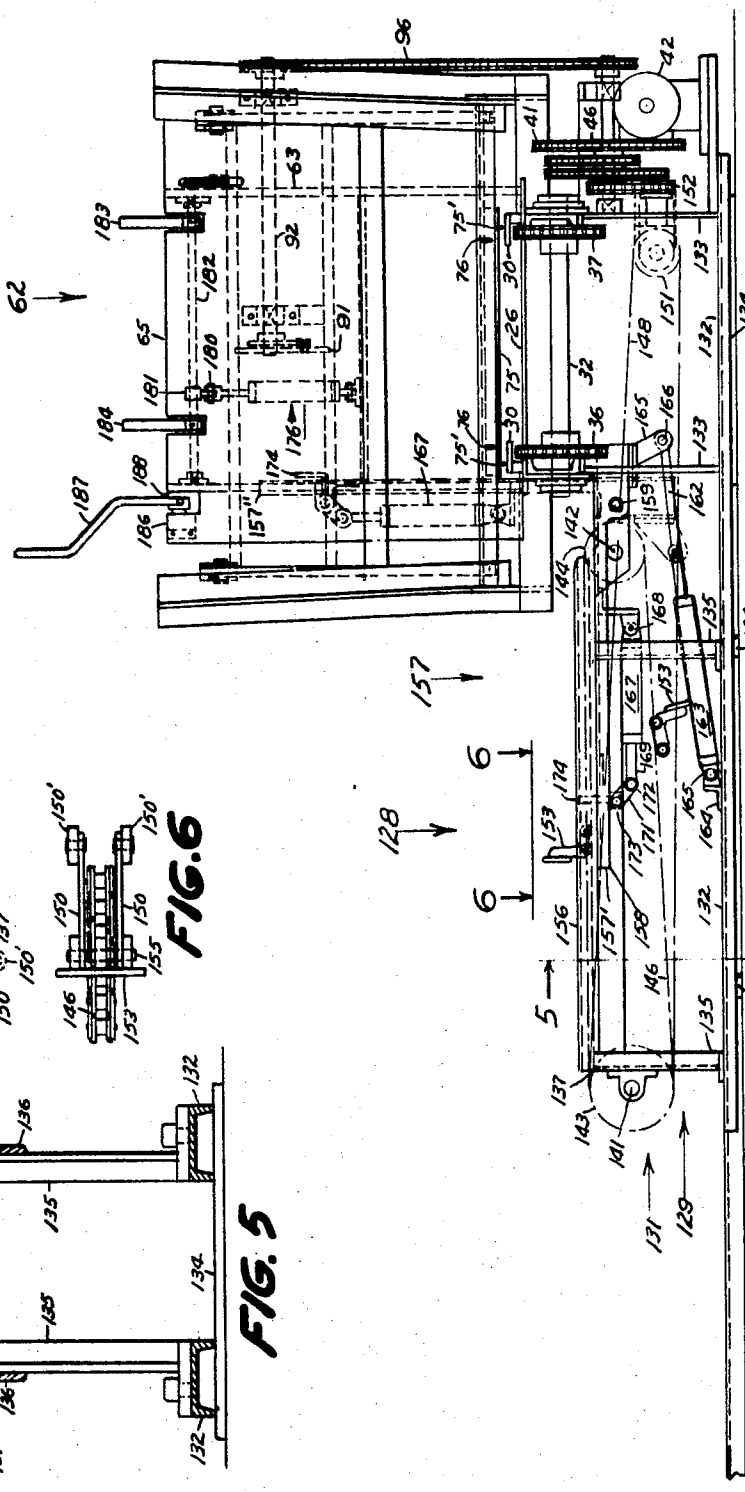


FIG. 4

FIG. 5

FIG. 6

FIG. 7

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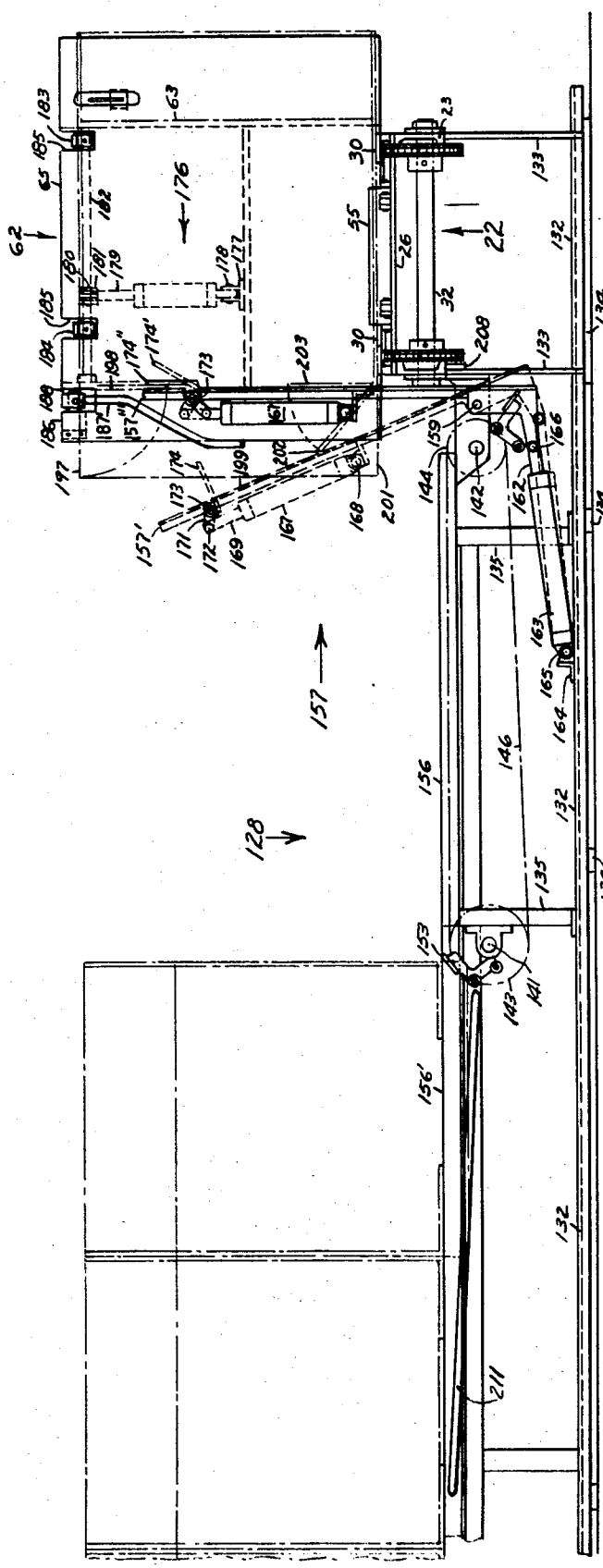


