Nov. 4, 1969 R. A. FULLER ET AL 3,476,023

CARTON HANDLING MACHINE

Original Filed June 20, 1966 6 Sheets-Sheet 1

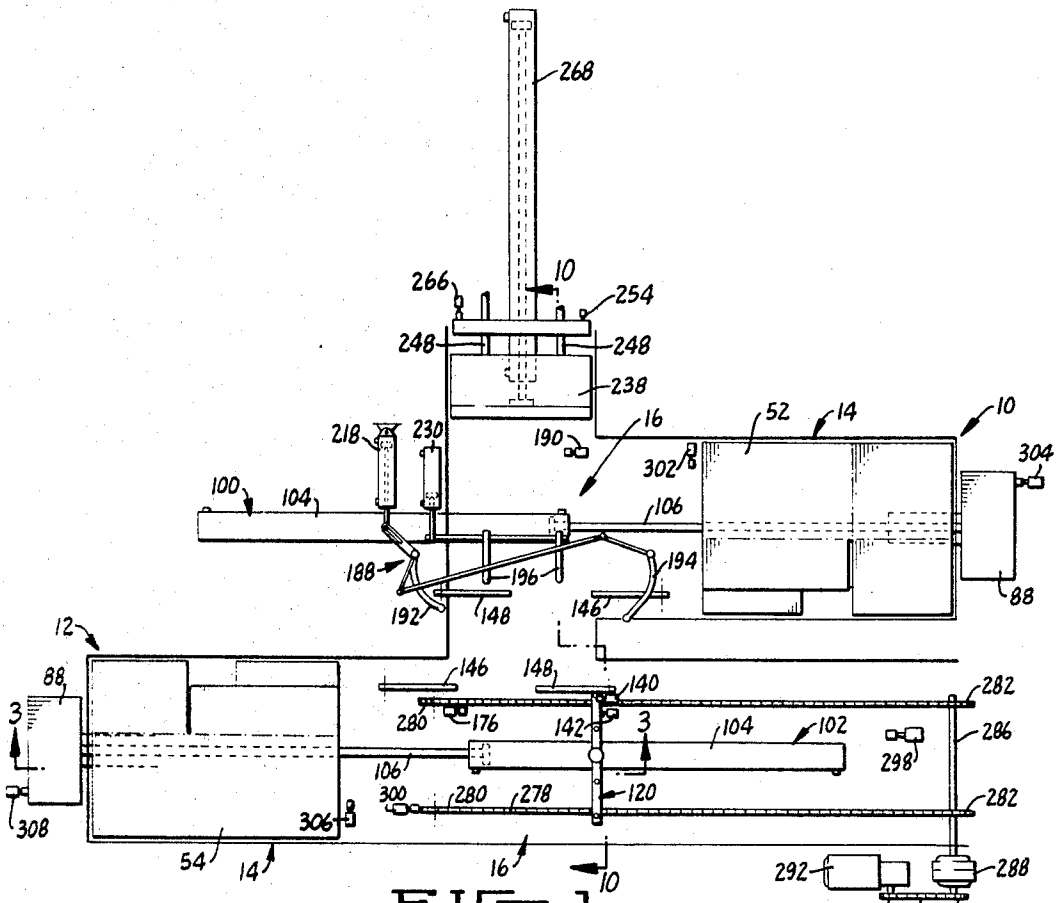


FIG. 1.

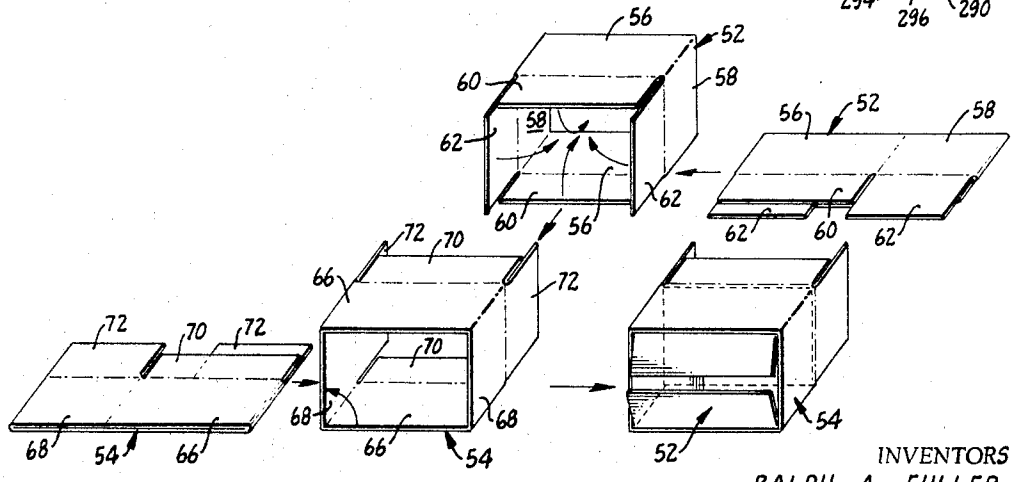


FIG. 2.

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Original Filed June 20, 1966 6 Sheets-Sheet 2

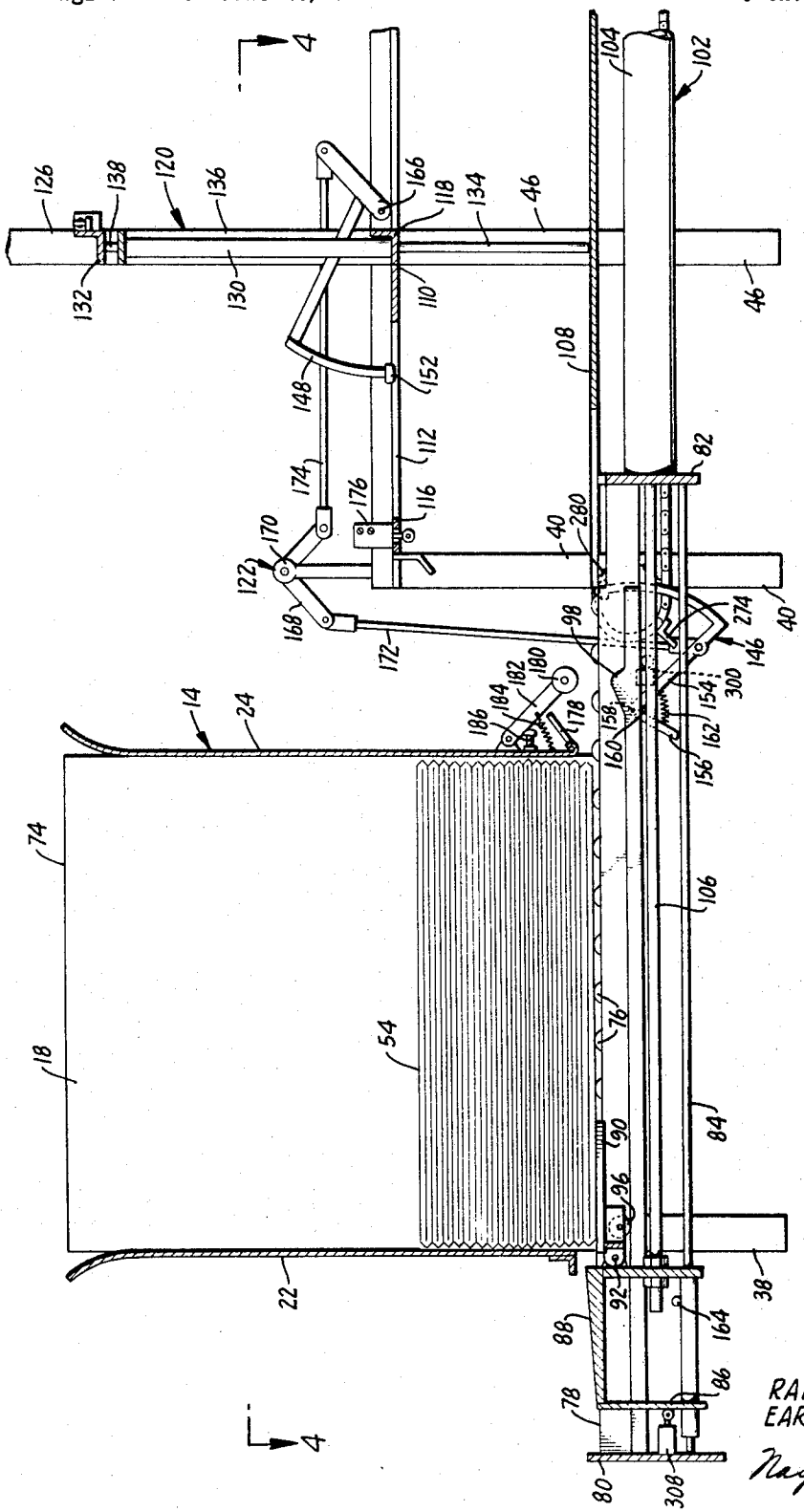


FIG. 3.

