July 16, 1963 J. L. NEAL ETAL 3,097,463

PACKAGING MACHINE

Original Filed Oct. 9, 1959 15 Sheets-Sheet 1

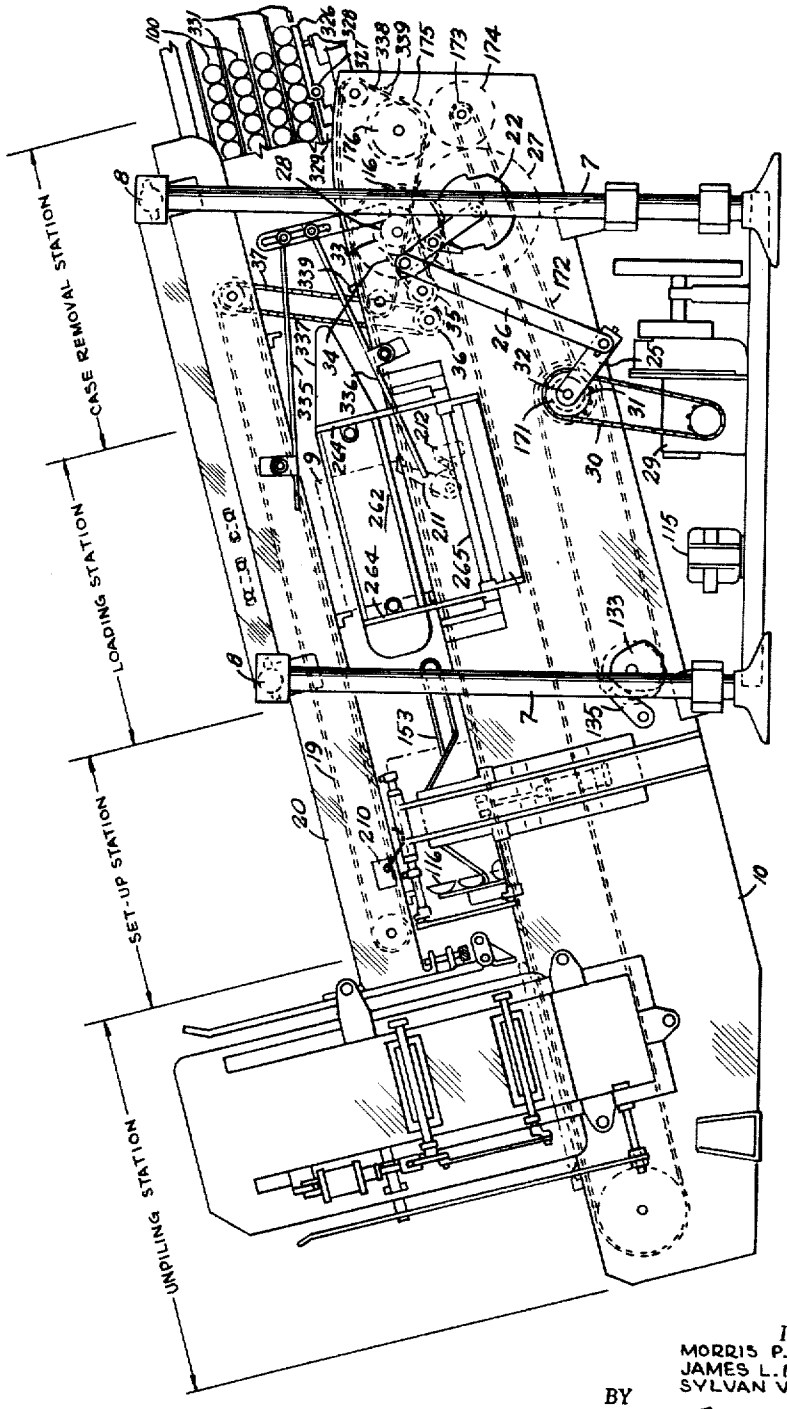


Fig. 1.

INVENTORS.
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July 16, 1963 J. L. NEAL ETAL 3,097,463

PACKAGING MACHINE

Original Filed Oct. 9, 1959 15 Sheets-Sheet 2

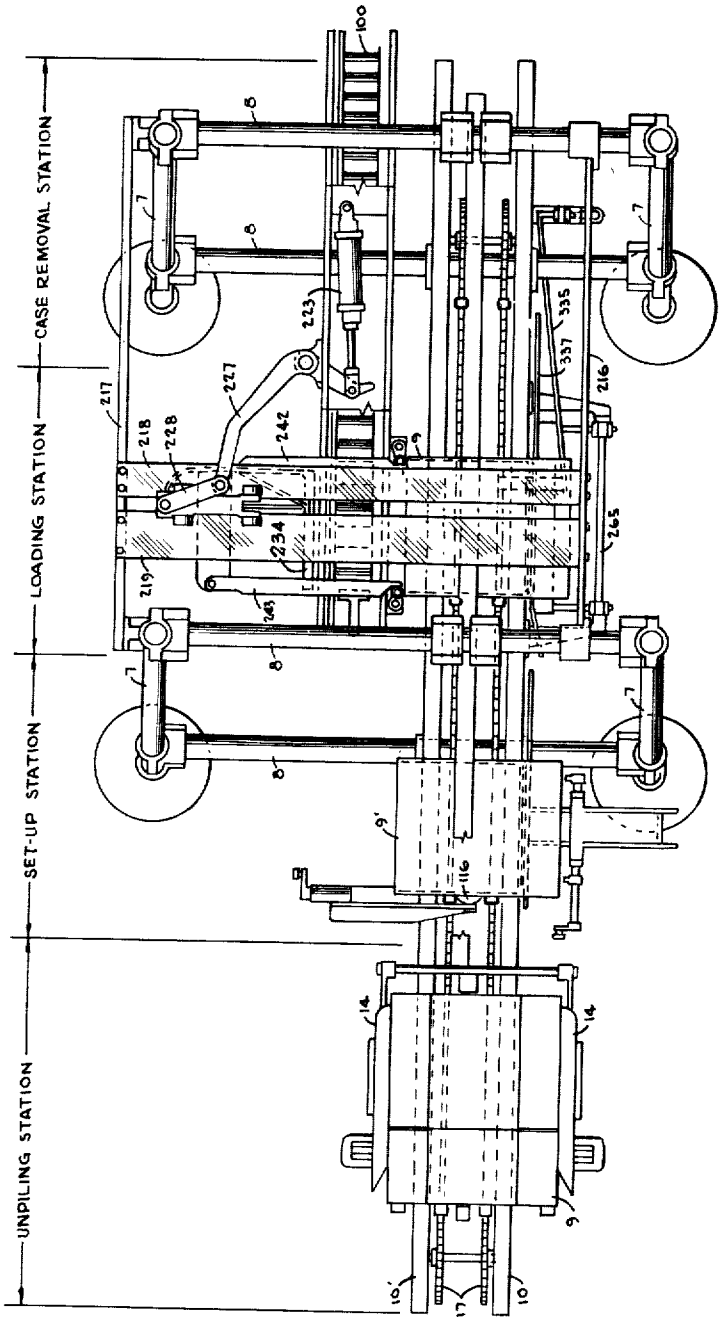


Fig. 2.

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PACKAGING MACHINE

Original Filed Oct. 9, 1959

15 Sheets-Sheet 3

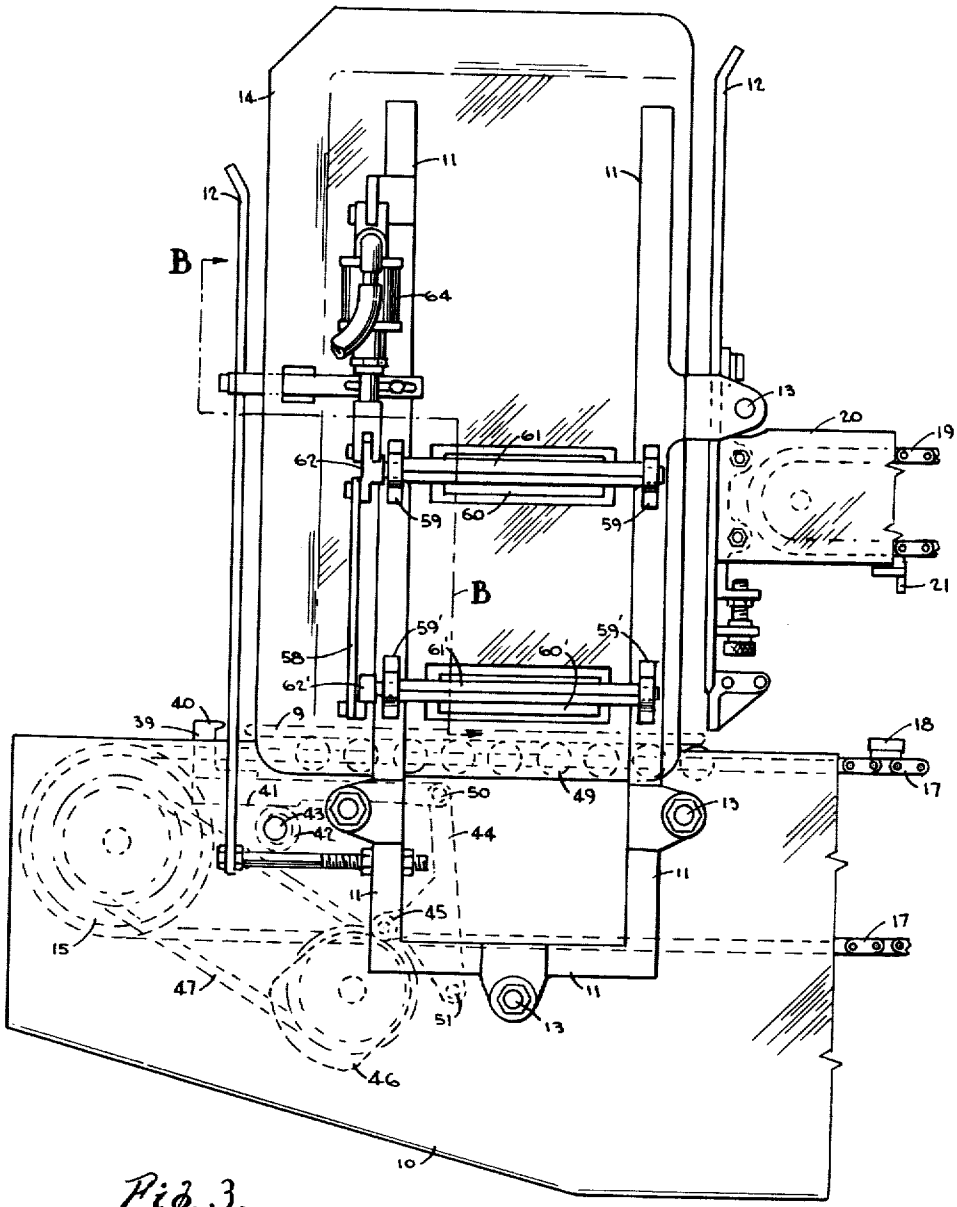


Fig. 3.

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PACKAGING MACHINE

Original Filed Oct. 9, 1959 15 Sheets-Sheet 4

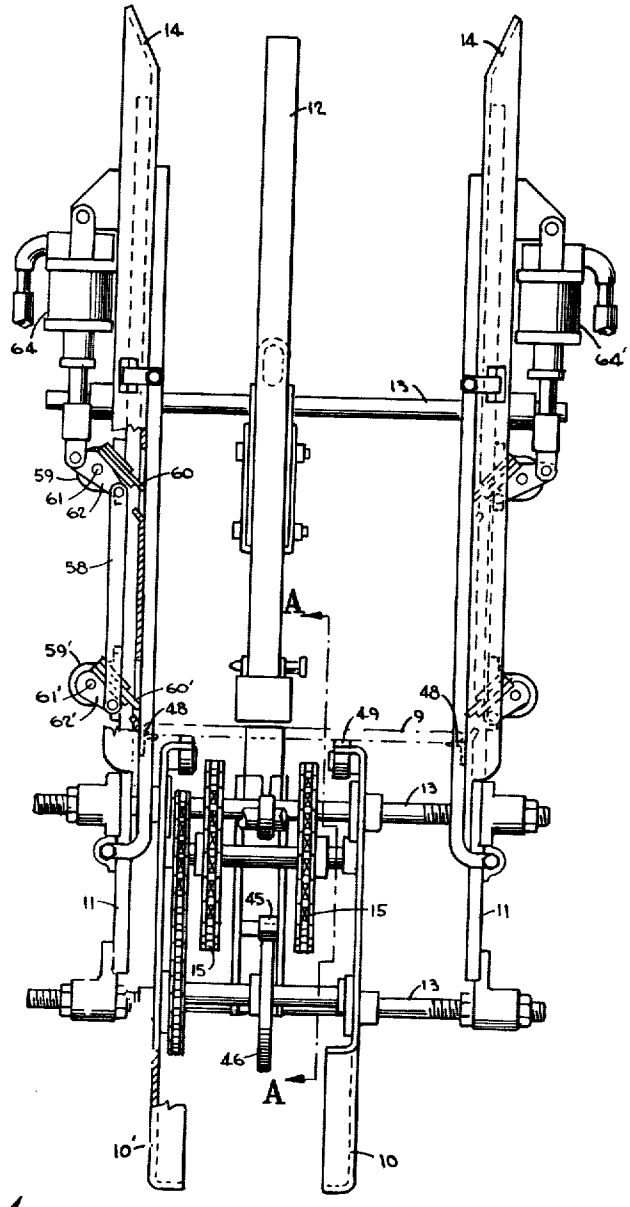


Fig. 4.

