July 21, 1964 D. G. COLEMAN 3,141,391

EGG CARTON SET-UP MACHINE

Filed May 28, 1962 7 Sheets-Sheet 1

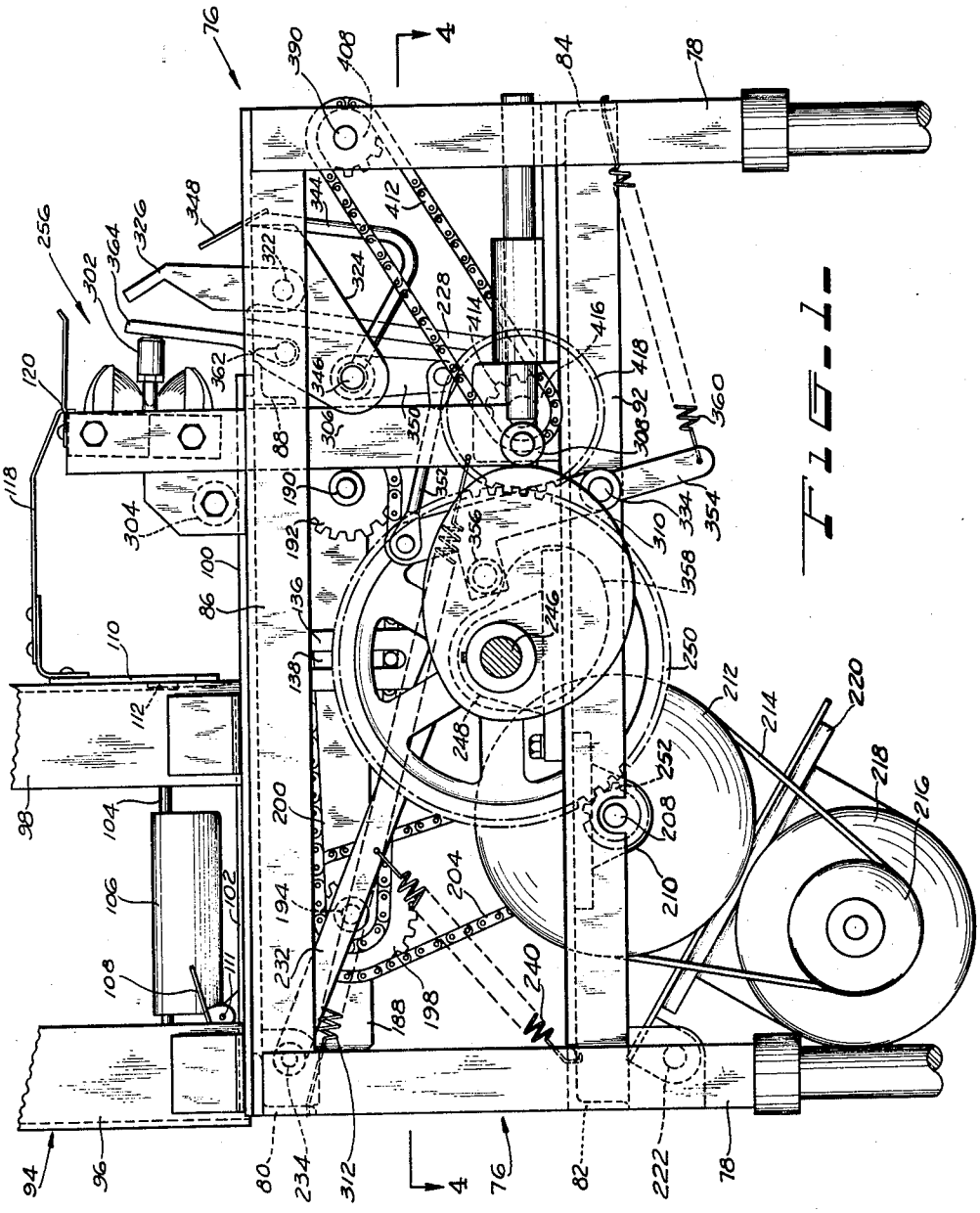


FIG. 1

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July 21, 1964 D. G. COLEMAN 3,141,391

EGG CARTON SET-UP MACHINE

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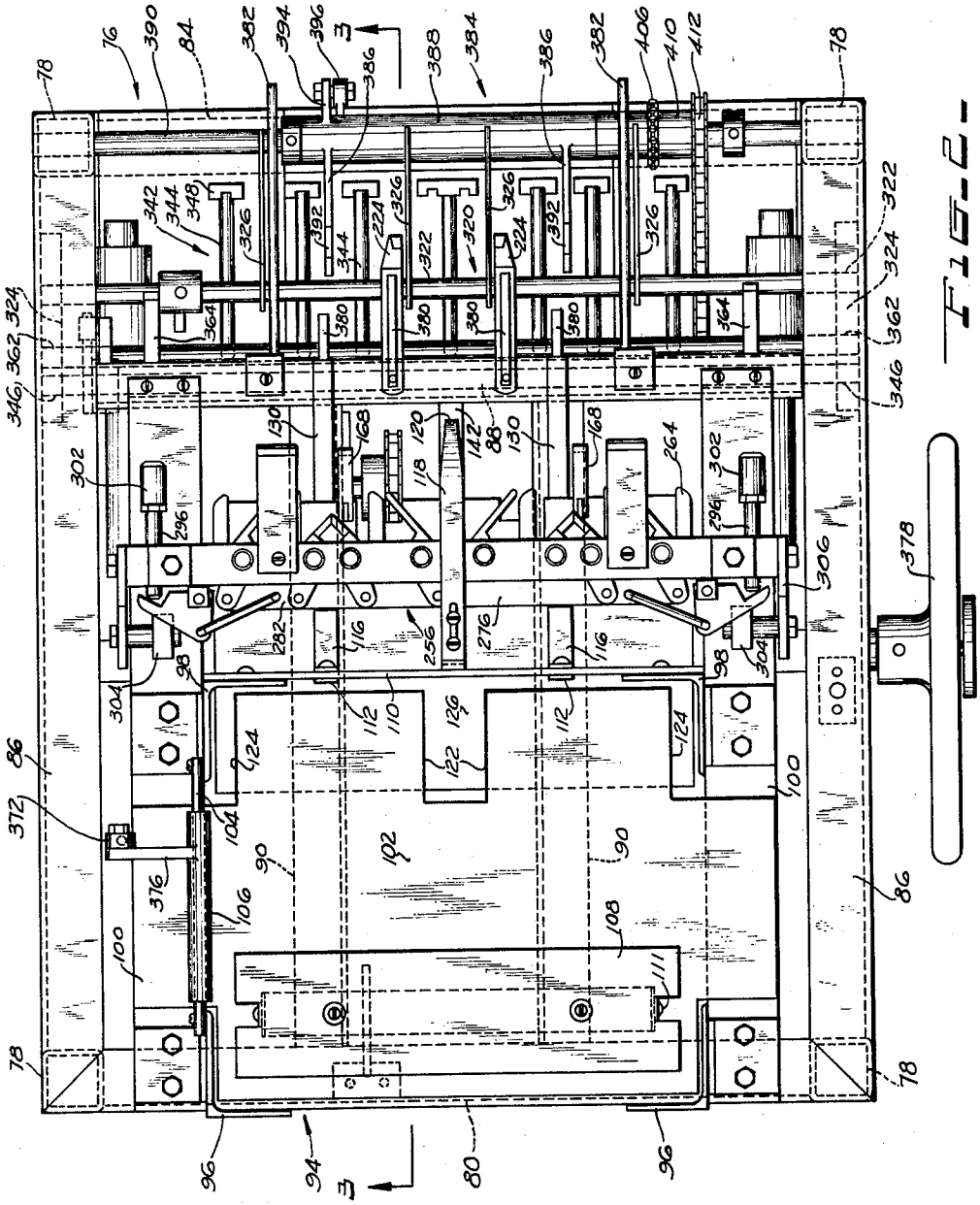


FIG. 2

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EGG CARTON SET-UP MACHINE

Filed May 28, 1962 7 Sheets-Sheet 3

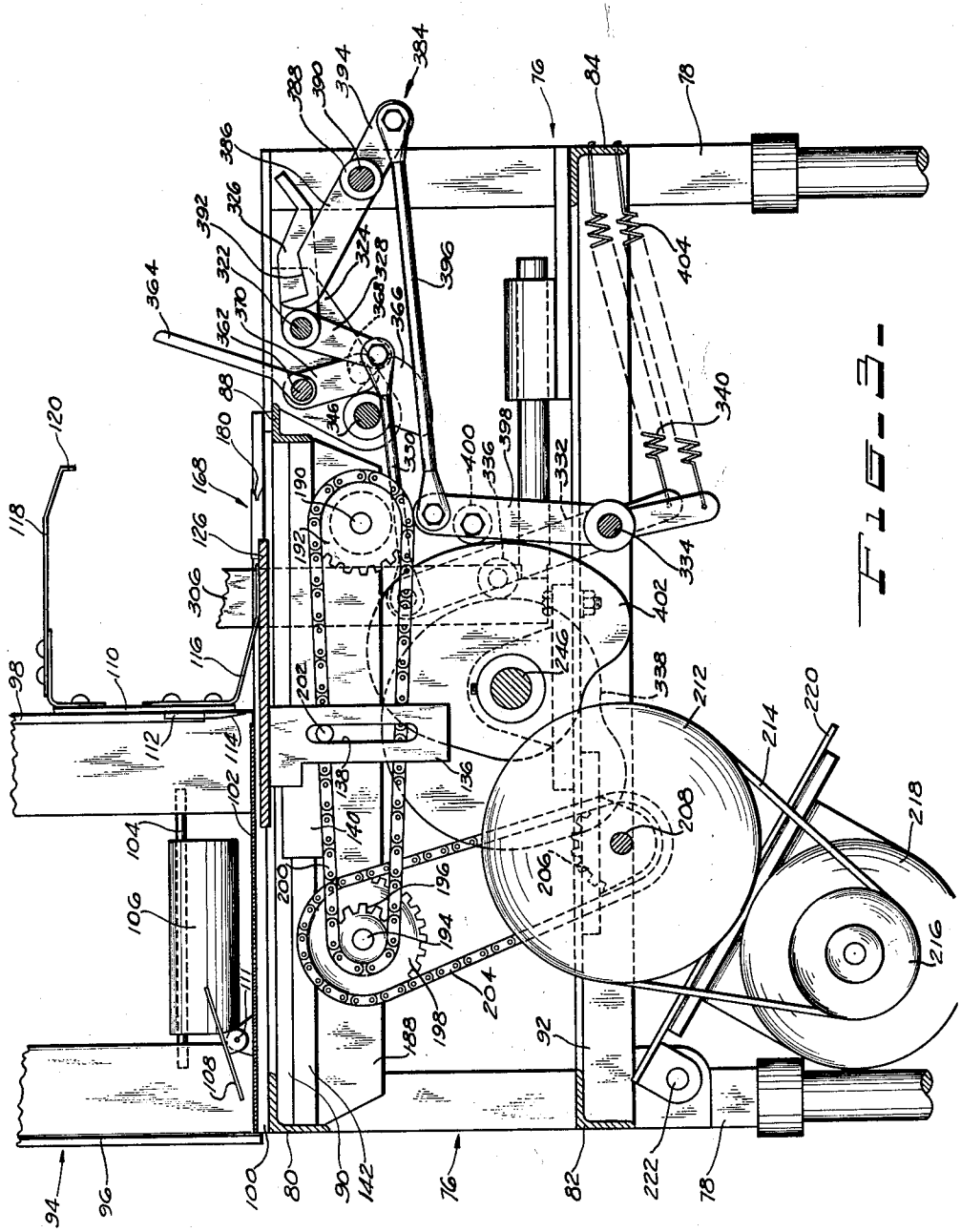


FIG. 3.