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Original Filed June 20, 1966 6 Sheets-Sheet 3

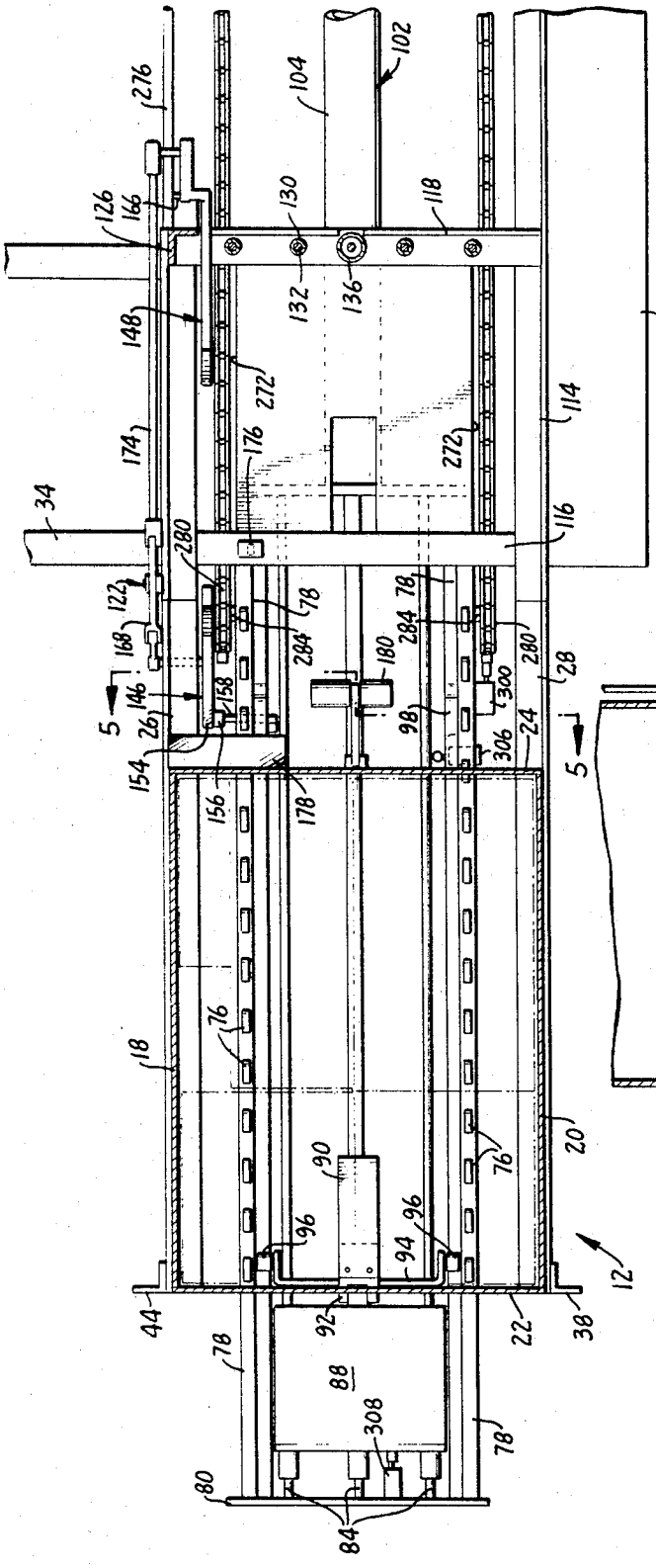


FIG. 4.

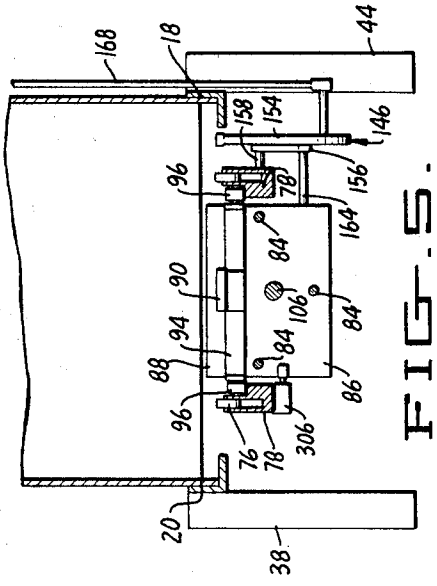


FIG. 5.

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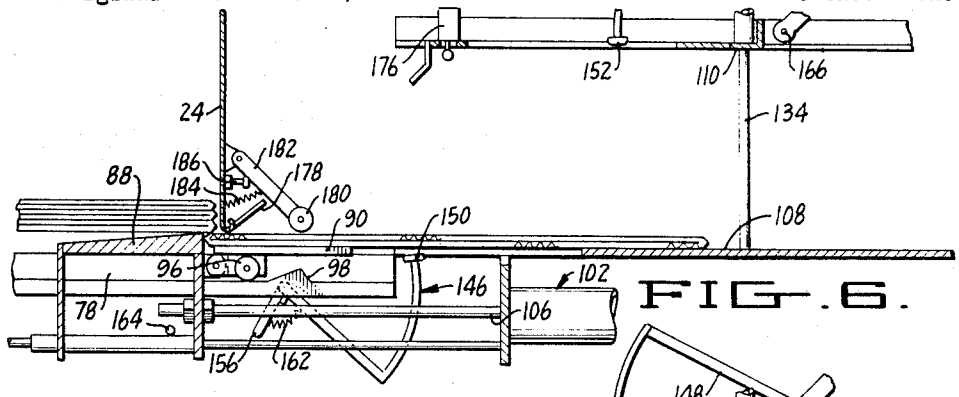


FIG. 6.

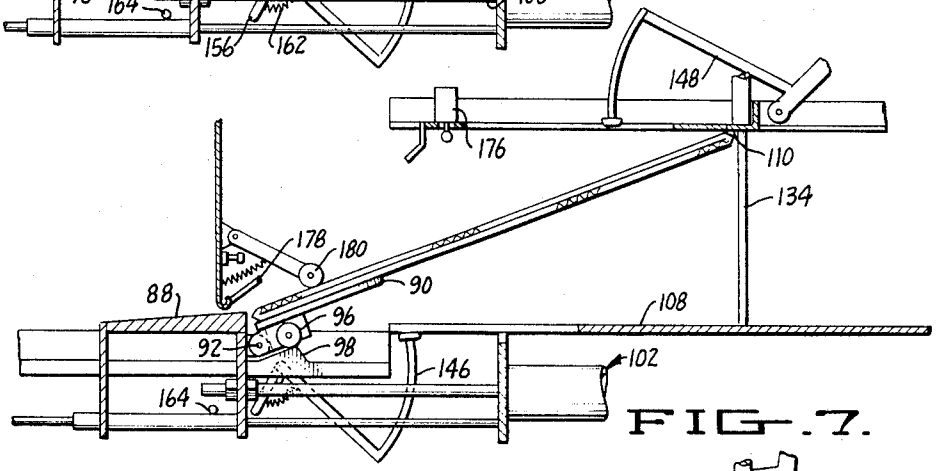


FIG. 7.

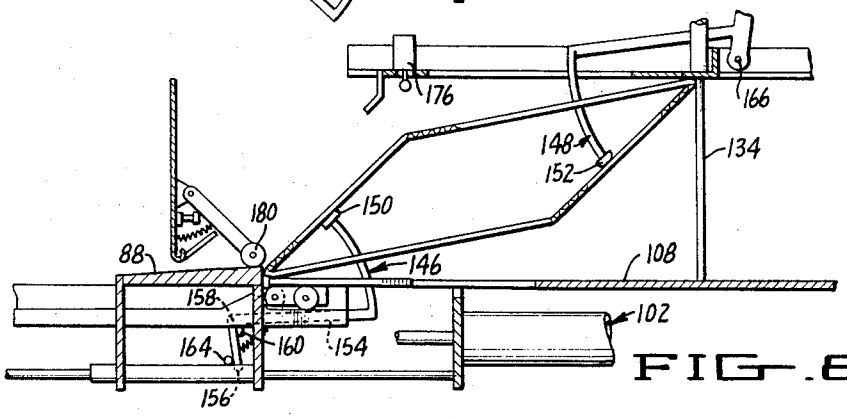


FIG. 8.

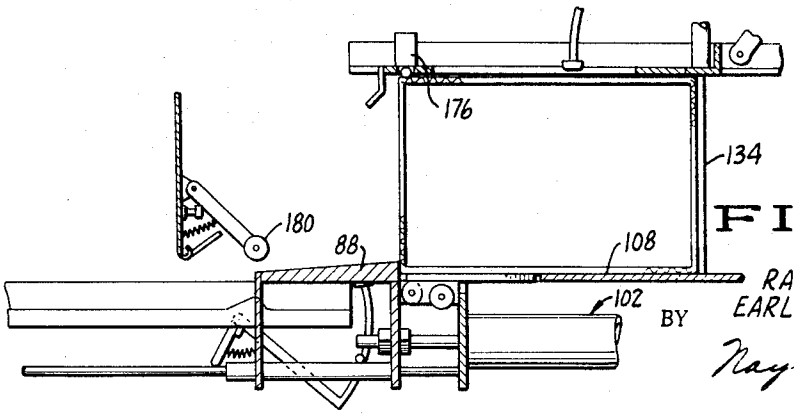


FIG. 9.