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PACKAGING MACHINE

Original Filed Oct. 9, 1959

15 Sheets-Sheet 5

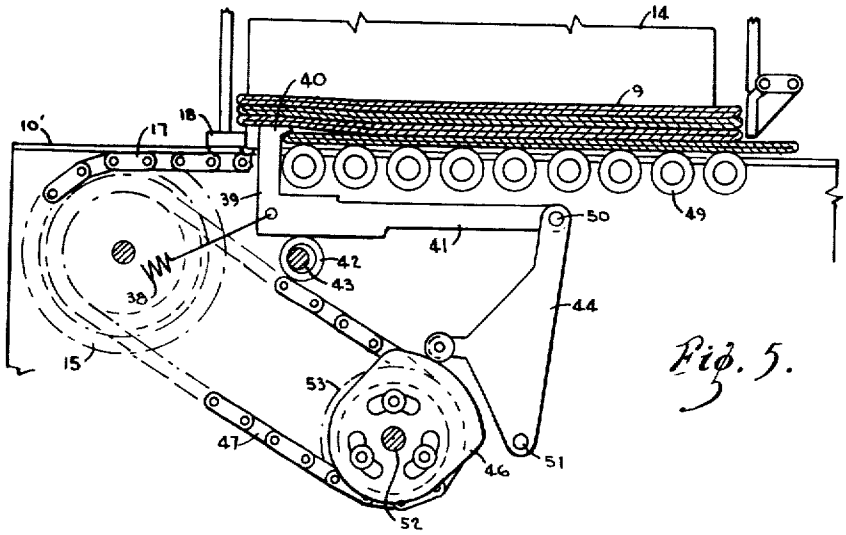


Fig. 5.

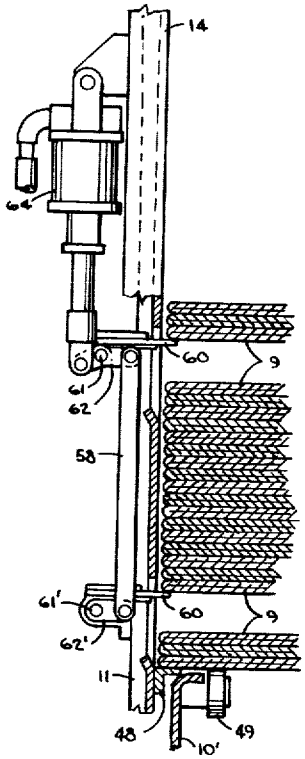


Fig. 6.

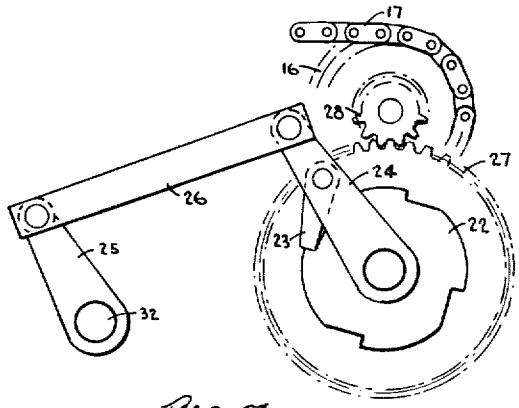


Fig. 7.

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PACKAGING MACHINE

Original Filed Oct. 9, 1959

15 Sheets-Sheet 6

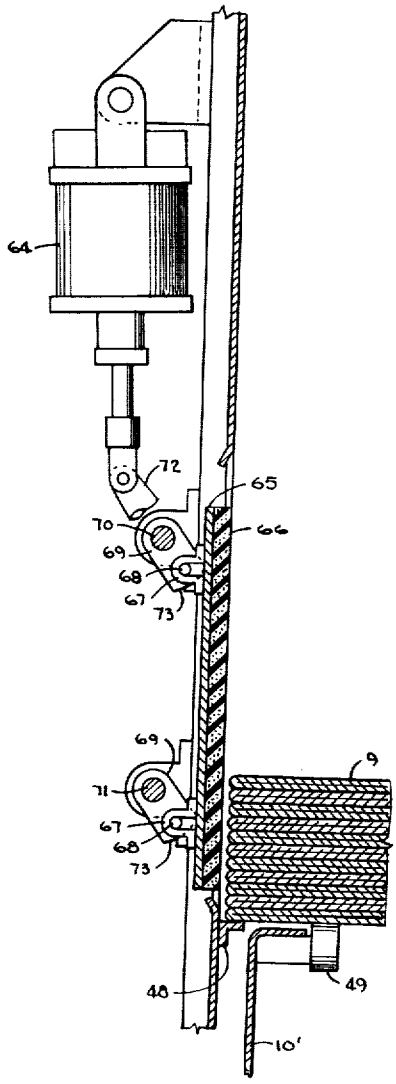


Fig. 8.

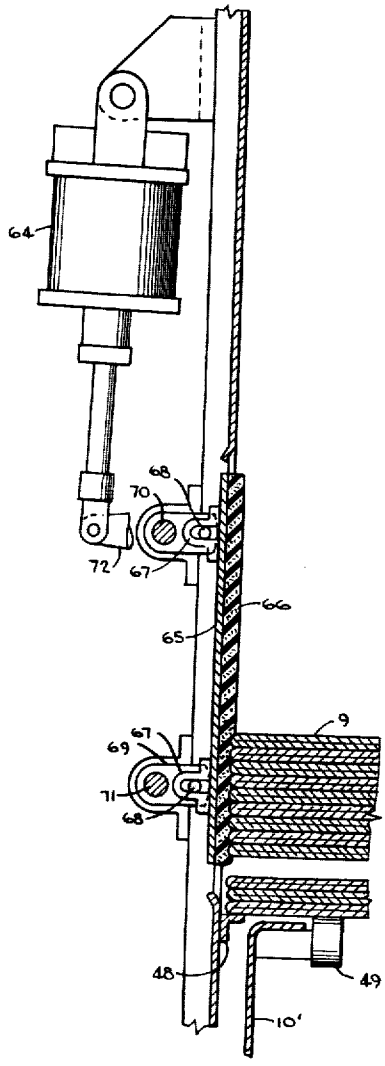


Fig. 9.

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July 16, 1963 J. L. NEAL ETAL 3,097,463

PACKAGING MACHINE

Original Filed Oct. 9, 1959

15 Sheets-Sheet 7

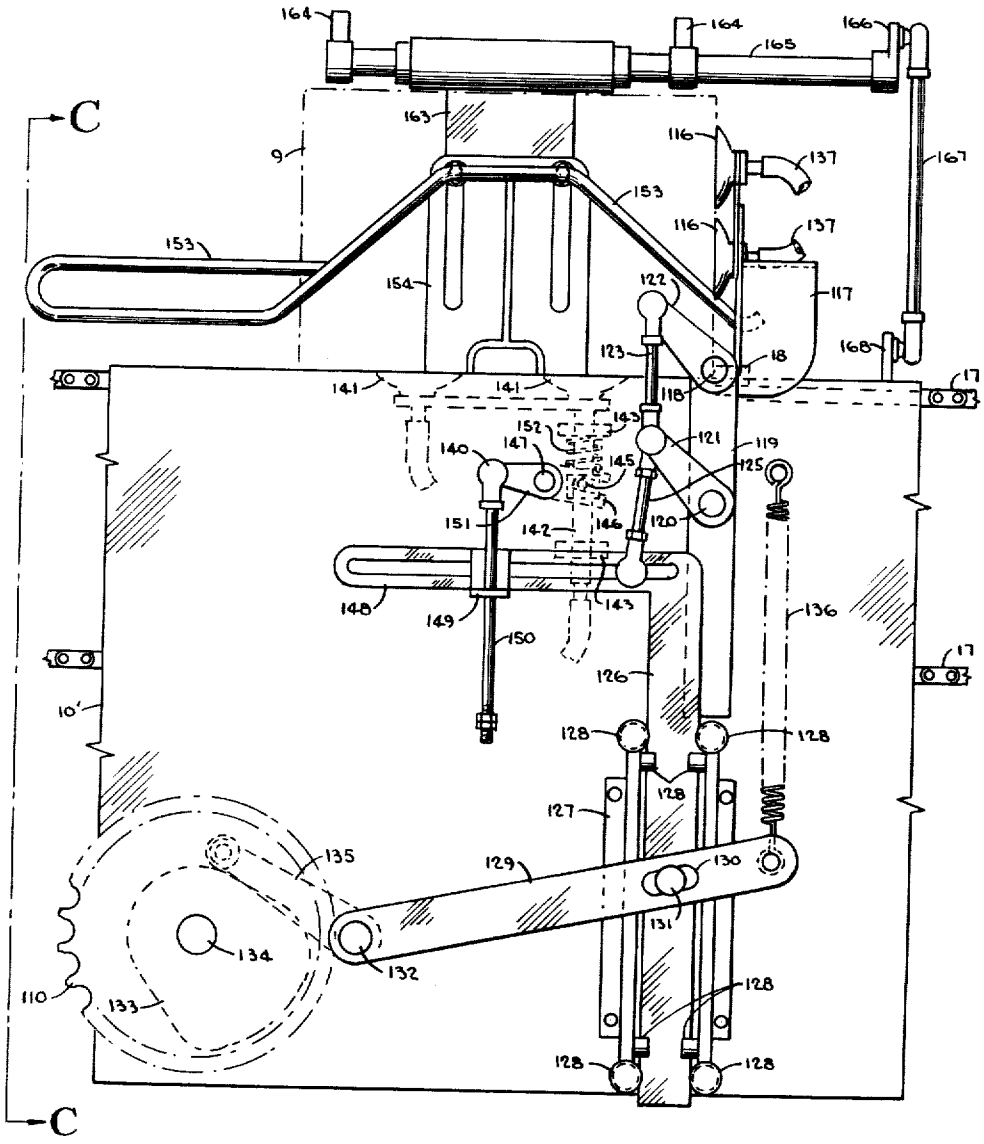


Fig. 10

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PACKAGING MACHINE

Original Filed Oct. 9, 1959 15 Sheets-Sheet 8

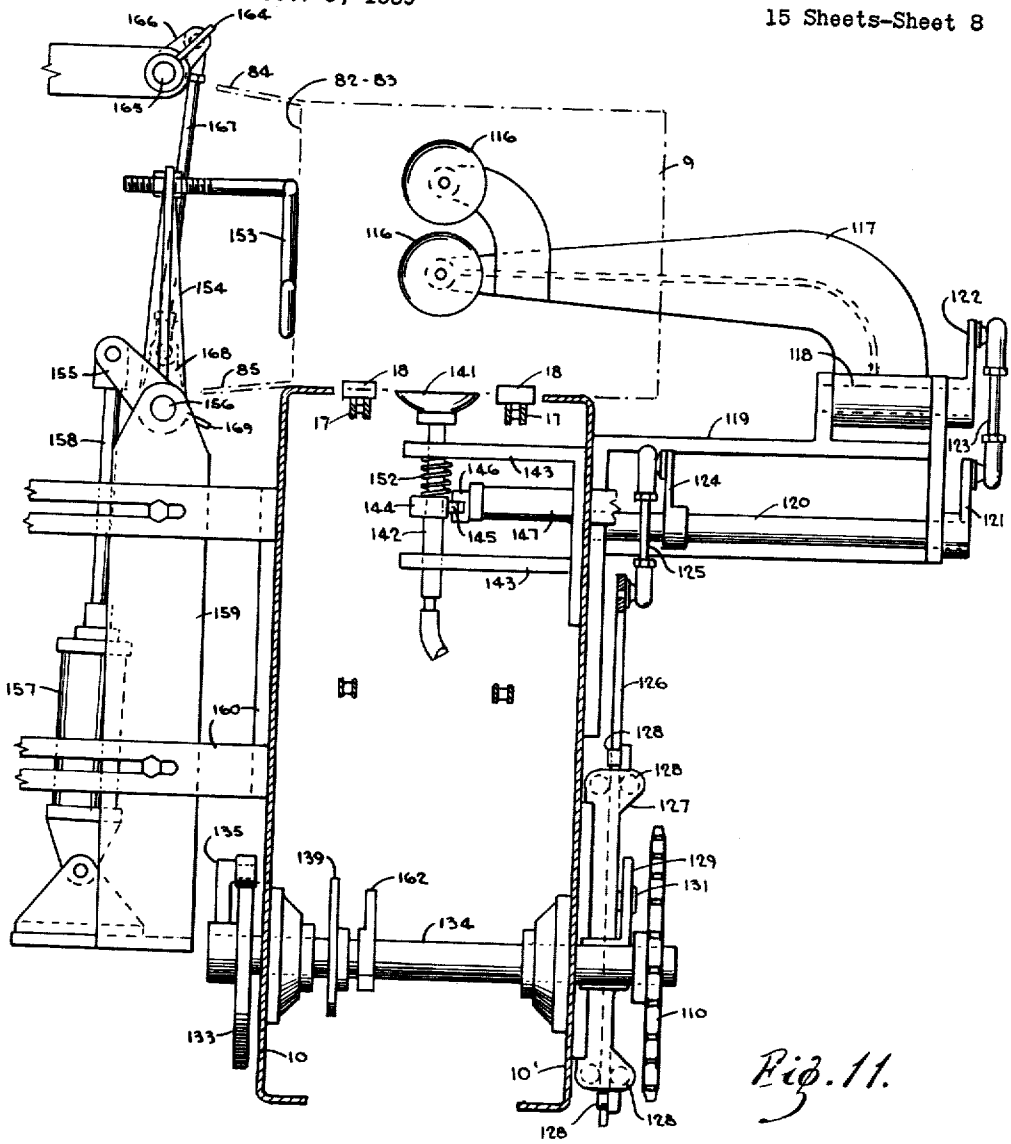


Fig. 11.