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EGG CARTON SET-UP MACHINE

Filed May 28, 1962 7 Sheets-Sheet 4

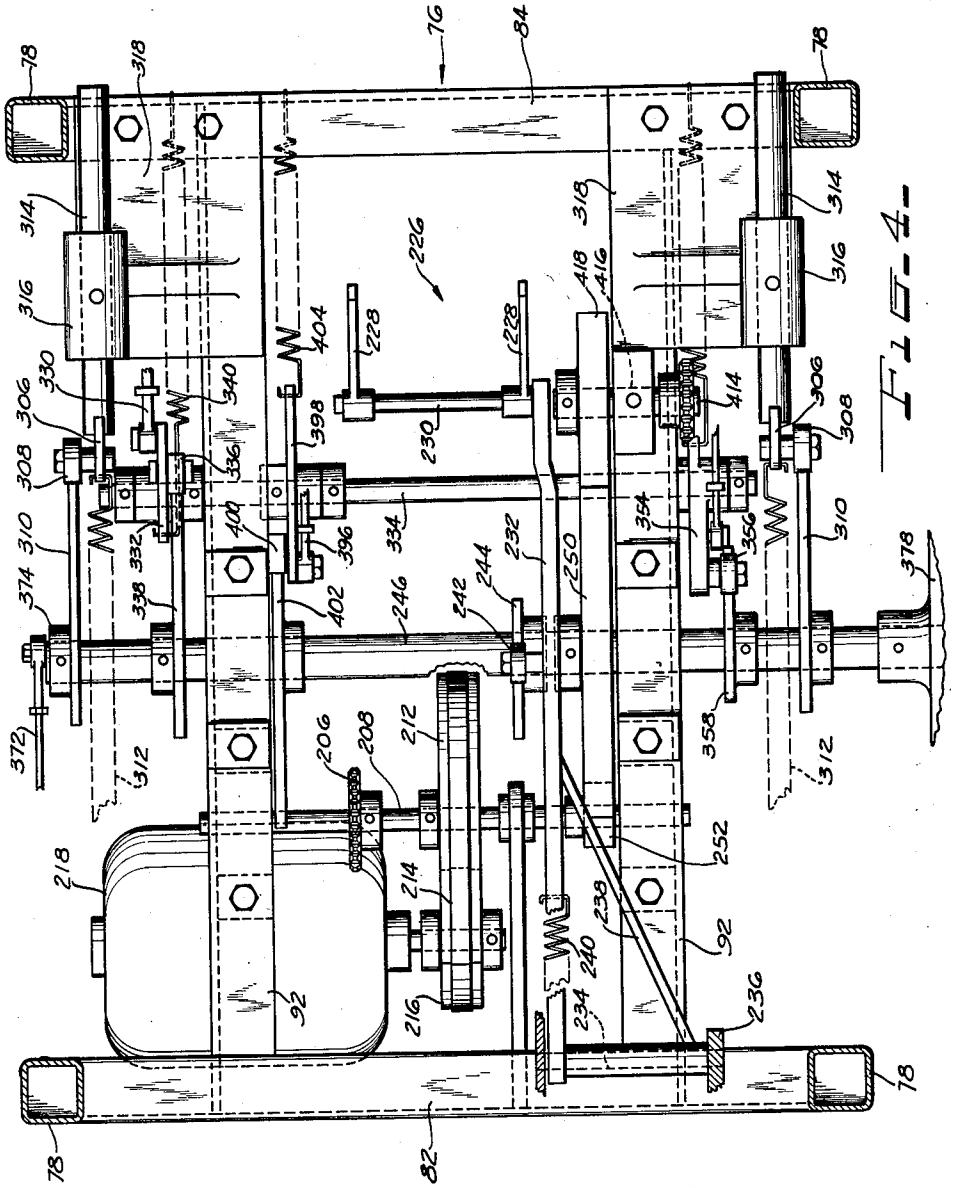



FIG. 4

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EGG CARTON SET-UP MACHINE

Filed May 28, 1962 7 Sheets-Sheet 5

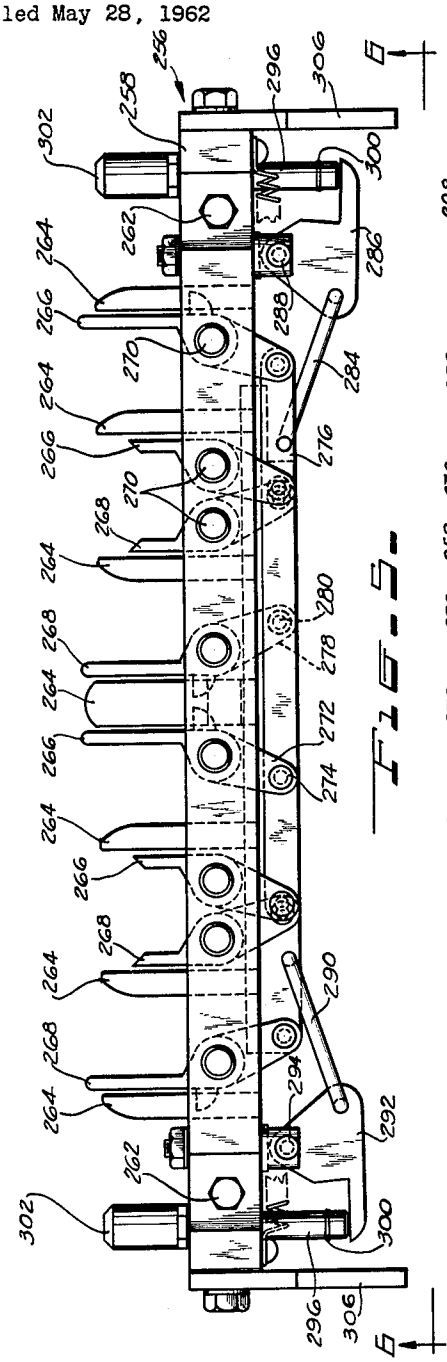


FIG. 5.

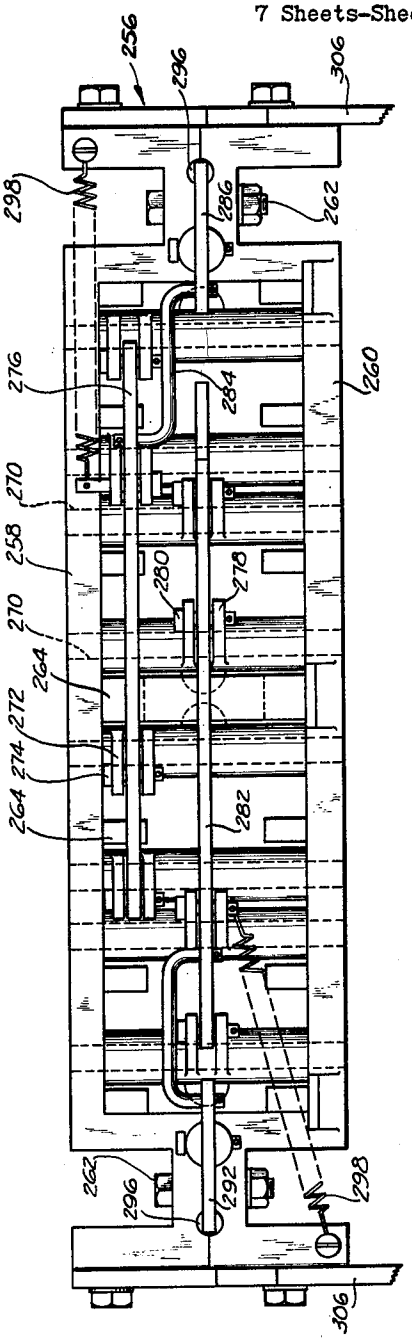


FIG. 6.

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EGG CARTON SET-UP MACHINE

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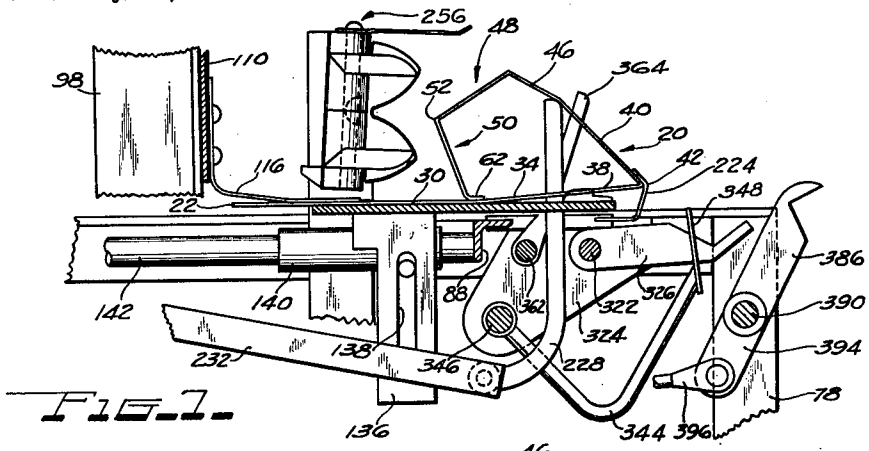



FIG. 7.

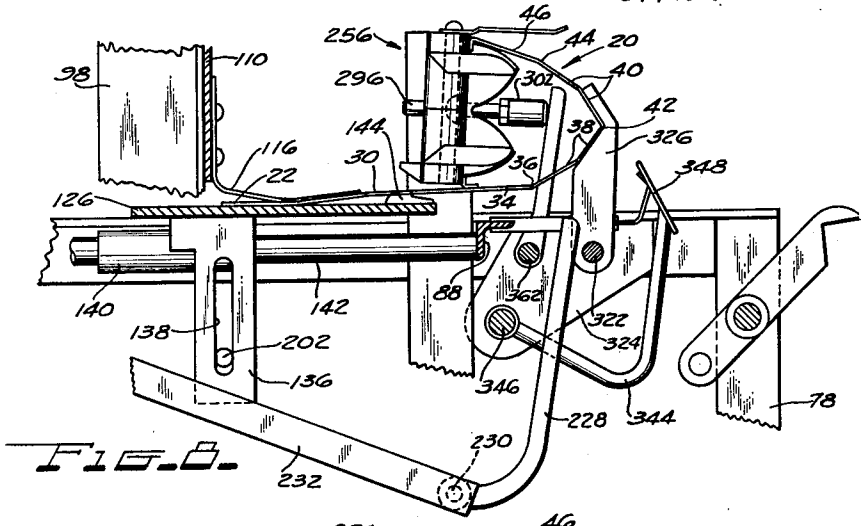



FIG. 8.