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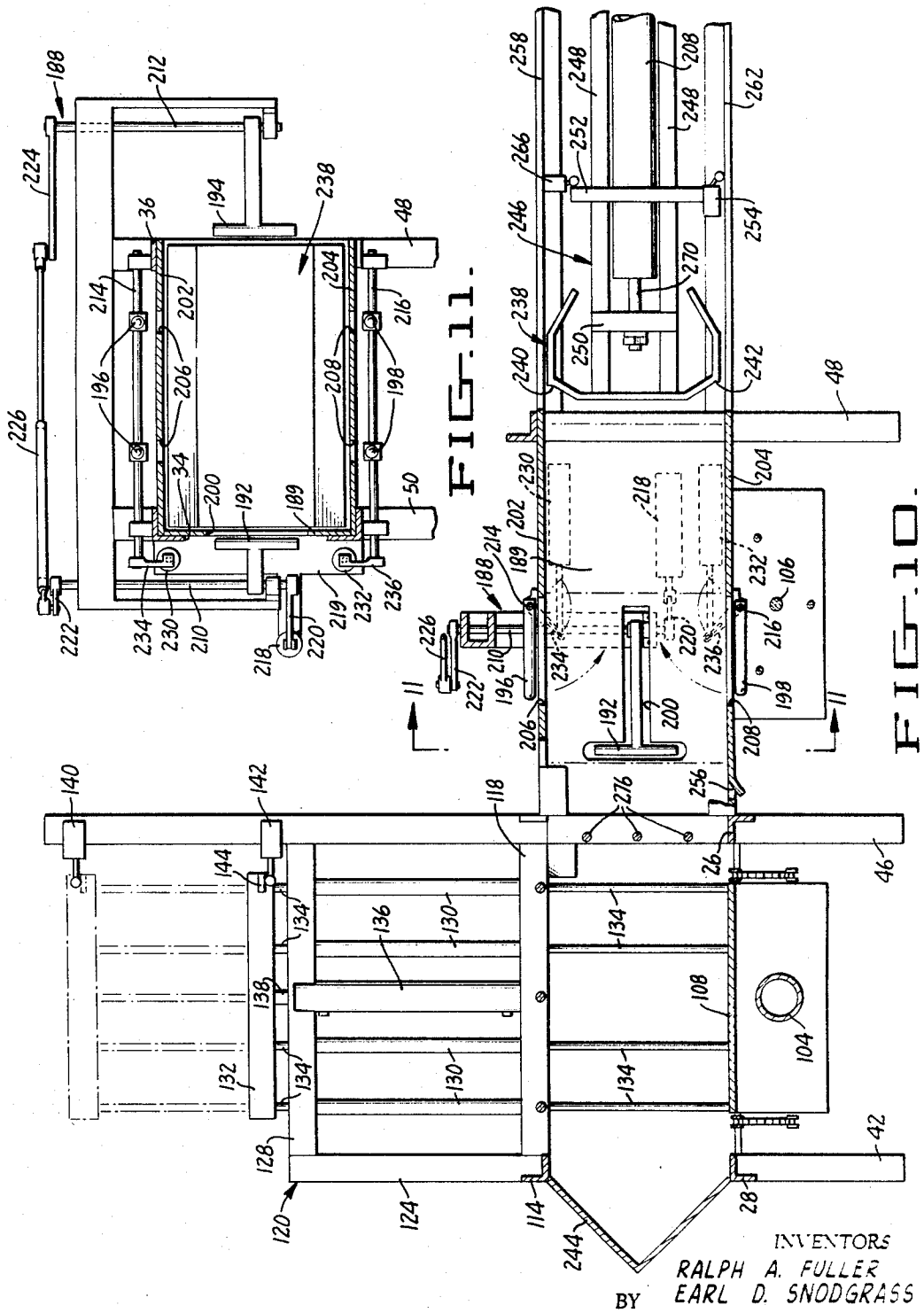


FIG. 11.

FIG. 10.

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CARTON HANDLING MACHINE

Original Filed June 20, 1966 6 Sheets-Sheet 6

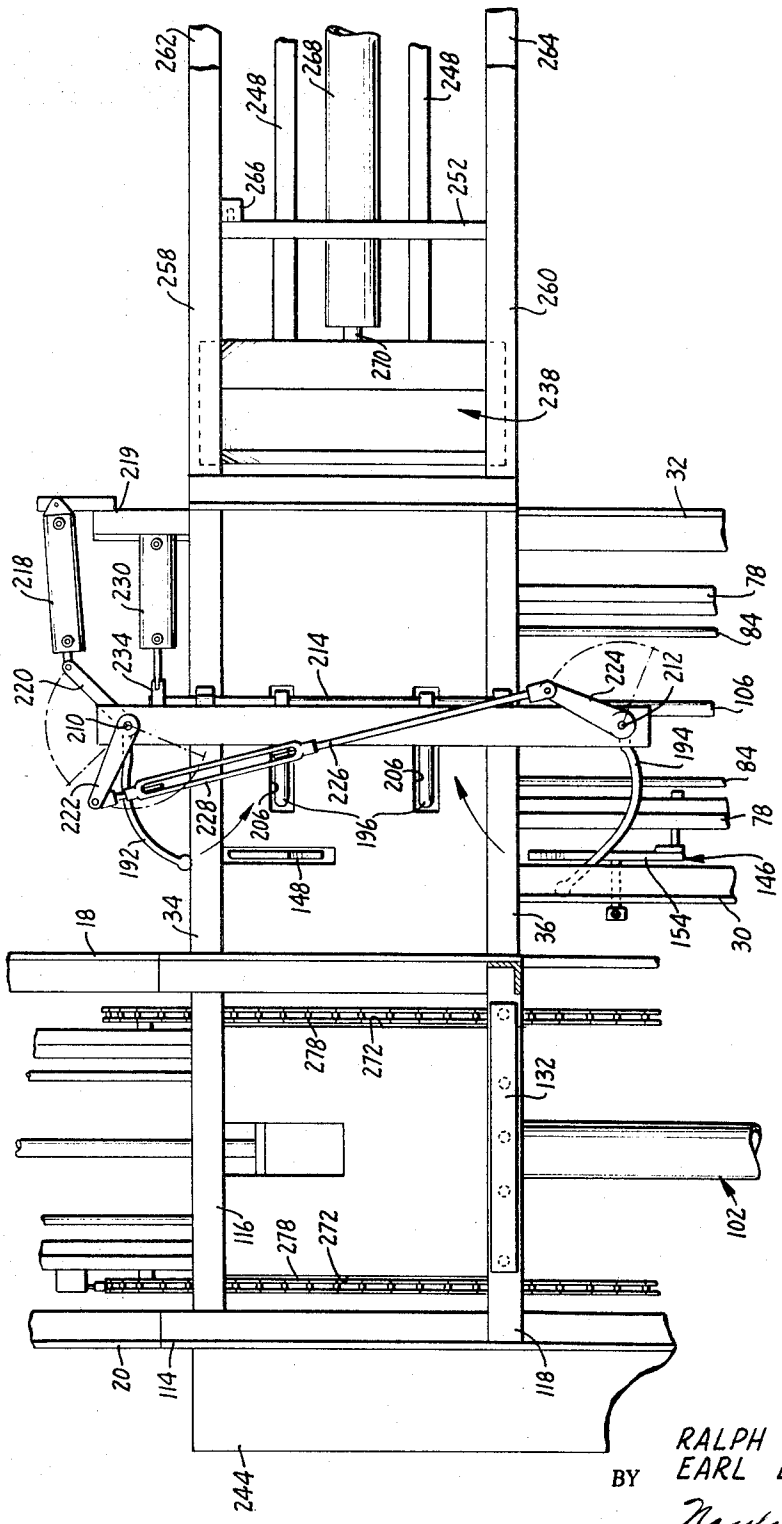


FIG. 12

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United States Patent Office 3,476,023 Patented Nov. 4, 1969

3,476,023

CARTON HANDLING MACHINE

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Continuation of application Ser. No. 558,731, June 20, 1966. This application Oct. 24, 1968, Ser. No. 764,049
Int. Cl. B31b *17/74, 3/74, 1/78*
U.S. Cl. 93—39.1 22 Claims

ABSTRACT OF THE DISCLOSURE

A machine for automatically unfolding pairs of carton blanks and telescoping them together to form a single composite carton. The machine comprises a pair of magazines adapted, respectively, to contain stacks of unfolded inner and outer carton blanks, a transfer and unfolder mechanism associated with each of the magazines to effect the one-at-a-time removal of carton blanks therefrom and the erection of the blanks upon removal, a plunger-like assembly mechanism to telescope the carton blanks together after their erection, and an extraction and delivery mechanism adapted to remove the erected and telescoped blanks from the area of the assembly mechanism.

This application is a continuation of our co-pending application Ser. No. 558,731 filed June 20, 1966, now abandoned, and entitled Carton Handling Machine.

The present invention relates to a machine for unfolding and assembling folded carton blanks and, more particularly, is directed to such a machine for the handling of cartons comprised of telescoping sections. The invention is especially concerned with a machine for the handling of cartons of the type used in the packing of fruit, such as oranges.