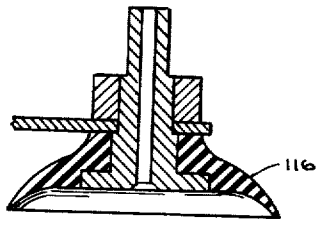


Fig. 12.

INVENTORS.
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PACKAGING MACHINE

Original Filed Oct. 9, 1959 15 Sheets-Sheet 9

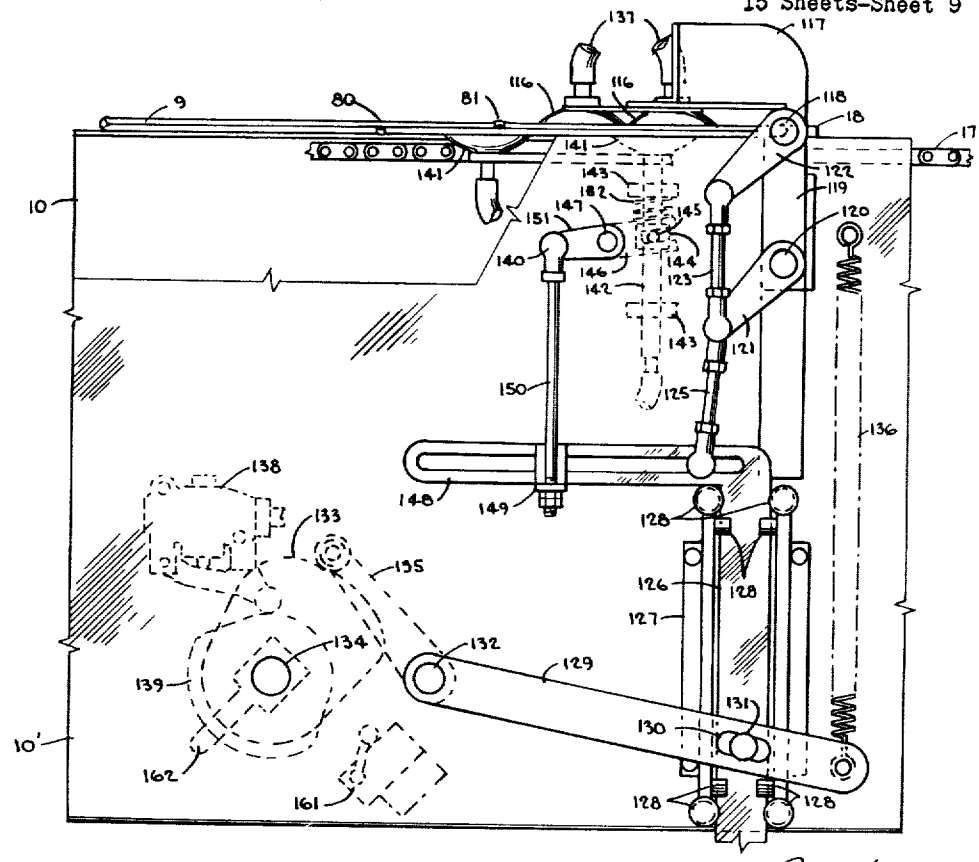


Fig. 13.

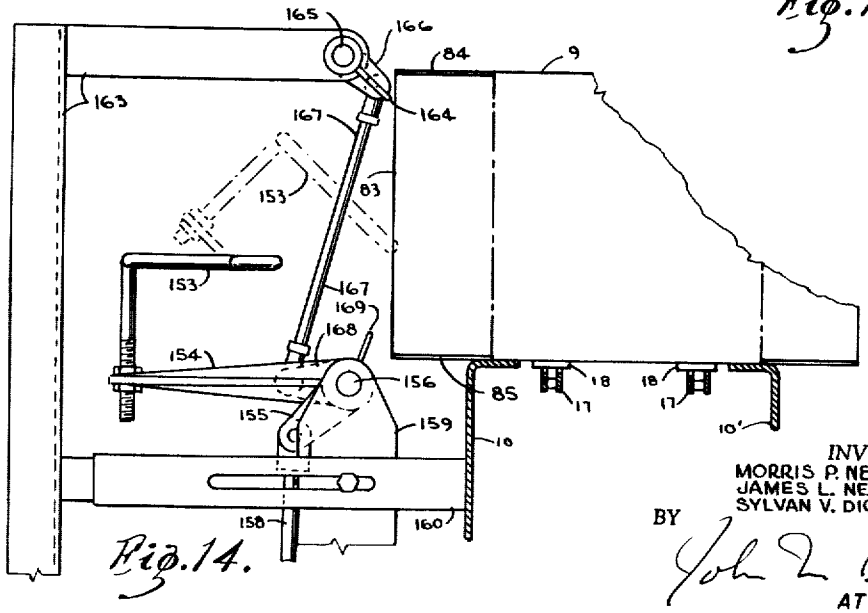


Fig. 14.

INVENTORS.
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PACKAGING MACHINE

Original Filed Oct. 9, 1959 15 Sheets-Sheet 10

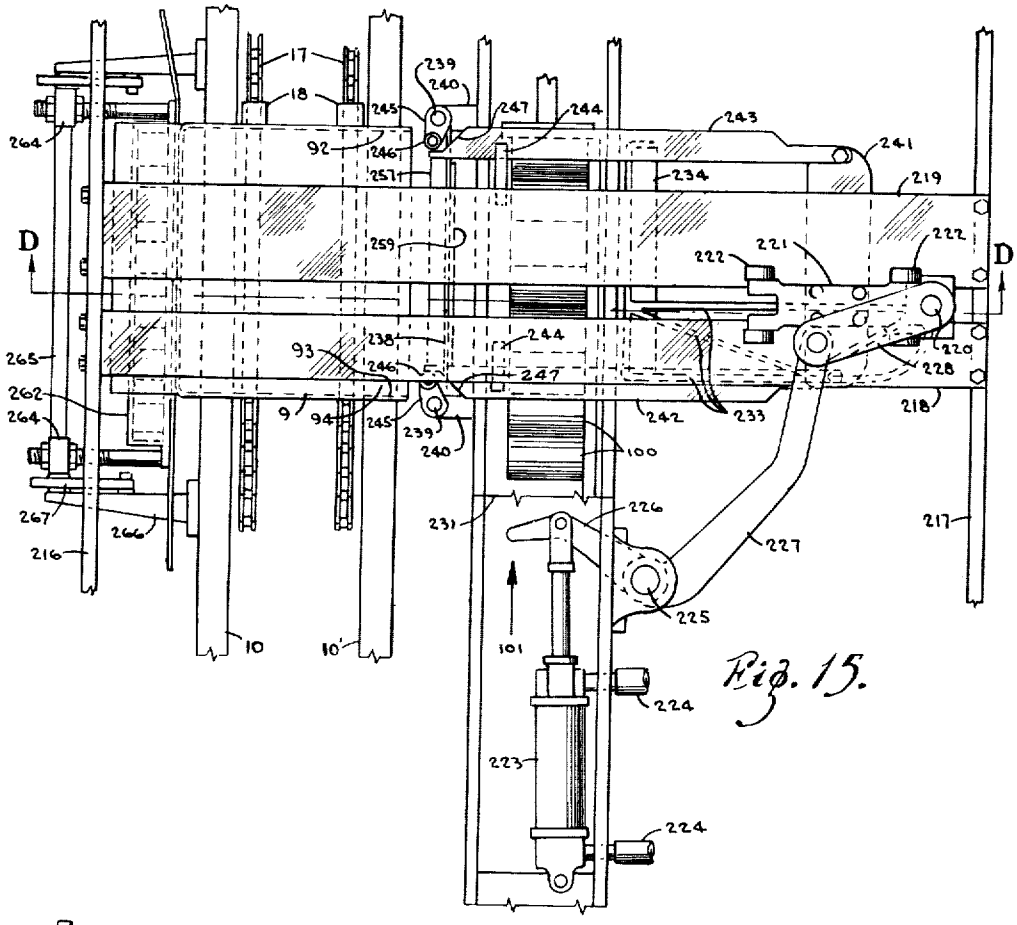


Fig. 15.

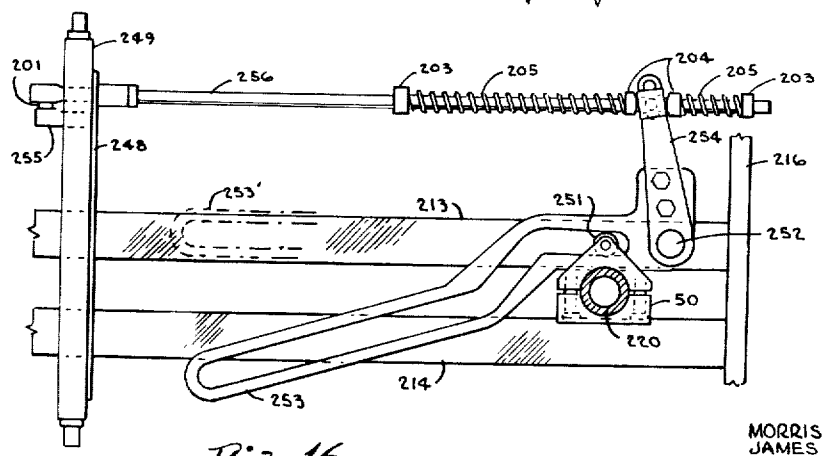


Fig. 16.

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PACKAGING MACHINE

Original Filed Oct. 9, 1959

15 Sheets-Sheet 11

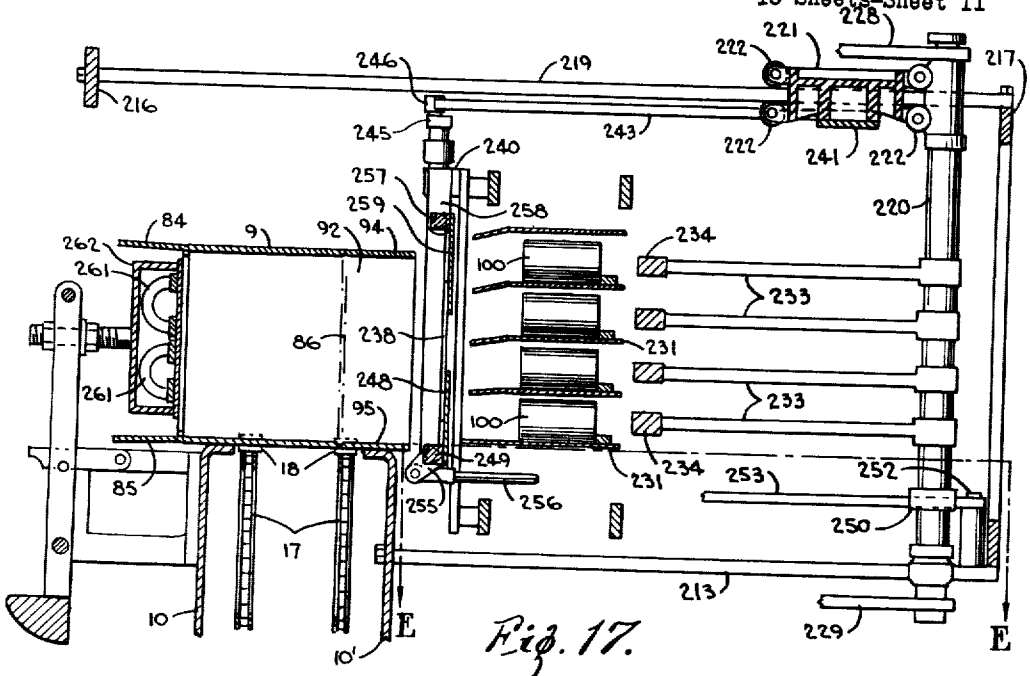


Fig. 17.

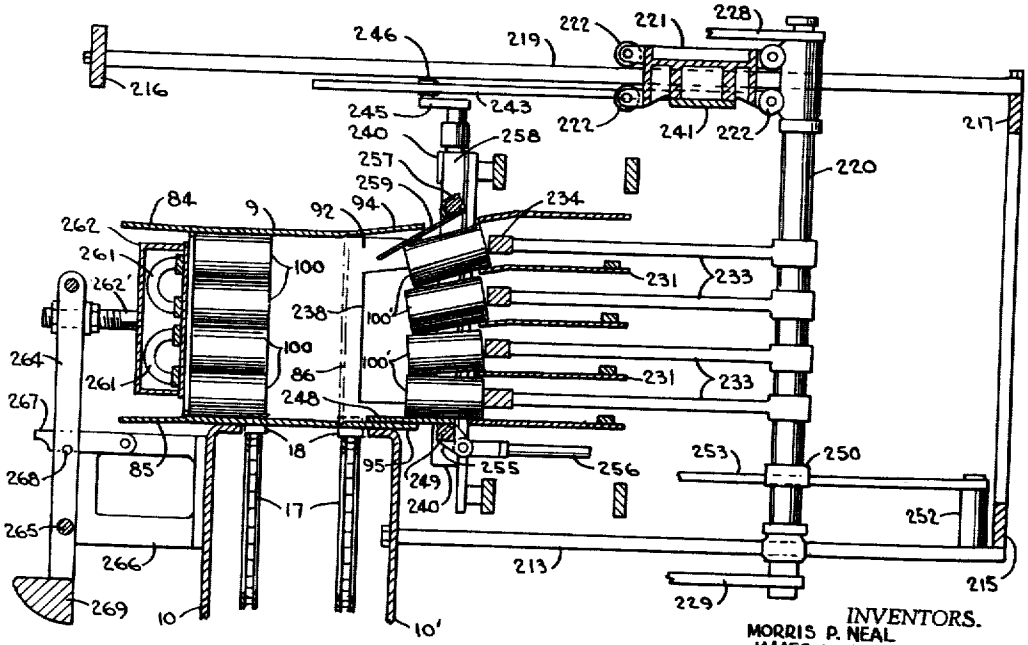


Fig. 18.