FIG. 8

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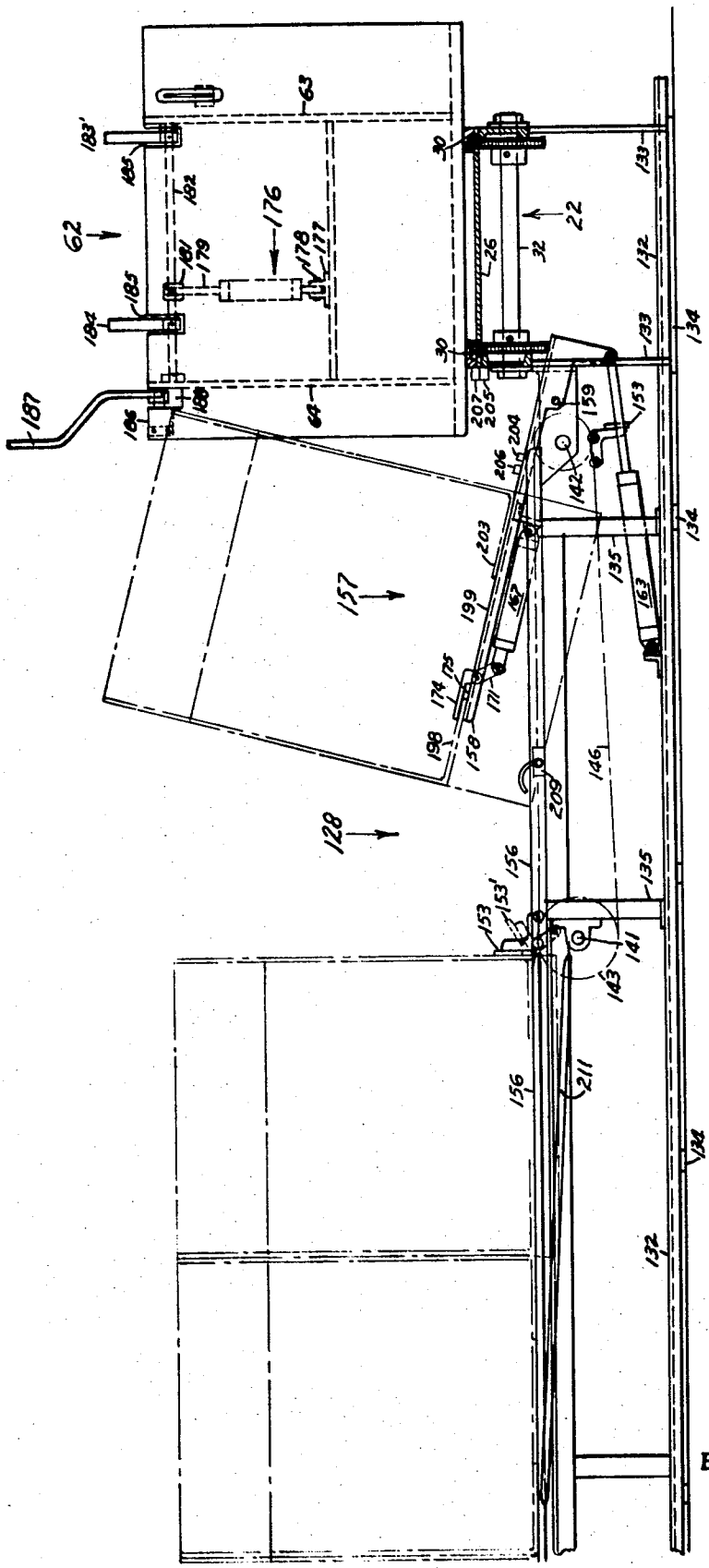


FIG. 9

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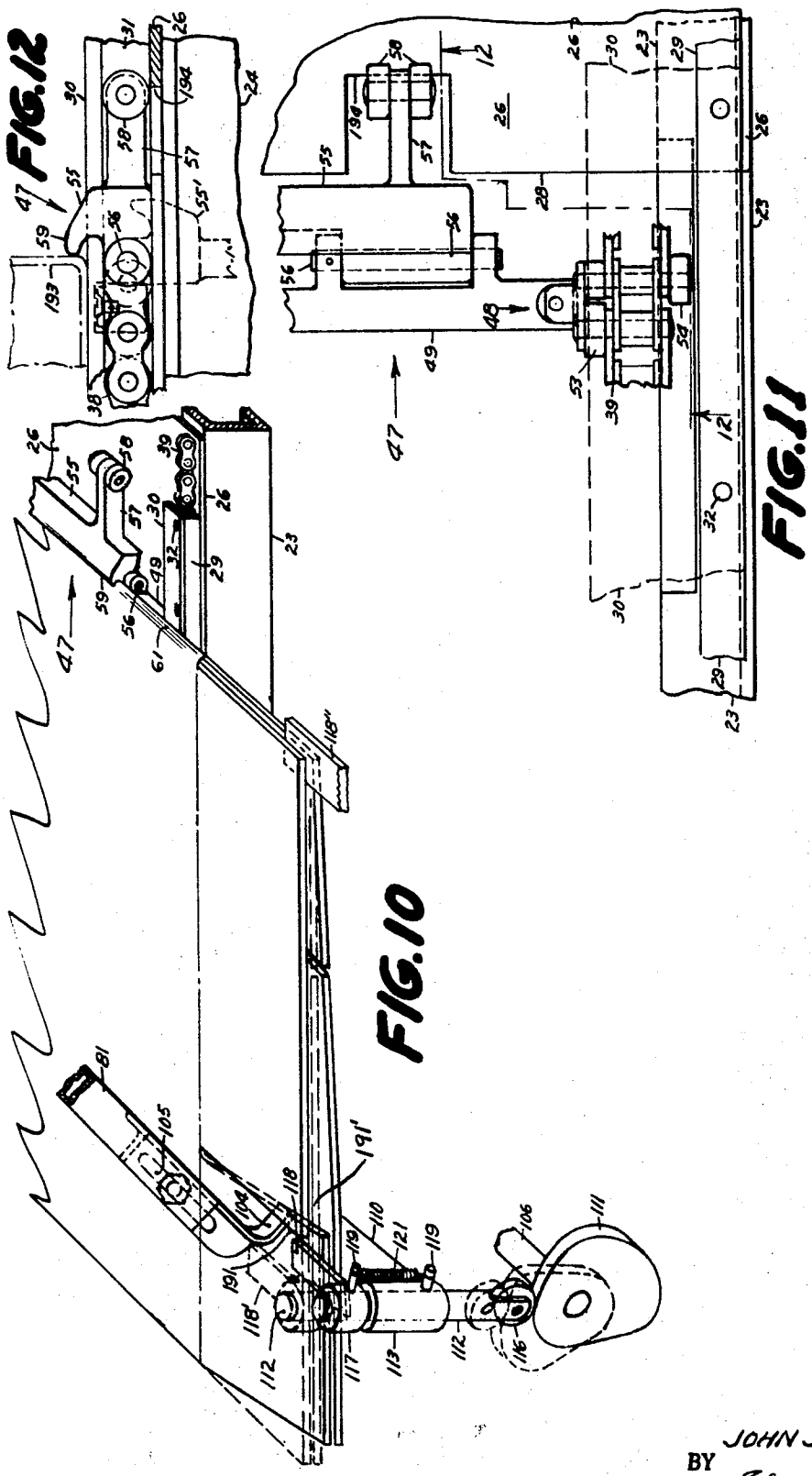