In the fruit packing art, it is common to pack fruit subject to shrinkage during transit and storage, such as oranges, in cartons comprised of telescoping upper and lower sections. When employing such cartons, the lower section is typically packed to a height slightly above its upper edge and the upper section is closed over the lower section so as to rest on the fruit extending thereabove. Through this arrangement, when the fruit in the lower section shrinks, the upper carton will move downwardly on the lower carton, thus maintaining contact with the fruit contained in the lower carton. As a result, the fruit in the lower carton is maintained in a compacted state. This characteristic has the advantage that fruit is less likely to be damaged or spoiled while in the carton. Furthermore, even after shrinkage of fruit in such a carton, upon opening of the carton it appears to be "full to the brim."

Presently used telescoping cartons of the aforementioned kind are assembled from pairs of folded blanks which, upon erection, are telescoped together to form the composite carton. These blanks each comprise juxtaposed top and bottom plies defining scored connected end and side forming panels having end flaps along the edges at one side thereof. Assembly of these blanks is typically carried out through a hand operation where the side and end forming panels are first raised to erect condition and then the blanks are telescoped together. During this operation, it is also general practice to pull the end flaps on the lower blank to the closed position while maintaining the end flaps on the upper blank in the open position. Thus, upon assembly of the blank, a composite carton having a closed bottom and open top is presented. It is through this open top that the fruit is packed. Upon completion of the packing, the end flaps of the upper blank are closed and sealed.

It is common practice in the fruit packing industry to effect the aforedescribed hand assembly operation through the employment of two workers located at the upstream end of a packing assembly line. In the assembly of each carton, these workers first individually erect the respective upper and lower carton blanks and then, together, telescope the blanks into assembled condition. It can be appreciated that, in a large packing plant, the employment of carton assembly workers in this manner considerably adds to the total work force and resultant expense of packing. This is particularly true where packing is automated as, for example, through the employment of automated machinery of the type disclosed in our co-pending application, Ser. No. 504,858, filed Aug. 24, 1965.

Although automated carton assembly machinery is known in the prior art, this machinery has not provided for the effective assembly of telescoping cartons of the aforedescribed type. As a result, even in food packing plants which are highly automated, hand assembly of cartons is prevalent.

It is, accordingly, a principal object of the present invention to provide for the automatic assembly of telescoping cartons of the type employed in the fruit packing industry.

Another and more specific object of the invention is to provide for the automatic unfolding, assembling and delivery of telescoping cartons.

Yet another object of the invention is to provide an improved mechanism to effect the automated erection of folded carton components.

In its broad aspects, the present invention is directed to an automated carton handling machine comprising a pick-up and unfold stage; an assembly stage; and, an extraction and delivery stage. The pick-up and unfold stage comprises a pair of magazines adapted, respectively, to contain a plurality of inner and outer carton blanks in stacked folded condition and an unfolder operatively associated with each of said magazines to effect the individual extraction and erection of carton blanks therefrom. In its more specific aspects, the unfolder associated with the inner carton blank includes a flap folding mechanism adapted to effect the inward folding of the end flaps on the carton upon the erection thereof. The assembly stage comprises a mechanism adapted to automatically effect the telescoping of an inner and outer pair of carton sections together upon the erection thereof by the unfolder. The extraction and delivery stage comprises a transfer and support mechanism cooperating with the assembly stage to effect the removal of composite cartons therefrom upon assembly.

The foregoing and other objects and the detailed construction of the invention will become more apparent when viewed in the light of the following description and accompanying drawings, wherein:

FIG. 1 is a plan view illustrating the machine of the present invention in its entirety;

FIG. 2 is a perspective view diagrammatically illustrating a pair of carton blanks in the process of being assembled by the machine of the invention;

FIG. 3 is a sectional view taken on the plane designated by line 3—3 of FIG. 1;

FIG. 4 is a sectional view taken on the plane designated by line 4—4 in FIG. 3;

FIG. 5 is a sectional view taken on the plane designated by line 5—5 in FIG. 4;

FIGS. 6, 7, 8 and 9 are sectional side elevational views, similar to FIG. 3, sequentially illustrating the pick-up and unfold stage in the process of erecting a carton blank;

FIG. 10 is a sectional view taken on the plane designated by line 10—10 in FIG. 1;

FIG. 11 is a sectional view taken on the plane designated by the line **11—11** in FIG. 10; and ,

FIG. 12 is a plan view, with parts thereof broken away, illustrating, in detail, the flap folder cooperating with the inner carton pick-up in unfold stage of the inventive machine.

As noted above, the machine of the present invention may be defined as comprising three stages, namely: pick-up and unfold; assembly; and extraction and delivery. The pick-up and unfold stage is comprised of two substantially identical sections, each of which sections comprises a magazine and unfolder. These sections are provided, respectively, for the handling of inner and outer carton blanks to be assembled into composite telescoping cartons by the machine. For the sake of simplicity, the detailed description herein will be directed primarily to the pick-up and unfold stage for outer carton blanks. It is to be understood that the pick-up and unfold stage for inner carton blanks corresponds, with the exception of the differences hereinafter noted, to the pick-up and unfold stage for outer cartons.

For the sake of clarity, the following detailed description of the machine construction will be divided into segments corresponding to the machine stages. This description will be integrated with and followed by a description of the overall machine operation.

PICK-UP AND UNFOLD STAGE

This stage, as noted above, is comprised of two substantially identical sections provided, respectively, for the handling of inner and outer carton blanks. These sections are designated in their entirety, respectively, by the numerals **10** and **12**. Each of the sections **10** and **12** is comprised, generally, of a magazine **14** and unfolder **16**. Since the magazine and folder for each section correspond substantially in structure and operation, like numerals will be used to designate corresponding elements therein and the following description will be directed primarily to the outer blank pick-up and unfold section **12**, as illustrated in FIGS. 3–9.

(I) Magazine

The magazines **14** each comprise a vertically extensive receptacle of rectangular plan configuration defined by side walls **18** and **20** interconnected by end walls **22** and **24**. The side and end walls forming the magazine of the section **12** are rigidly supported on longitudinally extending frame members **26** and **28**. Although not illustrated in detail, the side and end walls forming the magazine of the section **10** are similarly supported on longitudinally extending frame members **30** and **32** (see FIG. 12). The longitudinally extending frame members **26** to **32** are rigidly interconnected by transversely extending frame members **34** and **36**. The basic framework thus provided is supported, in part, by legs **38**, **40**, **42**, **44**, **46**, **48** and **50**; and has fixed thereto and supported thereof a plurality of upwardly disposed frame members. It is to be understood that support legs in addition to those illustrated are provided where necessary. For example, support legs are provided at the extremities of the section **10**. These legs are of conventional form corresponding closely to those illustrated. The upwardly disposed frame members supported on the basic framework and the various elements cooperating therewith will be developed in the subsequent discussion.

The side and end walls of the magazines **14** comprise an upwardly disposed tubular guide adapted to contain folded carton blanks therein in horizontally disposed stacked orientation (see FIG. 3). When stacked in this orientation, the respective inner and outer carton blanks are also deliberately positioned as illustrated in FIG. 1. This positioning is effected by the operator when stacking the carton blanks in the magazines. Specifically, the inner and outer carton blanks are stacked, respectively, with the end flaps thereof directed inwardly of the machine.

For convenient reference, the inner and outer carton blanks illustrated in the drawings will hereinafter be referred to by the numerals **52** and **54**. These blanks differ from each other primarily in the dimensional characteristics thereof which facilitate telescoping of the inner blank into the outer blank upon erection of the blanks to carton forming condition. In the folded condition, each blank comprises a pair of juxtaposed plies. The plies each comprise carton end and side forming paneled having end flaps attached to and extending from one side thereof. Attachment of the end flaps to the panels is also provided by scored connections. In the drawings, as can best be seen from FIG. 2, the side and end forming panels of the carton **52** are designated, respectively, by the numerals **56** and **58**. The end flaps attached to the side and end panels of the blank **52** are designated, respectively, by the numerals **60** and **62**. The blank **54** is similarly comprised of side panels **66**; end panels **68**; and end flaps **70** and **72**.

The magazines **14** are provided with outwardly flared open upper ends **74** through which cartons are loaded into the stacked condition illustrated in FIG. 3. In the stacked condition, the cartons are supported through support of the lowermost thereof on rollers **76**. The rollers **76** are mounted beneath and extend longitudinally across the magazines thereabove.

(II) Unfolder

The magazines in the respective sections **10** and **12** each have cooperating therewith unfolder structure adapted to effect the individual removal and direction of carton blanks therefrom. To the extent that the components of the respective unfolder structures correspond, like numerals are employed herein and reference is only made to the unfolder structure cooperating with the magazine of section **12**.