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July 16, 1963 J. L. NEAL ETAL 3,097,463

PACKAGING MACHINE

Original Filed Oct. 9, 1959 15 Sheets-Sheet 12

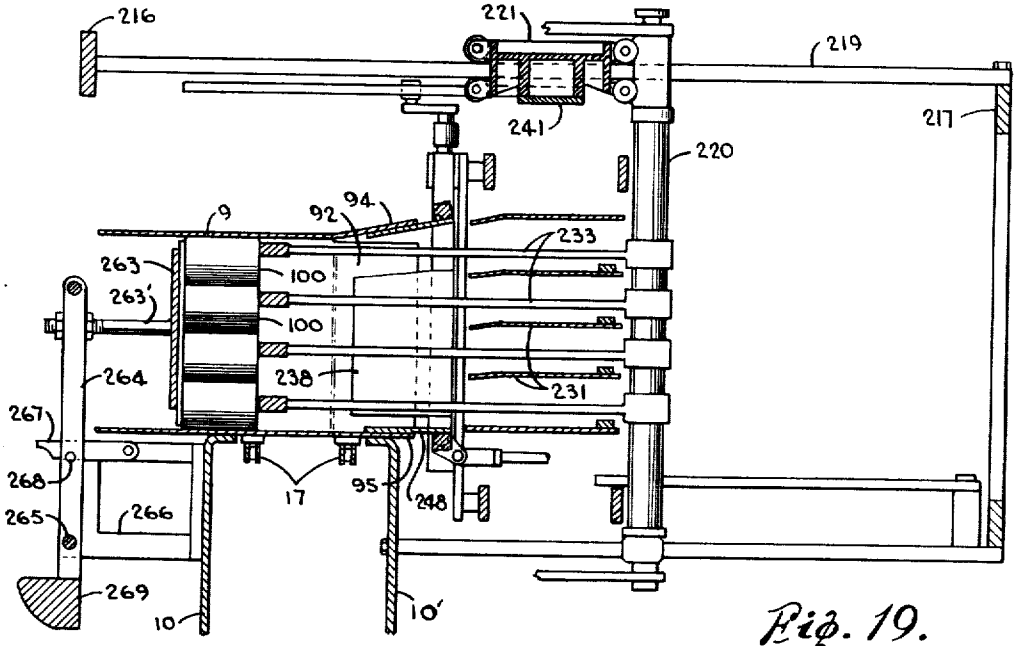


Fig. 19.

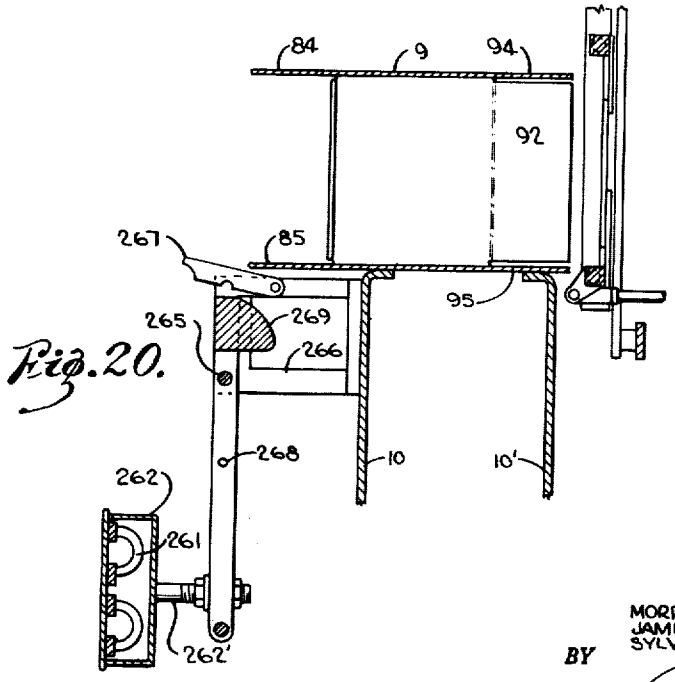


Fig. 20.

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PACKAGING MACHINE

Original Filed Oct. 9, 1959

15 Sheets-Sheet 13

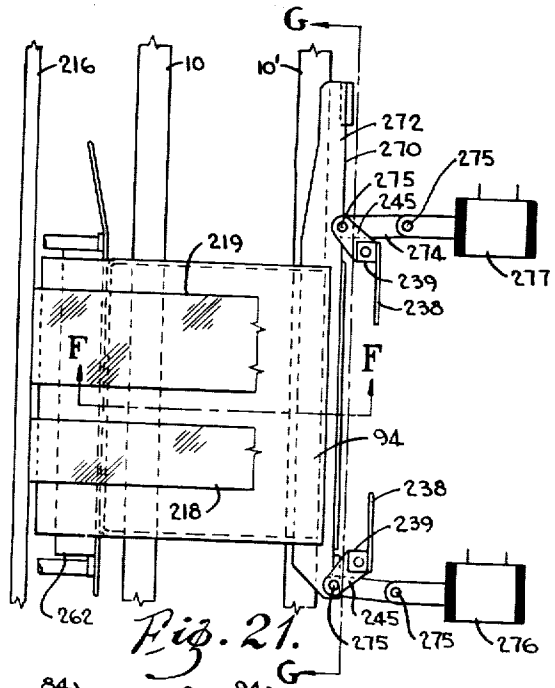


Fig. 21.

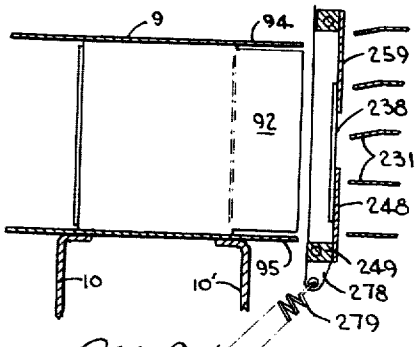


Fig. 24.

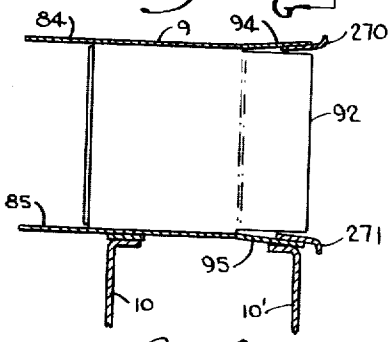


Fig. 22.

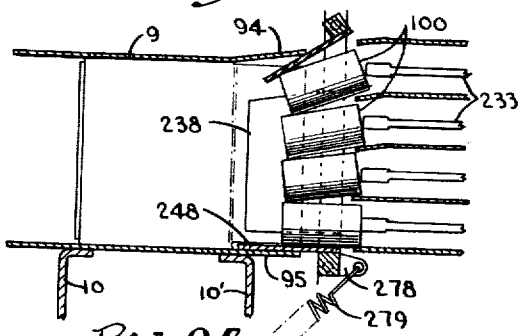


Fig. 25.

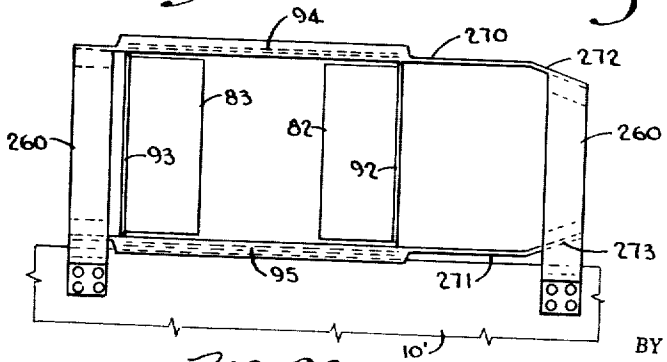


Fig. 23.

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July 16, 1963 J. L. NEAL ETAL 3,097,463

PACKAGING MACHINE

Original Filed Oct. 9, 1959 15 Sheets-Sheet 14

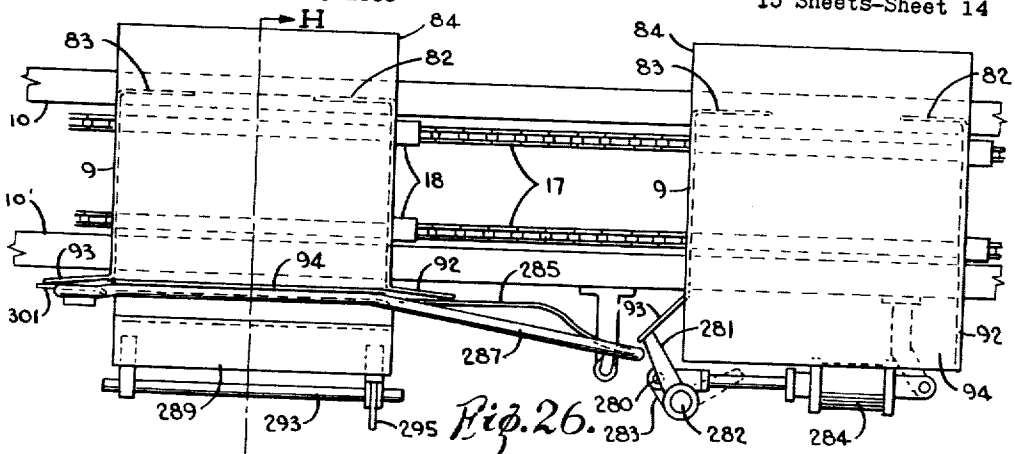


Fig. 26.

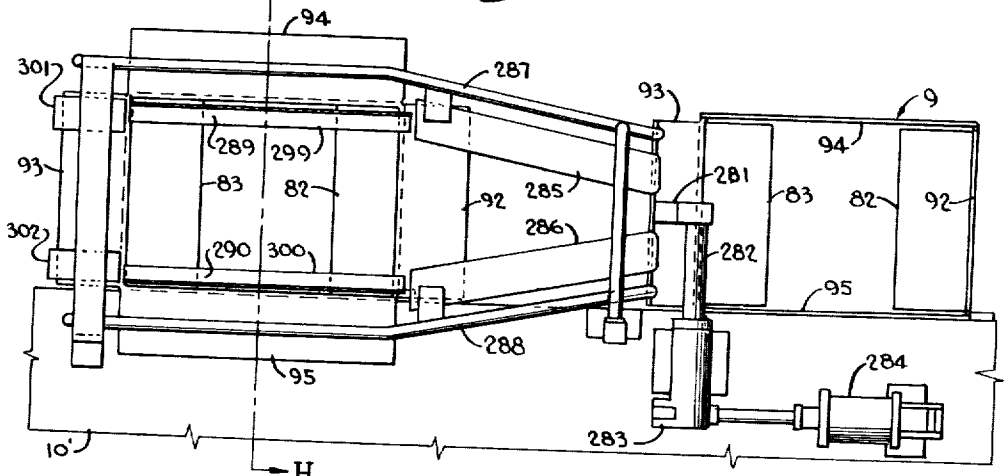


Fig. 27.

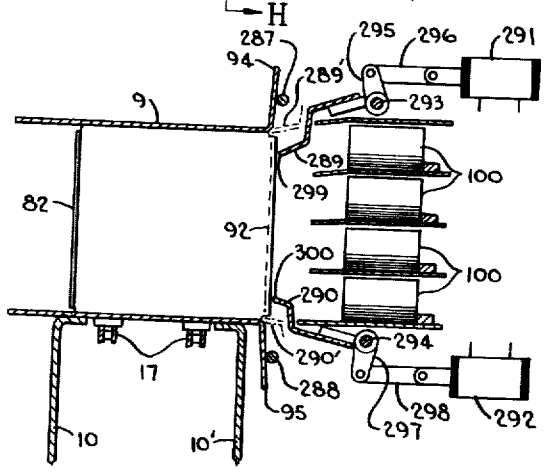


Fig. 28.

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PACKAGING MACHINE

Original Filed Oct. 9, 1959 15 Sheets-Sheet 15

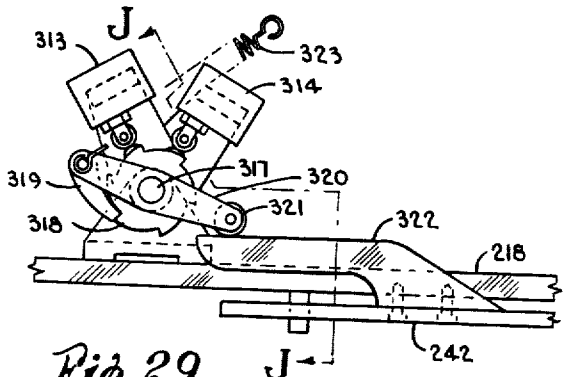


Fig. 29.

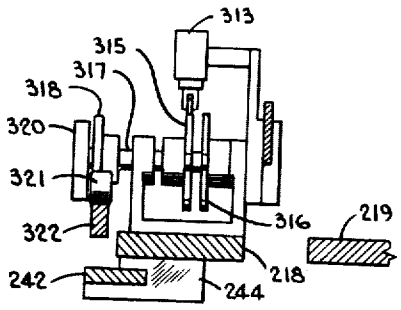


Fig. 30.

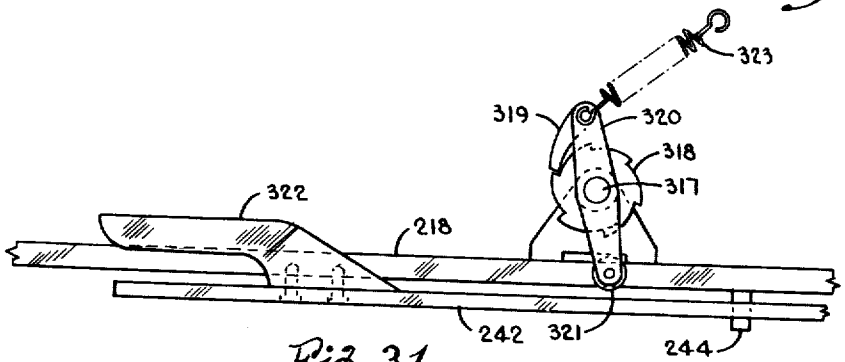


Fig. 31.