FIG. 12

FIG. 11

FIG. 10

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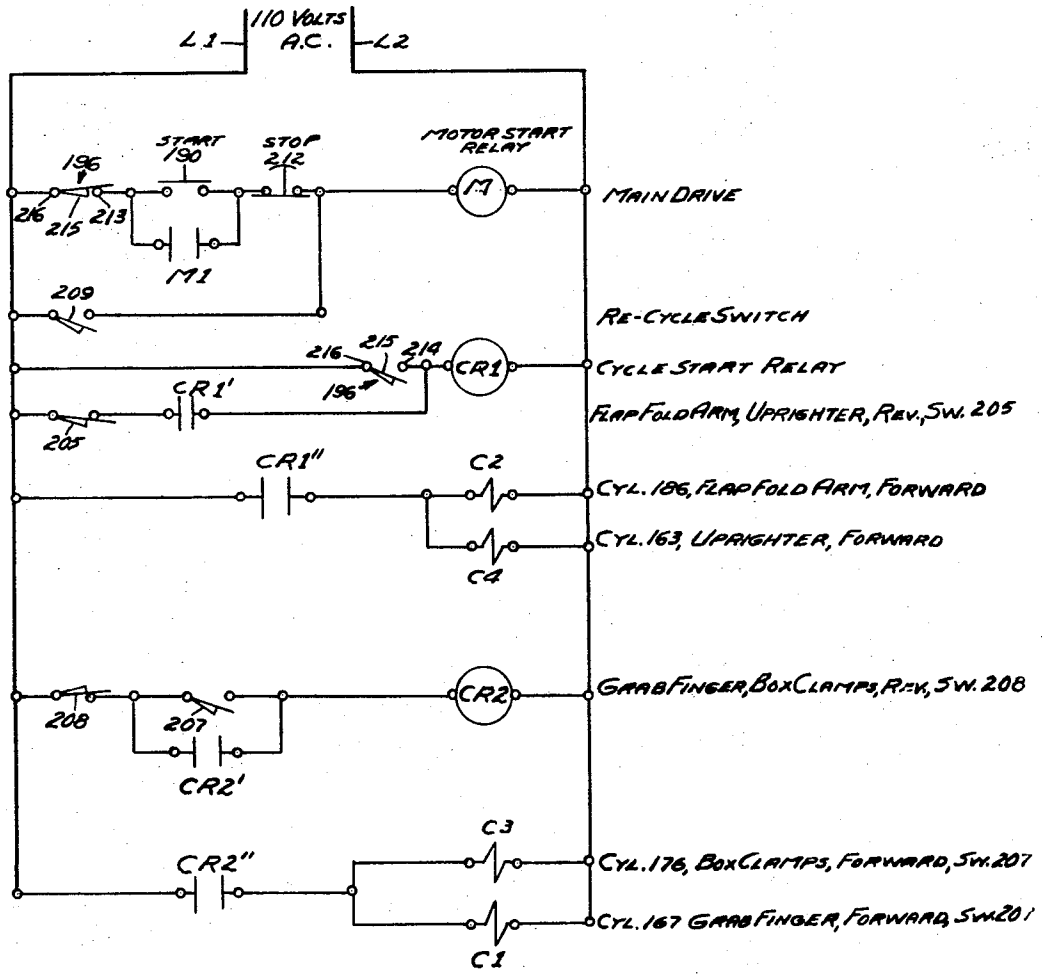


FIG. 13

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APPARATUS FOR ERECTING AND FORMING INITIALLY COLLAPSED CARTONS INTO CONTAINERS

This invention is designed to automatically open containers or cases of a foldable paperboard construction from a flattened, folded or collapsed condition to an open erected state. Such cases comprise a generally rectangular blank of paperboard, of suitable dimensions, having fold lines defining four side panels, and flaps projecting from each end of said panels to be folded to form end closures for the case, the free ends of said paneled blank being hingedly connected as by adhesive tape or the like, to form a rectangular container when fully opened.

The case opener is automatically sequentially operable to erect the body or shell portion of the advancing initially folded case, and fold the closure flaps at one end of said shell to their closed position, the folded case being disposed transversely of the direction of travel, that is, with the end flaps extending outwardly of the movement or path of travel of the case.

An object of this invention is the provision of means for exposing and engaging the side edge of an advancing collapsed case thereby to erect said case;

Another object is to provide means for depressing a flap of a transversely advancing collapsed case to expose a side edge of a trailing flap thereof for engagement by oscillatable means to aid in erecting said case;

Still another object is the provision of depressor means for engaging and depressing a flap of a transversely disposed and advancing collapsed case to expose a lateral edge of a trailing adjacent flap, and cooperative oscillatable hook means operative to engage said exposed lateral edge and erect said case;

A further object is to provide case uprighter means operative laterally of a horizontally disposed erected case to engage a folded bottom flap thereof and to deposit said case upright.

Other specific features and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the FIGS. thereof and wherein:

FIG. 1 is a plan view of an embodiment of the case opener apparatus embodying the concepts of the present invention, showing the main conveyor means and a smaller lateral take-away conveyor means;

FIG. 2 is a front elevation view of the apparatus shown in FIG. 1, as viewed from the operator's station, illustrating the pickup arm in several stages of its operation related to a case, and showing the uprighter means in its full raised position;

FIG. 3 is a rear elevation view of the apparatus shown in FIG. 1, showing the drive means;

FIG. 4 is a right end elevation view of the apparatus shown in FIG. 1;

FIG. 5 is an end elevation view of the take-away conveyor taken on line 5–5 of FIG. 4;

FIG. 6 is a fragmentary plan view taken on line 6–6 of FIG. 4, showing only a flight pivotally connected to the endless chain of the take-away conveyor;

FIG. 7 is a fragmentary elevation view taken on line 7–7 of FIG. 1, showing the flight at the end of rollway surface 137, illustrating the flight roller dropping over the end thereof, and being further illustrated in FIGS. 8 and 9;

FIG. 8 is an end elevation view similar to FIG. 4, but showing the uprighter means in a raised flap closing position and a subsequent fully raised position;

FIG. 9 is an end elevation view similar to FIG. 8, but showing the uprighter means in a return stage, about to deliver a case to the take-away conveyor;

FIG. 10 is a fragmentary perspective view taken on line 10–10 of FIG. 1 illustrating the flap depressor means and a cooperative pickup arm in operative relation with a case in its collapsed and folded condition, and showing an associated conveyor pickup flight for advancing said case;

FIG. 11 is a fragmentary plan view taken on line 11–11 of FIG. 2, showing the main conveyor and pivotal pickup flight means thereon, at the fall-away slot in the roller deck plate;

FIG. 12 is a fragmentary section view taken on line 12–12 of FIG. 11, illustrating the pivotal pickup flight at the fall-away slot at the end of the deck plate, and showing the pickup flight in drive and retractible position; and

FIG. 13 is a schematic electrical wiring diagram of one embodiment of electrical control circuits utilized for automatically controlling the cyclic operation of the several components of the case opener apparatus comprising the present invention.

Referring now to the drawings, wherein like reference numerals designate like or corresponding parts throughout the several views, there is shown generally indicated 20 a horizontally disposed main conveyor means, comprising support means generally indicated at 21, and endless chain means generally indicated at 22 revolvably mounted on said support means, see FIGS. 1 and 2.

Said main conveyor means 20 functions to advance a collapsed case or carton container along a predetermined conveyance path with the closure flaps extending laterally of said path, as hereinafter described.

The support means 21 comprises a pair of spaced parallel channel beams 23 and 24 horizontally disposed, supported on leg means such as indicated at 25. The flanges of the channels are disposed, inwardly, confronting each other.

A roller plate or deck 26 is mounted on and across said longitudinal frame beams, and secured thereto as by welding, said plate or deck terminating inwardly of the ends of said frame beams, as at 27 and 28, see FIG. 1.

A pair of spaced longitudinal slide rails or tracks such as indicated at 30, see FIG. 11, are disposed raised along the side edges of said deck plate 26. The slide rails are spaced above the deck plate by means of longitudinal spacer bars 29 and 31, respectively, and the rails and bars are secured to the deck plate as by screws 32. The slide rails project inwardly of the spacer bars, cantileverlike, to provide a cover over the space thereunder, for the reception of an endless conveyor chain hereinafter described.

The endless chain means 22, see FIGS. 1 and 2, comprises a pair of spaced shafts 32 and 33 rotatably mounted across said beams 23 in bearings such as 34 and 35 carried on the webs of said beams.