As a basic component, the unfolder structures each comprise a transfer mechanism, including as a part thereof the rollers **76**. The transfer mechanism also comprise: a pair of secondary longitudinally extending frame members **78** fixedly secured to the primary framework and having supported thereon the rollers 76; a pair of secondary transversely extending frame members 80 and 82 fixed to and depending downwardly from the opposed ends of the members **78**; three longitudinally extending guide rods 84 fixed to and extending between the members 80 and 82; a carriage 86 slidably received on the rods 84 for rectilinear movement thereon beneath the magazine 14; a shoe 88 fixedly supported on the carriage 86 for abutting engagement with the trailing edge of a lowermost carton contained in the magazine 14 upon movement of the carriage beneath the magazine; a lift tab **90** pivotally secured to the carriage **86** by a hinge **92** for pivotal movement relative to the carriage about the transverse axis defined by the hinge; a beam **94** fixed to and extending across the tab **90** to one side of the hinge **92**; a pair of rollers **96** secured to the ends of the beam **94** for rolling engagement with the secondary frame members **78**; and a pair of cam surfaces **98** formed on the members **78** to one side of the magazine **14** thereabove in the path of the rollers **96**. Selective movement of the carriages **86** associated, respectively, with the sections **10** and **12** is provided by pneumatic cylinders **100** and **102**. These cylinders are identical in structure and mode of operation and are each of the double acting type comprised of a cylinder **104** and a cylinder rod **106**. The rods **106** are extensible and retractable from the cylinder sections in conventional manner and are connected at their free ends to the carriages **86**.

Through selective operation of the cylinders **100** and **102**, the carriages **86** may be moved longitudinally back and forth beneath the magazines thereabove. Upon retraction of the cylinders from the position illustrated in FIG. 3, the shoe **88** supported on the carriage engages the lowermost carton blank contained in the magazine **14** there-

above and moves this blank out of the magazine in a planar path as can be seen in FIG. 6. Shortly after reaching the position illustrated in FIG. 6, continued movement of the carriage functions to force the rollers **96** onto the cam surfaces **98**. On the later occurance, the lift tab **90** is raised to the position illustrated in FIG. 7, thus lifting the blank supported thereabove upwardly.

It is here noted that the end walls **22** and **24** of the magazine **14** are raised above the support surface provided by the rollers **76** by a distance slightly greater than the thickness of a folded carton blank. As a result of this characteristic, only the lowermost carton blank contained in each of the magazines **14** is removed therefrom upon movement of the shoe **86** therebeneath responsive to retraction of the cylinders **100** and **102**. Upon extension of the cylinders **100** and **102** to return the carriage **86** to the position illustrated in FIG. 3, the tapered profile of the shoes **88**, together with the lower extremity of the magazine walls **22**, assures that the shoes will pass beneath the carton blanks in the magazines thereabove.

Referring now specifically to the right-hand portion of FIG. 3 and to FIGS. 6 to 9, therein is illustrated the receiver to which the transfer mechanism of the section **12** directs carton blanks from the magazine **14** thereof. This receiver functions in cooperation with the aforedescribed transfer mechanism and, in part, includes the carriage **86** and lift tab **90** of the mechanism. The illustrated receiver forming part of the section **12** further comprises: a surface **108** supported on the machine framework in a position substantially coplanar with the support surface provided by the rollers **76**; a rectangular subframe supported above the surface **106** to define, in part, a surface **110** spaced from the surface **108** by a distance substantially equal to the width of the end panel of an outer carton blank (i.e., the width of the panel **68**) to be handled by the section **12**; interconnected horizontally disposed members **112**, **114**, **116** and **118** defining the upper portion of the subframework; vertically disposed members, comprising in part, the members **40** and **46** (the remainder of these members are not illustrated), connected to the intersecting corner portions of the members **112** to **118** to effect the support thereof; a gate mechanism **120**; and, an unfold mechanism **122**. It is here noted that the vertically disposed members of the receiver subframework, comprising in part the legs or members **40** and **46**, are spaced apart transversely by a distance sufficient to permit the unrestricted passage of a folded blank **54** therebetween in the direction indicated by the lower left arrow line in FIG. 2. These members are spaced apart longitudinally by a distance sufficient to permit the unrestricted passage therebetween of an erected inner carton blank in the direction indicated by the straight line leading from the erected carton blank **52** illustrated in the midportion of FIG. 2.

The gate mechanism **120**, as can best be seen from FIG. 10, is supported by rigidly interconnected frame members **124**, **126** and **128** fixed to and supported above the member **118**. The mechanism comprises: a plurality of guide tubes **130** fixed between and opening through the frame members **118** and **128**; a carriage **1-32** movably disposed above the member **128** and have fixed thereto a plurality of elongated rods **134** extending slidably through the guide tubes **130**; a double acting pneumatic cylinder **136** having its body fixedly mounted on the member **118** and the piston rod **138** thereof secured to the carriage **132**; upper and lower limit switches **140** and **142**, respectively, mounted on the frame member **126**; and, an abutment **134** fixed to the carriage **132** for triggering engagement with the switches **140** and **142** upon movement of the carriage **132** to its upper and lower extremities, as indicated by phantom and solid line representations thereof in FIG. 10.

In operation, as can be seen from FIGS. 6–9, the gate mechanism is in the downwardly disposed position during the unfolding of carton blanks. In this position, the rods **134** function, together with the surface **110**, as an abutment for the leading edge of a carton directed into the receiver. Upon the complete unfolding of an outer carton blank against the rods **134** and the telescoping of an inner blank thereinto, the cylinder **136** is activated to raise the rods to a position permitting passage of the asembled carton therebeneath. The latter operation, together with the associated functions of the switches **140** and **142**, will be developed in detail in the subsequent description of the overall machine operation.

The unfolder mechanism for the receiver of the section **12** comprises as its basic elements, simultaneously operable levers **146** and **148** having flap engaging bumpers **150** and **152**, respectively, on the free ends thereof. These bumpers, as can be appreciated from observation of FIG. 2 and FIGS. 6–9, are adapted to engage the end flaps **72** of a folded carton blank to force the plies of the blank apart and toward the extended condition. This operation is facilitated by the fact that the bumpers **150** and **152** move in a path where they engage only the outwardly disposed end portions of the flap **72**. The lever **146** comprises: first and second arm sections **154** and **156**, respectively, pivotally secured together for movement about the axis of a pin **158** fixed to and extending outwardly from one of the frame members **78** (see FIG. 5), a stop **160** fixed to the section **156** adjacent the connection thereof to the section **154** to limit movement of said sections toward each other; and, a tension spring **162** connection between the sections **154** and **156** to normally bias these sections toward each other about the axis of the pin **158**. The section **156** is disposed in the path of a trip finger **164** fixed to the carriage **86**. Through this interrelationship, when the cylinder **102** is retracted to the position illustrated in FIG. 8, the lever **146** is raised. Upon retraction of the cylinder beyond this position, as illustrated in FIG. 9, the finger **164** passes out of engagement with the section **156**, thus permitting the lever **164** to return to the retracted position. Upon extension of the cylinder **102**, the hinged connection between the sections **154** and **156** permits the substantially unrestricted movement of the finger **164** beneathe the section **156**.

The lever **148** is pivotally secured to the member **112** about a pin connection **166** therewith and is joined, through linkage structure, to the lever **146** for simultaneous movement therewith. This linkage structure comprises: a crank **168** pivotally supported above the member **112** on a pedastal **170**, a first link **172** pivotally secured between the section **154** and one end of the crank **168**; and, a second link **174** pivotally secured between the other end of the crank **168** and the lever **148**.

In operation, upon retraction of the cylinder **102**, the levers **146** and **148** function through the sequence illustrated in FIGS. 7, 8 and 9 to assist in the unfolding of a carton blank. The assistance thus provided is supplemental to the carton unfolding force imparted by the shoe **68** as it forces the carton being unfolded against the abutment defined by the intersection of the surface **110** and the rods **134**. Upon unfolding of a carton to the fully extended condition illustrated in FIG. 9, further movement of the carton is limited by abutment of the lower leading edge thereof with the lower ends of the rods **134**. In the fully extended condition, the unfolded carton also functions to trigger a limit switch **176** supported on the frame member **116**. The function of the switch **176** will be developed in the subsequent description of overall machine operation.

It is here noted that the lift tab **90** functions to direct a folded carton blank toward the abutment defined by the intersection of the surface **110** and rods **134** immediately prior to the operation of the unfolder arms **154** and **156**. This operation is best illustrated in FIG. 7. From this figure, it can be seen that a flap hold down tab **178** and roller **180** are provided to assure that the folded carton blank being handled is maintained in contact with the tab **90** during lifting thereby. The tab **178**

is connected directly to one side of the magazine side wall **24** adjacent thereto. The roller **180** is supported on the wall **24** connected to the tab **178** through means of an arm **182**. The arm **182** is pivotally secured at one end to the wall **24** and at the other end to the roller **180** and has connected to the intermediate portion thereof a tension coil spring **184** extending into connection with the wall **24**. Through this arrangement, the coil spring **184** functions to resiliently urge the roller **180** downwardly and against a carton which may be disposed therebeneath on the tab **90**. Downward movement of the roller **180** may be selectively limited by an adjustable stop **186** disposed beneath the arm **182** for abutment therewith.

The structure and mode of operation of the aforedescribed unfolder receiver forming part of the section **12** is substantially duplicated in the receiver of the section **10**. Accordingly, for the sake of simplicity, the unfolder receiver of the section **10** is only herein illustrated and described in detail to the extent that it distinguishes from the receiver of the section **12**. Illustrated elements of the section **10** receiver corresponding identically to those of section **12** are designated in the accompanying drawings by like numerals.