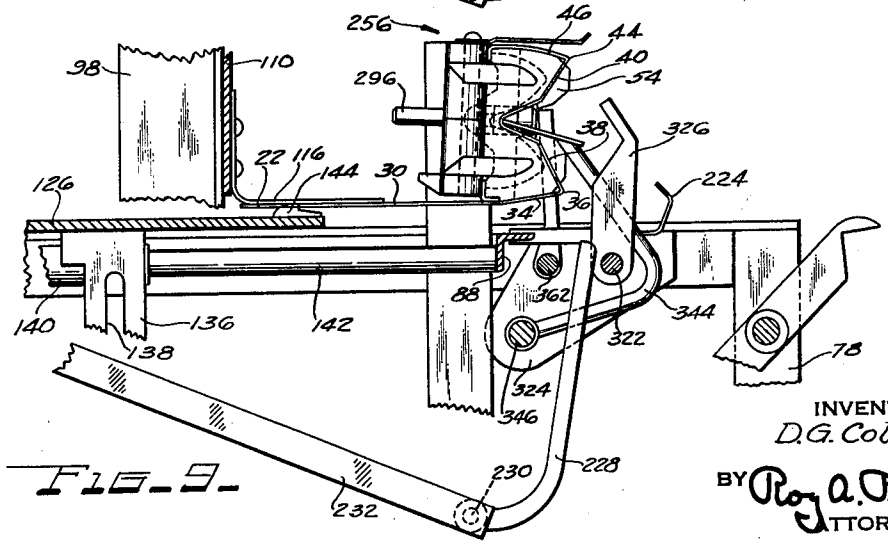



FIG. 9.

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EGG CARTON SET-UP MACHINE

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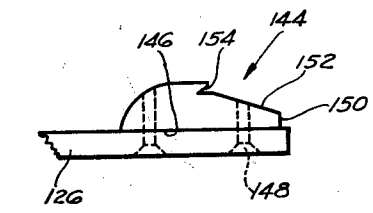



FIG. 11

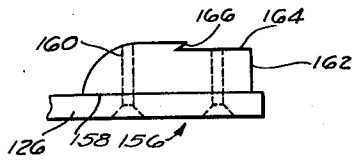



FIG. 11a

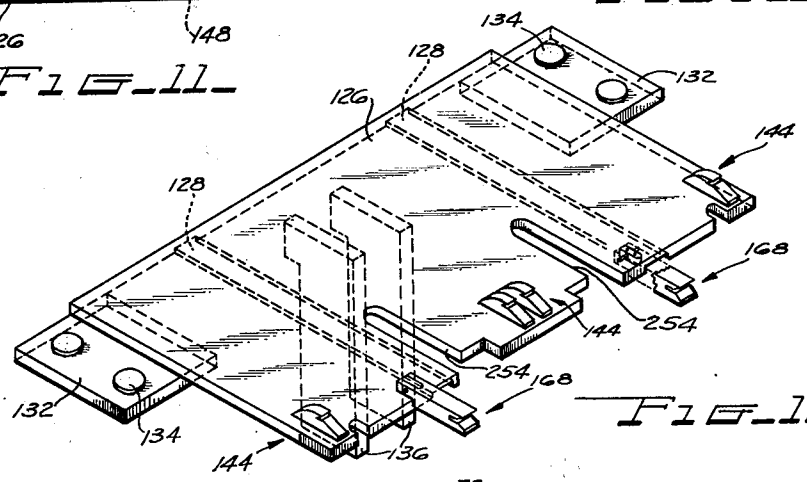



FIG. 10

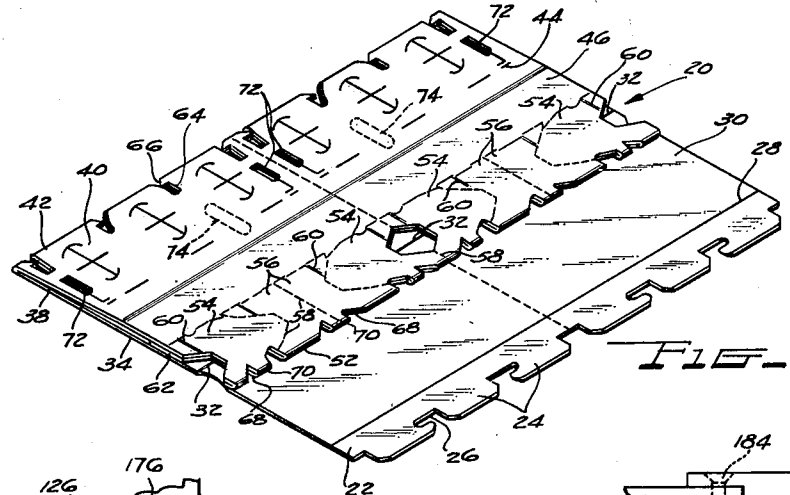



FIG. 14

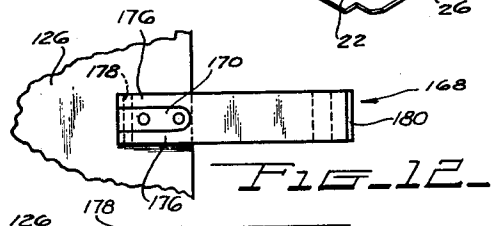



FIG. 12

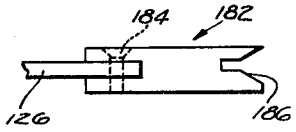



FIG. 13a

FIG. 13

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United States Patent Office 3,141,391 Patented July 21, 1964



3,141,391

# EGG CARTON SET-UP MACHINE

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Filed May 28, 1962, Ser. No. 198,096
12 Claims. (Cl. 93—37)

This invention relates to a method and apparatus for setting up or erecting paper board cartons and, in particular, relates to a method and apparatus for setting up or erecting a collapsed paper board carton blank into a cellular carton for receiving and storing eggs.

It has heretofore been proposed to set-up or erect cellular cartons, such as egg cartons, by providing an apparatus comprising several set-up instrumentalities for successively acting upon a plurality of collapsed paper board carton blanks which are supplied one at a time from a stack thereof contained in a supply magazine. With specific reference to the set-up of cartons for receiving and storing a plurality of eggs therein, such collapsed carton blanks are characterized by a connected series of panel members adapted to be erected into top, side and bottom wall forming members of the finally set-up carton, and further includes cross partition forming panel members foldable out of the plane of the top wall forming member into interlocking engagement with the bottom wall forming member to form the finally set-up or erected carton and the cell structure thereof for receipt of the eggs. The set-up apparatus of the prior art has typically included means for feeding a collapsed carton blank from the aforementioned supply magazine one at a time to a set-up zone in which means are provided for at least partially expanding the carton blank and disposing the top wall forming member thereof in engagement with a reciprocable set-up head equipped with a plurality of pivoted folding plates or leaves adapted to engage and fold the cross partition forming panel members out of the plane of the top wall forming member for subsequent interlocking engagement with the bottom wall forming member of the carton blank which is tucked into engagement therewith by suitable tucking means. While such prior apparatus and method have been employed with some success, they have presented certain problems which seriously detract from the efficiency of the carton set-up or erecting operation, and frequently malfunction in properly erecting egg cartons thereby resulting in considerable waste in paper board carton blanks.

For example, in one known apparatus of this type, a plurality of pick-up cleats or fingers are mounted on the leading or feeding edge of a feed mechanism so as to engage in corresponding pick-up openings in the lowermost collapsed carton blank of a stack thereof contained in the aforementioned supply magazine so as to feed said lowermost carton blank from the stack into a set-up zone on the apparatus. However, it frequently happens that one or more of the pick-up fingers or cleats carried by the feed mechanism extends not only into the lowermost carton blank in the stack but also into the blank immediately thereabove, thereby resulting in the feed mechanism attempting, if not successfully so, to feed two carton blanks to the set-up instrumentalities in the set-up zone. Such a situation is intolerable in an apparatus of the type in question, and merely results in waste in the carton blanks since the set-up instrumentalities are incapable of acting upon carton blanks fed more than one at a time.

In addition, in order to enhance pick-up of the lowermost carton blank in the stack thereof in the magazine, it is quite important that the lowermost carton blank be positioned properly for cooperating engagement between



the pick-up openings therein and the pick-up cleats or fingers on the feed mechanism. However, it happens that a given carton blank may become misaligned relative to the feed mechanism as it descends in the stack in the magazine resulting in failure to feed such carton blank and further waste.

Furthermore, in known apparatus of the type in question, the feed mechanism is additionally equipped with a plurality of ejecting fingers or cleats along the leading or feeding edge thereof and extending therebeyond and adapted to engage a portion of an erected carton to eject the latter from the set-up zone of the apparatus as the feed mechanism feeds a successive carton blank for erection by the set-up apparatus. More specifically, these ejecting fingers or cleats have been adapted to engage with an edge of a locking strip or panel at one end of the carton blank which, upon erection of the carton, is adapted to engage therewith to close the top of the carton and enclose the eggs therein. It sometimes happens that a certain amount of warpage occurs along thhe aforementioned edge of the locking strip or panel causing the edge thereof to be bowed upwardly from the path of the feed mechanism equipped with the ejecting fingers or cleats, thereby frequently resulting in the ejecting fingers or cleats being unable to reach the aforementioned edge of the locking strip or panel to perform the ejecting operation.

Perhaps the most serious problem presented, however, by such apparatus heretofore known resides in operation of the aforementioned set-up head and the folding plates or leaves carried thereby for folding the cross partition forming panel members of the carton blank into position for interlocking engagement with the bottom wall forming member of the carton upon final set-up. More specifically, in one type of known apparatus the set-up head has been mounted for oscillatory movement between the supply magazine containing the stack of collapsed carton blanks and a set-up zone in which the set-up operation occurs, and the folding plates or leaves have been relatively impositively actuated; that is, as a function of the oscillatory movement of the set-up head itself and without any direct or positive relation to the position of the carton blank being set-up or other set-up instrumentalities of the apparatus. Thus, it frequently happens that the folding plates are partially operated before they even engage the cross partition forming panel members of a partially erected carton, thereby resulting in the plates or leaves attempting to pierce through the cross partition forming members rather than folding them into position for operative engagement with the bottom wall forming member of the carton blank. It was a recognition of these and other problems in this art that led to the conception and development of the present invention.

Therefore, the objects and features of the present invention include the provision of an improved set-up apparatus and method by which successive collapsed paper board carton blanks may be fed one at a time from a magazine and set-up quite rapidly and efficiently into erected cellular cartons of the type adapted to receive eggs, while avoiding one or more of the problems discussed above.

It is yet another object and feature of the invention to provide an improved carton set-up apparatus and method including means in association with a supply magazine for a stack of collapsed carton blanks for aligning one above the other at least the lower portion of carton blanks in the stack to facilitate feed thereof to a set-up zone.

It is yet another object and feature of this invention to provide a method and apparatus for erecting or setting up cellular paper board cartons from a collapsed paper board carton blank characterized by an improved means

for feeding the carton blanks one at a time from a stack contained in a magazine, and in which the feeding means includes a pick-up cleat or finger which positively insures entry thereof into a cooperating pickup opening only in the lowermost carton blank of the stack and to the exclusion of any carton blank lying immediately thereabove.