A pair of spaced sprockets such as 36 and 37 are fixed on each of said shafts to rotate therewith. A pair of endless link chains 38 and 39 are trained over such associated sprockets to be driven as hereinafter described. The sprockets are disposed to direct and guide the upper run of the chains in the space under the slide rails, above described, the upper or conveying run of the endless chains being slidably supported on the deck plate.

The drive means for conveyor shaft 33 and sprocket 41 therein comprises a drive motor 42 driving through reduction gear box 43, output shaft 44 therefrom, sprocket 45 thereon, and endless chain 46 trained over sprockets 41 and 45, see FIG. 1.

Said motor and gear box 43 is supported on bracket means 40 pending from longitudinal frame beam 24.

The conveyor chains carry a plurality of transverse conveyor lug means, such as generally indicated at 47, see FIG. 11 secured to the chains by any conventional chain connector means such as indicated generally at 48, see FIG. 11. The distance between the adjacent lugs being substantially equal to or greater than the width of the collapsed carton to be conveyed and opened. Thus, each carton is held in a space between the lugs so that the lugs slide such cartons along the slide rails 27 and 28 while holding them evenly spaced to position each of such cartons properly at the various operating stations in timed and spaced relation.

The conveyor lug means include a transverse support bar 49 connected across and to the conveyor chains by means of said conventional chain connector means 48. The connector

means includes rollers 53 and 54 pin connected to the chain to reduce frictional resistance developed by the working lug. The support bar 49 is disposed below the level of the slide rails 40 to prevent engagement with a collapsed case on the slide rails.

A conveyor flight 55, see FIGS. 11, 12 and 13, is pivotally connected to conveyor support bar 49 by means of space d pins such as 56, said flight being disposed in trailing relation with the support bar 49.

A pair of spaced arms such as at 57 extend rearwardly from said pivotal flights, and are provided with friction reducing rollers 58 at the ends thereof. Said rollers engage the deck plate, and in conjunction with the arms 57, maintain the pivotal flight 55 properly oriented and engageable with the case during the conveying and opening stages of the collapsed case. The upper or nose portion 59 of the pivotal flight 55 is disposed above the level of the slide rails 30 so as to engage a collapsed case 61 resting on said slide rails. Said nose portion extends upwardly and engages only the bottommost of a stack or pile of collapsed cartons as hereinafter described.

The rollers 58 are aligned with a pair of notches 60, see FIGS. 1 and 11, provided in the end portion 28 of deck plate 26 for purposes hereinafter described.

An upright abutment or stop wall generally indicated at 62, see FIGS. 1 and 2, is mounted transversely on the end portion of the longitudinal beams 23, against which the fully opened cases are stopped in abutment with said wall as hereinafter described.

Said abutment wall comprises a base plate, a pair of spaced upstanding leg members 63 and 64 mounted on said base plate, and a face plate 65 secured to said leg members. The assembled wall is secured, upstanding, to the longitudinal beams, by any means such as by welding. The slide rails 30 terminate at said wall.

A supply hopper or magazine, see FIGS. 1, 2 and 3, generally indicated at 66, wherein collapsed cases are stacked, is provided at the head end of the conveyor means.

Said magazine comprises oppositely disposed horizontal support brackets, such as indicated at 67 and 68, projecting sidewise from each longitudinal beam and secured thereto as by welding.

Magazine sidewalls 69 and 71 are supported on said brackets and held upright against paired vertical post members, such as indicated at 72 and 73, respectively, which posts are also supported by said brackets.

A magazine front side wall 74 is provided on frontal post members 72 and 73. Mounted on the bottom portion of front side 74 is a suitable conventional adjustable gate means 75, see FIG. 4, adjustable up and down by slot and screw means such as indicated at 76, to permit the withdrawal of collapsed cases one at a time from the bottom of the stack of collapsed cases stored in the magazine, through the adjustable space 75' between the bottom edge of said adjustable gate and the top surface of the slide rails on which the collapsed cases rest and slide.

Collapsed cases are loaded into the magazine through the open top and rear side of the magazine.

A pair of oppositely disposed guide rails 77, see FIGS. 1 and 2, are provided, engageable with the side edges of the advancing collapsed case, to maintain the collapsed case properly centered and oriented on the slide rails. The guide rails are supported at one end on the magazine structure, at the discharge slot thereof, and at the other end on oppositely disposed braces 78 which extend from the longitudinal beams, respectively.

A pair of auxiliary slide rails, such as indicated at 80, supported on brackets 67 and 68, are provided to aid in conveying the collapsed cases.

As a collapsed case leaves the hopper or magazine 66 it enters the opening, forming or erecting zone, generally indicated at 79, characterized by a movable device such as pickup arm means. Said pickup arm means, see FIG. 2, comprise a pair of spaced arms 81 and 82 pivotally mounted at one end on aligned shafts 83 and 84 journaled in brackets 85 and 86, respectively, mounted on the upper edge portion of magazine front wall 74.

A pair of spaced parallel brackets 87 and 88, see FIG. 1, are welded across said pickup arms; and a longitudinal brace 89 is welded across said spaced brackets, centrally thereof.

Said pivotal pickup arm means is actuated by cam means, see FIGS. 1, 2, and 3, comprising a heart cam 91 fixed on shaft 92 to rotate therewith, said shaft being journaled in spaced bracket bearings 93 and 94, said bracket bearings being mounted on the magazine front wall 74.

The cam shaft 92 is driven by a power train including a sprocket 95 fixed on said shaft 92, see FIG. 3, an endless chain 96 trained over said sprocket and also over a sprocket 97 fixed on a lower shaft 98 journaled in spaced bracket bearings 99 secured to the underside of the longitudinal frame beams 23 and 24.

A cam follower or roller 101, see FIGS. 1, 2, 3, is rotatably mounted on pickup arm brace 89, through means of pin 102, for engagement with heart cam 91 for purposes hereinafter described.

Hook elements 103 and 104, see FIGS. 1 and 10, are mounted on the ends of pickup arms 81 and 82, respectively. Said hooks are mounted thereon telescopically adjustable as by slot and screw means indicated at 105.

Said cam is operative to raise, and lower said pivotal pickup arms, see FIG. 2, from a low position 81 for engagement with an exposed case flap edge hereinafter described, to a high position 81'' disengaged from said exposed case flap edge hereinafter described, and thence down again for engagement with said flap edge, see FIG. 10.

Said pivotal arm is movable in a plane substantially normal to the plane of said flaps and substantially at right angle to the lateral edges of said flaps.

Flap depressor or deflector means are provided, comprising a flap depressor cam shaft 106, see FIGS. 1, 2, 3 and 10, journaled in spaced bearings 107 and 108 mounted on oppositely disposed brackets 110 secured to the sides of longitudinal frame beams 23 and 24, respectively.

Cams 109 and 111, see FIG. 10, are fixed on the ends of said shaft to rotate therewith. Said cams actuate separate depressor finger means engageable with said cams, respectively. Since both such depressor means are similar, the description of only one will suffice.

A movable cam follower pin 112, vertically reciprocable in tubular guideway 113 fixed on the end of bracket 110, is provided with a roller 116 rotatably mounted on the lower end thereof and engaged with the edge of said cam 101.

A collar 117, having a finger 118 extending therefrom, is fixed on the upper end of said reciprocable follower pin 112 by any means such as a set screw (not shown). Said finger projects inwardly towards the frame beams to overlie collapsed case flaps hereinafter described.

Anchor pins such as indicated at 119 are fixed to the collar 117 and the tubular guideway 113, and tension springs 121 are connected thereacross to bias and urge the cam follower roller 116 against the edge of cam 110, see FIGS. 2, 3 and 10.