The section **10** receiver differs from that of section **12** primarily in that: it includes a flap folding mechanism **188**; and, the end wall thereof is formed by a fixed surface **189**, rather than by movable rods **134**. The receiver of the section **10** also distinguishes from that of the section **12** in that the switch **190** thereof corresponding to the switch **116** performs a slightly different function than the switch **116**. This difference in function will be developed in the subsequent description of overall machine operation.

The flap folding mechanism **188** is best illustrated in FIGS. 10, 11 and 12. From these figures, it can be seen that the mechanism includes opposed end flap folders **192** and **194** and opposed side flap folders **196** and **198**. These end and side flap folders are disposed, respectively, to swing inwardly into engagement with the end and side flaps of a blank **52** upon the assumption thereby of erect condition in the receiver of the section **10**. Swinging movement of the folder **192** is facilitated by an opening **200** therefor in the surface **189**. Unrestricted swinging movement of the end flap folder **194** is provided by the open side of the receiver adjacent thereto. Walls **202** and **204**, respectively, define the upper and lower surfaces of the section **10** receiver and are provided with openings **206** and **208** therethrough to facilitate swinging of the folders **196** and **198**. The upper surface defined by the wall **204** corresponds substantially to the surface **108** of the section **12**. The intersection of the surface **189** and the interior surface of the wall **202** defines an abutment corresponding in function to the abutment provided by the intersection of the surface **110** and rods **134** in section **12**.

The end flap folders **192** and **198** are fixedly secured to vertically disposed shafts **210** and **212**, respectively, which shafts are supported for rotation about the longitudinal axes thereof. The side flap folders **196** and **198** are fixedly secured to shafts **214** and **216**, respectively, which shafts are supported for rotation about the longitudinal axes thereof. Selective simultaneous rotation is imparted to the end flap folders **192** and **194** through operation of a double acting pneumatic cylinder **218** and a linkage mechanism operatively connected thereto. The cylinder **218**, as can be seen from FIG. 12, is pivotally supported on a fixed support member **219**. The linkage mechanism operatively connected to the cylinder **118** comprises: an arm **220** pivotally secured at one end to the piston rod of the cylinder **218** and fixedly secured at the other end of the shaft **210**; an arm **222** fixedly secured to and extending from the shaft **210**; an arm **224** fixedly secured to and extending from the shaft **212**; and, a link **226** secured between the arms **222** and **224** by pivotal connections to the free end portions of said arms. The link **226** comprises, in part, a turn buckle **228** to provide for adjustment of its length.

Selective simultaneous rotation is imparted to the side flap folders **196** and **198** through means of double acting pneumatic cylinders **230** and **232**, respectively, fixedly mounted on the support member **219**. The cylinder **230** is drivingly connected with the folders **196** through means of an arm **234** pivotally connected at one end to the piston rod of the cylinder and fixedly secured at the other end to the shaft **214**. An arm **236** is similarly connected between the piston rod of the cylinder **232** and the shaft **216** to effect driving connection to the holders **198**.

ASSEMBLY STAGE

This stage cooperates with the receivers of the aforedescribed sections **10** and **12** to effect the telescoping assembly of erected inner and outer carton blanks. The operation of this stage in the assembling or carton blanks is diagrammatically illustrated in the midportion of FIG. 2. From this figure, it can be seen that, upon erection in the receivers of sections **10** and **12**, the blanks **52** and **54** assume an aligned condition with the flap portions thereof in substantially opposed relationship. In this condition, immediately prior to operation of the assembly stage, the end flap folders **192** and **194** and the side flap folders **196** and **198** are activated to turn the flaps of the blank **52** inwardly as indicated by the curved arrow lines in FIG. 2. The latter operation is preferably perfected in timed sequence with the activation of the end flap folders **192** and **194** preceding the activation of the side flap folders **196** and **198** by a time interval sufficient to prevent inter-fouling of the flaps engaged thereby. It is after activation of the flap folders that the assembly stage operates to effect telescoping of erected blanks **52** and **54**.

The assembly stage comprises as its prime component a plunger **238** mounted for rectilinear movement transversely of the machine and through the receiver cavity defined by the surface **189** in the interior surfaces of the walls **202** and **204**. The face of the plunger **238** is provided with upper and lower edges **240** and **242**, respectively, disposed so as to pass in close proximity to the interior surfaces of the walls **202** and **204**. It is through abutment of these edges with the side panel edges of a blank **52** received in the receiver of the section **10** that movement of the plunger is imparted to the blank. It is this movement that effects telescoping of an inner carton blank **52** into an outer carton blank **54** in the manner diagrammatically illustrated in FIG. 2. During this movement, the outer carton blank is held against movement transversely of the machine by abutment with a wall **244**. The wall **244**, as can be seen from FIG. 10, is of outwardly bowed configuration to accommodate the flaps of the inner blank **52**.

The plunger **238** has fixed thereto an extending rearwardly therefrom a carriage **246** mounted for rectilinear movement therewith. The carriage **246** comprises: elongated members **248** fixed to and extending rearwardly from the plunger **238** in the direction of travel thereof; a first member **250** interconnecting the members **248** immediately adjacent to the plunger **238**; and, a second member **252** interconnecting the members **248** rearwardly of the member **250**. The member **252** carries a limit switch **254** adapted to be activated upon the pasage thereof over an opening **256** formed in the wall **204**.

The plunger **238** and carriage **246** are mounted for rectilinear movement between a plurality of transversely extending frame members **258**, **260**, **262** and **264**. The member **258** has supported thereon a limit switch **266** disposed to be activated by the member **252** upon retraction of the plunger **238**. A double acting pneumatic cylinder **268** is mounted between the frame members **258**, **260**, **262** and **264** by a fixed connection (not illustrated) therewith. The cylinder **268** has a piston rod **270** fixedly connected to the member **250** of the carriage **246**. Through the latter arrangement, extension and retraction of the piston rod **270** functions to traverse the plunger **238** back

and forth through the receiver of the section **10**. Although not illustrated, it is to be understood that the carriage **246** may be provided with additional guide means to assure its smooth movement throughout the stroke of the rod **270**.

EXTRACTION AND DELIVERY STAGE

This stage is provided to effect the removal of a composite assembled carton from the receiver of the section **12**. The operation of this stage is diagrammatically illustrated by the arrow line leading to the composite carton shown in the lower right hand portion of FIG. 2. From the movement indicated by this arrow line, it will be appreciated that the operation of the extraction and delivery stage depends, in part, on the structure and mode of operation of the receiver in the section **12**. Specifically, before movement of a composite assembled carton can be effected by the extraction and delivery stage, the gate mechanism **120** must be actuated to raise the rods **134**.

The structure of the extraction and delivery stage also includes as a part thereof the surface **108** of the section **10** receiver. This surface effects support of a composite assembled carton during its initial movement by the stage and has formed therethrough longitudinally extending slots **272** through which dogs **274** forming the carton gripping elements of the extraction and delivery stage are adapted to extend. During initial movement of the composite carton by the extraction and delivery stage, the carton is laterally guided by the wall **244** and a plurality of rods **276**. The rods **276**, as can be seen from FIGS. 4 and 10, are fixed to the frame member **126** and extend therefrom in substantially parallel relationship to the wall **244**.

The dogs **274** are supported for movement longitudinally through the slots **272** on a pair of chains **278** mounted beneath the surface **108**. The chains **278** are each supported at the opposite ends thereof by sprockets **280** and **282**. The sprockets **280** are mounted for idling rotation about stub axles **284** secured to the frame members **78**. The sprockets **282** are fixedly mounted on a driven axle **286** rotatably supported on the machine framework. Selective rotation of the axle **286** is effected through a drive train comprising: a magnetic clutch **288** fixed on one side thereof to the axle **286** and on the other side thereof to a driven sprocket **290**; an electric motor and gear reducer unit **292** mounted on the machine framework to one side of the clutch **288**; a sprocket **294** drivingly connected to the unit **292**; and, a chain **296** trained around the sprockets **290** and **294**. In operation of this drive train, the unit **292** is continuously driven and rotation is selectively imparted to the shaft **286** through activation of the clutch **288**.

In operation of the extraction and delivery stage, each time the clutch **288** is activated, the dogs **280** traverse across the surface **108** from left to right, as viewed in the drawings. Upon thus traversing the surface **108**, the dogs engage the trailing edge of a composite carton disposed in the receiver of the section **12** and effect movement of this carton as diagrammatically illustrated in the lower left hand portion of FIG. 2. Carton movement terminates at the point where the dogs travel around the sprockets **282**. As the cartons are moved across the surface **108**, a limit switch **298** disposed in the path of carton movement is triggered. A limit switch **300** is triggered by the outermost dog **274** upon movement thereof around the sprocket **280**. The function of the switches **298** and **300** will be developed in the following discussion of overall machine operation.

OVERALL MACHINE OPERATION

The operation of the aforedescribed machine is effected in sequential fashion through selective activation of the various double acting pneumatic cylinders. Although not illustrated, it is to be understood that air is supplied to and vented from these cylinders through valve structure of conventional nature. This valve structure is controlled through relays activated in response to limit switches which are triggered at various points in the machine operation. These limit switches are all illustrated in FIG. 1. From this figure, it can be seen that, in addition to the limit switches hereinbefore described, the machine includes limit switches **302** and **304** disposed in the path of the carriage **86** in section **10** and limit switches **306** and **308** disposed in the path of the carriage **86** in section **12**. The limit switches **302** and **306** are triggered, respectively, upon retraction of the cylinders **100** and **102** to the position where the lift tabs **90** are raised. The limit switches **304** and **308**, respectively, are triggered upon extension of the cylinders **100** and **102** to the position illustrated in FIG. 1 wherein the shoes **88** are removed to one side of the magazines associated therewith.