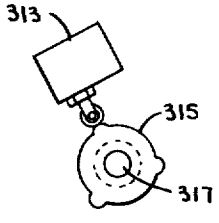


Fig. 32.

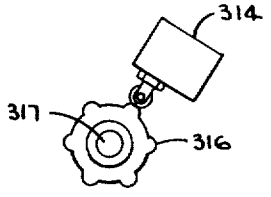


Fig. 33.

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United States Patent Office 3,097,463 Patented July 16, 1963

3,097,463

PACKAGING MACHINE

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Original application Oct. 9, 1959, Ser. No. 845,442. Divided and this application Aug. 29, 1960, Ser. No. 52,509

24 Claims. (Cl. 53—186)

This invention relates to a device for removing folded cartons from a pile, setting them up, loading cans into them and closing all the flaps of the cartons, at a high rate of speed and with an extreme minimum of jamming, skipping of cartons and other difficulties. The cartons may be of corrugated paper board and the cans may be empty or full.

This application is a divisional application of our pending application Serial No. 845,442, filed October 9, 1959.

The particular advantages of the device of our invention and the means whereby the objectives are accomplished are described below in connection with the detailed description.

The most important, outstanding and significant advantage of our machine is its extremely high rate of speed. The speed is so great that the machine can handle cases at a higher rate than cans can be fed into the machine, and can load cans into cases at a higher rate than cans can be introduced into the loading station. Therefore, it is a significant advantage of the machine and unique with respect to machines of this type that the machine has a speed which is limited only by the rate at which cans can be fed to the machine.

An object of the invention is to provide such a machine which will not fail or jam if one or more of the cartons in the pile which is fed to the machine are jammed or battered.

Another object is such a machine which operates at an especially high rate of speed with a minimum of malfunctioning.

Other objects will become apparent from the drawings and from the following detailed description in which it is intended to illustrate the applicability of the invention without thereby limiting its scope to less than that of all equivalents which will be apparent to one skilled in the art. In the drawings like reference numerals refer to like parts and:

FIGURE 1 is a partially schematic elevation of one embodiment of the machine of the invention, taken from what will be called herein, as a convention, the right hand side;

FIGURE 2 is a partially schematic plan view of the machine of FIGURE 1;

FIGURE 3 is a detailed elevation from the right hand side of the unpiling station portion of the machine of FIGURE 1;

FIGURE 4 is a partially cutaway and elevation of the portion of FIGURE 3, taken from the left end;

FIGURE 5 is a partial cross-sectional view of the portion of FIGURES 3 and 4 taken on line A—A in FIGURE 4;

FIGURE 6 is a fragmentary cross-sectional view taken on line B—B in FIGURE 3;

FIGURE 7 is a fragmentary enlarged cutaway elevation of a portion of the drive mechanism;

FIGURE 8 is a fragmentary cross-sectional view of a modification of the embodiment of FIGURE 6;

FIGURE 9 is a fragmentary cross-sectional view of the modified embodiment of FIGURE 8 wherein the elements thereof are in a different position;

FIGURE 10 is a fragmentary detailed elevation of the

setup station portion of the machine of the embodiment of FIGURE 1, taken from the lefthand side;

FIGURE 11 is a partially cutaway, cross-sectional detailed view of a portion of the embodiment of FIGURE 1 which is shown in FIGURE 10, taken on lines C—C in FIGURE 10;

FIGURE 12 is a detailed cross-sectional view of one of the elements of FIGURES 10 and 11;

FIGURE 13 is an elevation corresponding to FIGURE 10, of a portion of a mechanism of FIGURE 10 showing some of the elements thereof in a different position;

FIGURE 14 is a fragmentary cross-sectional view from the same point as FIGURE 11, of a portion of a mechanism of FIGURE 11 showing some elements of FIGURE 11 in a different position;

FIGURE 15 is a detailed plan view of the loading station portion of the embodiments of FIGURES 1 and 2;

FIGURE 16 is a fragmentary cutaway detailed plan view of a portion of the mechanism for operating one of the elements of FIGURE 15 taken on line D—D in FIGURE 15;

FIGURE 17 is a cross-sectional detailed view of the portion of FIGURE 15 taken on line D—D in FIGURE 15;

FIGURE 18 is a cross-sectional detailed view corresponding to FIGURE 17 showing some of the elements thereof in a different position;

FIGURE 19 is a partially schematic, partially fragmentary cross-sectional view of a modified embodiment taken from the same point as FIGURE 17;

FIGURE 20 is a fragmentary, cross-sectional view corresponding to FIGURES 17, 18, and 19, showing a portion of the elements thereof in a different position;

FIGURE 21 is a schematic plan view of a modified embodiment of a portion of the loading station;

FIGURE 22 is a fragmentary cross-sectional view taken on line F—F in FIGURE 21;

FIGURE 23 is a fragmentary elevation taken on line G—G in FIGURE 21;

FIGURE 24 is a fragmentary cross-sectional view of a portion of a modified embodiment of the loading station taken at about the center of the loading station;

FIGURE 25 is a fragmentary schematic cross-sectional view corresponding to FIGURE 24 showing a different position of part of the elements therein;

FIGURE 26 is a cutaway, fragmentary plan view of a modified embodiment of a portion of the loading station;

FIGURE 27 is an elevation of the modification of FIGURE 26;

FIGURE 28 is a cross-sectional view of the modification of FIGURES 26 and 27 taken on a plane corresponding to line G—G in each of FIGURES 26 and 27;

FIGURE 29 is a fragmentary elevation of switching mechanism;

FIGURE 30 is a cross-sectional view taken on lines H—H in FIGURE 29;

FIGURE 31 is a fragmentary view of a portion of FIGURE 29 plus additional elements, showing change of position;

FIGURE 32 is a fragmentary view of elements from FIGURES 29 and 30; and

FIGURE 33 is a fragmentary view of elements from FIGURES 29 and 30.

For convenience, the detailed description of the machine has been divided into sections devoted to several stations. At each of the stations a carton passing through the machine is maintained stationary for a certain length of time.

The first station comprises means for maintaining a pile of cartons and feeding cartons one at a time from the pile to the next station. It has been designated the "unpiling

station" and may also be referred to variously as the "magazine" station or "feeding" station. The second station is referred to as the "set up station" and at this station each folded carton is set up, that is, unfolded into rectangular form. It is also preferred to close two of the flaps at this station. Following the setup station, the case travels to the "loading station" where cans are loaded into the case. As a final step, loaded cases are removed from the loading station and one or more additional flaps may be closed. The loaded cases may then be transported to storage areas or to other machines by any sendable method.

No means are shown for maintaining the flaps closed, as by bonding or gluing with cement or adhesive or by fastening with staples or the like, but, if desired such means may be added to the machine or provided in a machine through which the cases may pass after leaving the machine of the invention.

The machine of the invention may be utilized in many instances to load empty cans into cases which are then not securely fastened shut but are transported to areas where the cans are filled, the cans first being removed from the cases, then filled and then reloaded into the cases whereupon the flaps of the cases are then sealed closed.

The main frame of the machine comprises right main frame member **10** and left main frame member **10'**.

The machine may be supported by tubular upright frame members **7** and tubular horizontal members **8** and held thereby in an angular position to cause cans **100** to roll or slide into the loading station by gravity.

In FIGURES 1 and 2 there are shown inclined tracks **331** down which cans **100** are fed into the machine. A part of the lowermost track **331** is a hinged plate **326** pivotally mounted on shaft **327**. The plate is forced downward by the weight of cans **100** to thereby close switch **328**. If there are no cans on plate **326** it is raised by the action of counterweight **329**, which opens switch **328** to stop the machine, by reason of switch **328** being wired in series with a control for the main drive of the machine.

Unpiling Station

At this station the machine maintains a pile of folded cartons each lying in a horizontal position and each piled one above another, removes one carton at a time from the bottom of the pile and feeds each such carton to the next station.

The frame of the magazine is provided by bars **11** and **12** which are supported by cross bars **13**, the lowermost three of bars **13** being attached to and supported by main frame members **10** and **10'**. Cross bars **13** are threaded to permit adjustment of the lateral spacing of bars **11** to accommodate various sizes of cartons.

To the bars **11** are attached walls **14** which hold the pile of folded cartons in lateral position. The bars **12** hold the cartons in fore or aft position.

Between frame members **10** and **10'** are sprockets **15** and **16** which carry chains **17**. Attached to chains **17** are lugs **18** which carry the cartons from one stage to the next along main frame members **10** and **10'**. A second chain **19** is mounted in a frame **20** and has lugs **21** thereon which move from stage to stage simultaneously with lugs **18**. The chain **19** is driven intermittently from ratchet wheel **22** thru gear **27**, pinion **28**, sprocket **33**, chain **34**, gears **35** and **36** (which reverse the direction of rotation) and chain **37**, as shown in FIGURE 1.

The intermittent movement of chain **17** is obtained by means of the ratchet wheel **22** and pawl **23** mounted on arm **24** (see FIGURES 1 and 7). Arm **24** is driven by crank **25** acting thereon, crank **25** being driven by main drive motor **29** which drives chain **30** which passes over sprocket **31** attached to shaft **32** to which crank **25** is firmly attached. The ratchet wheel **22** drives gear **27** engaging a pinion **28** fastened to the shaft of sprocket **16**. The gear ratio is 4 to 1, so that 90 degree rotation of the ratchet wheel will cause one complete turn of sprocket **16**.

Before lugs **18** engage a folded carton, and to make sure that only one carton is carried forward at a time, additional driving means is provided, as shown especially in FIGURE 5 and also in FIGURES 3 and 4, to select one carton and position it for the lugs to carry forward. This means comprises arm **39** and finger **40**. Arm **39** is mounted on a bar **41** which is held by spring **38** downwardly against roller **42** adjustable for height by rotation of rotatable eccentric shaft **43**. Bar **41** is reciprocated by arm **44** which is pivotally attached at **50** to arm **41** and pivotally mounted on fixed shaft **51**. Cam follower roller **45** is attached to plate **44** and driven by cam **46** to impart motion to plate **44**. Cam **46** is rotatably driven at a speed determined from that of main chains **17**, by reason of drive chain **47** being driven by a sprocket mounted on the shaft on which sprocket **15** is mounted.

Arm **39** is shown in FIGURE 3 in a retracted position. Finger **40** may be wedge shaped as shown and when the arm is carried forward by the cam, as shown in FIGURE 5, finger **40** can separate the lowest carton from the carton next above at its rearward edge. Arm **39** can then carry it forward to break any adhesion between the lowest carton and next carton.

Cam **46** may be rotatably adjustable on shaft **52** in relation to sprocket **53** which is rigidly affixed to shaft **52** and driven by the chain drive **47**. Such adjustment permits timing of the drive so that the separating action of finger **40** and driving action of arm **39** take place just before the lugs **18** begin to drive the carton forward.

Folded cartons **9** may be partly supported by angle members **48** as shown in FIGURE 6, but the greater part of the weight of the pile of cartons **9** may be carried by the rollers **49** to reduce the force required to drive each bottom carton forward out from under the pile and thereby prevent damage to the edge of the cartons by the driving lugs **18**.

To further reduce the force required to slide each bottom carton out from under the pile, lifting plates **60** and **60'** may be placed at each side of the magazine. These plates may be fixed to bars **61** and **61'** pivotally mounted in bearings **59** and **59'** and can be turned by cranks **62** and **62'** through an angle of 45 degrees. The plates **60** and **60'** are shown in their inoperative position in FIGURE 4. In FIGURE 6 the plates are turned to their lifting position in which they lift the cartons **9** while the lowest carton is removed; then the plates are returned to the position in FIGURE 4 to allow the cartons to feed downward.

Cranks **62** and **62'** may be operated by compressed air cylinders **64** which act directly against cranks **62** which in turn drive cranks **62'** through links **58**. The air to the cylinders may be regulated by suitable valves and cams (not shown), but driven by chain **17**. The return stroke of each cylinder may be made by the action of an internal spring within each cylinder.

In the alternative method of lifting the folded cartons as shown in FIGURES 8 and 9 there may be provided at each side of the magazine a plate **65** having at its inner surface a layer of foam rubber or like spongy material **66**. Plates **65** may be supported by slotted brackets **67** mounted on pins **68** carried by arms **69**. Arms **69** may be fixed to shafts **70** and **71** and the upper shaft **70** may have an arm **72** connected to a cylinder **64**.

When air is admitted to cylinder **64**, arms **69** move plates **65** inward and upward. Arms **69** may have cylindrical surfaces **73** so that when the plates **65** reach the position shown in FIGURE 9, the plates are moved upward only, with the cylindrical surfaces **73** maintaining a constant pressure on the plates to lift the cartons. Plates **65** and brackets **67** form the connections by which the lower arms are caused to follow the movement of the upper arms, that is, serve the function of links **58** in the embodiment of FIGURES 3, 4 and 6.

Set-Up Station

At this station the cases are unfolded and two of the flaps may be closed. The chains **17** carrying lugs **18** are driven by an intermittent motion which causes the cases to stop at the set-up station while these operations are performed.

The cases are formed with cutway parts to form flaps as shown at points **80** and **80** (FIGURE 13). The cases are also formed with creases at **80** and **81** so that they will hinge at these points in being set up.

To lift the end wall of the case, vacuum cups **116** are mounted on a swinging arm **117**. The arm **117** is mounted on a shaft **118**, the center of which is coaxial with the rear hinge point of the case when the case is carried into temporarily stationary position at the set-up station by the lugs **118**.