It is yet another object and feature of this invention to provide the aforementioned feeding means with an ejecting cleat or finger means adapted to engage the locking strip or panel at one end of an erected cellular paper board carton between the usual locking hooks positioned therealong, whereby warping of the locking strip or panel in the area of the locking hooks does not prevent the aforementioned ejecting finger or cleat to engage the aforesaid one end of an erected carton to perform the ejecting operation.

It is yet another object and feature of this invention to provide a method and apparatus for setting up a collapsed paper board carton blank into an erected cellular carton of the type adapted to receive a plurality of eggs nested therein characterized by means for feeding carton blanks one at a time to a set-up zone, means for engaging the top wall forming member of the carton with a reciprocable set-up head provided with a plurality of pivotal folding plates or leaves for folding the cross partition forming members of the carton blank into position for operative interlocking engagement with a bottom wall forming member of the carton which may be interlocked therewith upon operation of a bottom tucking means, and drive means for the reciprocable set-up head adapted to hold the latter substantially stationary in a set-up zone of the apparatus during operation of the folding plates or leaves and the tucking finger means.

It is yet another object and feature of this invention to provide a method and apparatus as aforedescribed further characterized by means for operating the folding plates or leaves in direct response to operation of the bottom tucking finger means whereby the folding plates or leaves are not operated until the set-up head arrives at a substantially complete stop in the set-up zone and the cross partition forming members are engaged therewith, and the tucking finger means has reached a predetermined point in its bottom tucking cycle of operation.

Still further objects and advantages of the invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the steps and means hereinafter fully described and particularly pointed out in the claims, the annexed drawings and the following description setting forth in detail certain means and modes of carrying out the invention, such disclosed means and modes illustrating, however, but several of the various ways in which the principle of the invention may be used.

In the annexed drawings:

FIGURE 1 is a side elevation of an egg carton set-up apparatus illustrating the positions of various set-up instrumentalities thereof just prior to the final carton set-up operation, and particularly illustrating the set-up head disposed in one extreme position at the set-up zone of the apparatus where final carton set-up or erection takes place;

FIGURE 2 is essentially a plan view of the apparatus of FIGURE 1, but with the set-up head in its other extreme position remote from the set-up zone, a position it occupies prior to moving forwardly to the position of FIGURE 1 for final set-up of a carton blank fed to the set-up zone;

FIGURE 3 is a sectional view taken on line 3—3 of FIGURE 2 with certain parts broken away or eliminated or shown fragmentarily so as not to obscure certain details of the invention;

FIGURE 4 is a sectional view taken on line 4—4 of FIGURE 1 with certain parts broken away, eliminated or shown fragmentarily so as not to obscure certain details of the invention;



FIGURE 5 is an enlarged fragmentary view of FIGURE 2 illustrating certain details of the set-up head, and showing the folding plates or leaves thereof in the fully opened position they assume upon completion of a folding operation on a carton blank;

FIGURE 6 is a view taken on line 6—6 of FIGURE 5;

FIGURE 7 is a fragmentary side elevational sectional view of the apparatus of FIGURE 1 showing various set-up instrumentalities thereof in the positions they assume while partially expanding a paper board carton blank in the set-up zone of the apparatus;

FIGURE 8 is a view corresponding generally to FIGURE 7, but showing the position of the various set-up instrumentalities at the time when a partially set-up paper board carton blank is in position against the set-up head in the set-up zone;

FIGURE 9 is a view corresponding generally to FIGURES 7 and 8, but showing the positions of the various set-up instrumentalities at final set-up of the carton;

FIGURE 10 is a perspective view of the feed plate of the apparatus which feeds collapsed carton blanks one at a time to the set-up instrumentalities aforementioned;

FIGURE 11 is a side elevation of one of the pick-up fingers or cleats mounted on the feed plate of FIGURE 10;

FIGURE 11*a* is a view corresponding to FIGURE 11 but showing another embodiment of a pick-up finger or cleat which may be mounted on the feed plate of FIGURE 10;

FIGURE 12 is a fragmentary top plan view of the feed plate of FIGURE 10 illustrating one of the ejecting cleats or fingers mounted thereon;

FIGURE 13 is a side elevation of the ejecting cleat or finger of FIGURE 12;

FIGURE 13*a* is a view corresponding generally to FIGURE 13, but showing another embodiment of an ejecting cleat or finger which may be mounted on the feed plate of FIGURE 10; and

FIGURE 14 is a perspective view of a collapsed paper board carton blank adapted to be set-up into an erected carton by the apparatus and method of this invention.

In FIGURE 14, the numeral **20** generally designates the type of collapsed partially folded paper board carton blank adapted to be manipulated and set-up into an erected carton for subsequent use. As is well known in the art, a carton blank of this type is formed from a unitary paper board blank which is cut, creased, folded and glued so as to result in the collapsed carton blank illustrated in FIGURE 14 which also illustrates the condition of the carton blank as it is supplied to the user thereof.

More specifically, and referring also to FIGURES 7 to 9, the carton blank **20** comprises a relatively narrow locking panel or strip **22** extending across one end of the blank from which the carton blank is formed, and includes a plurality of spaced locking hooks **24** along its free edge resulting in recessed openings **26** along the locking panel or strip between the aforementioned locking hooks. The locking panel or strip is bendable along a fold line **28** with respect to a cover forming panel member **30** adapted to close the top of an erected carton upon engaging the locking hooks **24** in one edge thereof. The cover forming panel member is bendable along a fold line **32** with respect to one side wall forming panel member **34** which is bendable along a fold line **36** with respect to one bottom wall forming panel member **38** which is, in turn, bendable with respect to another substantially duplicate bottom wall forming panel member **40** along the medial fold line **42**. The other bottom wall forming panel member **40** is, in turn, bendable along a fold line **44** with respect to the other side wall forming panel member **46** which is substantially a duplicate of the side wall forming panel member **34**. A pair of top wall forming panel members are indicated generally at

48 and 50 in FIGURE 7, and are joined together by the medial fold line 52. Referring to FIGURE 14, each top wall forming panel member includes a plurality of interconnected cross partition forming panel members 54 and 56 which are separable along the score lines 58 by a folding means to be hereinafter described, and foldable out of the respective planes of the top wall forming panel members 48 and 50 inwardly of a partially erected carton for engagement with the bottom wall forming panel members 38 and 40.

To this end, one end of each of the cross partition forming panel members 54 and 56 is swingably connected to one edge of the side wall forming panel member 46 by means of small tabs jointed on fold lines indicated at 60, while the other ends of the cross partition forming panel members are similarly swingably connected to an elongated terminal glue strip 62 attached by glue or other adhesive to the inner surface of the side wall forming panel member 34.

A row of spaced elongate openings 64 including hook members 66 extend along the medial fold line 42 separating the bottom wall forming panel members 38 and 40, and are adapted to be tucked inwardly of a carton during erection or set-up thereof for engagement with a plurality of locking apertures 68 including bridging members 70 spaced along the medial fold line 52 between the top wall forming panel members 48 and 50. Additionally, upon folding or swinging the cross partition forming panel members 54 and 56 out of the plane of the top wall forming panel members 48 and 50 inwardly of the carton during the erection of the latter, the terminal ends of the cross partition forming members 54 are adapted to be received within a plurality of spaced locking slits including pick-up openings 72 formed in the bottom wall forming panel members 38 and 40.

Each of the pick-up openings 72, herein shown to be four in number, are slightly elongate and are adapted to receive a pick-up cleat or finger on a carton blank feed mechanism to be described to feed carton blanks in the collapsed condition of FIGURE 14 to various instrumentalities for setting the carton blank up into an erected cellular carton. Furthermore, a pair of spaced elongate slots 74 extend between the bottom wall forming panel member 38 and the side wall forming panel member 34 across the fold line 36 joining the latter, and each is adapted to receive carton expanding finger means to be hereinafter described which are then engageable with the opposite overlying wall member of the carton blank to spread the opposite walls thereof away from each other to initially expand the carton blank for erecting purposes.

As is clearly indicated in FIGURE 14, in its collapsed or knocked down condition, the carton blank 20 is partially folded upon itself along the medial fold line 42 at one end thereof and again at the medial fold line 52 to permit securing the terminal glue strip 62 to the side wall forming member 34. As a result, the respective side, bottom and top wall forming panel members including the cross partition forming panel members aforementioned overlie each other and form a double ply thickness of the carton blank material extending from one end thereof through somewhat more than one half of its length, the cover forming panel member 30 and locking panel or strip 22 being, therefore, of single ply. A plurality of collapsed cartons as illustrated in FIGURE 14 are adapted to be stacked one upon the other in a supply magazine with the cover forming panel member and the panel members connected thereto lying on the bottom, and the edge of the carton blank at the medial fold line 42 forming the leading edge of a carton blank fed from the magazine.

Referring particularly to FIGURES 1 through 4, the drawings disclose an apparatus comprising a supporting frame indicated generally at 76 and which includes four spaced, vertically disposed corner frame members or posts 78. The corner frame members or posts 78 at one end



of the supporting frame are interconnected by vertically spaced end rails 80 and 82, while a single end rail 84 interconnects such members 78 at the other end of the supporting frame. A pair of side rails 86 extend between and interconnect the upper ends of the corner frame members or posts at each end of the supporting frame, while a cross frame member 88 is connected between side rails 86 between the ends of the latter. A pair of frame members 90 extend between and connect end rail 80 and cross frame member 88. Finally, the end rails 82 and 84 are connected by a pair of frame members 92.

A supply magazine for a stack of carton blanks in the collapsed condition of FIGURE 14 is indicated generally at 94, and comprises the rectangularly spaced end and inner angle members 96 and 98, respectively, suitably rigidly secured to and upstanding from a pair of support plates 100 extending between and having their opposite ends suitably secured to the end rail 80 and the cross frame member 88 disposed transversely of the supporting frame between the ends of the latter. A magazine bed or floor plate 102 is likewise suitably secured to the support plates 100 at the lower end of the magazine angle members 96 and 98 so as to form a support for the lowermost collapsed carton of a stack of cartons contained within the magazine angle members 96 and 98. A shaft 104 extends between and has its opposite ends suitably secured to the magazine angle members 96 and 98 at one side thereof so as to support an aligning plate 106 for oscillation thereon in a manner to be described and in engagement with the lower portion of a stack of carton blanks in the magazine, whereby oscillation of the plate constantly shuffles one edge of a stack of carton blanks within the magazine to keep them substantially aligned one above the other for the purpose of feeding them to the set-up instrumentalities to be hereinafter described. A teeter plate 108 extends between the magazine angle members 96 and has its central portion suitably pivotally connected at 111 to the magazine floor plate 102 whereby, with the magazine loaded with carton blanks, the teeter plate will tip clockwise in FIGURES 1 and 3 to provide an inclined ramp for directing the lowermost collapsed carton in the magazine toward a feeding mechanism to be described. Preferably a limit switch and suitable circuitry (not shown) or any other suitable position-sensing means is mounted on the supporting frame 76 for engagement with the teeter plate in its tipped position aforementioned whereby the electric drive motor for the apparatus to be described will be incapable of being energized in the absence of a stack of collapsed carton blanks in the magazine.