At the outset of machine operation, the magazines **14** are filled with carton blanks as illustrated in FIG. 1 and the gate mechanism **120** is in the lower position illustrated in FIG. 3. With the machine so conditioned, operation is initiated by simultaneous retraction of the cylinders **100** and **102** to effect movement of the lowermost carton blanks contained in the magazines **14** through the sequence illustrated in FIGS. 6–9. Upon assumption of the sequence illustrated in FIG. 7, the limit switches **302** and **306** are triggered to activate, respectively, exhaust port restriction means (not illustrated) for the cylinders **100** and **102**. The latter function operates to slow down retraction of the cylinders during the sequence of FIGS. 7, 8 and 9 and, thus alleviates problems which may result from the creation of a vacuum between the plies of a blank being unfolded.

Upon complete retraction of the cylinders **100** and **102**, the inner and outer carton blanks being unfolded assume the erect condition represented in FIG. 9. In this condition, the inner carton blank triggers the switch **190** and the outer carton blank triggers the switch **176**. Triggering of the switch **190** effects activation of the operating cylinders for the end and side flap folders. As noted in the foregoing discussion, these folders operate in timed sequence. Triggering of the switch **176** operates, together with the triggering of the switch **190**, to activate the cylinder **268** for extension. The switch **190** provides that the latter extension will not occur prior to complete operation of the flap folders.

Extension of the cylinder **268** functions to telescope the inner and outer blanks being handled into composite carton forming condition. Completion of this function is indicated by triggering of the switch **254** by the opening **256**. Upon its triggering, the switch **254** effects activation of the cylinder **268** to retract the plunger **238** to the position illustrated in FIG. 10. Return of the plunger **238** to the retracted position functions, in turn, to trigger the switch **266**. Triggering of the switch **266** activates the cylinder **126** to raise the gate rods **134**.

Upon complete raising of the gate mechanism, the switch **140** is triggered by the abutment **144**. Triggering of the switch **140** effects engaging activation of the clutch **288**. Thus, traversal of the dogs **274** across the surface **108** and the resultant removal of an assembled composite carton is effected. It is here noted that the clutch **288** is set to slip when a carton engaged by the dogs **274** meets excessive resistance, such as may occur when several completed cartons have accumulated at the delivery end of the machine. As a result of this characteristic, upon over production by the machine, movement of the dogs **274** is automatically arrested. Upon the latter occurrence, as will become more apparent subsequently, the sequential operation of the machine is interrupted to prevent the unfolding and assembly of further cartons.

As a carton engaged by the dogs **274** approaches the end of its path, it triggers the limit switch **298**. Triggering of this switch functions to activate the cylinders **100** and **102** to full extension, thus returning the carriages **86** and shoes **88** secured thereto to the positions illustrated in FIG. 1. Upon the latter occurrence, the switches **304**

and **308** are triggered to effect preparation of the machine for the further unfolding of carton blanks by retraction of the cylinders **100** and **102**. The switches **304** and **308** are so wired, however, that they cannot effect retracting activation of the cylinders **100** and **102** until the switch **142** is closed by lowering of the gate mechanism. Lowering of the gate mechanism is effected upon triggering of the switch **300** by the outermost dog **274**. Triggering of the switch **300** functions both to activate the cylinder **136** for lowering of the gate mechanism and to deactivate the clutch **288**.

Through the foregoing arrangement and operation of the various limit switches, the machine effects the continuous and automatic unfolding and assembly of carbon blanks. The slipping characteristic of the clutch **288** provides for the automatic interruption of this operation in the event of over production. Thus, the machine is capable of operating without the necessity of a human attendant, even under conditions of varying demand.

It is to be understood that the invention is not intended to be limited to the specific embodiment herein illustrated and described, but rather is defined by the following claims.

We claim:

1. In the assembly of cartons from folded components, comprising:

(a) a first blank having juxtaposed top and bottom plies comprising end and side forming panels attached together by scored connections; and

(b) a second blank having juxtaposed top and bottom plies comprising end and side forming panels attached together by scored connections; and wherein,

(1) said blanks are each adapted to be unfolded to position said panels in carton forming condition; and

(2) upon assuming said condition said first blank is adapted to be telescoped within said second blank to form a composite carton;

a machine for assembling cartons from said blanks, comprising:

(A) a first magazine adapted to contain a plurality of said first folded blanks in parallel stacked relationship relative to each other;

(B) a second magazine adapted to contain a plurality of said second folded blanks in parallel stacked relationship relative to each other;

(C) transfer means operatively associated, respectively, with each magazine to effect the individual removal of a blank contained at one end thereof through movement of said blank laterally of said magazine in a substantially planar path extending in a direction normal to the scored connections of the end and side forming panels of said blank;

(D) first and second receivers disposed, respectively, in the path of the transfer means operatively associated with said first and second magazines, said receivers each comprising:

(1) abutment means adapted to engage and arrest movement of the leading edge of a folded blank directed to said receiver;

(2) unfolding means adapted to effect the unfolding of the plies of a blank directed to said receiver upon disposition of said blank in a predetermined position relative to said receiver; and,

(3) limit means adapted to limit the unfolding of a blank by said unfolding means to the erect condition of said blank;

(E) assembly means operatively associated with said receivers to, upon the assumption of erect condition by first and second blanks in said receivers, effect telescoping of said blanks together to form a composite carton.

2. A machine according to claim **1** further comprising discharge means to, upon the forming of a composite carton by said assembly means, effect the discharge of said carton from said assembly means.

3. A machine according to claim **2**, wherein said discharge means comprises:

(A) at least one support member disposed to effect the slidable support of a composite carton upon the forming thereof through the telescoping together of a pair of said first and second blanks by said assembly means; and,

(B) at least one gripping element operatively associated with said support member to grip a composite carton supported thereon, said element being adapted to grip and move a carton off of said support surface upon the complete forming of said carton by said assembly means.

4. In the assembly of cartons from folded components according to claim **1**, wherein said components further comprise:

(a) end flaps secured to said first blank along the edges at one side thereof by scored connections with the end and side forming panels thereof; and,

(b) end flaps secured to said second blank along the edges at one side thereof by scored connections with the side and end forming panels thereof;

the machine further comprising flap folding means to effect the inward folding of the end flaps on a first blank after the erection thereof and immediately prior to the telescoping thereof with a second blank by said assembly means.

5. A machine according to claim **4** wherein:

(A) the first and second receivers are so oriented relative to each other that, upon assumption of the erect condition by blanks directed thereto, said blanks are disposed in substantially aligned relationship with the respective end flaps thereof disposed in opposed relationship; and

(B) said assembly means effects relative rectilinear movement between said blanks when in said substantially aligned relationship to telescope the folded flaps of the first thereof within the side and end panels of the second thereof.

6. A machine according to claim **5** wherein said assembly means comprises:

(A) restraining means adapted to engage a first blank upon assumption thereby of the erect condition and arrest movement of said blank in the direction of the scored connections of the end and side forming panels thereof; and,

(B) traversing means adapted to upon assumption by a second blank of substantially aligned relationship with a first blank engaged by said restraining means, engage said second blank and effect traversal thereof into said first blank.

7. A machine according to claim **1**, wherein:

(A) said first and second magazines are each adapted to maintain folded blanks contained therein in horizontal orientation; and,

(B) said transfer means each comprise:

(1) at least one support element disposed beneath the magazine operatively associated therewith for supporting engagement with the lower ply of the lowermost blank contained in said magazine; and,

(2) at least one carton engaging element disposed proximate to the lower portion of the magazine operatively associated therewith, said element being moveable and adapted to engage and move the lowermost blank contained in said magazine from beneath the blanks thereabove in said substantially planar path.

8. In the assembly of cartons from folded blanks having juxtaposed top and bottom plies comprising end and side forming panels attached together by scored connec-

tions, a device for unfolding said blanks to erect condition comprising:

(A) transfer means to engage and effect the movement of one of said blanks in a substantially planar path extending in a direction normal to the scored connections of the end and side forming panels thereof; and,

(B) a receiver disposed in the path of the transfer means, said receiver comprising:

(1) a substantially planar surface adapted to effect the support of the lower ply of a blank directed to said receiver by said transfer means;

(2) a deflector adapted to lift the leading edge of a blank from said surface upon movement of said blank to a predetermined position on said surface;

(3) abutment means adapted to engage and arrest movement of the leading edge of a folded blank directed to said receiver, said abutment means comprising a blank engaging element spaced from said surface by a distance substantially equal to the width of the lower leading panel of a blank directed thereto by said transfer means;

(4) unfolding means adapted to effect the unfolding of the plies of a blank directed to said receiver upon disposition of said blank in a predetermined position relative to said receiver, said unfolding means comprising at least one ply engaging element adapted to engage one ply of a blank engaged by the blank engaging element said abutment means and, together with the force imparted to said blank by said transfer means, force said ply away from the other ply of said blank; and,

(5) limit means adapted to limit the unfolding of a blank by said unfolding means to the erect condition of said blank, said limit means comprising at least one panel engaging element spaced from the blank engaging element of said abutment means to engage and limit movement of an interconnected pair of panels of a blank engaged by said blank engaging element upon the assumption of erect condition by said blank.