The depressor cam shaft 106 is driven by a power train including a sprocket 122 fixed on said shaft 106, see FIGS. 1 and 3, an endless chain 123 trained over said sprocket and also over a sprocket 124 fixed on conveyor drive shaft 33.

Drive power is transmitted to lower shaft 98, for driving pickup arm cam shaft 92, from depressor cam shaft 106 by means of sprockets 125 and 126 fixed on said shafts, respectively, and an endless chain 127 trained over said sprockets.

A take-away conveyor, generally indicated at 128, see FIGS. 1 and 4, is provided at the end of main conveyor 20. Said take-away conveyor includes the function of conveying the erected cases away from the main conveyor.

Said take-away conveyor is disposed substantially at right angle to the main conveyor, and its upper work run and slide rails are at an elevation lower than the slide rails of said main conveyor to receive the opened and partially closed case as hereinafter described.

The take-away conveyor comprises support means generally indicated at **129**, and endless chain means generally indicated at **131** revolvably mounted on said support means, see FIG. **4**.

The support means comprises floor base means consisting of a pair of elongated spaced channel members **132** rigidly connected to the longitudinal frame beams **23** and **24** of the main conveyor through means of vertical struts **133** welded thereacross, see FIGS. **4**, **8** and **9**.

Spaced cross braces **134** are welded across said base channels, see FIGS. **4** and **5**.

Spaced leg members **135**, see FIGS. **4** and **5** are mounted on said base channels **132** and extended upwardly therefrom.

Spaced longitudinal angle iron rails **136**, see FIG. **5**, are welded across the top ends of said legs **135**, one of the angle iron legs being disposed horizontally and the other vertically downwardly, the horizontal leg presenting a rollway surface **137** and endless chain support means hereinafter described.

Along the edges of said large angle iron rollways **137** are welded a pair of spaced and relatively smaller angle iron elements such as indicated at **138**, the horizontal legs of said angle iron elements extending toward each other and cooperating with the rollways, respectively, to form a partially closed channel or T-slot guideway **139**.

The endless chain means **131**, for the take-away conveyor, comprises a pair of spaced shafts **141** and **142** rotatably mounted on said support means through conventional bearing means, see FIGS. **1**, **4** and **8**.

A pair of spaced sprockets, such as indicated at **143** and **144**, are fixed on each of said shafts to rotate therewith.

A pair of endless chains **145** and **146** are trained over said sprockets. The sprockets are disposed to direct and guide the upper run of the endless chains into the guideway channels **139**, respectively, and said upper run being slidably supported on the rollway **137** thereof.

The drive means for said take-away conveyor **128** comprises a sprocket **147** fixed on shaft **141**, see FIGS. **1** and **4**, and an endless chain **148** trained thereover and also trained over sprocket **149** fixed on the output shaft (not shown) of right angle gear box means **151**. Said gear box means **151** is driven by motor **42** through connecting sprocket and chain means indicated at **152**.

A plurality of pairs of oppositely disposed lugs or flights such as indicated at **153** and **154** are pivotally mounted on endless chains **145** and **146** by means of pins such as **155**, see FIGS. **1**, **4**, **5**, **6**, **7** and **9**. Additional such paired lugs are longitudinally spaced along the chains to accommodate the reception of erected cases as hereinafter described, see FIGS. **1**, **4** and **9**.

Each of said flights **153** and **154** is provided with a pair of rigidly extending and trailing spaced arms **150** and friction rollers **150'** at the ends thereof, disposed astraddle their associated chains, respectively. Said rollers engage rollway surface **137** and maintain their associated flights properly oriented to convey cases on the slideway surface **156** thereabove. When said flights reach the end **137'** of rollway surface **137**, see FIG. **7**, the rollers **150'** drop over said end edge **137'** and the flights pivot and tilt backwardly and disengage from a driven case as at **153'**, see FIG. **9** and **8**, thereby delivering the case to the slideway surface **156** extended as at **156'**. As said rollers drop over said rollway end edge **137'**, the spaced arms become disposed astraddle the end sprockets **143** and are carried therearound by the endless chains **146**, respectively.

The top portion of said flights extends through the slot in the T-slot guideways and project above the guideway structure for engagement with a case conveyed on the top surface or slideway **156** thereof comprising the horizontal leg members of the angle iron elements **138**.

An uprighter means, generally indicated at **157**, is provided to transfer the erected case from the main conveyor to an upright position onto the take-away conveyor, see FIG. **4**. During such transfer operation, the uprigher means functions to close the adjacent bottommost flap of the case, and dispose the case on the take-away conveyor, in an upright position.

The uprighter means comprises an elongated, flat rocker arm **158** mounted, adjacent one end thereof, on a rockshaft **159**, to oscillate therewith, said rockshaft being journaled in spaced brackets **161** mounted on longitudinal frame beam **23** of the main conveyor **20**, see FIG. **1**.

The uprighter means is adapted to nest in a normal horizontal stop position within the take-away conveyor, that is, in a horizontal stop position **157'** between the spaced guideways **139** and below the top surface or slideways **156** thereof, to clear the conveyance of cases on such slideways thereabove, see FIG. **4**.

The upward swing of the uprighter means is limited to a substantially vertical position by means hereinafter described. Thus the uprighter means is adapted to oscillate about 90° between a horizontal and vertical position.

Said uprighter means is actuated by means of a piston rod **162**, see FIGS. **4** and **8**, comprising an element of a first reciprocable electropneumatic actuator **163** or air cylinder means. The cylinder of the actuator is pivotally connected to a fixed brace **164** by means of pin **165**, and said piston rod **162** is pivotally connected to the lower power arm portion of the uprighter means by pin **166**.

A second reciprocable electropneumatic actuator **167** or air cylinder means, see FIGS. **4**, **8** and **9**, is pivotally connected to the underside of the uprighter by means of pin **168**, and the piston rod thereof **169** is pivotally connected to one end of a modified bell crank **171** by means of pin **172**, and the bell crank being pivotally mounted on the uprighter on a pin **173** mounted across an opening hereinafter described. The free end of the pivotal bell crank comprises a transfer or grab finger **174** which is disposed to operate through said opening **175** in the face of the uprighter, and is adapted to oscillate substantially 90°, that is, from a normally projecting open solid line position **174**, see FIGS. **4** and **8**, at right angle to the face of said uprighter, to an intermediate position **174'**, thence to a closed or grasp position **174''** substantially parallel to the face of said uprighter. The adjacent face portion of the uprighter arm cooperates with said finger to grip a case flap therebetween as hereinafter described.

A third reciprocable electropneumatic actuator **176** or air cylinder means, see FIGS. **2** and **9**, is pivotally mounted on the back side of the abutment or case stop wall **62**. Said actuator is pivotally connected to wall bracket **177** by means of pin **178**, and the piston rod thereof **179** is pivotally connected by pin **180** to a rocker arm **181** fixed on a horizontal rockshaft **182** journaled in the upper portions of wall uprights **63** and **64**. A pair of spaced hold down bars or clamps **183** and **184** are fixed on said rockshaft to oscillate therewith, and are disposed to operate through slots **185** in the faceplate **65** of said stop wall **62**. Said hold down clamps **183** and **184** are adapted to oscillate from a normal operative horizontal position in engagement with the erected case thrust under said hold down clamps, to an inoperative vertical position **183'** and **184'**, respectively, and fingers acting through said slots **185**.