A mounting plate 110 extends between and connects the magazine angle members 98. A suitable number of vertically extending guide bars 112 are secured to one side of the mounting plate within the magazine, and each includes a tapered lower end 114 extending beneath the bottom edge of the mounting plate to guide carton blanks from the magazine to the feeding mechanism to be described. A pair of spring fingers 116 are secured in spaced relation to the other side of the mounting plate 110, and the free ends thereof are adapted to wipingly engage a carton blank being fed from the magazine so as to hold it on the feeding mechanism to be described. An ejecting finger 118 is also secured to the mounting plate, extends away therefrom and includes a terminal abutment member 120 cooperable with a set-up head to be described to eject therefrom fully set-up cartons.

It will be noted particularly from FIGURE 2 that a central elongate opening 122 and a pair of elongate side openings 124 extend inwardly of the magazine bed or floor plate 102 from one edge thereof which, as will appear hereinafter, is the edge over which a collapsed carton blank is fed from the magazine. These openings are adapted to receive pick-up means carried by a reciprocable feed mechanism to be hereinafter described.

Referring now particularly to FIGURES 2, 3 and 10, the

carton blank feeding mechanism comprises a feed plate **126** including a pair of spaced longitudinally extending recessed tracks **128** on the lower surface thereof slidable on and about rail members **130** suitably rigidly secured to the frame members **90**. A bearing plate **132** is suitably rigidly secured to the lower surface of the feed plate at each side thereof and is equipped with suitable bearing means such as the bearing buttons **134** engaging the lower surface of the support plates **100**. A pair of cam follower brackets **136** have their upper ends suitably rigidly secured to the bottom surface of the feed plate **126** and depend vertically therefrom, and each includes a vertically elongate slot or opening **138** therein. The brackets **136** embrace and are rigidly secured to a guide bushing or bracket **140** having a bore therethrough slidably receiving a guide rod **142** extending between and having its opposite ends rigidly secured to the end rail **80** and cross frame member **88**. By means of the aforementioned construction, the feed plate **126** is guided for rectilinear reciprocation along the supporting frame **76** by means to be hereinafter described.

Referring primarly to FIGURES 10 and 11, a plurality of pick-up cleats or fingers **144**, herein shown to be four in number, are secured to the upper surface of the feed plate **126** adjacent the leading or feeding edge thereof. The two outermost pick-up cleats or fingers are so disposed as to be received within the elongate side openings **124** in the magazine bed or floor plate **102** as the feed plate moves therebeneath, while the middle pair of pick-up fingers or cleats cooperate in a similar fashion with the central elongate opening **122** located substantially centrally of the magazine bed or floor plate. The pick-up fingers or cleats **144** illustrated in FIGURES 10 and 11 each comprise a base portion **146** adapted to be suitably rigidly secured to the upper surface of the feed plate as by means of fasteners indicated at **148**. Each cleat further includes an upstanding vertical leading edge or wall portion **150** terminating in an upwardly and rearwardly sloping ramp surface **152** which finally terminates in a notched abutment means **154** adapted to be received within each of the four pick-up openings **72** in the carton blank **20** which is then resting on the magazine floor plate or bed **102**.

Another embodiment of a pick-up cleat or finger is illustrated generally at **156** in FIGURE 11*a*, and comprises as in the first embodiment a base portion **158** adapted to be rigidly secured to the upper surface of the feed plate **126** by means of fasteners **160**. In this embodiment, each of the cleats further comprises a leading edge or wall portion **162** upstanding substantially perpendicularly to the upper surface of the feed plate **126**, and a carton blank supporting surface **164** extending from the upper end of the leading wall portion **162** rearwardly substantially parallel to the upper surface of the feed plate and terminating in a notched abutment means **166** extending a predetermined distance above surface **164** and adapted to engage a pick-up opening in a carton blank as aforedescribed.

The pick-up finger or cleat illustrated in FIGURE 11*a* has certain advantages over that illustrated in FIGURES 10 and 11, particularly with respect to insuring that only the lowermost carton blank in the stack in the magazine is engaged as the feed plate moves forwardly from beneath the latter. More specifically, and as will be readily apparent to those skilled in the art, relatively close tolerances are normally required in manufacturing pick-up cleats or fingers of the aforementioned type to insure that when they project through the respective openings **122** and **124** in the magazine floor plate that they extend far enough beyond the latter so as to engage the lowermost carton blank in the magazine and no others, particularly that resting immediately on top of the carton blank being picked up. However, as a cleat of the type illustrated in FIGURES 10 and 11 moves forwardly within the elongate openings in the magazine bed or floor plate and from beneath the latter, it is possible that the lowermost wall (bottom wall forming panel member **38** in FIGURE 14) of the lowermost carton blank may become "hung-up" somewhere between the leading wall portion **150** of the cleat and the notched abutment means **154** thereon; that is, somewhere along the inclined ramp surface **152** of the cleat, thereby resulting in the possibility that the pick-up opening **72** on the carton blank immediately above that desired to be picked up will still be engageable with the notched abutment means **154** of the cleat thereby resulting in malfunctioning of the feeding mechanism.

The cleat illustrated in FIGURE 11*a* avoids this problem in that the carton blank supporting surface **164** extends substantially parallel to the base portion thereof and is joined therewith by means of the perpendicular leading wall portion **162**. As a result, more coarse tolerances may be employed in the manufacture of a cleat of the type shown in FIGURE 11*a* by reason of the fact that the distance between the base portion thereof and the surface **164** thereof is not as critical as in the cleat previously described. Thus, once the surface of a lowermost carton blank in the magazine rides onto the carton blank supporting surface **164** of the cleat, and due to the fact that the notched abutment means **166** of the cleat extends a predetermined distance above the surface **164**, it is physically impossible for more than one carton blank, to wit the lowermost one, to be picked up by the pick-up cleat or finger. Accordingly, the pick-up cleat or finger of FIGURE 11*a* is preferred for use with the feeding mechanism of this invention.

Referring now particularly to FIGURES 10, 12 and 13, a plurality of ejecting cleats **168**, herein shown to be two in number, are mounted in spaced relation on and project beyond the leading or feeding edge of feed plate **126**. Each cleat is supported by means of a bracket **170** suitably secured to the feed plate as by means of fasteners **172**. One end of each cleat is notched as indicated at **174** and bifurcated to form arms **176** embracing and pivotally connected to bracket **170** as by means of pivot pin **178**. The other end of each cleat includes notched abutment means **180** for engagement with a portion of the locking panel or strip **22** of a fully erected carton to eject the latter from the supporting frame as the feed plate advances a successive carton blank for set-up, as will be described hereinafter.

FIGURE 13*a* illustrates another embodiment of an ejecting cleat, indicated at **182**, which may be used on the feed plate **126**. Cleat **182** includes one end rigidly secured to the feed plate as by fastening means **184**, and notched abutment means **186** at the other end thereof adapted for engagement with a portion of the locking panel or strip **22** of a fully erected carton for the purpose aforementioned and in a manner to be described.

In order to reciprocably drive the feed plate **126**, and referring particularly to FIGURES 1, 3 and 4, there is provided a support plate **188** rigidly secured to and depending from one of the frame members **90**, and rotatably supporting in horizontally spaced relation from each other a shaft **190** mounting a sprocket **192** and a shaft **194** mounting a pair of sprockets **196** and **198**. A drive chain **200** is entrained about the sprockets **192** and **196**, and a pair of rotatably mounted drive cam rollers **202** are suitably hingedly connected in the linkage of the chain **200** and are received, respectively, within the elongate slots **138** in the cam follower brackets **136**. Thus, as the upper and lower runs of the chain **200** rotate about the horizontally spaced sprockets **192** and **196**, the cam rollers **202** will drive the brackets **136**, bushing **140** and hence the feed plate **126** in one direction and then in the other after passing around the sprockets. In this regard, it may be noted that as the rollers **202** move from the upper run of the chain around a sprocket at either end thereof and along the lower run thereof, the rollers will move vertically within the elongate slots **138** thereby re-

sulting in a period of deceleration and acceleration at each extreme end of movement of the feed plate.

In order to rotatably drive the chain 200 and reciprocate the feed plate 126, the sprocket wheel 198 is connected through a drive chain 204 with a sprocket 206 suitably secured on a rotatable main drive shaft 208 suitably supported as by the bearings 210 on the supporting frame 76. A pulley 212 is also secured on the main drive shaft 208 and is connected by belt 214 to another pulley 216 mounted on the output shaft of a suitable motor herein shown to be in the form of an electric motor 218 suitably supported on a hanger plate 220 pivotally connected to the supporting frame at 222. Although not shown, it will be readily apparent that this motor mount normally includes an adjustable hanger means extending between and connecting the hanger plate 220 and some fixed portion of the supporting frame 76.

From the foregoing description, it should now be readily apparent that a stack of carton blanks 20 in their collapsed or knocked-down condition is mounted within the supply magazine as previously described, and the feed mechanism including particularly the feed plate 126 having the pick-up cleats or fingers 144 or 156 thereon repeatedly reciprocated rectilinearly from beneath the magazine floor plate 102 to supply the lowermost carton blank from the stack one at a time to other instrumentalities of the set-up machine at a set-up zone as to be described. As the carton blanks are so fed, the movement thereof is arrested in the set-up zone as indicated in FIGURE 7 by engagement of the leading edge thereof, or the medial fold line 42 in FIGURE 14, with a pair of arresting hooks or stops 224 suitably secured to and extending from the cross frame members 88.

Referring now particularly to FIGURES 4 and 7, after a collapsed carton blank 20 has been fed into the set-up zone on the supporting frame and further advancing movement thereof arrested by the stops 224 as aforedescribed, the carton blank is adapted to be partially expanded by means of an oscillating finger or fork assembly indicated generally at 226, in FIGURE 4. This assembly comprises a pair of curved elongate expanding forks or fingers 228 suitably secured to a shaft 230 extending from one end of an elongate follower arm 232 pivotally mounted for oscillatory movement on a shaft 234 extending between aframe member 90 and an ear 236 fixed to the end rail 80. A brace member 238 is provided to stabilize the follower arm 232. A spring 240 extends between and has its opposite ends connected to the follower arm 232 and the end rail 82 of the supporting frame so as to continuously urge a cam follower roller 242 pivotally mounted to one side of the follower arm into engagement with a drive cam 244 suitably rigidly secured to a main cam shaft 246 suitably rotatably supported as by the bearings 248 to the frame members 92. The main cam shaft 246 also mounts a large gear 250 meshing with a drive gear 252 suitably secured to the main drive shaft 208 whereby, upon operation of the motor 218, the main drive shaft 208 continuously drives the main cam shaft 246 including the cam 244 previously described and those to be described hereinafter to drive various other set-up instrumentalities of the apparatus.

As will be apparent particularly from FIGURES 7 through 9, the shape of the cam 244 is such as to alternately raise and lower or oscillate the fingers 228 from a lowered position as shown in FIGURE 9 to a raised positian as shown in FIGURE 7. These fingers are received through elongate openings 254 in the feed plate 126 as the latter advances and through the openings 74 in the bottom wall member of the collapsed carton so as to engage the opposite wall of the carton blank and move it upwardly therefrom as illustrated particularly in FIGURE 7. Thus, the carton blank is expanded and partially set-up, and is ready to be acted upon by other set-up instrumentalities to be hereinafter described.