9. A device according to claim **8** further comprising a magazine adapted to contain a plurality of said folded blanks in horizontally orientated parallel stacked relationship, and wherein, said transfer means comprises:

(A) at least one support element disposed beneath said magazine for supporting engagement with the lower ply of the lowermost blank contained in said magazine; and,

(B) at least one carton engaging element disposed proximate to the lower portion of said magazine, said element being adapted to engage and move the lowermost blank contained in said magazine from beneath the blanks thereabove in said substantially planar path.

10. In the assembly of cartons from folded blanks according to claim **9**, wherein said blanks further comprise end flaps secured to said blanks along the edges of at least one side thereof by scored connections with the end and side forming panels thereof, the device further comprising, flap folding means to effect the inward folding of the end flaps of a blank upon the erection thereof by said receiver means.

11. In the assembly of cartons from folded components, comprising:

(a) a first blank having juxtaposed top and bottom plies comprising end and side forming panels attached together by scored connections; and,

(b) a second blank having juxtaposed top and bottom plies comprising end and side forming panels attached together by scored connections; and wherein

(1) said blanks are each adapted to be unfolded to position said panels in carton forming condition; and,

(2) upon assuming said condition said first blank is adapted to be telescoped within said second blank to form a composite carton;

a machine for assembling cartons from said blanks, comprising:

(A) a first magazine adapted to contain a plurality of said first folded blanks in parallel stacked relationship relative to each other;

(B) a second magazine adapted to contain a plurality of said second folded blanks in parallel stacked relationship relative to each other;

(C) transfer means operatively associated, respectively, with each magazine to effect the individual removal of a blank contained therein and the movement of said blank in a substantially planar path extending in a direction normal to the scored connections of the end and side forming panels of said blank;

(D) first and second receivers disposed, respectively, in the path of the transfer means operatively associated with said first and second magazines, said receivers each comprising:

(1) abutment means adapted to engage and arrest movement relative thereto of a blank directed to said receiver;

(2) unfolding means adapted to effect the unfolding of the plies of a blank directed to said receiver upon disposition of said blank at a predetermined position relative to said receiver; and,

(3) limit means adapted to limit the unfolding of a blank by said unfolding means to an erect condition;

(E) assembly means operatively associated with said receivers to, upon the assumption of the erect condition by first and second blanks in said receivers, effect telescoping of said blanks together to form a composite carton.

12. In the assembly of cartons from folded components, comprising:

(a) a first blank having juxtaposed top and bottom plies comprising end and side forming panels attached together by scored connections; and,

(b) a second blank having juxtaposed top and bottom plies comprising end and side forming panels attached together by scored connections; and wherein,

(1) said blanks are each adapted to be unfolded to position said panels in carton forming condition; and,

(2) upon assuming said condition said first blank is adapted to be telescoped within said second blank to form a composite carton;

a machine for assembling cartons from said blanks, comprising:

(A) a first magazine adapted to contain a plurality of said first folded blanks;

(B) a second magazine adapted to contain a plurality of said second folded blanks;

(C) transfer and unfolding means operatively associated with each of said magazines to effect the individual removal of blanks contained therein, the unfolding of said blanks to an erect condition, and the directing of respective inner and outer blanks into alignment and,

(D) assembly means operatively associated with said transfer and unfolding means to, upon alignment of said first and second blanks thereby, effect telescoping of said cartons together to form a composite carton.

13. A machine according to claim **12** further comprising discharge means to, upon the forming of a com-

posite carton by said assembly means, effect the discharge of said carton from said assembly means.

14. A machine according to claim 13, wherein said discharge means comprises:

(A) at least one support member disposed to effect the slidable support of a composite carton upon the forming thereof through the telescoping together of a pair of said first and second blanks by said assembly means; and,

(B) at least one gripping element operatively associated with said support member to grip a composite carton supported thereon, said element being adapted to grip and move a carton off of said support surface upon the complete forming of said carton by said assembly means.

15. A machine according to claim 12 wherein said assembly means comprises:

(A) restraining means adapted to engage a first blank upon assumption thereby of erect condition and arrest movement of said blank in the direction of the scored connections of the end and side forming panels thereof; and,

(B) traversing means adapted to, upon assumption by a second blank of substantially aligned relationship with a first blank engaged by said restraining means, engage said second blank and effect traversal thereof into said first blank.

16. In the assembly of cartons from components comprising:

(a) an outer tubular blank of rectangular cross-section made up of wall forming panels attached together by scored connections, said blank having oppositely disposed open ends, one of which is bounded by substantially coplanar edges on said panels and the other of which is bounded, at least in part, by closure flaps flexibly secured to and extending from said panels;

(b) an inner tubular blank of rectangular cross-section made up of wall forming panels attached together by scored connections, said blank having oppositely disposed open ends, one of which is bounded by substantially coplanar edges on said panels and the other of which is bounded, at least in part, by closure flaps flexibly secured to and extending from said panels;

and wherein said blanks are adapted to be telescoped together to define a composite carton wherein the closure flaps on the respective blanks are disposed at the opposite ends of said carton to provide for the closure thereof; a machine for telescoping and inner and outer pair of said blanks into composite carton forming conditions, said machine comprising:

(A) first support means adapted to support an outer blank in an erect condtion with the closure flaps thereof in an extended open condition;

(B) second support means adapted to support an inner blank in an erect condition, said first and second support means being interrelated to dispose respective blanks suported thereon in axially aligned condition with the ends thereof bounded by the closure flaps facing each other;

(C) transfer means operatively associated with said second support means to engage a blank supported thereon and effect the axial translation of said blank in a flap-first direction from said second support means and into the flap bounded open end of an outer blank supported on said first support means; and,

(D) restraining means operatively associated with said first support means to restrain axial movement of a carton blank supported thereon responsive to the movement of an inner blank thereinto by said translation means.

17. A machine according to claim 16 wherein said first and second support means each comprise at least one blank engaging element adapted to abut against at least one of the panels of a blank supported thereon to arrest movement of said blank in a direction transverse to the axis thereof during translation of an inner blank into an outer blank by said transfer means.

18. A machine according to claim 16 wherein said restraining means comprises a stop disposed for abutment with at least one of the coplanar boundary defining edges of an outer blank supported on said first support means, said stop being removed from the path of an inner blank being translated by said transfer means sufficiently to permit the closure flaps of an inner blank being so translated to extend through the coplanar edge bounded open end of an outer blank supported on said first support means.

19. A machine according to claim 16 wherein said transfer means comprises:

(A) a carriage mounted for rectilinear movement across said second support means towards and away from said first support means;

(B) a thrust imparting mechanism coupled to said carriage to selectively and alternatively effect movement thereof towards and away from said first supporting means; and,

(C) an abutment carried by said carriage for thrust imparting engagement with at least one of the boundary defining coplanar edges of an inner carton supported on said second support means, upon movement of said carriage towards said first support means.

20. A machine according to claim 19 wherein said restraining means comprises a stop disposed for abutment with at least one of the coplanar boundary defining edges of an outer blank supported on said first support means.

21. A machine according to claim 19 wherein said abutment comprises a head having:

(A) coplanar edge portions adapted to peripherally engage the boundary defining coplanar edges of an inner blank supported on said second support means; and,

(B) a central portion adapted to extend into an inner blank supported on said second support means upon the peripheral engagement of the bounary defining edges of said blank by said edge portions.

22. In the assembly of cartons from components comprising:

(a) an outer tubular blank of rectangular cross-section made up of wall forming panels attached together by scored connections, said blank having oppositely disposed open ends, one of which is bounded by substantially coplanar edges on said panels and the other of which is bounded, at least in part, by closure flaps flexibly secured to and extending from said panels;

(b) an inner tubular blank of rectangular cross-section made up of wall forming panels attached together by scored connections, said blank having oppositely disposed open ends, one of which is bounded by substantially coplanar edges on said panels and the other of which is bounded, at least in part, by closure flaps flexibly secured to and extending from said panels;

and wherein said blanks are adapted to be telescoped together to define a composite carton wherein the closure flaps on the respective blanks are disposed at the opposite ends of said carton to provide for the closure thereof; a machine for telescoping an inner and outer pair of said blanks into composite carton forming condition, said machine comprising:

(A) first support means adapted to support an outer blank in an erect condition with the closure flaps thereof in an extended open condition;

(B) second support means adapted to support an inner blank in an erect condition, said first and second support means being interrelated to dispose

respective blanks supported thereon in axially aligned condition with the ends thereof bounded by the closure flaps facing each other;

(C) transfer means and restraining means operatively associated with said first and second support means to abut the coplanar edge bounded open ends of a pair of blanks supported thereon and effect relative axial translation of said blanks so that the flap bounded end of the inner of said blanks telescopes through the flap bounded edge of the outer of said blanks.

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