Also on the back side of the stop wall **62**, at a corner at the upper edge portion thereof, is secured a fourth suitable conventional reversible rotary electropneumatic actuator **186**, such as sold under the trademark RoTAC, or equivalent. To the output shaft of said actuator is fixed an offset flap fold arm **187** to oscillate therewith. Said arm is disposed to swing through wall slot **188** and forwardly of said stop wall. The flap fold arm is adapted to oscillate from a normal inoperative upward vertical position **187** to an operative downward vertical position **187'** engaging and folding the adjacent topmost flap of an erected case, as hereinafter described.

The above said electropneumatic actuators are connected to a suitable source of air and are provided with conventional solenoid valve means, not shown, to control the air for operating said actuators, said solenoid valve means being energized for operation by electrical control circuit means shown in FIG. **13**, and are provided with spring return means for resetting

said actuators when deenergized, as hereinafter described in greater detail.

Operation: The present case forming apparatus is designed to automatically erect a collapsed case, such as a paperboard container which comprises a central shell or body portion having fold lines defining four side panels thereof, and closure flaps extending from the opposite ends of said panels, the flaps at one end being closable to a closed bottom position, and the flaps on the other end being disposed in an open top position to accommodate the reception of articles for filling the fully erected and open case.

The collapsed case is delivered onto the present case forming apparatus, and conveyed thereon along a predetermined path, said collapsed case being oriented relative to such apparatus so that the flaps project outwardly sidewise on opposite sides of said apparatus, that is, transversely of said conveyance path.

The present apparatus automatically, sequentially and cyclically operates to erect the shell or body portion of the case disposed lying on its side, thereafter folds two of the bottom closure flaps, thence transfers such partially formed container, upright, unto a take-away conveyor, and finally folds the remaining two bottom flaps, to thereby present an upright, open top container ready for filling with articles.

To initiate the case opening operation, collapsed cases **189**, see FIG. **3**, are stacked and stored in a flattened condition in magazine or hopper **66** at the head end of main conveyor means **20**, said stack resting on slide rails **30**.

The collapsed cases are withdrawn from said magazine, by means of the conveyor flights, through adjustable gate means **75**, which permits the withdrawal of the collapsed cases one at a time from the bottom of said stored stack and through gate opening **75'**, the collapsed cases being advanced, slid and moved on and along said conveyor slide rails **30**.

To accomplish such withdrawal and subsequent erecting operation, the operator closes a starting switch **190** that energizes main drive motor **42** which drives the conveyors **20** and **128** and associated shafts and apparatus as hereinafter described.

As conveyor **20** becomes operative, conveyor flight **55** thereof engages the rearmost or trailing edge of the bottommost collapsed case **61**, in stack **189**, and moves it through gate **75** and into the erection zone **79**, see FIGS. **3** and **10**.

As the collapsed case is advanced into the erection zone, the leading edge of said case passes under oppositely disposed raised depressor fingers **118'** held raised by companion coacting rotating cams **109** and **111**, respectively, see FIG. **10**.

When said leading edge has passed beyond the raised depressor finger, said rotatable cams permit the fingers **118** to lower unto the leading upper, underlying case flaps and urge them downwardly thereby moving a lateral edge of the leading flap away from the adjacent lateral edge of the adjacent trailing flap and thus presenting exposed nondepressed interior lateral edges **191** of the trailing adjacent flaps, on opposite sides of the case, respectively.

Said exposed lateral edges **191** are then engaged by hook-ends **103** and **104** of pivotal oscillatable pickup arms **81** and **82**, respectively, as the case is advanced to said hook-ends.

The combination of the continued advancement of the collapsed case by conveyor flight **55** and the raising of the hooked pickup arms **81** and **82** by cam **91**, causes the engaged case flaps and connected panels to be lifted upwardly thereby initially opening and unfolding the shell or body portion of the case to be a dotted line position indicated at **192**, and the pickup arm to a dotted line position **81'**, see FIG. **2**.

Further advancement of such partially erected case by conveyor flight **55**, and the continued raising of the pickup arms by said cam **91**, causes the case shell to be fully erected to an open tubular state and disposed against the face **65** of stop wall **62** and thrust under and in engagement with the operatively positioned holddown clamps **183** and **184**, see FIG. **2**.

While it is preferred to have the cam work in concert with the advancing case to raise the pivotal arms **81** and **82**, it is obvious that for the above part of the operation the cam need not be operative to act on and raise said arms, reliance for such operation may be had on the movement of the advancing case only, for engaging the hook ends and for raising the pivotal pickup arms, that is, said operation may be operatively responsive to the movement of said advancing case.

Just prior to the abutment of the fully erected case against the stop wall, cam **91** lifts hooked pickup arms **81** and **82** free and clear of the case, to a disengaged dotted line position indicated at **81''**, see FIG. **2**.

After the above mentioned initial depressor action, and during further advancement and erection of the case, the depressor finger substantially retains its depressed position and enters into the opening and space **191'**, see FIG. **10**, between the separated upper and lower flaps, resulting as a consequence of said depressing action, and slidably engages the lower of said separated flaps, and said finger finally emerges and disengages therefrom at the trailing edges of the rearmost flaps, as at **118''**. The function of the depressor finger, while between the flaps, is to hold the lower flaps, and attached panels of the case, down against the slide rails during the erection of the upper panels, thereby to stabilize the case on the slide rails during the erection of the case.

An at substantially the instant that the conveyor flight **55** advances the case into abutment with stop wall **62**, see FIGS. **11** and **12**, the rollers **58** on the advancing conveyor flight commence to drop over the end edge **194** of deck plate **26** thereby causing said conveyor flight to pivot downwardly and away from the erected case, and disengage therefrom, and dispose itself downwardly to dotted line position indicated at **55'**.

The electric switches hereinafter mentioned comprise switch means connected into the electric control circuit shown in FIG. **13**, the cyclic operation, and the results to be accomplished thereby, to be later described in detail. The components of said circuit are each shown in their normal or deenergized position.

When the conveyor flight is thus disengaged from the fully erected shell, a radial finger **195**, mounted on shaft **98** to rotate therewith, see FIG. **2**, actuates a microswitch **196** mounted on the main conveyor frame. The actuation of said microswitch simultaneously deenergizes the coil of the start relay of main drive motor **42** to temporarily stop the conveyors **20** and **128** to thereby delay the delivery of the next collapsed container to the erection zone, it also energizes a circuit controlling the uprighter actuator **163** to cause the uprighter means **157** to start to move forwardly and upwardly, and it also energizes a circuit controlling the flap fold actuator **186** to cause its flap fold arm **187** to start to move forwardly and downwardly, to fold the adjacent uppermost flap to its closure position.

As the uprighter **157** swings upwardly, the flap fold arm **187** moves form its normal upright position to its lowered operative position **187'**, see FIGS. **2** and **8**, folding bottom flap **197** to its folded position **198** thereby comprising a closure portion of the bottom side of the case.

As the uprighter **157** continues to move upwardly to position **157''**, see FIGS. **8** and **4**, its face **199** engages the opposite bottom flap **201**, as at **202**, and thereafter folds it to its fully folded position **203**, at which time the uprighter has moved substantially to its vertical position **157''**.

As the uprighter approaches a substantially vertical position the normally projecting grab finger **174** passes between the ends of folded flaps **198** and **201**. At a substantially vertical position of the uprighter, a lug **206** on the lower face portion of the uprighter engages and actuates a switch **207**, see FIG. **9**, mounted on the face of the main conveyor frame. The actuation of said switch **207** simultaneously energizes a circuit controlling both the grab finger actuator **167** on the uprighter, and the box clamps actuator **176** on the stop wall **62**, see FIGS. **8** and **9**. As a result thereof, box clamps **182** and **184** are caused to reverse, disengage from the case, and move upwardly to the positions **183'** and **184'**, respectively, and the

grab finger **174** to move to intermediate dotted line position **174'** and thence to a fully closed solid line position **174''** to grasp and clamp folded flap **198** between said finger and the face of the uprighter.