Referring now primarily to FIGURES 1 through 6, a set-up head indicated generally at 256 is mounted on the supporting frame 76 for rectilinear reciprocation therealong between the magazine 94 and the aforementioned set-up zone toward the other end of the supporting frame. The set-up head comprises upper and lower generally U-shaped bracket members 258 and 260 adapted to be suitably rigidly secured together in opposing relationship such as by fasteners 262 at either end thereof to form an open rectangular head structure. A plurality of fixed folding plates or abutments 264 are suitably rigidly secured to the upper and lower bracket members 258 and 260 so as to project forwardly therefrom a predetermined distance. A plurality of folding plates or leaves 266 and 268, respectively, are pivotally mounted between the bracket members 258 and 260 by means of pivot pins 270. Each of the pivotal folding plates 266 includes an integral lug 272 pivotally connected at 274 to actuating plate 276 while, in similar fashion, each of the pivotal folding plates or leaves 268 also include an integral lug 278 pivotally connected at 280 to an actuating plate 282. The actuating plate 276 is suitably connected as through the rod 284 to one end of a bell crank actuating lever 286 pivotally connected at 288 to the head 256. In similar fashion, the actuating plate 282 is connected through a rod 290 to one end of a bell crank actuating lever 292 pivotally connected at 294 to the other end of the head. Another end of each of the actuating levers 286 and 292 is also adapted for engagement with one end of a push rod or plunger 296 suitably reciprocably mounted at each end of the set-up head. Spring means 298 extend between the respective levers 286 and 292 and a portion of the set-up head so as to continuously urge the levers in a direction to push the plungers or push rods 296 forwardly from the head or upwardly as viewed in FIGURE 5 so as to dispose the folding plates 266 and 268 in the position shown in FIGURE 2 in which the pivotal folding plates assume a generally V-shaped configuration with each other and the fixed plates 264. FIGURE 2 illustrates the position of the folding plates 264, 266 and 268 before starting a folding operation on the cross partition wall forming panel members 54 and 56 of the carton blank illustrated in FIGURE 14. A snap ring 300 mounted on the ends of the push rods or plungers 296 retain the latter on the head while being acted upon by the spring means 298. The heads 302 of the push rods or plungers are adapted to be reciprocated rearwardly of the set-up heads or downwardly in FIGURE 5 to actuate the levers 286 and 292 and actuating plates 276 and 282 to pivot the folding plates 266 and 268 to the full open position of FIGURE 5 by means of a push rod or plunger operating assembly to be hereinafter described. A pair of spaced retainer or guide members 303 are secured to and extend forwardly from the set-up head 256 for cooperation with a carton blank being set-up, as will appear hereinafter.

The set-up head 256 is mounted for rectilinear reciprocation along the supporting frame 76 by means of a bracket at each side of the head rotatably mounting a support roller 304 riding on the upper surfaces of the support plates 100. An arm 306 is rigidly secured to and depends from each side of the set-up head and each arm rotatably supports a cam follower roller 308 adapted to be engaged with the respective drive cams 310 mounted at opposite ends of the main cam shaft 246. A spring 312 extends between each of the arms 306 and the end rail 80 to continuously urge the cam follower rollers 308 into engagement with the respective drive cams 310 and also tends to always return the set-up head to its rearwardmost position adjacent the magazine 94. A pair of guide rods 314 are also respectively connected to each arm 306 and are slidably disposed within a bushing or guide bracket 316 suitably rigidly secured to the supporting frame 76 as by means of the plates 318 fixed to the end rail 84. Thus, the guide rods 314 and bushings 316 together with the supporting rollers 304 support and guide the set-up head for rectilinear reciprocation between mag-

azine 94 as illustrated in FIGURE 2 and a set-up zone as illustrated in FIGURE 1.

While a carton blank is being expanded and partially set-up as illustrated in FIGURE 7 and as previously described, the set-up head 256 through its associated driving mechanism will be in the process of being reciprocated toward the set-up zone where the aforementioned expanding operation is taking place. Thereafter, the set-up head will move into the set-up zone and into the position illustrated in FIGURES 8 and 9 where it is retained substantially stationary by its driving mechanism. While in this position, and as illustrated in FIGURE 8, the expanded and partially set-up carton is fed reversely thereto by a reverse feeder assembly to be described.

Referring particularly to FIGURES 2 through 4, the reverse feeder assembly indicated generally at 320 in FIGURE 2 comprises a rock shaft 322 having its opposite ends suitably oscillatably supported in depending brackets 324 secured to each of the side rails 86. A plurality of reverse feeding fingers 326, herein shown to be four in number, each have one end thereof suitably secured to the rock shaft 322 and the other ends formed with a generally V-shaped configuration for engagement with the medial fold line 42 of the carton blank and the bottom wall forming panel members 38 and 40 to either side thereof. In order to oscillate the reverse feeding fingers 326, an arm 328 is fixed to the rock shaft 322 and has its free end pivotally connected to a rod 330 which is also pivotally connected to the upper end of a lever 332 suitably rotatably supported on a fixed support shaft 334 extending between the frame members 92 of the supporting frame 76. A cam follower roller 336 is pivotally mounted on the lever 332 beneath its connection to the rod 330, and engages the reverse feeder assembly drive cam 338 suitably rigidly secured to the main cam shaft 246. The lower end of the lever 332 is connected through a spring 340 to the end rail 84 of the supporting frame so as to continuously urge the lever counterclockwise in FIGURE 3 and the cam follower roller 336 continuously into engagement with the drive cam 338. It will thus become apparent that, as the cam shaft 246 is driven rotatably, the drive cam 338 will rotate in suitable timed relation to the other drive cams carried by the shaft to oscillate the reverse feeding fingers 326 from a position beneath the path of travel of the feed plate 126 as illustrated in FIGURE 7 to a position illustrated in FIGURES 1 and 8 wherein they engage the bottom wall forming panel member 38 and 40 of the carton blank and the medial fold line therebetween to feed the expanded and partially set-up carton blank into engagement with the set-up head 256 then in the FIGURE 8 position, the retainer or guide members 303 assisting in guiding and retaining the carton blank during this reverse feeding operation. With the carton blank and other instrumentalities in the FIGURE 8 position, it should again be noted that movement of the set-up head 256 has stopped and the latter is substantially stationary, and that the folding plates 266 and 268 have not as yet been operated and are in the position illustrated in FIGURE 2. It will also be noted, referring particularly to FIGURE 1, that the abutment member 120 on ejecting finger 118 engages the forward face of the set-up head 256 so as to be disposed between the latter and a carton blank reversely fed thereto.

In order to complete the final set-up or erection of the carton blank as illustrated particularly in FIGURE 9, there is provided a tucking finger assembly indicated generally at 342 in FIGURE 2 and comprising a plurality of bowed arms 344, herein shown to be seven in number, each having one end thereof secured to a rock shaft 346 oscillatably supported between the aforementioned brackets 324. The other end of each tucking arm includes tucking finger means 348 adapted to engage the medial fold line 42 between the bottom wall forming panel members 38 and 40 of the carton blank to reversely bend the latter into a generally V-shaped configuration as illustrated in FIGURE 9 and interlock the latter with the cross partition forming panel members 54 and 56 as previously described. Referring particularly to FIGURES 1 and 4, it may be seen that the rock shaft 346 and hence the tucking arms 344 are oscillatable by means of an arm 350 having one end secured to the rock shaft and the other end connected to a rod 352 the other end of which is connected to the upper end of a lever 354 pivotally mounted on the support shaft 334. A rotatable cam follower roller 356 is suitably connected to the lever 354 and engages the tucking finger drive cam 358, while the spring 360 extends between the lower end of the lever and the end rail 84 of the supporting frame to continuously urge the lever counterclockwise in FIGURE 1 and the cam roller into continuous engagement with its drive cam 358.

Thus it may be seen that the tucking finger drive cam 358 operating in predetermined timed synchronism with the other drive cams and the instumentalities controlled thereby, operates to oscillate the tucking finger means 348 from a lowered position as illustrated in FIGURE 7 to the position illustrated in FIGURE 9 in which the tucking operation of the bottom wall forming panel members of the carton has been completed by interlocking same with the cross partition forming panel members of the carton blank as previously described. However, prior to completion of the tucking operation as illustrated in FIGURE 9, it is necessary to fold the cross partition forming panel members 54 and 56 inwardly of the partially erected carton substantially perpendicular to the side wall forming panel members thereof and to the bottom wall forming panel members thereof which is, as aforementioned, accomplished by operation of the folding plates or leaves 266 and 268 from the position shown in FIGURE 2 to that shown in FIGURES 5 and 6.

To operate the folding plates or leaves 266 and 268, there is provided a shaft 362 extending between and having its opposite ends mounted for oscillation within the aforementioned brackets 324. A pair of push rod or plunger operating fingers 364 each have one end secured to the shaft 362 while the other ends thereof are disposed for swingable engagement with the heads 302 of the push rods or plungers 296. Oscillation of the shaft 362 and hence the fingers 364 and reciprocation of the plungers 296 from the position shown in FIGURE 8 to that shown in FIGURE 9 to operate the folding plates or leaves 266 and 268, is accomplished in direct response to movement of the tucking finger assembly 342.

To this end, and reference being made particularly to FIGURE 3, a drive cam 366 for operating the plunger operating fingers is suitably rigidly secured to the oscillatable shaft 346 mounting the tucking arms 344. This cam drivingly engages a cam follower roller 368 rotatably supported at one end of an arm 370 secured to the oscillatable shaft 362 supporting the plunger operating fingers 364. Hence at a predetermined point in the travel of the tucking finger means from their position shown in FIGURE 8 to the fully tucked position of FIGURE 9 in which the carton is completely erected, and while the set-up head 256 is substantially stationary as aforedescribed, the cam 366 operating through the cam follower 368 and arm 370 causes the fingers 364 to fully reciprocate the push rods 296, thereby fully opening the folding plates or leaves 266 and 268 as illustrated in FIGURE 5 to fully fold and position the cross partition forming panel members 54 and 56 for interlocking engagement with the bottom wall forming panel members of the carton blank as previously described.

At this juncture it may be noted that the aligning plate 106 associated with the magazine 94 for the purpose aforementioned and described is oscillated through a linkage 372 connected eccentrically to hub 374 on main cam shaft 246 (FIGURE 4) and to an arm 376 secured to the plate as illustrated in FIGURE 2. Furthermore, as shown in FIGURES 2 and 4, the other end of the

main cam shaft 246 is provided with a fly wheel 378 which may be used to operate the apparatus manually.

As a collapsed or knocked-down carton blank is being fed from the magazine toward the set-up zone on the apparatus, the set-up head 256 reciprocates from the set-up zone toward the magazine 94, and a preceding carton blank which has been fully set-up is ejected from the apparatus away from the magazine onto a delivery chute, not shown. Thus, as the set-up head so moves, it moves away from the abutment member 120 on eject finger 118 which ejects the set-up carton from the head. Furthermore, and referring particularly to FIGURES 1, 3, 10, 12, 13 and 13*a*, as the feed plate 126 advances along the supporting frames 76, the notched abutment means 180 or 186 of ejecting cleats 168 or 182, respectively, are adapted to engage and push the trailing locking panel 22 of the fully erected carton, as will be described more fully hereinafter. As an erected carton is thus ejected from the apparatus as the feed plate feeds a succeeding collapsed carton blank to the set-up zone thereof, a plurality of leaf spring members 380 (FIGURE 2), herein shown to be four in number, direct the erected carton upwardly from the supporting frame onto a pair of guide rods 382 for delivery to the chute. These leaf spring members and guide rods each have on end secured to the cross frame member 88 and extend forwardly and upwardly therefrom.