The arm **117** and shaft **118** are carried by a bracket **119** which may be supported by frame member **10'**. To operate the arm **117**, a second shaft **120** may be mounted in bracket **119** and the shafts may have crank arms **122** and **121** attached respectively thereto. Link **123** may be pivotally attached to the ends of arms **121** and **122**. Shaft **120** may also carry crank arm **124** having link **125** pivotally attached thereto at its outer end. The link **125** may be pivotally attached at its other end to slide bar **26** which may be supported by guiding member **127** which is provided with a series of rollers **128** to reduce friction when the bar **126** is moved by arm **129** which is provided with slot **130** which receives stud **131** fixed to bar **126**.

Lever **129** may be securely fixed to a shaft **132** rotatably mounted in the frame and shaft **132** may be oscillated by a cam **133** mounted on a shaft **134** which is rotatably mounted in the frame so that cam **133** drives lever **135** firmly fixed to shaft **134**.

The action of cam **133** through levers **135** and **129** and stud **131** may drive the bar **126** downward to swing the arm **117** and vacuum cups **116** down on to the folded carton in the position shown in FIGURE 13, acting through the linkages previously described. The downward movement of lever **129** also increases the tension in the spring **136** which has one end connected to the lever **129** and the other end connected to the frame.

Vacuum cups **116** may be connected through tubes **137** (only partly shown for simplicity) to vacuum pump **115** (FIGURE 1). By means of valve **138** whch may close and open tubes **137** vacuum cups **116** are enabled to hold or release the carton as the valve **138** is operated by cam **139** on shaft **134**.

The cycle of operations is therefore: first, a case or carton **9** is carried to the position shown in FIGURES 13 and 14. The arm **116** is then brought downward so that vacuum cups **116** are pressed onto the upper surface of the case. Then valve **138** opens so that vacuum is applied to the cups. The cam **133** then releases the arm **135** and the spring **136** raises the lever **129**. By means of the connecting links and levers the arm **117** is hingeably moved to the position shown in FIGURES 10 and 11 and the vacuum cups bring the upper side of the case to a vertical.

While one side of the case is being raised it is desirable to hold down the lower side of the case with vacuum cups **141** which are positioned below the case. Cups **141** are mounted on a sliding tube **142** supported by brackets **143**. On the tube **142** is a block **144** provided with a stud **145**. Tube **142** extends through a helical compression spring **152** which bears upwardly against the uppermost of brackets **143** and downwardly against block **144**. A forked lever **146** engages the stud and the lever **146** is fixed as a crank arm to a shaft **147**.

The slide bar **126** has an extension **148** carrying a lug **149**. Rod **150** is pivotally connected at **140** to crank arm **151** on shaft **147** and extends slidably through lug **149**. At the lower end of rod **150** are nuts positioned so that when the extension **148** is at the lowest point of travel,

the lug **149** will act thereagainst to pull rod **150** downward and thereby raise the cups **141** up firmly against the lower side of the case **9**. This movement also compresses spring **152** between block **144** and upper bracket **143**.

When cam **133** releases arm **135** and permits spring **136** to raise lever **129**, it also allows spring **152** to force downward block **144**, tube **142** and vacuum cups **141**. The vacuum cups move only a small distance and hold the lower side of case **9** firmly down against the frame members **10** and **10'** while the upper side is forced into set-up position by cups **116** but they preferably do not move far enough downward to break the vacuum of the cups.

After the case has been set-up to the position shown in FIGURES 10 and 11, two of the vertical flaps shown as flaps **82** and **83** may be closed by arm **153**. Arm **153** may be mounted on one end **154** of a bell crank extended from shaft **156**. The other end **155** of the bell crank may be connected to an air cylinder **157** by a rod **158**. Shaft **156** and cylinder **157** may be supported by a frame **159** attached to frame member **10**. Compressed air is admitted to cylinder **157** through tubing (not shown) extending from switch **161** to the cylinder and is controlled by a valve opened at the correct time by switch **161** which is operated by arm **162** on shaft **134**.

Arm **153** is shown in retracted position in FIGURE 14. This figure also shows the arm in dotted outline in a position about halfway through its stroke. FIGURES 10 and 11 show the arm in the position of having closed the flaps.

The case is formed with upper and lower flaps shown as **84** and **85**. It is desired to spread these flaps outward during at least the initial portion of the time of closing the vertical flaps **82** and **83**. To lift flap **84**, fingers **164** are mounted on a shaft **165** which is mounted on bracket **163** which is rotated by an arm **166** and rod **167**. The rod **167** is moved by an arm **168** on shaft **155**. Another pair of fingers, one of which is shown at **169**, is carried by shaft **155** to press down the lower flap **85**. The fingers **164** and **169** are positioned so that they engage upper and lower flaps **84** and **85** and push them out of the way just before arm **153** begins to close the vertical flaps.

Shaft **134** is driven by a sprocket **110** timed to operate in conjunction with chains **17**, so that the set-up operation is performed while chains **17** are not in motion.

Loading Station

In FIGURES 15 and 17 a carton and cans are shown in position for loading. In FIGURE 18 part of the loading action is shown as having been completed. In FIGURE 19 the cans are shown as having been forced fully into the carton by loading rams. In FIGURE 20 there is shown the manner in which a portion of the machine may be swung outward to permit a case to be removed.

In the modified embodiment of FIGURES 21, 22, and 23, two flaps may be plowed open as the carton is moved along the frame prior to reaching the loading station. In FIGURES 24 and 25 and also in FIGURES 26, 27 and 28 there are shown additional modified embodiments.

Referring now to FIGURES 15, 16, 17 and 18, attached to main frame members **10** and **10'** there may be provided horizontal bars **213** and **214** (FIGURE 16).

Longitudinal bars **215** and **216** and **217** are supported parallel to members **10** and **10'** by bars **213** and **214** which extend horizontally from member **10'** to bar **215** and by bracket members, not shown, but attached to the frame members **10** and **10'**. Two horizontal guide plates **218** and **219** extend between bar **216** and bar **217**.

Carriage **221** is supported by plates **218** and **219** and can move laterally along the plates on wheels **222** above and below the plates which also serve to cause tube **220** which depends downward from the carriage, to be maintained in a vertical position. Tube **220** may also be guided at its lower end by bars **213** and **214** between which it extends.

To move the tube **220** laterally a double acting cylinder **223** is provided. The cylinder is operated by compressed air supplied to tubes **224** from air valves, not shown, but operating in conjunction with movement of the chains **17**.

Cylinder **223** may rotate a vertical shaft **225** thru arm **226** firmly attached to the shaft. Fixed to the upper and lower ends of shaft **285** are arms **227** pivotally connected to links **228** and **229** which are pivotally connected to tube **220**. When the cylinder is operated it therefore moves the tube **220**, by means of the arms **227** and links **228** and **229**, along the guide bars toward the carbon.

Furthermore, lever **211** (FIGURE 1) is operated by carton **9** to close switch **212** and thereby indicate that a carton has arrived at the loading station; switch **212** is installed as an interlock with the switch (not shown) which governs the operation of cylinder **223**, so that rams **233** will not operate to drive cans into a carton unless a carton is present at the loading station to receive the cans.

The cans **100** are supported by a series of decks **231** which are the bottom surfaces or members of runways of tracks in which cans are fed to the machine. The decks form inclined planes so that the cans are fed by gravity in the direction of the arrow **101** (FIGURE 15).

Vertical tube **220** has attached to it a series of rams **233**, each of which has a wide end at **234** to push against a number of cans. The rams are spaced to fit between the decks and therefore when the tube **220** is moved thru its stroke the cans are pushed into the carton.

As shown in FIGURES 15, 17 and 18 the carton **9** has foldable vertical flaps **92** and **93** and foldable horizontal flaps **94** and **95**. To make sure that these flaps are wide open and to provide a funnel for entrance of the cans to maintain correct orientation of the cans and prevent jamming, a series of hinged smooth plates are positioned at the entrance to the carton.

Two of these funnel plates **238** are attached to vertical shafts **239** which are journaled in brackets **240**. Attached to carriage **221** is plate **241**, to which are attached cam bars **242** and **243**. The cam bars are also supported by guides **244**. Shafts **239** have attached to their upper ends, cranks **245** which have at their ends rollers **246**. Cam bars **242** and **243** have cam surfaces **247** at their ends which are adapted to move rollers **246** so that when tube **220** is moved thru the first part of its stroke, the cam bars cause shafts **239** to turn thru 60° to 90°. This rotation of shafts **239** brings the funnel plates **238** against flaps **92** and **93** and into the carton as shown in FIGURE 18 to provide smoothly converging sides to guide the cans into the carton.

To provide a smooth entrance for the cans at the lower side of the carton plate **248** may be mounted on square horizontal shaft **249** which may be rotated by the linkage shown in FIGURE 16. Tube **220** carries a bracket **250** which is provided with a roller **251**. Stud **252** on bar **213** pivotally supports slotted arm **253** and roller **251** operates in the slot of arm **253**. The slot is shaped so that the first part of the stroke of the tube **220** does not operate the arm; the second part of the stroke moves the arm to the position shown in dotted lines **253'** and the third part of the stroke does not move the arm. Arm **253** has attached to it arm **254**. Shaft **248** has attached to it crank arm **255** which is connected to arm **254** by rod **256**, one end of which is pivotally connected to arm **254** by rod **256**, one end of which is pivotally connected to crank **255** at **201**. Collars or blocks **203** are firmly fixed to rod **256** and collars or blocks **204** are slideably mounted thereon; interposed between collars **203** and **204** are springs **205**. Arm **254** is provided at its end with an aperture through which rod **256** passes so that collars **204** are urged against opposite sides of the end of arm **254** by springs **205**. When arm **253** is moved it will therefore turn shaft **249** thru 60° to 90° to bring plate **248** down on flap **95** so that plate **248** then provides a smooth runway for the cans **100** to slide on.

Near the upper surface of the carton may be another square shaft **257** rotatably mounted in brackets **258**. Shaft **257** carries plate **259** which normally hangs in a vertical position by gravity. As the cans are forced into the carton the upper layer of cans force the plate **259** under the flap **94** to open it somewhat and assure smooth entrance of the cans.

One of the features of the machine of our invention is that it can load one layer of cans into a carton, or, by adjustment, load two layers of cans into a carton as indicated in FIGURE 18. To accomplish the latter the rams are caused to make two loading strokes while the carton remains in the position shown. The distance moved in the loading stroke by rams **233** may be the same for loading both the first and second layer of cans, the ends of the rams being approximately at line **86** which is the hinge point of the carton flaps at the end of each stroke. Accordingly, the stroke of the rams is not long enough to drive the first layer cans fully into the carton. To cause the first layer of cans to travel the remaining distance into each carton, they may be given a sufficiently high velocity by the rams that inertia carries them at least part of the remaining distance and may be provided in a housing **262** against which the carton rests to create a magnetic field which may act on the cans to cause them to travel the entire distance into the carton.

Thus, as shown in FIGURE 18 a first layer of cans **100** after being loaded into the carton may be held in place by magnets **261** while a second layer of cans **100'** is being forced past the funnel plates by rams **233**.

A preferred sequence of operations may thus be as follows:

A carton is carried into position by chains **17** and lugs **18** and operates lever **211** to close switch **212** (FIGURE 1) and cause the cans resting on hinged portion **326** of lowermost deck **331** to maintain switch **328** closed. The air cylinder **223** begins to move tube **220** and carrying rams **233**. The cam surfaces **247** of cam bars **242** and **243** turn funnel plates **238** so that plates **238** extend into the carton and force carton flaps **92** and **93** somewhat outwardly. Shaft **249** is turned to cause plate **248** to hold down flap **95** and extend into the carton as a ramp on which the cans can travel. The cans are pushed forward by rams **233** and they force plate **259** into the position shown in FIGURE 18 to guide cans into the carton. At the end of the ram stroke rams **233** stop moving toward the carton but the cans due to their inertia continue to move into the carton.

As the cans leave rams **233** and travel into the carton, toward the closed flaps **82** and **83**, they may enter the field of magnets **261** and be drawn with rapidly increasing force, as they approach the magnets, toward and against flaps **82** and **83** and may be held thereagainst by the field of said magnets acting thereupon.

After the return stroke of the rams, a second layer of cans may be fed along the inclined surfaces of the decks and into position to be carried by a second stroke of the rams into the carton. The carton is then carried away by the chains and the next carton brought into position.

Referring now to FIGURE 19 there is shown a modified embodiment wherein the rams have sufficient stroke to force the cans fully into the carton. In this case no magnets are used but a plate **263** holds the carton in position.

Magnet housing **262** or plate **263** is supported so that it can be swung out of position to permit sidewise manual removal of a case **9** from the loading station if this should be necessary due to jamming of the cans in the case or other malfunction at the loading station.

Arms **264** are attached to housing **262** or plate **263** by members **262'** or **263'** and are hingably supported on hinge bar **265** mounted in bracket **266**. Arms **264** are normally held upright by latch **267** on pin **268**. The latch

can be raised and the frame swung outward as shown in FIGURE 20. Counter weight **269** may be attached to arms **264** to balance the weight of magnets **261** and housing **262** or the weight of plate **263** and thus facilitate raising the unit back to the upright position.

In FIGURES 21, 22 and 23 there is shown means for plowing outward the upper and lower horizontal flaps of the case in place of utilizing plates **248** and **259** and the mechanism for operating them. Plates **270** and **271** are supported by suitable brackets **260** which may be attached to **10'**. The plates have inclined surfaces at **272** and **273** and when a case is carried along the frame by lugs **18** the horizontal flaps **94** and **95** of the case are plowed open by plates **270** and **271**, which thereupon act as funnel members to direct cans into the carton. Side funnel members may be provided by plates **238** which may be operated through links **274** pivotally attached at points **275** by solenoids **276** and **277**, as an alternative to being operated by cams **242** and **243**.