Almost simultaneously therewith, but an instant after the above switch **207** is actuated, another lug **204**, also on the lower face portion of the uprighter, engages and actuates a companion switch **205**, see FIG. **9**, mounted on the face of the main conveyor frame. The actuation of said switch **205** deenergizes the aforesaid circuit controlling the previous forward motion of the uprighter and flap fold arm, and causes said flap fold arm to reverse and return to its normal vertical position of rest and the uprighter to reverse and commence to move downwardly to its normal position of rest nested in take-away conveyor **128**.

As said uprighter moves downwardly, it carries the finger clamped flap and attached case along with it, see FIG. **9**, and deposits the case, upright, on lateral take-away conveyor **128**.

When the uprighter swings down to its normal horizontal nested position, the lower face portion of the uprighter engages and actuates a switch **208** mounted on the bottom side of the adjacent conveyor frame, see FIGS. **2** and **8**. The actuation of said switch simultaneously deenergizes the circuit controlling the grab finger **174**, and the box clamps **183** and **184**, thereby causing the grab finger to release its grasp of the case flap and retract to its normal projecting position, and the box clamps to return to their operative projecting holddown position, in readiness to receive a subsequently erected case to be thrust thereunder.

Substantially simultaneously therewith, as the case is deposited on the take-away conveyor **128**, the case engages and actuates a restart cycle switch **209**, see FIG. **9**, which is suitably mounted on said conveyor for actuation by the deposited case. Said switch energizes the drive motor **42** and starts the conveyors moving again the advance the next collapsed case on conveyor **20**, and to eventually discharge the uprighted case from conveyor **128**.

As the uprighted case is moved along the take-away conveyor **128** the remaining two bottom flaps are folded by any conventional means such as by oppositely disposed fixed folding bars **211**, disposed in the paths of said remaining bottom flaps and responsive to the movement of said case along said conveyor to move said flaps into closed position with respect to said one end.

With reference now directed to wiring diagram FIG. **13**, a preferred embodiment of electrical control circuit is herein disclosed, and is seen to disclose a suitable electrical voltage source of approximately 110 volts, the latter being connected across power leads L1 and L2. The components of said circuit are each shown in their normal or deenergized position.

To provide a suitable control for the conveyor drive motor **42**, the instant electrical control circuit includes a motor start relay which has one end of its coil M connected to power lead L2, and the opposite end is connected to a series arrangement of a normally closed manually operated stop switch **212**, a normally open manually operated start switch **190**, a microswitch **196**, and thence to power lead L1. A normally open relay contact M1 is connected in parallel across said start switch **190**. A normally open switch **209** is connected across microswitch **196**, start switch **190**, and stop switch **212**, for recycling the operation and restarting the temporarily stopped conveyor drive motor **42** hereinafter described.

Microswitch **196**, also called a toggle switch, comprises a first normally closed contact terminal **213**, a second normally open contact terminal **214**, and a common contact arm **215**, and a common terminal **216**. The common contact arm is spring urged to normally close against contact terminal **213**.

The aforesaid series of the microswitch **196** is by connection to its common terminal **216** and to its normally closed contact terminal **213**.

The aforementioned microswitch **196** and its normally open terminal **214** is also connected in series with coil CR1 of a control relay, said series arrangement being connected, in turn, across the power leads L1 and L2. The normally open contact CR1' of the aforesaid relay is connected in series with normally closed switch **205**, said series arrangement is connected across the normally open terminal **214** of said microswitch **196** and power lead L2.

With the above circuit design, when the normally open start switch **190** is manually actuated closed by an operator, coil M of the motor start relay is energized to thus provide for the energization of the associated drive motor **42** (not shown in circuit diagram) for the conveyor means.

Thereupon, normally open contact M1 of said motor start relay is actuated to its closed position thus connecting said coil M directly through said contact M1 to thereby lock, or hold said coil M across the power leads L1 and L2, and maintain said drive motor in its energized condition when the operator releases the start switch **190** and allows it to retract to its normal open position.

Immediately after the fully erected shell is delivered against abutment wall **62**, a radial finger **195** on shaft **98**, see FIG. **2**, actuates the contact arm of normally closed microswitch **196** to a momentarily closed position against second terminal **214**.

Thereupon coil M of the motor start relay is deenergized which is effective to stop the drive motor and conveyor means.

The aforesaid actuation simultaneously energizes coil CR1 of a control relay and as a consequence open contact CR1' closes to thereby lock or hold said coil CR1 energized, across power leads L1 and L2, after the rotatable radial finger sweeps past and releases microswitch **196** and allows its contact arm **215** to retract to its normal closed position against terminal **213**.

Simultaneously therewith normally open contact CR1'' of said relay is likewise actuated to its closed position thereby to energize coils C2 and C4 of conventional solenoid valves, the latter, in turn being connected to a suitable source of air and to the aforementioned air actuators or cylinders **186** and **163**, respectively. As a result of said coil energization, cylinder **186** is connected in air circuit with the source of air effective to actuate said cylinder and propel the flap fold arm **187** forwardly and downwardly to fold bottom flap **197** to its folded closure position; and likewise, cylinder **163** is also connected in air circuit with the source of air effective to actuate said cylinder and retract its piston rod whereby to swing the uprighter **157** upwardly to engage companion flap **201** and fold it to its folded closure position at which time said uprighter has moved to a substantially vertical position.

The switches **205** and **207** are next to be actuated, almost simultaneously, by the uprighter **157** as it is moved to its substantially vertical position.

As seen in the wiring diagram, normally closed switch **208** and normally open switch **207** are connected in series with the coil CR2 of a second control relay, with an open contact CR2' thereof connected in parallel across said open switch **207**.

Likewise, a second normally open contact CR2'' thereof is connected in series with a pair of coils C3 and C1 of two separate conventional solenoid valves, said coils being connected in parallel so as to be simultaneously energized. Said series circuit, comprising said contact CR2'' and the solenoid coils C3 and C1, is seen to be connected across the aforesaid power leads L1 and L2.

As the uprighter reaches its substantially vertical position, a lug **206** on its lower face portion engages and actuates normally open switch **207** mounted on the conveyor frame and closes it thereby to energize coil CR2, and as a consequence the open contact CR2' is closed to lock and hold coil CR2 energized.

Simultaneously therewith normally open contact CR2'' of said relay is likewise actuated to its closed position thereby to energize coils C3 and C1 of conventional solenoid valves, the latter, in turn being connected to a suitable source of air and to the aforementioned air cylinders **176** and **167**, respectively. As a result of said coil energization, cylinder **176** is connected in air circuit with the source of air effective to actuate said cylinder and propel the companion hold down box clamps **183**

and **184** vertically upwardly to positions **183'** and **184'**, respectively, to an unobstructing position to permit the removable of the case; and likewise, cylinder **167** is also connected in an air circuit with the source of air effective to actuate said cylinder to propel the box grab finger **174** vertically upwardly to dotted line position **174''** to thereby clamp and grasp folded flap **198** between said finger and the adjacent face of the uprighter, in preparation for transfering the case to the take-away conveyor **128**.

An instant after said switch **207** is actuated, a lug **204** on the lower face portion of the uprighter engages normally closed switch **205** and opens it, thereby to deenergize coil **CR1**, which is effective to cause contacts **CR1'** and **CR1''** to return to their normal open or deactuated positions, resulting in coils **C2** and **C4** being deenergized, thereby reversing the flaps folder arm **187** and returning it to its normal vertical position of rest and causing the uprighter to start reversing its movement, carrying the grasped case along with it for deposit on the take-away conveyor **128**.

When the uprighter moves down to its normal horizontal nested position within take-away conveyor **128**, it deposits the grasped case onto said conveyor **128**, and substantially simultaneously therewith the uprighter engages and actuates normally closed switch **208** to an open position thereby to deenergize coil **CR2**, which is effective to cause contacts **CR2'** and **CR2''** to return to their normal open or deactuated positions, resulting in coils **C3** and **C1** being deenergized, thereby reversing the grab finger **174** and causing it to release its grasp of the case flap and retract to its normal projecting position, and the box clamps to reverse and return to their operative horizontal position in readiness to receive a subsequently erected case to be thrust thereunder.

Substantially simultaneously with the actuation of said switch **208**, and as the case is deposited on the take-away conveyor **128**, said case engages and actuates a restart cycle switch **209** mounted on said take-away conveyor, to initiate the next container erecting cycle. Said normally open switch is thereby closed, resulting in the reenergization of motor start relay coil M and drive motor **42** and the resulting restarting of the conveyor means to advance the next collapsed case on main conveyor **20** into the erecting zone, and to advance the already erected and uprighted case on take-away conveyor **128** for discharge therefrom.

The energization of coil M also results in the closing of contact **M1** thereby to lock or hold said coil M energized across power leads **L1** and **L2** to maintain the drive motor **42** in a running condition for driving said conveyors **20** and **128**.

As the already uprighted case is advanced on take-away conveyor **128**, it is moved away from switch **209**, thereby allowing the switch to return to its normal open position in readiness for the reception of and actuation by the next uprighted case.

Some characteristic features of this invention are the provision of an apparatus for erecting a collapsed case having means for engaging a transverse side edge of a flap on said case thereby to aid in erecting said case; the provision of such case erecting apparatus having depressor means for engaging a flap on said case thereby exposing an edge of an adjacent flap for engagement by oscillatable hook means operable to erect said case; and the provision of case erecting apparatus wherein the case shell is disposed laterally of its path of movement and means for uprighting the erected case shell, said uprighting means being operative to engage a folded bottom flap of said case shell and deposit said case shell, upright.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood, that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed and desired to be protected by Letters Patent of the United States is:

I claim:

1. Case forming apparatus for erecting a collapsed case having a shell including closure flaps hingedly connected to the ends of the panels of said shell, comprising:

a. conveyor means for advancing such collapsed case horizontally with the closure flaps of said case extending laterally of said conveyor means;

b. deflector means, including a member movable in a direction substantially normal to the plane of said flaps, disposed along said conveyor means, and adapted to engage an upper flap of said advancing case and deflect it relative to an adjacent upper flap thereby moving a lateral edge of said upper flap away from the adjacent lateral edge of said adjacent upper flap to expose said adjacent lateral edge, said movable member being operative to subsequently disengage from said case;

c. pivotally movable hook means swingable upwardly and forwardly, disposed along said conveyor means, for engaging said exposed lateral edge and raising said shell to a fully erected tubular state;

d. means for disengaging said hook means from said shell when said shell is raised to a fully erected tubular state;

e. stop wall means at the end of said conveyor means for abuttingly receiving said fully erected shell from said conveyor means; and

f. clamp means on said stop wall means for engaging said fully erected shell and holding said shell fully erected adjacent said stop wall means.

2. The apparatus of claim **1** wherein said pivotally movable hook means is operatively responsive to movement of said advancing case.

3. The apparatus of claim **1** wherein said pivotally movable hook means is operatively responsive to included mechanical means.

4. Case forming apparatus for erecting a collapsed case having a panel body shell including overlaying upper and lower closure flaps hingedly connected to the ends of the panels of said shell, comprising:

a. conveyor means, including track means for slidably supporting said collapsed case, for advancing said collapsed case horizontally along said track means with the closure flaps of said case extending laterally of said track means;

b. deflector means, disposed fixed along said track means, including a movable finger for slidably engaging the upper leading flap of said advancing case and depressing it relative to the adjacent upper trailing flap thereby moving the interior lateral edge of said upper leading flap away from the adjacent interior lateral edge of said adjacent upper trailing flap to expose said adjacent interior lateral edge and form a V-shaped opening between said separated edges, said finger subsequently entering said opening between said separate flaps and slidably engaging the upper faces of the lower of said separated flaps to hold a lower portion of said case against said track means as said case advances;

c. pivotal arm means swingable upwardly and forwardly and having a hook at the end thereof for engaging said exposed lateral edge and raising said shell to a fully erected tubular state, said pivotal arm being disposed above said upper flaps and movable in a plane substantially normal to the plane of said upper flaps and substantially at right angle to said interior lateral edges;

d. means for disengaging said pivotal arm means from said shell when said shell is fully erected;

e. stop wall means at the end of said track means for abuttingly receiving said fully erected shell from said conveyor means; and

f. clamp means on said stop wall means for engaging said fully erected shell for releasably holding said shell fully erected adjacent said stop wall means.

5. The apparatus of claim **4** wherein said pivotal arm means is operatively responsive to the movement of said advancing case.

6. Case forming apparatus for erecting a collapsed case having a panel body shell including overlaying upper and lower closure flaps hingedly connected to the ends of the panels of said shell, comprising:

a. conveyor means, including track means for slidably supporting said collapsed case, for advancing said collapsed case horizontally along said track means with the closure flaps of said case extending laterally of said track means;

b. deflector means, disposed fixed along said track means, including a movable finger for slidably engaging the upper leading flap of said advancing case and depressing it relative to the adjacent upper trailing flap thereby moving the interior lateral edge of said upper leading flap away from the adjacent interior lateral edge of said adjacent upper trailing flap to expose said adjacent interior lateral edge and form a V-shaped opening between said separated edges, said finger subsequently entering said opening between said separated flaps and slidably engaging the upper faces of the lower of said separated flaps to hold a lower portion of said case against said track means as said case advances;

c. pivotal arm means swingable upwardly and forwardly and having a hook at the end thereof for engaging said exposed lateral edge and raising said shell to a fully erected tubular state, said pivotal arm being disposed above said upper flaps and movable in a plane substantially normal to the plane of said upper flaps and substantially at right angle to said interior lateral edges;

d. means for disengaging said pivotal arm means from said shell when said shell is fully erected;

e. stop wall means at the end of said track means for abuttingly receiving said fully erected shell from said conveyor means;

f. clamp means on said stop wall means for engaging said fully erected shell for releasably holding said shell fully erected adjacent said stop wall means;

g. flap fold means, on said stop wall means, having a movable arm operative to engage the uppermost flap on one end of said fully erected and held shell and move it to a closed position relative to said one end and to releasably hold said flap in said closed position;

h. pivotal uprighter means, at said stop wall means, operative laterally of said track means and pivotal from a substantially horizontal position to a substantially vertical position adjacent said folded upper closed flap, said pivotal uprighter means being operable to engage the lowermost flap on said one end and move it to a closed position relative to said one end responsive to the upward movement of said uprighter means;

i. grab means on said uprighter means operative to releasably grasp said fully erected shell when said uprighter means is swung adjacent said uppermost closed flap;

j. second conveyor means disposed to receive said grasped shell, in an upright position, from said uprighter means when said uprighter means swings down to its substantially horizontal position; and

k. bar means fixedly disposed in the path of the remaining closure flaps on said one end and responsive to the movement of said shell on said conveyor to move said remaining flaps into a closed position relative to said one end.

7. The apparatus of claim 4 wherein the pivotal arm is operatively driven by included mechanical means.