The ejecting cleats 168 or 182 are located on the feed plate 126 so as to engage a portion of the carton blank locking panel 22 during the ejecting operation as aforedescribed. The spacing and positioning of the ejecting cleats may be such as to engage a spaced pair of the locking hooks 24 at the extreme trailing edge of the locking panel of set-up carton, or such as to engage a spaced pair of the recessed openings 26 between the locking hooks. Spacing and positioning the ejecting cleats so as to engage a pair of the recessed openings 26 is preferred since it is more fool proof. More specifically, as will be clear particularly from FIGURE 3 of the drawings, the notched abutment means 180 or 186 of the respective ejecting cleats 168 or 182 are substantially in the plane of feed plate 126. It sometimes happens that the locking panel 22 or a portion thereof is warped upwardly, which warpage is most extreme at the trailing edge thereof and least extreme in the area of the recessed openings 26 which are nearer the fold line 28. Thus, if such warpage does occur, the edges of the recessed openings 26 to be engaged by the ejecting cleats will be closer to the plane of feed plate 126 and the cleats than will the extreme trailing edge of the locking hooks 24. Hence, spacing and positioning the cleats so as to engage within the recessed openings 26 provides more positive assurance that such engagement will occur, notwithstanding the fact that some warpage occurs. Referring to the embodiment of the ejecting cleat 168, the pivotal mounting thereof as aforedescribed permits the cleat to pivot counterclockwise in FIGURE 13 and upwardly relative to feed plate 126 as the carton rides up the leaf spring members 380 and guide rods 382 toward the delivery chute as aforementioned.

To further facilitate the ejecting operation onto the delivery chute which, as aforementioned, is not shown, there is provided an ejector assembly indicated generally at 384 in FIGURES 2 and 3. Referring particularly to FIGURES 2 through 4 this assembly comprises a pair of eject arms 386 secured to a bushing 388 supported for oscillation on a fixed shaft 390 extending between the corner frame members 78 at the delivery end of the apparatus. The upper end of each of these fingers is provided with a hook-like configuration indicated at 392 to engage a portion of the erected carton so as to eject or throw the latter off the supporting frame 76 into a delivery chute. A drive arm 394 is secured to the bushing 388 and is connected through a drive rod 396 to the upper end of a lever 398 rotatably supported on shaft 334. A cam follower roller 400 is rotatably supported on the lever 398 and engages an ejector drive cam 402 suitably secured to the main cam shaft 246, a spring 404 being connected between the lower end of the lever 398 and the end rail 84 to continuously urge the cam follower roller 400 into engagement with its drive cam 402. Again, the ejector drive cam 402 is so formed and operates in such timed relation with the other cam-driven instrumentalities of the apparatus so as to rotate the eject arms illustrated particularly in FIGURE 3 clockwise to the position illustrated in FIGURE 7 to eject a fully erected carton from the supporting frame as the feed plate 126 feeds a succeeding carton blank to the set-up zone of the apparatus.

Referring now particularly to FIGURES 1, 2 and 4, a power take-off means for the delivery chute, not shown, is also provided as a part of the apparatus aforedescribed, and comprises a power take-off sprocket 406 and a drive sprocket 408 secured to a common bushing 410 rotatably supported on the fixed shaft 390 which also mounts the eject arms 386. The sprocket 408 and, hence, the sprocket 406 is driven by the chain 412 entrained thereabout and about a drive sprocket 414 mounted on one end of a suitably rotatably supported shaft 416 mounting on the other end thereof a gear 418 engaged with the driven gear 250 secured to the main cam shaft 246. Thus, by connecting a drive chain about the sprocket 406 and the driving member of the chute of a type well known in the art, the latter may be driven from the motor mechanism herein disclosed.

In view of the foregoing description of the structure and function of the individual instrumentalities of the apparatus and method herein described, it should only be necessary to briefly summarize the operation of the apparatus and method of this invention in connection with the manner in which these instrumentalities cooperate in erecting a cellular paper board carton from a carton blank supplied in a collapsed or knocked-down condition. In this regard, it will of course be appreciated that the motor 218 drives the main drive shaft 208, main cam shaft 246 and the various set-up instrumentalities and ejecting means in a predetermined timed synchronism to be hereinafter described.

Thus, the feed mechanism including particularly the feed plate 126 is rectilinearly reciprocable from a position beneath the magazine bed or floor plate 102 toward a set-up zone on the apparatus and, in so moving, the pick-up cleats or fingers 144 or 156 are receivable within the openings 72 in a collapsed carton blank as illustrated in FIGURE 14 to advance the carton along the supporting frame. In being so advanced, the carton blanks are fed one at a time beneath the mounting plate 110 and are held in a flattened condition on the feed plate by the spring fingers 116. As the feed table advances from beneath the magazine and into a region substantially adjacent to the cross frame member 88, the carton expanding fingers 228 begin to rise from beneath the feed plate or the position illustrated in FIGURE 9 through the FIGURE 8 position to the FIGURE 7 position. When the forward edge of the feed plate 126 reaches a point almost directly over the oscillatable rock shaft 322 for the reverse feeding fingers 326, the carton expanding fingers 228 begin to accelerate in their upward movement and then ride into the two longitudinal slots 254, in the feed plate while the feed plate travels to a point at which the leading edge of the collapsed carton strikes the arresting hooks or stops 224. At this time, feed plate travel discontinues and the carton expanding fingers have entered the carton blank opening 74 so as to move the panel members 40, 46, 48 and 50 upwardly as illustrated in FIGURE 7. Just slightly prior to the carton expanding fingers reaching their upward limit of travel as indicated in FIGURE 7, the reverse feeding fingers 326 begin to move counterclockwise in FIGURES 7 through 9. Further upward movement of the carton expanding fingers then discontinues entirely, and the reverse feeding fingers are rotated up into position.

In so moving, the medial fold line 42 between the bottom wall forming panel members 38 and 40 of the carton blank cams up the inclined surface at the free end of the reverse feeding fingers until the base of the carton sits in the V-shaped notch of the feeding fingers. This condition will occur when the reverse feeding fingers are not quite vertical or the position illustrated in FIGURE 8. The carton expanding fingers then begin to lower as the reverse feeding fingers now rapidly move toward the set-up head 256 which has now been disposed substantially stationary in the set-up zone as indicated in FIGURE 8. In the FIGURE 8 position, the carton expanding fingers have now been lowered out of the path of movement of the feed plate and the carton blank carried thereon, the reverse feeding fingers are essentially vertical as shown and the tucking finger means 348 have begun to move upwardly. As these tucking finger means move upwardly on their oscillatable support shaft 346, the drive cam 366 on the latter acting through the cam follower roller 368 on arm 370 secured to the oscillatable support shaft 362 for the plunger operating fingers 364 begins to rotate the latter toward the heads of the plungers 296 on the set-up head. In the position shown in FIGURE 8 in which the set-up head 256 is substantially stationary and the foldable plates or leaves mounted thereon are disposed as illustrated in FIGURE 2, the operating fingers 364 are just engaging the heads of the plungers so that further movement of the fingers 364 will reciprocate the plungers and operate the folding plates to the full open position illustrated in FIGURE 5.

As the tucking finger means move from the position shown in FIGURE 8 to that shown in FIGURE 9, they engage the medial fold line 42 on the carton blank as previously described at a time when the plungers 296 have been reciprocated so as to partially open the folding plates on the set-up head toward the position of FIGURE 5. Between the positions illustrated in FIGURES 8 and 9, the tucking finger means will make a shallow V-crease in the bottom wall forming panel members of the carton blank at a time when the plungers 296 are completely reciprocated within the set-up head 256, and the leaves have been folded wide open as illustrated in FIGURE 5 to fold the cross partition wall forming panel members within the carton blank. Thereafter, further movement of the tucking finger means follows to tuck the bottom wall forming panel members of the carton into the cross partition forming panel members as illustrated in FIGURE 9 and as previously described. Upon completion of this tucking operation, the reverse feeding fingers 326 begin to rotate back to their initial position and the set-up head 256 begins to retract causing the ejecting finger 118 to eject the carton from the head, while the feed plate 126 is coming forward with another carton blank to be set-up. As the feed plate comes forward, the ejecting cleats or fingers thereon engage a portion of the locking panel 22 of the set-up carton as previously described, and thrusts it over the leaf spring members 380 onto the guide rods 382 for cooperation with the eject arms 386 for ejectment into the delivery chute, not shown.

While but one basic form of the inventive apparatus including several embodiments of component parts thereof have been shown and described as well as but one manner of practicing the inventive process of this invention, other forms will now be apparent to those skilled in the art. Therefore, it will be understood that the embodiments shown in the drawings and described above are merely for illustrative purposes, and are not intended to limit the spirit and scope of the invention.

Other modes of applying the principle of my invention may be employed instead of those explained, change being made as regards the means and the steps herein disclosed provided those stated by any of the following claims or their equivalent be employed.

I therefore particularly point out and distinctly claim as my invention:



1. A method for setting-up a collapsed paper board carton blank into an erected cellular carton, said blank being of the type characterized by a connected series of panel members adapted to be erected into side wall forming members and a bottom wall forming member of an erected carton and including cross partition forming members foldable out of the plane of a top wall forming member into interlocking engagement with said bottom wall forming member; said method comprising the steps of moving said side wall forming members away from each other to at least partially expand said blank with said top wall forming member connected between said side wall forming members, holding said top wall forming member substantially stationary while folding said cross partition forming members toward said bottom wall forming member for interlocking engagement with the latter, and moving said bottom wall forming member into interlocking engagement with said cross partition forming members.

2. A method for setting up a collapsed paper board carton blank into an erected cellular carton, said blank being of the type characterized by a connected series of panel members adapted to be erected into side wall forming members and a bottom wall forming member of an erected carton and including cross partition forming members foldable out of the plane of a top wall forming member into interlocking engagement with said bottom wall forming member; said method comprising the steps of moving said side wall forming members away from each other to at least partially expand said blank with said top wall forming member connected between said side wall forming members, holding said top wall forming member substantially stationary while folding said cross partition forming members between said side wall forming members and toward said bottom wall forming member for interlocking engagement with the latter, and moving said bottom wall forming member between said side wall forming members and into interlocking engagement with said cross partition forming members.

3. A method for setting up a collapsed paper board carton blank into an erected cellular carton, said blank being of the type characterized by a connected series of panel members adapted to be erected into side wall forming members and a bottom wall forming member of an erected carton and including cross partition forming members foldable out of the plane of a top wall forming member into interlocking engagement with said bottom wall forming member; said method comprising the steps of moving said side wall forming members away from each other to at least partially expand said blank with said top wall forming member extending between said side wall forming members, engaging said top wall forming member including said cross partition forming members with a set-up head, holding said set-up head substantially stationary while folding said cross partition forming members between said side wall forming members and toward said bottom wall forming member for interlocking engagement with the latter, and tucking said bottom wall forming member between said side wall forming members toward said set-up head and into interlocking engagement with said cross partition forming members.