As shown in FIGURES 24 and 25, plate **243** mounted on shaft **249** may be operated by utilizing a spring in place of the mechanism of FIGURE 16. Shaft **249** may be provided with crank arm **278** having tension spring **279** attached to the end thereof so that plate **248** is normally held upright by the action of spring **279**. When cans are forced into the case as shown in FIGURE 25, plate **248** is forced by the cans toward a horizontal position and holds down the case flap **95** and provides a smooth ramp or funneling member to guide the cans **100** into carton **9**.

Referring now to FIGURES 26, 27 and 28, flaps **92**, **93**, **94** and **95** may be moved out of the way of entering cans by mechanism operating at both the set up station and the loading station and also between these two stations.

The forward end flap **93** is first opened to a position where it can be plowed back. This is accomplished at the set up station by an arm **281** mounted on a shaft **282** supported by the frame. Connected to the shaft **232** is an arm **283** operated by a cylinder **284**, the piston of which is pivotally connected to the outer end of arm **283** at **280**. Cylinder **284** may be connected to the source of air which operates air cylinder **151** to tuck in flaps **82** and **83** as shown in FIGURES 14 and 11 and cylinder **284** may thus be operated simultaneously with cylinder **157**.

As the case is moved forward by chains **17** the vertical flaps **92** and **93** may then be plowed back by plates **285** and **286** and then held open by edges **299** and **300** of plates **289** and **290** until the case moves to the position where flap **93** is held open by plates **301** and **302**. Horizontal flaps **94** and **95** are plowed open by inclined bars **287** and **288** and thus when the case reaches the loading position all four front flaps are open.

Vertical flaps **92** and **93** are held open as the case passes the loading station by edges **299** and **300** of movable plates **289** and **290** which prevent these flaps from returning to their previous position. Plates **289** and **290** are fixedly attached to shafts **293** and **294** which are journaled in brackets not shown and are provided with crank arms **295** and **297**. These arms may be acted on by solenoids **291** and **292** through links **296** and **298**, each pivotally connected at each end, to rotate shafts **293** and **294**. After the case **9** is in position for loading at the loading station and before cans **100** begin to enter the case, the plates **289** and **290** are moved to the position shown by lines **289'** and **290'** by solenoids **291** and **292** while flaps **93** and **92** are held in open position respectively by plates **301** and **302** and by plates **285** and **286**.

In FIGURES 29, 30, 31 and 32 and 33 there is shown means whereby rams **233** may be caused to operate either once or twice while a case is at the loading station to load respectively either one layer of cans or two layers of cans into the case. The mechanism comprises switches **313** and **314**; switch **313** is operated by three-lobed cam **315** and switch **314** is operated by six-lobed cam **316**. The cams are mounted firmly on cam shaft **317** turned by ratchet wheel **318** which is mounted thereon and driven by pawl **319** which is pivotally attached to lever **320**; lever **320** is rotatably mounted to rotate around the axis of shaft **317** and restrained from such rotation by tension spring **323** attached to one end thereof. On one end of lever **320** is a roller **321** operated by a cam **322** mounted on the cam bar **242**, which moves with the stroke of the loading rams **233**. When the cam **322** is in the position shown in FIGURE 31 (at one extreme of the stroke of bar **242**) the spring **323** has turned lever **320** and pawl **319** to a new position. The position of the elements at the other end of the stroke of ram **233** and bar **242** is shown in FIGURE 29 and during the stroke of ram **233** and bar **242**, while roller **321** is operated by cam **322** to move lever **321**, pawl **319** turns the ratchet wheel and cams 60 degrees, so that at each stroke cam **316** operates switch **314** but switch **313** is operated only every second stroke. Either switch may be placed in circuit with the chain driving means by switches not shown. With switch **314** in circuit the case is moved forward after each ram stroke. With switch **313** in circuit the case is moved forward after every second ram stroke.

The speed of the machine of our invention is accomplished by the action in combination of nearly all of its elements rather than by an essential or critical single element or concept in the machine and the many factors and elements hereinbefore described contribute toward achieving such speed.

These contributions can be divided into two categories, the first category being those elements and inter-relationships which contribute toward accomplishing high speed when nothing is awry, for example, when all of the cases in the magazine meet every specification as to shape and size and have not been battered or otherwise damaged in shipping, when the cans themselves are undamaged and unbattered and do not turn sidewise or otherwise get out of position in the tracks (the tracks being of conventional prior art form) and when every element in the machine does its job just as it is supposed to do, for example, when no vacuum cup misses its grip, when lugs **18** and finger **40** do not fail to separate one and only one carton from the pile, when flaps of the carton are closed in the proper way and at the proper time, when no can turns sidewise as it is loaded into the carton, etc. Thus, speed is accomplished by providing elements which cooperating in combination provide high speed when no such malfunction occurs. Secondly, a high speed is provided when the elements cooperate in combination with an absolute and extreme minimum of malfunction on the part of any one element.

But the second category consists of reducing to a minimum the time which may be lost as a result of interruption of the process due to jamming or other malfunction and the damage caused to cans, cases or machine when any such malfunctioning occurs.

It may be seen from the foregoing detailed description that the cooperation of elements **18**, **49** and finger **40** and its driving mechanism at the unpiling station uniquely operate to separate one and only one carton from the pile and feed it to the next station in the machine even when the cartons have been damaged badly in shipping, as for example is the case when a stack of cartons are strapped with steel strapping and then dropped heavily so that the strapping bites deeply into the edges, or when a stack of cartons strapped with steel strapping is dropped from the height onto a corner of the stack. These elements of the magazine and feeding station also cooperate to feed a carton from the pile to the next station when only one, two or three cartons remain in the pile and this achievement is especially outstanding when it is observed that this is accomplished even though such one, two or three remaining cartons are badly damaged.

Thus the failure of the unpiling station is reduced to an extreme minimum which may be one in 1000 or one in 5000 or less.

Switch **210** however, is installed at the set-up station to indicate the presence at the set-up station of a carton and the elements of the set-up station will not function, in fact the entire machine stops, if this switch indicates that a carton is not at the set-up station when it is supposed to be. At the same time an indicator light is lit and an audible signal such as a horn or buzzer may be caused to be sounded. Thus, the operator is immediately informed of the omission and may immediately correct the omission with the result that the loss of time or interruption to the process may be held to as low as ten seconds or no more than thirty seconds.

An additional advantage provided at the unpiling station is that by withdrawing and feeding cartons from the bottom of a pile rather than from the top of a pile it is not necessary to provide a hold in the floor to receive the pile or to alternatively elevate the entire machine as would be the case if cartons were fed from the top of a pile.

In similar fashion, the co-action of the elements at the set-up station provides high reliability and a minimum of failure even though cartons be badly mashed, dented, battered or bent.

Extreme speed is provided at the loading station whereas in most machines heretofor proposed or heretofore used the speed with which the cans can be inserted into the carton is a limiting factor on the entire machine.

As previously mentioned, cans are virtually thrown into the carton by loading ram **233** and by reason of the presence of the magnets the bottom layer of cans is drawn into the carton and held in place by the action of the magnets without the loading ram being required to travel into the interior of the carton, thereby saving time in the loading ram cycle. The cans are caused to be introduced into the carton straight and parallel with one another by the action of the funnel flaps. As a result of these co-operating elements acting in combination, cans are introduced into the carton with extreme rapidity and with only the most seldom jammin gor turning crosswise of a can.

However, if at any time one or more cans turn crosswise while traveling into the carton, the jamming may be relatively easily and quickly cleared by unlatching the latch **267** and opening side **262**.

Jamming at the loading station is particularly minimized by the inter-action of switches **212** and **230** and **238** with the switch (not shown) which operates cylinder **223** whereby the presence of both a carton and the proper number of cans at the loading station actuates the loading action and whereby the loading operation is not begun unless both the cans and case are present. As a result the loading operation is not delayed as a result of a mechanical initiation of loading action. In other words, the loading operation begins just as soon as cans and case are present rather than undergoing the delay which would have to be provided as a safety factor if the operation were mechanically initiated. At the same time, jamming is avoided if either cans or case fail to arrive by the time such mechanical initiation of the operation would have begun.

Jamming is also minimized or prevented at the loading station by reason of the fact that cylinder **223** is air operated and the air pressure supplied to cylinder **223** is controlled by conventional means, which for simplicity are not shown, so that the operating force acting on rams **233** is limited, and therefore the force applied to the cans being loaded by the rams is limited to a maximum amount insufficient to crush the cans if one or more of the cans jams or turns crosswise during the operation. The force may be adjusted by adjusting the air pressure so that no cans are crushed or so that only a relatively few cans are somewhat dented but most are not denied or crushed. The result is that damage to the cans in the event of a jam is minimized and damage to the case almost entirely avoided.

The most important advantage, however, is that because most of the cans are not crushed, the jamming may be easily cleared by unlatching latch **262**, lowering arms **254**, and removing the case and cans. This can be done easily and quickly, whereas if the force is not thus limited the cans and case may be removed or pushed into surrounding parts of the machine so that relatively great time and effort are required to remove the resulting wreckage from the machine.

An important concept in providing for high speed operation and prevention of jamming is realized by the action of chains **17** and lugs **18**: from the moment the machine takes hold of a carton by virtue of lugs **18** becoming engaged with a carton at the unpiling station, and until the loading operation is completed and the case is delivered out of the loading station, the machine does not let loose of the carton at any time nor transfer the carton from one holding element to another. That is, once a carton is gripped by a pair of lugs **18**, the same pair of lugs grips the same cartons throughout the entire process. As a result, malfunctions which often occur when an object is transferred from one handling unit to another are entirely avoided.

A machine in accordance with this invention may be operated to load cans into cases at the rate of 50 per minute and operate at an effective rate nearly as high over prolonged periods of time. Prevention of jamming may be seen to be of the utmost importance in accomplishing such a high effective rate over a period of time. For example, in two hours 6000 cases are packed if there is no malfunction or jamming of the machine; this is equal to 12,000 cases in four hours or 24,000 cases in an eight hour shift. A malfunctioning or jamming in one-tenth of one percent of the operations conducted at each station, that is, one in 1000 times at each of the stations, which caused a down-time or interruption of one minute for each such jam or malfunction, might be typical of machines heretofore used or proposed and would result in nine minutes down-time per hour or a 15% reduction in the overall rate of efficiency. The total number of cases packed per hour would thereby be reduced from 2550 and in a day from 24,000 to 21,400, the effective rate reduction being from 50 per minute to 42.5 per minute.

With the machine of our invention, any jamming or malfunctioning might take place at each station once in every five-thousand to fifteen-thousand operations. For purposes of an example, we might assume a fairly severe rate of malfunctioning (for the machine of the invention) namely, malfunction and jamming at each station every 6000 cases. Then with a loss of time or interruption of twenty seconds for each jam or malfunction, the reduction in number of cases packed is 50 every two hours of 25 each hour. For a day the reduction is from 24,000 to 23,800 and the reduction in rate is only from fifty per minute to about 49.6 per minute.

While certain modifications and embodiments of the invention have been described, it is of course to be understood that there are a great number of variations which will suggest themselves to anyone familiar with the subject matter thereof and it is to be distinctly understood that this invention should not be limited except by such limitations as are clearly imposed in the appended claims.

We claim:

1. In a machine of the type described for removing flat, collapsed cartons from a pile, setting them up and filling them with containers at a loading station, the combination of means for providing flat, collapsed cartons in a pile so that the weight of the pile is on the lowermost carton, a first member engageable with the lowermost carton, means to move said first member substantially parallel to the flat surfaces of said carton to slidably remove said carton from under said pile and means to at the same time

restrain the pile from like movement, roller means to cause the underside of said lowermost carton to undergo rolling friction rather than sliding friction while removing said lowermost carton from under said pile, at least one additional and separate member engageable with said lowermost carton at nearly the same time it is engaged by said first member, to move said carton for a short distance in a direction at least nearly parallel to the direction of travel of said carton to aid in separating said carton from said pile and a plurality of lifting members to engage the side of said pile to at least partially lift a portion of the weight of said pile from said lowermost carton while said lowermost carton is slidably removed from under said pile.

2. In the machine of claim 1, means to ascertain the presence of a case at said loading station and to ascertain the presence of containers at said loading station and means to initiate the loading of said containers into said carton in response only to positive responses from said ascertainments.

3. In a machine of the type described, the combination of means for providing flat, collapsed cartons in a pile, means to move said member substantially parallel to the flat surfaces of said carton to slidably remove said carton from said pile to move said carton to a set-up station, and to move a set-up carton, mechanical thrusting members to directly engage said containers to thrust them into said carton during only a portion of their travel into said carton and means to cause said thrusting members to impart sufficient inertia to said containers so that at least a portion of the travel of said containers into said carton occurs as a result of said inertia imparted to them by said thrusting members, means to limit the action of said thrusting members so that the action is insufficient to crush most of the containers entering a carton at one time if a container jams in such manner as to restrain entry of at least some of said containers into the carton, and magnetic means to magnetically urge said containers toward the bottom of said carton during the final portion of the travel of said containers into said carton.

4. In a machine of the type described for removing flat, collapsed cartons, (each comprising four joined panels with flaps, including bottom end flaps and bottom side flaps extending therefrom) from a pile, setting them up and filling them with containers, the combination of means to move a carton from said pile to a set-up station, means to provide said carton flat and stationary at said set-up station, means to retain a lower panel stationary at said station comprising first vacuum means moveable vertically and immovable longitudinally and laterally, to grip one side panel of one such carton from below and prevent longitudinal and lateral movement of said panel and second vacuum means to grip one end panel of said carton from above at substantially the same time, the second vacuum gripping means fixedly connected to an arm, said arm extending from a transversely disposed axis to rotate substantially 90° upwardly and backwardly about said axis, said second vacuum means gripping said panel throughout said movement and being slidably immovable to provide said gripped end panel upstanding at substantially 90° to said gripped side panel to thereby provide said sides and ends in set-up position.

5. In a machine of the type described for removing flat, collapsed cartons (each comprising four joined panels with flaps, including bottom end flaps and bottom side flaps extending therefrom) from a pile, setting them up and filling them with containers, the combination of means for providing such flat collapsed cartons in a pile so that the weight of the pile is on the lowermost carton, a member engageable with the lowermost carton, means to move said member substantially parallel to the flat surfaces of said carton to slidably remove said carton from under said pile to a set-up station and means to at the same time restrain the pile from like movement, means to retain a lower panel stationary at said station comprising first vacuum means moveable vertically and immovable longitudinally and laterally to grip one side panel of said carton from below and prevent longitudinal and lateral movement of said panel while maintaining engagement of said member with said carton, and second vacuum means mounted on a laterally extending rotatable shaft to grip one end panel of said carton at substantially the same time, the second vacuum gripping means being moveable through an arc of substantially 90° around said shaft extending transversely across the machine and being slideably immovable to grip said panel throughout its movement through said arc and to provide said gripped end panel upstanding at substantially 90° to said gripped side panel to thereby provide said sides and ends in set-up position.

6. In a machine of the type described for removing flat, collapsed cartons from a pile, setting them up and filling them with containers at a loading station, magnetic means at said loading station to magnetically urge said containers toward the bottom of said carton during the final portion of the travel of said containers into said carton at said loading station.

7. In a machine of the type described for removing flat, collapsed cartons from a pile, setting them up and filling them with containers at a loading station, magnetic means at said loading station to magnetically urge said containers toward the bottom of said carton during the final portion of the travel of said containers into said carton at said loading station, mechanical thrusting members to directly engage said containers at said loading station to thrust them into said carton duirng only a portion of their travel into said carton and means to cause said thrusting members to impart sufficient inertia to said containers so that at least a portion of the travel of said containers into said carton occurs as a result of said inertia imparted to them by said thrusting members and means to limit the action of said thrusting members so that the action is insufficient to crush most of the containers entering a carton at one time if a container jams in such manner as to restrain entry of at least some of said containers into the carton.

8. In a machine of the type described for removing flat, collapsed cartons from a pile, setting them up and filling set-up cartons with containers at a loading station, thrusting means to thrust containers toward and into said carton in a generally horizontal direction at said loading station, means to limit the action of said thrusting means so that the action is insufficient to crush most of the containers entering a carton at one time if a container jams in such manner as to restrain entry of at least some of said containers into the carton, magnetic means at said loading station to magnetically urge said containers toward the bottom of said carton during the final portion of the travel of said containers into said carton at said loading station.

9. In a machine of the type described for removing flat, collapsed cartons from a pile, setting them up and filling them with containers at a loading station, mechanical thrusting members to directly engage said containers at said loading station to thrust them into said carton during only a portion of their travel into said carton and means to cause said thrusting members to impart sufficient inertia to said containers so that at least a portion of the travel of said containers into said carton occurs as a result of said inertia imparted to them by said thrusting members, the length of stroke of said mechanical thrusting members being substantially less than the distance said containers travel in passing into said carton, said thrusting members adapted to disengage the cartons prior to completion of the travel of the containers into the carton.

10. In a machine of the type described for removing flat, collapsed cartons from a pile, setting them up and causing containers to travel into the set-up cartons so as to fill them with containers at a loading station, magnetic means at said loading station to magnetically urge said containers toward the bottom of said carton during the final portion of the travel of said containers into said carton at said loading station.

11. In the machine of claim 10, mechanical thrusting members to directly engage said containers at said loading station to thrust them into said carton during only a portion of their travel into said carton and means to cause said thrusting members to impart sufficient inertia to said containers so that at least a portion of the travel of said containers into said carton occurs as a result of said inertia imparted to them by said thrusting members.

12. In a macihne for removing flat, collapsed cartons (each comprising two side panels and two end panels with each panel joined to other panels at two edges and having flaps extending from the other two edges, the flaps extending from one group of four adjoining edges being adapted to provide a top for the carton and the flaps extending from the other group of four adjoining edges being adapted to provide a bottom for the carton) from a pile, setting them up and filling set-up cartons with containers at a loading station, thrusting means to thrust containers toward and into a set-up carton in a generally horizontal direction at said loading station, means at said loading station to partially open and hold partially open at least two of the top carton flaps while said containers are thrust toward and into said cartons so that said carton flaps are partially open as said containers enter said carton, said means being a hinging ramp member adjacent each said flap which hingably opens toward the inside of said carton to thereby partially open said flap and to then hold partially open said flap from the inside and to provide a guiding ramp adjacent the inner surface of said flap to guide containers into said carton past the edge of the panel at which said flap is attached.

13. In a machine for removing flat, collapsed cartons from a pile, setting them up and filling set-up cartons with containers at a loading station, having means to mechanically thrust said containers at least part way into said carton at said loading station, magnetic means at said loading station to magnetically urge said containers toward the bottom of said carton during the final portion of the travel of said containers into said carton at said loading station.

14. In a machine for removing flat, collapsed cartons (each comprising two side panels and two end panels with each panel joined to other panels at two edges and having flaps extending from the other two edges, the flaps extending from one group of four adjoining edges being adapted to provide a top for the carton and the flaps extending from the other group of four adjoining edges being adapted to provide a bottom for the carton) from a pile, setting them up and filling set-up cartons with containers at a loading station, thrusting means to thrust containers toward and into a set-up carton in a generally horizontal direction at said loading station, means at said loading station to partially open and hold partially open all of the top carton flaps while said containers are thrust toward and into said carton so that said carton flaps are partially open as said containers enter said carton, said means being a hinging ramp member adjacent each said flap which hingably opens toward the inside of said carton to thereby partially open said flap and to then hold partially open said flap from the inside and to provide a guiding ramp adjacent the inner surface of said flap to guide containers into said carton past the edge of the panel at which said flap is attached.

15. In a macihne for removing flat, collapsed cartons from a pile, setting them up and filling set-up cartons with containers at a loading station, mechanical thrusting members to directly engage said containers to thrust them into said carton during only a portion of their travel into said carton and means to cause said thrusting members to impart sufficient inertia to said containers so that at least a portion of the travel of said containers into said carton occurs as a result of said inertia imparted to them by said thrusting members, means to limit the action of said thrusting members so that the action is insufficient to crush most of the containers entering a carton at one time if a container jams in such manner as to restrain entry of at least some of said containers into the carton, and magnetic means to magnetically urge said containers toward the bottom of said carton during the final portion of the travel of said containers into said carton.

16. In a machine for removing flat, collapsed cartons from a pile, setting them up and filling set-up cartons with containers at a loading station, mechanical thrusting members to directly engage said containers to thrust them into one of said cartons at said loading station, and means to cause said thrusting members to impart sufficient inertia to said containers so that at least a portion of travel of said containers into said carton occurs as a result of said inertia so imparted to them, magnetic means at said loading station to magnetically urge said containers toward the bottom of said carton during the final portion of the travel of said containers into said carton at said loading station.

17. In a machine for removing flat, collapsed cartons (each comprising four joined panels with flaps, including bottom end flaps and bottom side flaps, extending therefrom) from a pile, setting them up and loading them with containers: a symmetrical six lobed rotating cam member and a symmetrical three lobed rotating cam member, each of said cam members being rotatably driven through one-sixth of a revolution upon each operation of the machine to load a layer of containers into a carton, each of said cam members provided with a cam follower disposed to operate a switch, said switches being alternately connectable to switch means disposed to initiate each said loading operation.

18. In a machine of the type described for removing flat, collapsed cartons from a pile, setting them up and filling them with containers at a loading station, the combination of means for providing flat, collapsed cartons in a pile so that the weight of the pile is on the lowermost carton, a first member engageable with the lowermost carton, means to move said first member substantially parallel to the flat surfaces of said carton to slidably remove said carton from under said pile and means to at the same time restrain the pile from like movement, roller means to cause the underside of said lowermost carton to undergo rolling friction rather than sliding friction while removing said lowermost carton from under said pile and at least one additional and separate member engageable with said lowermost carton at nearly the same time it is engaged by said first member, to move said carton for a short distance in a direction at least nearly parallel to the direction of travel of said carton to aid in separating said carton from said pile, particularly characterized by said first member being extendable between said lowermost carton and the next uppermost carton.

19. In a machine of the type described for removing flat, collapsed cartons from a pile, setting them up and filling them with containers at a loading station, the combination of means for providing flat, collapsed cartons in a pile so that the weight of the pile is on the lowermost carton, a first member engageable with the lowermost carton, means to move said first member substantially parallel to the flat surfaces of said carton to slidably remove said carton from under said pile and means to at the same time restrain the pile from like movement, roller means to cause the underside of said lowermost carton to undergo rolling friction rather than sliding friction while removing said lowermost carton from under said pile and at least one additional and separate member engageable with said lowermost carton at nearly the same time it is engaged by said first member, to move said carton for a short distance in a direction at least nearly parallel to the direction of travel of said carton to aid in separating said carton from said pile, particularly characterized by said first member being extendable between said lowermost carton and the next uppermost carton, and a plurality of lifting members to engage the side of said pile to at least partially lift a portion of the weight of

said pile from said lowermost carton while said lowermost carton is slidably removed from under said pile.

20. In a machine for removing flat, collapsed cartons (each comprising two side panels and two end panels with each panel joined to other panels at two edges and having flaps extending from the other two edges, the flaps extending from one group of four adjoining edges being adapted to provide a top for the carton and the flaps extending from the other group of four adjoining edges being adapted to provide a bottom for the carton) from a pile, setting them up and filling set-up cartons with containers at a loading station, means to set the cartons up and to fill the set-up cartons with containers at the loading station and thrusting means to thrust containers towards and at least partially into each set-up carton in a generally horizontal direction at said loading station, characterized by: a hingedly mounted ramp member adjacent each of the top carton flaps, means to cause said ramp members to hingeably move towards said carton to partially open said flaps, means to hingeably move said ramp members to first slightly open the uppermost horizontal bottom flap after initiation of the step of loading the containers into said carton.

21. In a machine for removing flat, collapsed cartons (each comprising two side panels and two end panels with each panel joined to other panels at two edges and having flaps extending from the other two edges, the flaps extending from one group of four adjoining edges being adapted to provide a top for the carton and the flaps extending from the other group of four adjoining edges being adapted to provide a bottom for the carton) from a pile, setting them up and filling set-up cartons with containers at a loading station, means to set the cartons up and to fill the set-up cartons with containers at the loading station and thrusting means to thrust containers towards and at least partially into each set-up carton in a generally horizontal direction at said loading station, characterized by: a hingedly mounted ramp member adjacent each of the top carton flaps, means to cause said ramp members to hingeably move toward said carton to partially open said flaps, means to hingeably move said ramp members to first slightly open the vertical bottom flaps then slightly open the lowermost horizontal bottom flap and then to slightly open the uppermost horizontal bottom flap after initiation of the step of loading containers into said carton.

22. In a machine for removing flat, collapsed cartons (each comprising two side panels and two end panels with each panel joined to other panels at two edges and having flaps extending from the other two edges, the flaps extending from one group of four adjoining edges being adapted to provide a top for the carton and the flaps extending from the other group of four adjoining edges being adapted to provide a bottom for the carton) from a pile, setting them up and filling set-up cartons with containers at a loading station, means to set the cartons up and to fill the set-up cartons with containers at the loading station and thrusting means to thrust containers towards and at least partially into each set-up carton in a generally horizontal direction at said loading station, characterized by: a hingedly mounted ramp member adjacent each of the top carton flaps, means to cause said ramp members to hingeably move towards said carton to partially open said flaps, means to hingeably move said ramp members to first slightly open the lowermost horizontal bottom flap, then slightly open the vertical bottom flaps, and then to slightly open the uppermost horizontal bottom flap after initiation of the step of loading containers into said carton.

23. In a machine for removing flat, collapsed cartons (each comprising two side panels and two end panels with each panel joined to other panels at two edges and having flaps extending from the other two edges, the flaps extending from one group of four adjoining edges being adapted to provide a top for the carton and the flaps extending from the other group of four adjoining edges being adapted to provide a bottom for the carton) from a pile, setting them up and filling set-up cartons with containers at a loading station, means to set the cartons up and to fill the set-up cartons with containers at the loading station and thrusting means to thrust containers towards and at least partially into each set-up carton in a generally horizontal direction at said loading station, characterized by: a hingedly mounted ramp member adjacent each of the top carton flaps, means to cause said ramp members to hingeably move towards said carton to partially open said flaps, means to hingeably move said ramp members to first slightly open the vertical bottom flaps and then to slightly open the lowermost horizontal bottom flap.

24. In a machine for removing flat, collapsed cartons (each comprising two side panels and two end panels with each panel joined to other panels at two edges and having flaps extending from the other two edges, the flaps extending from one group of four adjoining edges being adapted to provide a top for the carton and the flaps extending from the other group of four adjoining edges being adapted to provide a bottom for the carton) from a pile, setting them up and filling set-up cartons with containers at a loading station, means to set the cartons up and to fill the set-up cartons with containers at the loading station and thrusting means to thrust containers towards and at least partially into each set-up carton in a generally horizontal direction at said loading station, characterized by: a hingedly mounted ramp member adjacent each of the top carton flaps, means to cause said ramp members to hingeably move towards said carton to partially open said flaps, means to hingeably move said ramp members to first slightly open the vertical bottom flaps and then to slightly open both the horizontal bottom flaps after initiation of the step of loading containers into said cartons.

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