4. A method for setting up a collapsed paper board carton blank into an erected cellular carton, said blank being of the type characterized by a connected series of panel members adapted to be erected into side wall forming members and a bottom wall forming member of an erected carton and including cross partition forming members foldable out of the plane of a top wall forming member into interlocking engagement with said bottom wall forming member; said method comprising the steps of feeding a single carton blank from a stack thereof into a set-up zone, moving said side wall forming members away from each other to at least partially expand said blank with said top wall forming member extending between said side wall forming members, holding said

top wall forming member substantially stationary, in said set-up zone while folding said cross partition forming members toward said bottom wall forming member for interlocking engagement with the latter, and moving said bottom wall forming member into interlocking engagement with said cross partition forming members.

5. A method for setting-up a collapsed paper board carton blank into an erected cellular carton, said blank being of the type characterized by a connected series of panel members adapted to be erected into side wall forming members and a bottom wall forming member of an erected carton and including cross partition forming members foldable out of the plane of a top wall forming member into interlocking engagement with said bottom wall forming member, said method comprising the steps of feeding a single carton blank from a stack thereof into a set-up zone, moving said side wall forming members away from each other to at least partially expand said blank with said top wall forming member extending between said side wall forming members, feeding said top wall forming member including said cross partition forming members into engagement with a set-up head in said set-up zone, holding said set-up head substantially stationary while folding said cross partition forming members between said side wall forming members and toward said bottom wall forming member for interlocking engagement with the latter, and tucking said bottom wall forming member between said side wall forming members toward said set-up head and into interlocking engagement with said cross partition forming members.

6. Apparatus for setting-up a collapsed paper board carton blank into an erected cellular carton, said blank being of the type characterized by a connected series of panel members adapted to be erected into side wall forming members and a bottom wall forming member of an elected carton and including cross partition forming members foldable out of the plane of a top wall forming member into interlocking engagement with said bottom wall forming member; said apparatus comprising a supporting frame including a set-up zone, a set-up head mounted for movement along said supporting frame to and from said set-up zone, a plurality of pivotally mounted folding plates mounted on said head for engagement with and folding said cross partition forming members in said set-up zone, means for moving said set-up head to and from said set-up zone and being operable to hold said set-up head substantially stationary in said set-up zone during operation of said folding plates, means for disposing a carton blank in said set-up zone with said cross partition forming members in engagement with said set-up head, moveable tucking means engageable with said bottom wall forming member to move the latter toward said set-up head and into a final set-up position interlocking with said cross partition forming members, and means operatively connecting said trucking means to said folding plates to actuate the latter to fold said cross partition forming members in response to movement of said tucking means.

7. Apparatus for setting up a collapsed paper board carton blank into an erected cellular carton, said blank being of the type characterized by a connected series of panel members adapted to be erected into side wall forming panel members and a bottom wall forming member of an erected carton and including cross partition forming members foldable out of the plane of a top wall forming member into interlocking engagement with said bottom wall forming member; said apparatus comprising a supporting frame including a set-up zone, a set-up head mounted for movement along said supporting frame to and from said set-up zone, a plurality of pivotally mounted folding plates mounted on said head for engagement with and folding said cross partition forming members in said set-up zone, means for moving said set-up head to and from said set-up zone and being operable to hold said set-up head substantially stationary in said set-up zone during operation of said folding plates to fold said cross partition forming members, means for disposing a carton blank in said set-up zone with said cross partition forming members in engagement with said set-up head, movable tucking means engageable with said bottom wall forming member to move the latter toward said set-up head and into a final set-up position interlocking with said cross partition forming members, and means operatively connecting said tucking means to said folding plates to actuate the latter to fold said cross partition forming members in response to movement of said tucking means.

8. Apparatus for setting-up a collapsed paper board carton blank into an erected cellular carton, said blank being of the type characterized by a connected series of panel members adapted to be erected into side wall forming members and a bottom wall forming member of an erected carton and including cross partition forming members foldable out of the plane of a top wall forming member into interlocking engagement with said bottom wall forming member; said apparatus comprising a supporting frame including a set-up zone, a set-up head mounted for movement along said supporting frame to and from said set-up zone, a plurality of pivotally mounted folding plates mounted on said head for engagement with and folding said cross partition forming members in said set-up zone, an actuating linkage for pivoting said folding plates and including a push rod mounted for reciprocation on said set-up head, a first shaft mounted for oscillation on said supporting frame, a push rod operating finger secured to said shaft and engageable with said push rod to reciprocate the latter and operate said actuating linkage upon oscillation of said first shaft, a cam follower secured to said first shaft, means for moving said set-up head to and from said set-up zone and being operable to hold said set-up head substantially stationary in said set-up zone during actuation of said folding plates to fold said cross partition members, means for disposing a carton blank in said set-up zone with said cross partition forming members in engagement with said set-up head, a second shaft mounted for oscillation on said supporting frame, tucking finger means secured to said second shaft and engageable with said bottom wall forming member to move the latter toward said set-up head and into a final set-up position interlocking with said cross partition forming members in response to oscillation of said second shaft, and a cam secured to said second shaft and engageable with said follower secured to said first shaft to actuate said folding plates in response to movement of said tucking finger means.

9. Apparatus for setting-up a collapsed paper board carton blank into an erected cellular carton, said blank being of the type characterized by a connected series of panel members adapted to be erected into side wall forming members and a bottom wall forming member of an erected carton and including cross partition forming members foldable out of the plane of a top wall forming member into interlocking engagement with said bottom wall forming member; said apparatus comprising a supporting frame including a set-up zone, means for supplying a carton blank to be erected to said set-up zone, a set-up head mounted for rectilinear reciprocation along said supporting frame to and from said set-up zone, a plurality of pivotally mounted folding plates mounted on said head for engagement with and folding said cross partition forming members in said set-up zone, means for rectilinearly reciprocating said set-up head to and from said set-up zone and being operable to hold said set-up head substantially stationary in said set-up zone during actuation of said folding plates to fold said cross partition forming members, oscillatable carton blank expanding finger means moveable upwardly through an opening in a downwardly facing panel member of said carton blank to engage and move upwardly therefrom the opposite upwardly facing panel member thereby to separate the side wall forming members and position said top wall forming member con-

necting said side wall forming members for engagement with said set-up head, oscillatable reverse feeding finger means engageable with said bottom wall forming member for feeding said top wall forming member into engagement with said set-up head in said set-up zone, oscillatable tucking finger means engageable with said bottom wall forming member to move the latter toward said set-up head and into a final set-up position interlocking with said cross partition forming members, and means operatively connecting said tucking finger means to said folding plates to actuate the latter in response to movement of said tucking finger means.

10. Apparatus for setting up a collapsed paper board carton blank into an erected cellular carton, said blank being of the type characterized by a connected series of panel members adapted to be erected into said side wall forming members and a bottom wall forming member of an erected carton and including cross partition forming members foldable out of the plane of a top wall forming member into interlocking engagement with said bottom wall forming member; said apparatus comprising a supporting frame including a set-up zone, means for supplying a carton blank to be erected to said set-up zone, a set-up head mounted for rectilinear reciprocation along said supporting frame to and from said set-up zone, a plurality of pivotally mounted folding plates mounted on said head for engagement with and folding said cross partition forming members in said set-up zone, means for rectilinearly reciprocating said set-up head to and from said set-up zone and being operable to hold said set-up head substantially stationary in said set-up zone during actuation of said folding plates to fold said cross partition forming members, oscillatable carton blank expanding finger means movable upwardly through an opening in a downwardly facing panel member of said carton blank to engage and move upwardly therefrom the opposite upwardly facing panel member thereby to separate the side wall forming members and position said top wall forming member connecting said side wall forming members for engagement with said set-up head, oscillatable reverse feeding finger means engageable with said bottom wall forming member for feeding said top wall forming member into engagement with said set-up head in said set-up zone, oscillatable tucking finger means engageable with said bottom wall forming member to move the latter toward said set-up head and into a final set-up position interlocking with said cross partition forming members, and means operatively connecting said tucking finger means to said folding plates to actuate the latter in response to movement of said tucking finger means.

11. Apparatus for setting up a collapsed paper board carton blank into an erected cellular carton, said blank being of the type characterized by a connected series of panel members adapted to be erected into side wall forming members and a bottom wall forming member of an erected carton and including cross partition forming members foldable out of the plane of a top wall forming member into interlocking engagement with said bottom wall forming member; said apparatus comprising a supporting frame including a set-up zone, means for supplying a carton blank to be erected to said set-up zone, a set-up head mounted for rectilinear reciprocation along said supporting frame to and from said set-up zone, a plurality of pivotally mounted folding plates mounted on said head for engagement with and folding said cross partition forming members in said set-up zone, an actuating linkage for pivoting said folding plates and including a push rod mounted for reciprocation on said set-up head, a first shaft mounted for oscillation on said supporting frame, a push rod operating finger secured to said shaft and engageable with said push rod to reciprocate the latter and operate said actuating linkage upon oscillation of said first shaft, a driven cam follower secured to said first shaft, means for rectilinearly reciprocating said set-up head to and from said set-up zone and being operable to hold said set-up head substantially stationary in said set-up zone during actuation of said folding plates to fold said cross partition forming members, oscillatable carton blank expanding finger means moveable upwardly through an opening in a downwardly facing panel member of said carton blank to engage and move upwardly therefrom the opposite upwardly facing panel member thereby to separate the side wall forming members and position said top wall forming member connecting said side wall forming members for engagement with said set-up head, oscillatable reverse feeding finger means engageable with said bottom wall forming member for feeding said top wall forming member into engagement with said set-up head in said set-up zone, a second shaft mounted for oscillation on said supporting frame, tucking finger means secured to said second shaft and engageable with said bottom wall forming member to move the latter toward said set-up head and into a final set-up position interlocking with said cross partition forming members in response to oscillation of said second shaft, and a drive cam secured to said second shaft and engageable with said driven cam follower secured to said first shaft to actuate said folding plates in response to movement of said tucking finger means.

12. Apparatus for setting-up a collapsed paper board carton blank into an erected cellular carton, said blank being of the type characterized by a connected series of panel members adapted to be erected into side wall forming members and a bottom wall forming member of an erected carton and including cross partition forming members foldable out of the plane of a top wall forming member into interlocking engagement with said bottom wall forming member; said apparatus comprising a supporting frame including a set-up zone, a set-up head mounted for movement along said supporting frame to and from said set-up zone, a plurality of folding plates pivotally mounted on said head for engagement with and folding said cross partition forming members in said set-up zone, means for moving said set-up head to and from said set-up zone and being operable to hold said set-up head substantially stationary in said set-up zone during operation of said folding plates, means for disposing a carton blank in said set-up zone with said cross partition forming members in engagement with said set-up head, and movable tucking means engageable with said bottom wall forming member to move the latter toward said set-up head and into a final set-up position interlocking with said folded cross partition forming members.

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# UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,141,391 July 21, 1964

Donald G. Coleman

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 20, for "thhe" read -- the --; column 13, line 25, for "on" read -- one --; column 17, line 15, for "member," read -- member; --; line 36, for "elected" read -- erected --; line 55, for "trucking" read -- tucking --.

Signed and sealed this 19th day of January 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents