July 29, 1958 I. L. NELSON 2,844,930

CARTON CLOSING APPARATUS

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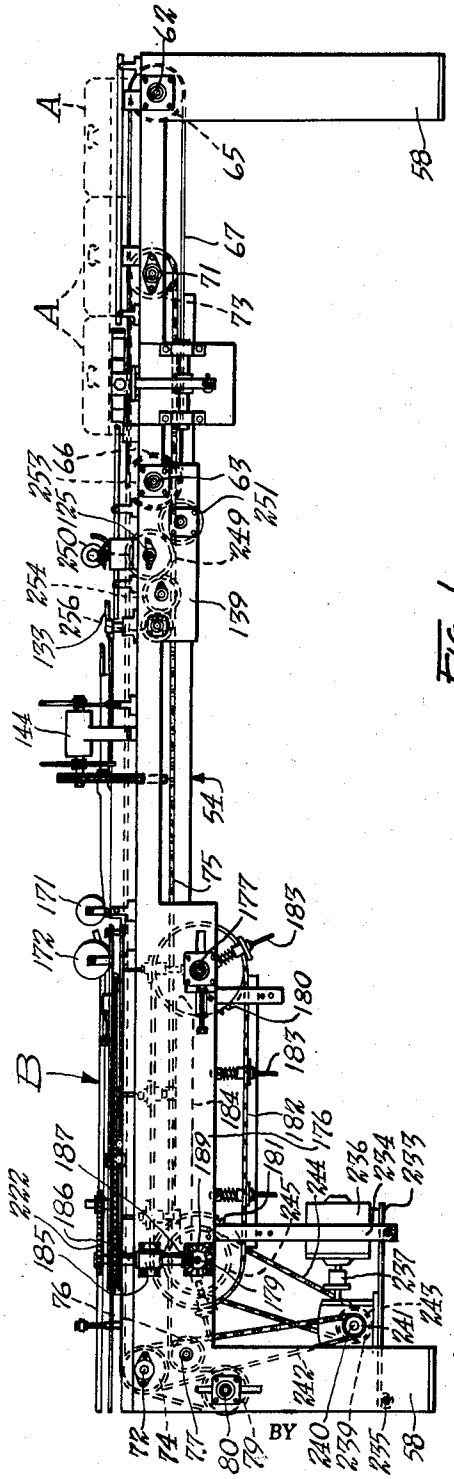


FIG. 1

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July 29, 1958 I. L. NELSON 2,844,930

CARTON CLOSING APPARATUS

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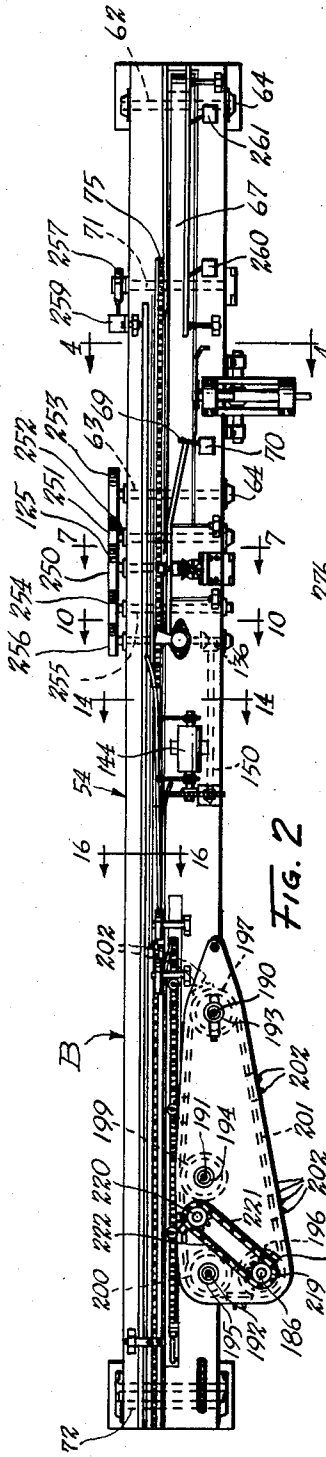


FIG. 2

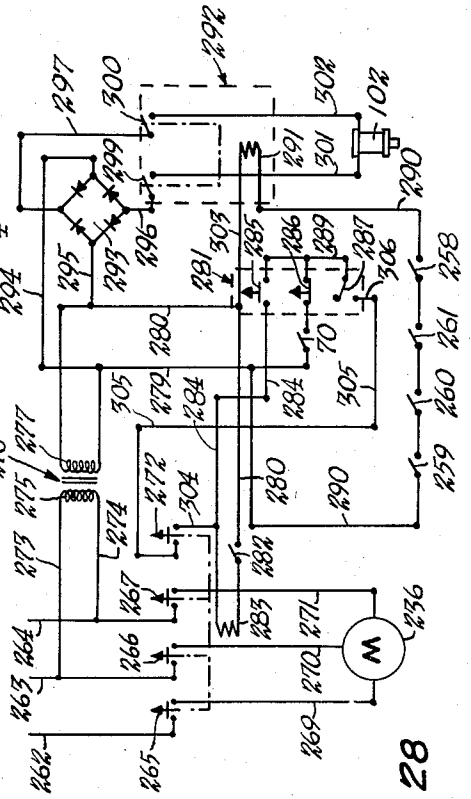


FIG. 2B

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July 29, 1958 I. L. NELSON 2,844,930

CARTON CLOSING APPARATUS

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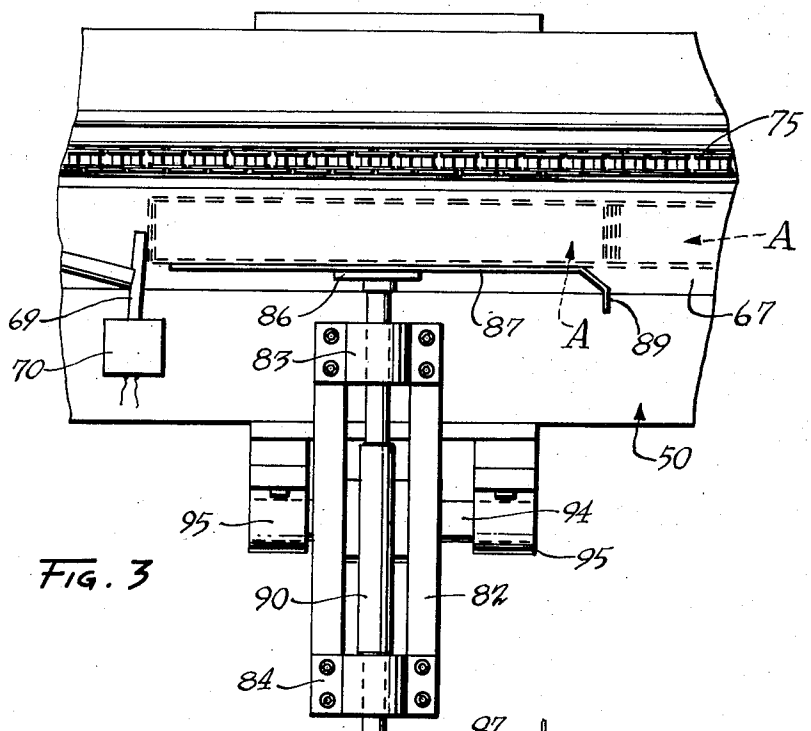


FIG. 3

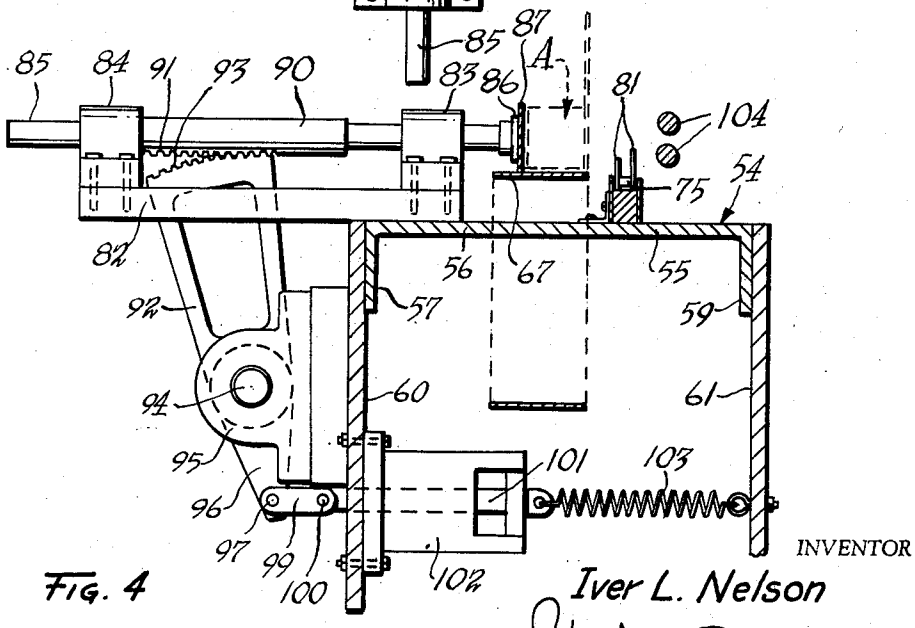


FIG. 4

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CARTON CLOSING APPARATUS

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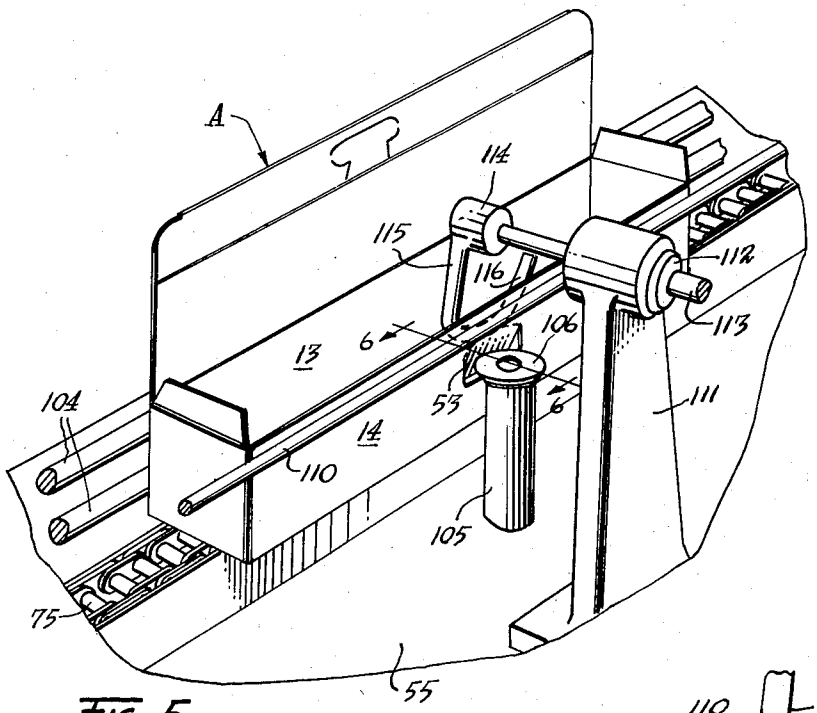


FIG. 5

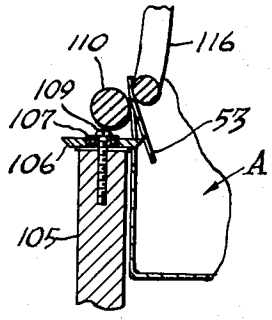


FIG. 6

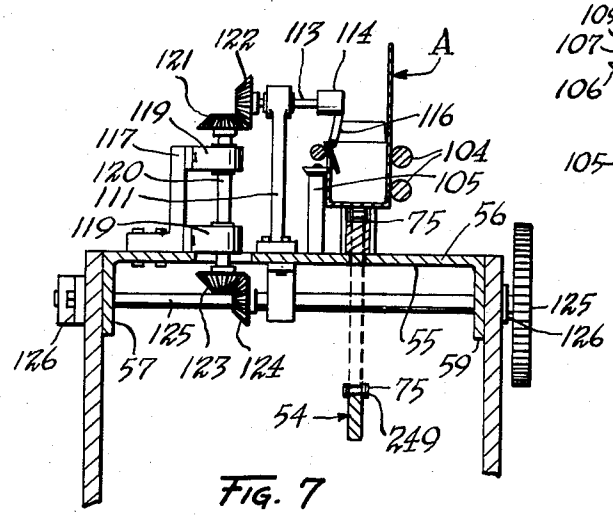


FIG. 7

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CARTON CLOSING APPARATUS

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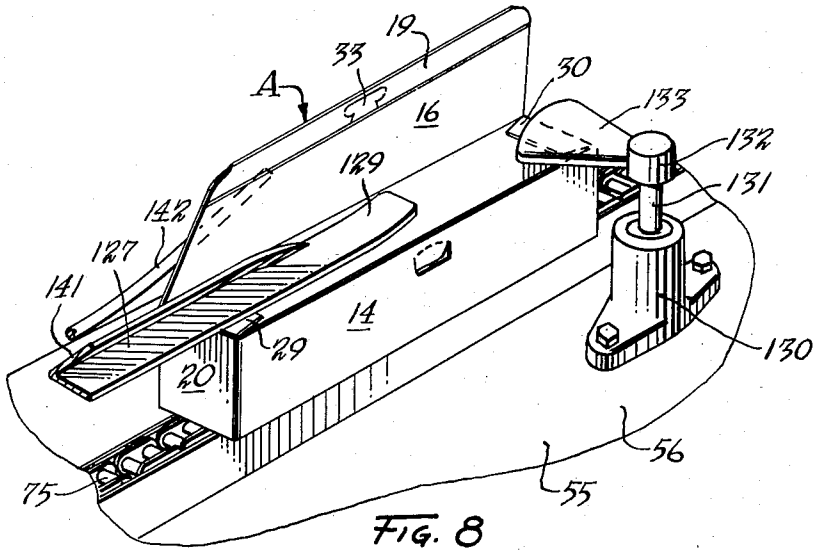


FIG. 8

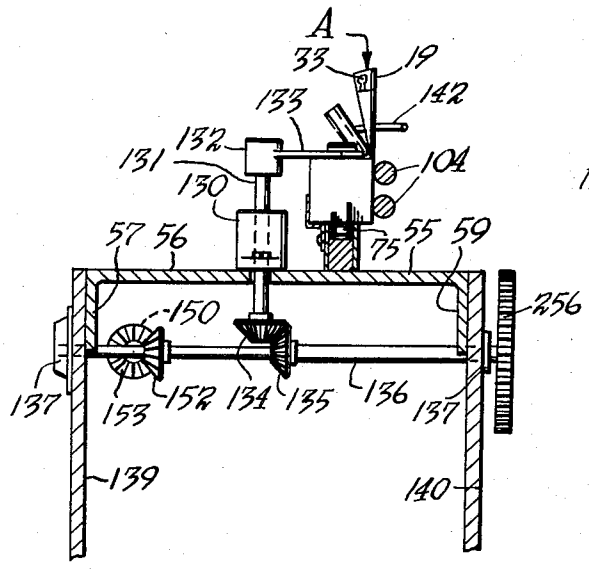


FIG. 10

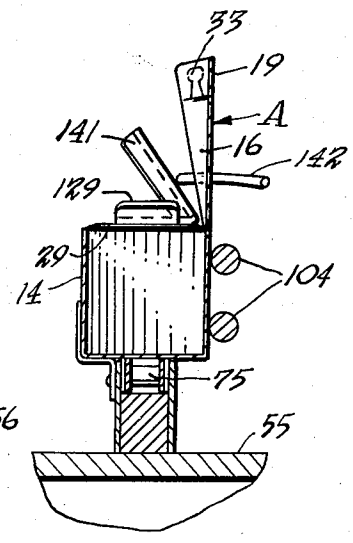


FIG. 9

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CARTON CLOSING APPARATUS

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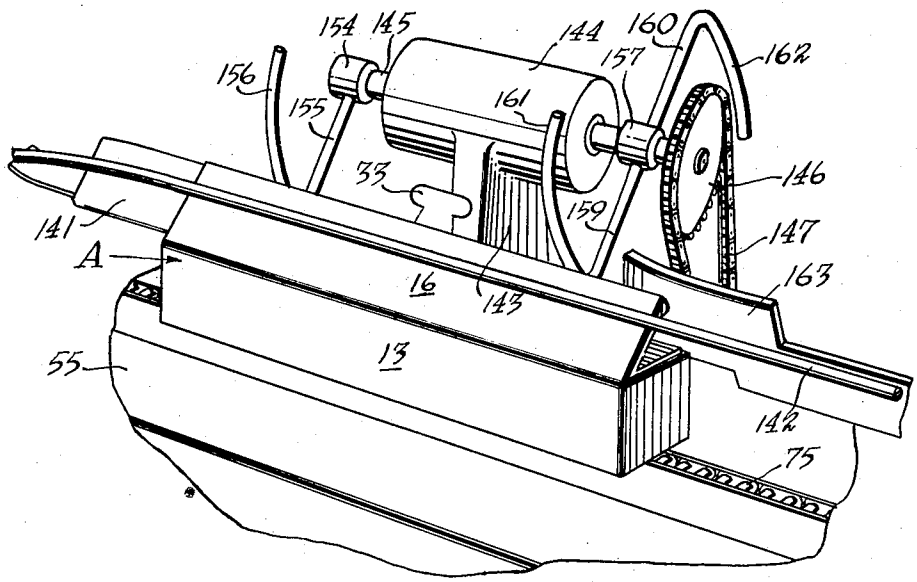


FIG. 11

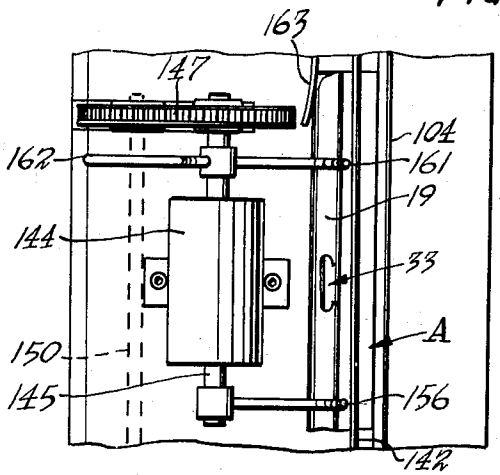


FIG. 13

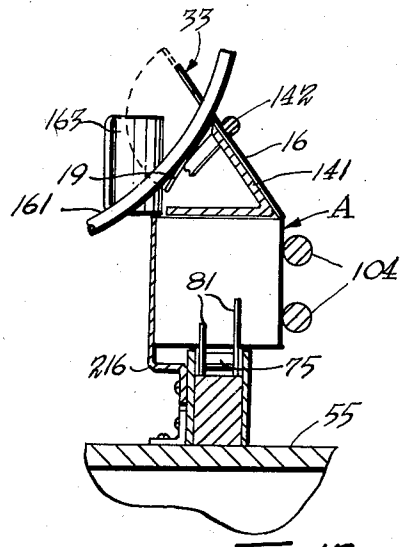


FIG. 12

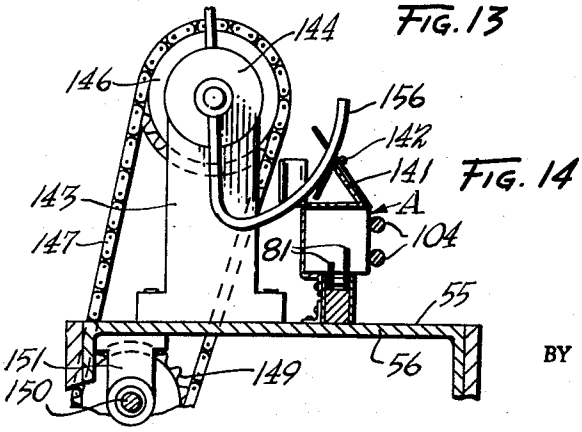


FIG. 14

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CARTON CLOSING APPARATUS

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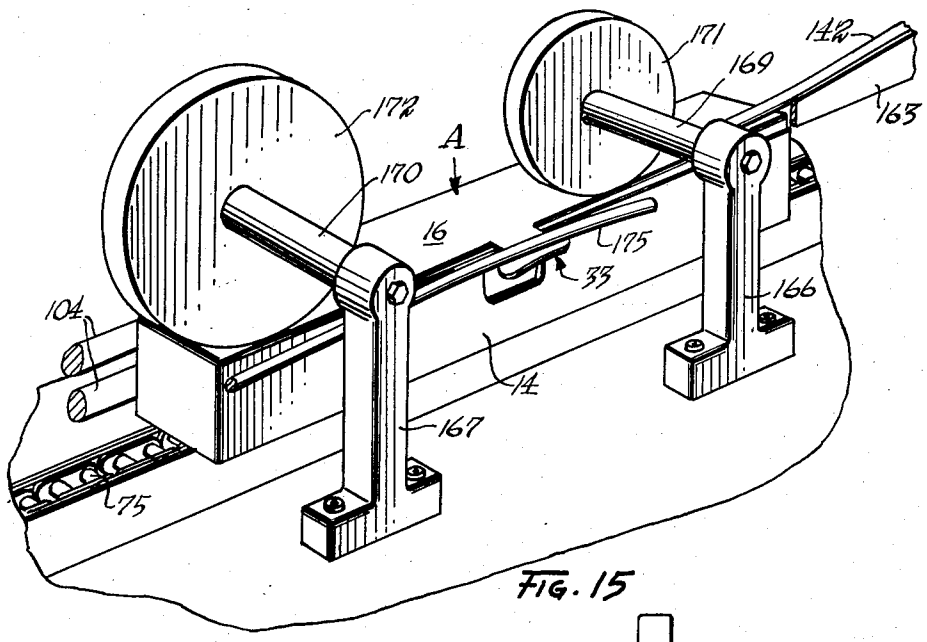


FIG. 15

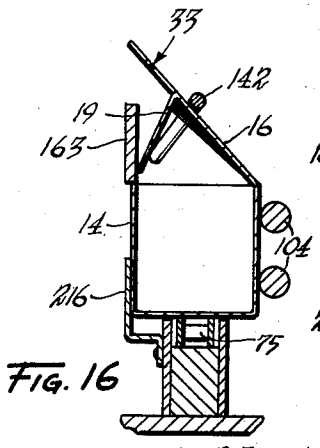


FIG. 16

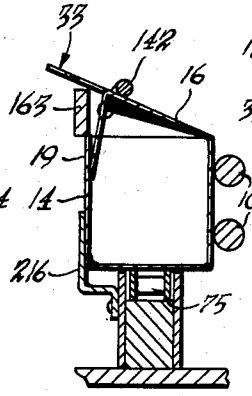


FIG. 17

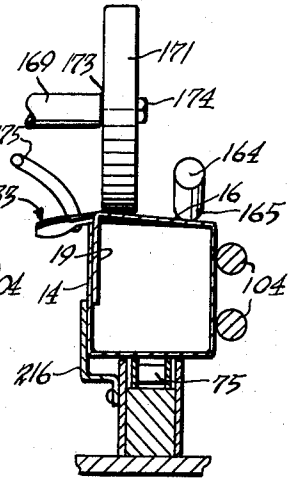


FIG. 18

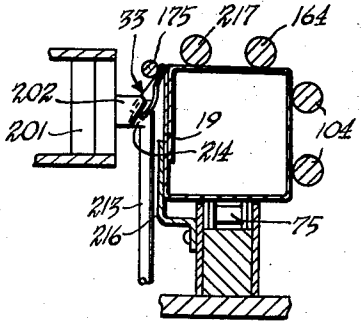


FIG. 19

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CARTON CLOSING APPARATUS

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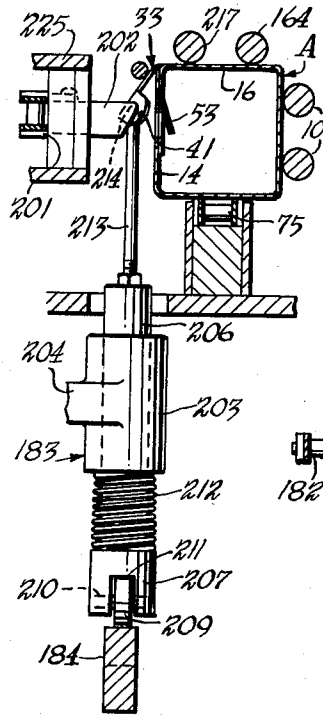


FIG. 20

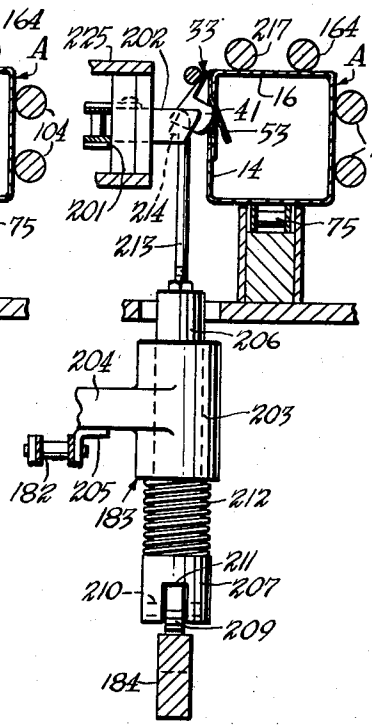


FIG. 21

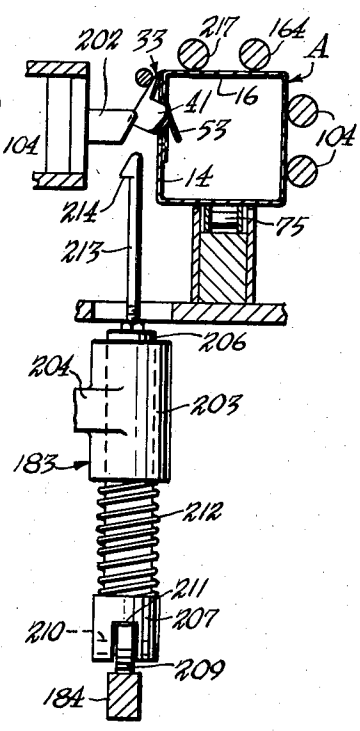


FIG. 22

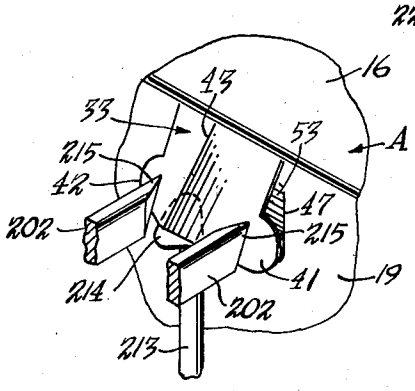


FIG. 23

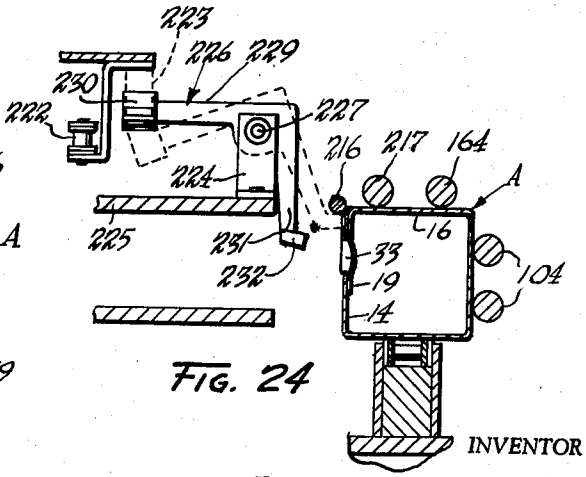


FIG. 24

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CARTON CLOSING APPARATUS

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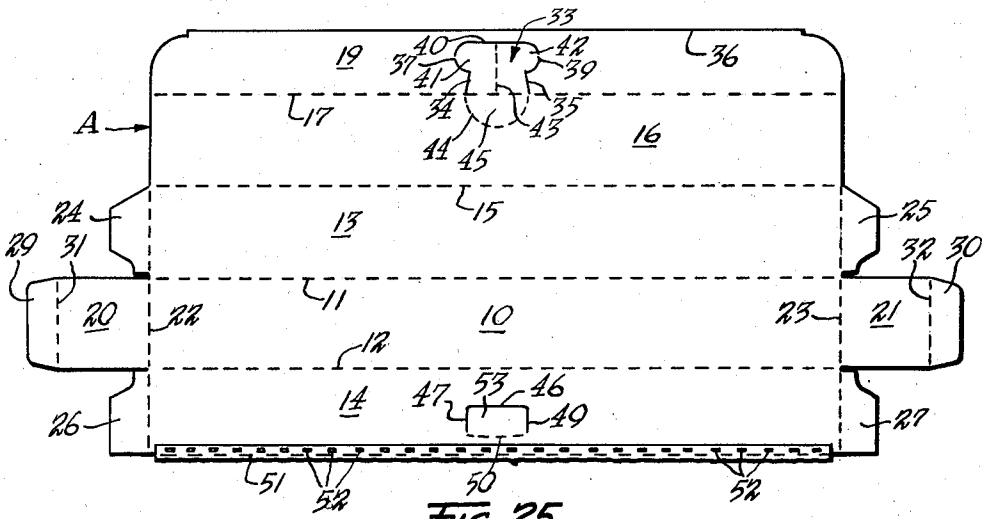


FIG. 25

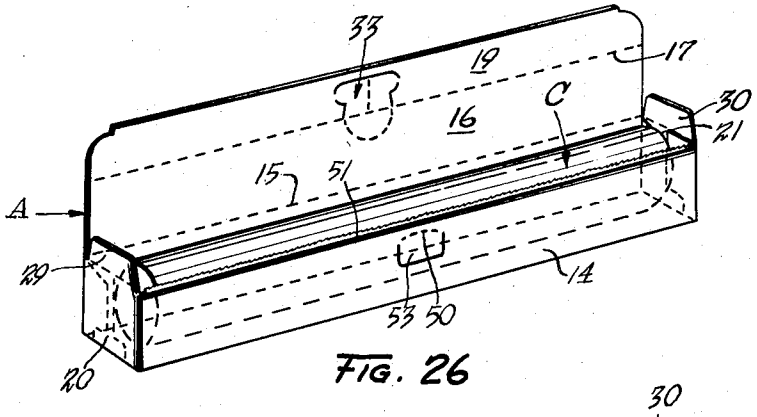


FIG. 26

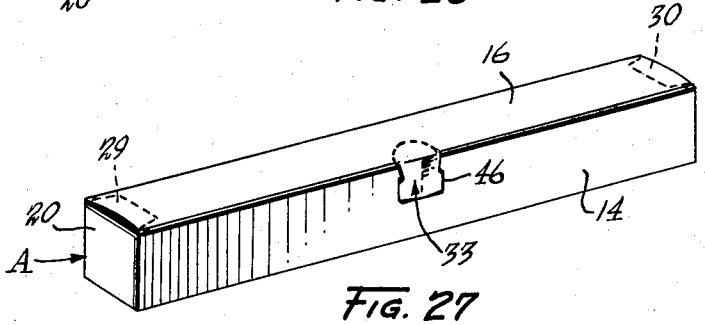


FIG. 27

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United States Patent Office 2,844,930 Patented July 29, 1958

2,844,930

CARTON CLOSING APPARATUS

Iver L. Nelson, Minneapolis, Minn., assignor to Waldorf Paper Products Company, Ramsey County, Minn., a corporation of Minnesota

Application February 11, 1957, Serial No. 639,562

14 Claims. (Cl. 53—376)

This invention relates to an improvement in apparatus for closing cartons and deals particularly with a means of locking a carton in closed position.

In the packaging of film used for wrapping products, the films being wax paper, foil or similar sheet material, it is common practice to place an elongated roll of the film in an elongated rectangular box having a cover panel which may be raised to disclose the contents. In some instances, the cover panel is provided with a tuck flap which tucks inwardly of the wall opposite that to which the cover panel is hinged. In the dispensing of the film, the film is drawn between the tuck flap and the outer wall of the carton and is folded over the front wall so that it may be torn off along a transverse tear line. The front wall of the carton is in many instances provided with a metal strip having a serrated edge over which the film may be bent to sever the sheet.

Unless some means is provided for maintaining the cover flap or panel in closed position, during transportation and sale of the product, there is a likelihood that the weight of the roll would press upon the cover panel with sufficient force to open the cartons accidentally in the event they were held in an inverted position. For this reason it is extremely desirable to provide a lock or some means of holding the cover panel closed until the carton is manually opened by the customer.

In order to accomplish this result, a locking tab has been cut from the tuck flap and is folded over the front wall of the carton to lock into a slot in the front wall. In the past it has been common practice to close these locks manually, an operation which requires considerable time and labor. The locking tab is preferably connected by a fold line to a portion of the cover panel of the carton which is removable from the remainder of the cover panel to provide an opening in the carton top. This opening permits access to the sheet contained within the carton after the lock has been removed to simplify the withdrawal of the film contained.

An object of the present invention resides in the provision of an apparatus for automatically locking the locking flaps of a carton of this type to the front wall of the carton and includes the operation of closing the carton, tucking the tuck flap inwardly of the front wall of the carton, folding the locking tab over the outer surface of the front wall, and inserting portions of the locking flap through a suitable slot or opening in the front wall of the carton to complete the closing operation.

A further feature of the present invention resides in the provision of an apparatus which acts automatically to swing closing flaps on the ends of the carton down into a common plane, to close the top panel of the carton, to tuck the tucking flap into place, and to lock the locking flap to the front wall in that sequence.

A further feature of the present invention resides in the provision of an apparatus for bending or flexing the locking flap intermediate its sides so that the ends of this flap may be inserted through spaced slots or through

a suitable opening in the front wall of the carton. When inserted, the locking flap flattens out so that the ends of the locking flap project laterally beyond the side edges of the slot or opening into which the side portions of the locking flap extend.

A further feature of the present invention resides in the provision of an apparatus of the type described which acts to produce its intended functions in sequence during the movement of the carton. Once the carton is moved into place upon a suitable conveyor, the carton continues to move at a predetermined rate of speed until it is discharged from the discharge end of the apparatus thus eliminating the necessity of stopping and starting the apparatus during movement of the carton from one set position to another, thereby providing continuous rather than intermittent motion in the closing operation.

A further feature of the present invention resides in the provision of a means movable with each carton and in timed relation thereto to engage against the interior surface of the locking flap while other fingers also operating in timed unison with the carton bend the ends of the locking flap inwardly to insert these lock ends into a suitable slot or aperture in the carton. The means engaging the inner surface of the locking flap is withdrawn after the ends of the lock are properly inserted in their locking slots and the locking flap is forced into substantially flat relation with the intermediate portion thereof lying outwardly of the front wall of the carton and with the ends of the locking flap extending through slots or openings in the front carton wall.

These and other objects and novel features of the present invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of the specification:

Figure 1 is a side elevational view of the carton closing and locking apparatus, showing the general arrangement of parts thereon.

Figure 2 is a top plan view of the apparatus illustrated in Figure 1.

Figure 3 is a top plan view of a detailed portion of the apparatus in enlarged form.

Figure 4 is a transverse sectional view through a portion of the apparatus, the position of the section being indicated by the line 4—4 of Figure 2 of the drawing.

Figure 5 is a perspective view of a detailed portion of the apparatus showing the manner in which the slots in the forward wall of the carton are opened prior to the closing of the package.

Figure 6 is a sectional view through a detailed portion of the apparatus shown in Figure 5, the position of the section being indicated by the line 6—6 of Figure 5.

Figure 7 is a cross-sectional view through a portion of the apparatus, the position of the section being indicated by the line 7—7 of Figure 2.

Figure 8 is a perspective view of another detailed portion of the apparatus.

Figure 9 is a cross-sectional view through a portion of the apparatus shown in Figure 8.

Figure 10 is a cross-sectional view through a portion of the apparatus, the position of the section being indicated by the line 10—10 of Figure 2.

Figure 11 is a perspective view of another detailed portion of the apparatus.

Figure 12 is a sectional view through a portion of the apparatus illustrated in Figure 11.

Figure 13 is a top plan view of the apparatus shown in Figure 11.

Figure 14 is a sectional view through a portion of the apparatus, the position of the section being indicated by the line 14—14 of Figure 2.

Figure 15 is a perspective view of another portion of the apparatus.

Figure 16 is a cross-sectional view through a portion of the apparatus, the position of the section being indicated by the line **16—16** of Figure 2.

Figure 17 is a view similar to Figure 16 showing the carton in a slightly later stage of the closing operation.

Figure 18 is a view similar to Figures 16 and 17, showing the carton in still a later position of the closing operation.

Figure 19 is a sectional view showing a slightly later stage of the closing operation from Figure 18.

Figure 20 is a cross-sectional view through a portion of the apparatus showing a later stage of the closing operation from that shown in Figure 19.

Figures 21 and 22 show successively later stages in the carton closing operation.

Figure 23 is a perspective view showing the manner in which locking tab is bent during the locking operation.

Figure 24 is a sectional view through the apparatus showing the final stage of the closing operation.

Figure 25 is a diagrammatic view of the blank showing the construction of the carton being closed.

Figure 26 is a perspective view of the unfilled carton in condition to receive its contents.

Figure 27 shows the carton in completely locked condition.

Figure 28 shows diagrammatically the wiring of the apparatus.

While the closing and locking apparatus is capable of closing cartons of various types, the particular form of construction illustrated is particularly designed to close the carton A which is illustrated in Figures 25, 26, and 27 of the drawings. This carton A includes a bottom panel **10** which is foldably connected along parallel fold lines **11** and **12** to a rear wall **13**, and a front wall **14** respectively. Obviously, the designations for the walls may vary depending upon whether or not the closure is to be on the front or top of the carton. In the particular arrangement illustrated, the carton is indicated as having the panel **10** lowermost.

The rear wall panel **13** is hingedly connected along a fold line **15** to the top panel **16**. This top panel **16** is foldably connected along a fold line **17** to a tuck flap **19**. This tuck flap **19** is designed to extend down into overlapping relation with the front wall panel **14** and the major portion of the tuck flap **19** is designed to extend inwardly of the front wall panel.

End walls **20** and **21** are foldably connected to opposite ends of the bottom panel **10** along parallel fold lines **22** and **23**. Flaps **24** and **25** are foldably connected to the ends of the rear wall panel **13** along extensions of the fold lines **22** and **23** respectively. Similar corner flaps **26** and **27** are foldably connected to the ends of the front wall panel **14** along continuations of the fold lines **22** and **23**. In the setup form of the carton, the flaps **24** and **26** are adhered to the inner surface of the end wall panel **20** to hold the various panels in generally right angular relation. In a similar manner the flaps **25** and **27** are foldably connected and are adhered to the inner surface of the end wall panel **21** to hold the various panels in right angular relation.

Flanges **29** and **30** are foldably connected to the end walls **20** and **21** along parallel fold lines **31** and **32**. When the carton is in the open form illustrated in Figure 26 of the drawings, these flanges **29** and **30** project upwardly in the plane of the end panels. However, in the closed condition of the carton, they are folded down to underlie the top panel **16** and to assist in supporting the same.

A locking flap or tab **33** is cut from the tuck flap **19** and in the particular arrangement illustrated is intermediate the ends of the tuck flap. The tab or flap **33** is defined by cut lines **34** and **35** which extend in converging relation from the fold line **17** toward the free edge **36** of the tuck flap **33**. The ends of the cut lines **34** and **35** are connected by arcuate cut lines **37** and **39** to a transverse cut line **40** which defines the end of the flap **33**. This arrangement provides laterally projecting locking shoulders **41** and **42** on opposite sides of the flap which project beyond the remainder of the flap. A fold line **43** extends throughout the length of the flap **33** intermediate the sides thereof, this fold line being for a purpose which will be later described in detail. A weakened line of separation **44** acts to connect the ends of the cut lines **34** and **35** which adjoin the fold line **17** so as to define a removable portion **45** in the top panel **16**.

When the carton is opened, the locking tab **33** is removed, together with the portion **45** of the top panel **16** which adjoins the tab **33**. This forms an opening in the top panel **16** which permits the customer to insert a finger or thumb partially into the package to assist in withdrawing the film therefrom.

The front panel **14** is provided with a generally U-shaped cut line **46** which include parallel cuts **47** and **49** which are spaced apart a distance substantially equal to the distance between the closest ends of the cut lines **34** and **35**. This permits the projections or shoulders **41** and **42** to be inserted through the front panel **14** so that these shoulders lie inwardly of the front wall and prevent the tuck flap from moving outwardly to open the carton. The central fold line **43** permits the lock to be bent intermediate its side edges so that these shoulders **41** and **42** may be withdrawn. If desired, a perforated line **50** may connect the ends of the U-shaped cut line **46** so that the part between the parallel cut lines **47** and **49** may be entirely removed if desired after the carton has been opened.

An elongated metal cutting strip **51** is attached in any suitable manner to the upper edge of the front panel **14** to project slightly above the same. This cutting edge **51** may have a serrated or tooth edge to facilitate the tearing of the film as it is dispensed. Ears **52** may be punched from the body of the strip **51** and inserted into or through portions of the front carton wall **14** so as to securely attach the strip **51** in place.

The apparatus which is indicated in general by the letter B is designed to close the cartons A and to lock the locking tabs or flap **33** into the U-shaped cut **46** in the front carton wall. In general, the cartons enter the apparatus on a conveyor belt which carries them against a suitable stop. The cartons are then pushed laterally in timed relation onto a parallel conveyor, this arrangement serving to index the cartons and to send them through the machine in properly timed relation. As a next stage of the operation, the flap **53** which is defined by the U-shaped cut line **46** is prebroken inwardly so as to provide an opening in the front wall through which the side edges of the locking flap **33** may extend. The flaps **29** and **30** are next folded down into a common plane to overlie the carton contents. Most of the views of the drawing omit the carton contents for the purpose of simplifying the drawing. However, Figure 26 of the drawings shows an elongated roll C of foil, waxed paper, or similar sheet material which is to be dispensed from the carton a portion at a time.

After the flaps **29** and **30** have been folded down into a common plane, the tuck flap **19** is folded out of the plane of the cover panel **16** so that the body of this tuck flap may be inserted inwardly of the carton front wall **14**. This is done in such a manner as to not fold the lock flap **33** and so that this locking flap **33** remains substantially in the plane of the cover panel during this portion of the operation. During the next series of operating steps, the tuck flap is guided down into the inside of the carton until the cover panel is in closed position and the locking flap **33** is projecting forwardly therefrom. Thus, it will be seen, that the locking flap overlies the upper edge of the front panel **14** when the cover panel **16** is closed.

During the next stage of operation, a locking flap is bent forwardly and downwardly and, while the center part of the locking flap is held from inward movement, the lateral edges of this flap flex toward the front wall of the carton until the laterally projecting ears or locking shoulders **41** and **42** extend through the opening in the front wall **14** provided by folding inwardly the flap **53**. The means holding the center portion of the locking flap is then retracted and the flap is urged inwardly into substantially the plane of the front panel **14** of the carton. When in this position, the ears or shoulders **41** and **42** project laterally beyond the sides of the U-shaped cut **46** so as to hold the cover panel from opening.

Having now described in general the operation of the apparatus, the construction which makes this operation possible will be described. The apparatus includes an elongated frame which is indicated in general by the numeral **54**, the frame being supported by legs **58** and **58'** at opposite ends thereof. As is perhaps best illustrated in Figure 4 of the drawings, the frame **54** includes an inverted channel **55**, the base **56** of which forms the top of the apparatus, and the vertical flanges **57** and **59** of which form a means of attachment with the sides **60** and **61** respectively of the frame. During the major portion of the length of the machine, the flanges **57** and **59** may form the frame sides except where shaft mountings and the like require a greater depth of frame side.

As is indicated in Figures 1 and 2 of the drawings, a pair of parallel shafts **62** and **63** are mounted in suitable bearings such as **64** extending transversely of the frame **54**. Pulleys such as **65** and **66** are mounted upon the shaft **62** and **63** respectively and these pulleys support an endless conveyor belt **67**. The cartons A, after they have been filled, travel along this endless conveyor belt **67** until the forward carton of the series engages a suitable stop **69**. This stop **69** also incorporates a switch **70** which is for a purpose later described.

The frame **54** also supports a pair of parallel shafts **71** and **72** which supports a pair of sprockets **73** and **74**. An endless conveyor chain **75** is mounted upon the sprockets **73** and **74**, the chain **75** also extending around an idle sprocket **76** on a transverse shaft **77** and an adjustable sprocket **79** on a vertically adjustable shaft **80**. By adjusting the position of the sprocket **79**, the tension on the conveyor chain **75** may be regulated.

As will be noted in the drawings, the conveyor **67** overlaps the conveyor chain **75** so that when the foremost carton A is against the fixed stop **69**, it is also alongside the conveyor chain **75**. This arrangement is best illustrated in Figure 3 of the drawings. The conveyor chain **75** is provided with spaced upwardly extending lugs **81** (see Figure 4) which engage the rear end of a carton overlying the conveyor chain **75** and move the carton in timed relation with the chain.

As is indicated in Figures 3 and 4, a laterally extending support **82** is secured to the frame **54** to extend laterally therefrom. The support **82** supports a pair of transversely aligned bearings **83** and **84**. These bearings support a plunger shaft **85** for reciprocable movement in the bearings. Suitable means is provided, not illustrated in the drawings, for holding the plunger shaft **85** from rotation in the bearings **83** and **84**.

The plunger shaft **85** is provided on its extremity with a flange **86** which supports a pusher plate **87**. The pusher plate **87** is designed to engage against the forward wall **14** of a carton A engaging against the stop **69** to urge this carton A laterally over the conveyor chain **75**. In preferred form, the belt **67** acts as a slip belt and operates continuously to urge cartons against the stop **69**. Thus, as soon as one carton is urged laterally in the position over the conveyor chain **75**, the next carton automatically moves against the stop **69**.

The pusher plate **87** is provided with an angularly bent flange **89** at one end thereof. This flange **89** is designed to engage the end of the second carton A while the first carton in line upon the conveyor **67** is being urged into position over the conveyor chain **75**. As soon as the pusher plate **87** returns to its inoperative position shown in Figures 3 and 4 of the drawings, the carton A which has been restrained from movement on the belt **67** by the flange **89** is permitted to progress against the fixed stop **79**.

In order to operate the pusher or bearing plate **87**, a sleeve **90** is secured upon the plunger **85**, this sleeve having rack teeth **91** on its under surface. A gear segment **92** having peripheral teeth **93** designed to mesh with the teeth **91** is pivotly supported upon a longitudinally extending shaft **94** supported by bearings such as **95** on the frame side plate **60**. The gear segment **92** is provided with a lever arm **96** which extends beyond the pivot shaft **94** and is pivotally connected at **97** to a link **99**. The link **99** is in turn pivotly connected at **100** to a solenoid armature **101** of a solenoid **102**. The armature **102** is normally held in one extreme position by a spring **103**. When energized, the solenoid **102** acts to move the armature **101** to the left as viewed in Figure 4 pivoting the gear segment **92** in a clockwise direction and urging the plunger **85** to the right a distance sufficient to force the foremost carton A from the position on the conveyor belt **67** to a position over the conveyor chain **75**. Suitable means such as the guide rods **104** assist in guiding the movement of the carton A as it travels along the apparatus frame with the conveyor chain **75**.

The first step in the closing operation of the carton A is indicated in Figures 5, 6 and 7 of the drawings. A post **105** is mounted upon the top **56** of the channel **55** to extend upwardly therefrom. As is indicated in Figure 6 of the drawings, this post **105** supports a rotary disc **106** by means of a bearing **107** encircling a bolt **109** extending axially into the post **105**. This disc **106** is designed to assist in opening the female portion of lock as will be later described. At this point of its travel, the carton A is traveling with the conveyor chain **75** and is guided between the guide bars **104** overlying the rear wall **13** of the carton and a parallel guide bar **110** extending longitudinally of the machine frame and resting against the forward wall **14** of the carton. The space between the guide bars **104** and **110** is sufficient to permit some outward flexing of the front wall **14**. The roller **106** is positioned to bear against the front wall **14** as it moves along the conveyor and may actually flex the front wall **14** inwardly to some extent. A bracket **111** is mounted upon the frame member **55** outwardly of the post **105**. The bracket **111** supports a bearing **112** which rotatively supports a transverse shaft **113**. A hub **114** is mounted upon the shaft **113** and the hub **114** is provided with a generally, radially extending arm **115** which terminates in a curved folding horn **116**. The curved horn **116** engages against the inner surface of the front wall **14** at the upper edge thereof to flex the front wall outwardly. This horn **116** rotates in timed relation with the conveyor chain **75** so that as the roller **106** exerts an inward force against the flap **53** in the carton front wall **14**, the horn **116** exerts an outward flexing force against the front wall of the carton just above the flap **53**. As a result, the flap **53** is bent inwardly as indicated in Figure 5 of the drawings so as to open the lock receiving slots and to simplify the insertion of the lock. While the contents of the carton A are not shown in place in this figure, the dimensions of the roll contained and of the carton are such as to permit the flap **53** to be forced inwardly out of the plane of the remainder of the front wall. Also, due to the fact that the carton normally contains an elongated cylindrical roll of material, the horn **116** does not interfere with the carton contents.

A bracket **117** is mounted upon the frame member **55** outwardly of the bracket **11** as shown in Figure 7. The bracket **117** supports spaced bearings **119** which support

a vertical shaft **120**. The shaft **120** is provided with a bevel gear **121** and its upper extremity which is in mesh with a bevel gear **122** mounted upon the previously described shaft **113**. The vertical shaft **120** is driven through suitable meshing bevel gears **123** and **124**, one of which is mounted on the lower end of the shaft **120** and the other of which is mounted upon a transverse shaft **125** supported by bearings such as **126** on the sides **57** and **59** of the frame **55**. Thus rotation of the shaft **125** in a manner which will be later described, causes rotation of the folding horn **116** in timed relation to the conveyor chain **75**.

After the flap **53** has been prebroken out of its normal plane, the carton A travels past a mechanism for folding down the flaps **29** and **30** of the carton into a common plane. This mechanism is best illustrated in Figures 8, 9 and 10 of the drawings. A blade **127** is shown in these figures supported just above the level of the end walls such as **20** of the carton A, the blade **127** being preferably provided with an upturned end **129**. The blade **127** is supported by suitable brackets which are not shown in detail in the drawings. As the carton A travels with the chain **75**, the flap **29** at one end of the carton is engaged by the upturned end **129** of the blade **127** and this flap **29** is folded down into a horizontal position in the manner best illustrated in Figure 8.

A vertical bearing **130** is mounted upon the base **56** of the channel frame member **55** to rotatively support a vertical shaft **131**. A hub **132** is mounted upon the shaft **131** and a generally radially extending blade **133** is supported upon the hub **132**. The shaft **131** rotates in a counter clockwise direction as viewed in Figure 8 and as the rear end of the carton A moves towards a position opposite the shaft **131**, the blade **133** engages the flap **30** and folds this flap down into horizontal position as also indicated in Figure 8.

The shaft **131** is operated by cooperable bevel gears **134** and **135**, one of which is mounted upon the shaft **131** and the other of which is mounted upon a transverse shaft **136**. The shaft **136** is mounted on suitable bearings **137** on side plates **139** and **140** secured to opposite side edges **57** and **59** of the frame member **55**. The blade **127** is provided with an angularly inclined flange **141** designed to engage against the inner or under surface of the cover panel **16** of the carton during a portion of the closing operation. A folding horn **142** is mounted in a suitable manner upon the frame, the details of the support of this horn not being shown. As is indicated in Figure 8 of the drawings, this folding horn **142** engages the outer or upper surface of the top panel **16** and folds this panel down against the flange **141** of the blade **127**.

Means are next provided on the apparatus for folding the tuck flap **19** of the carton downwardly relative to the cover panel **16** to which it is hinged while at the same time permitting the lock **33** to remain in the plane of the cover panel. This structure is best illustrated in Figures 11 through 14 of the drawings. In Figure 11 of the drawings the guide rods **104** have been omitted in order to more clearly show the construction of the device.

As is indicated in these figures, a bracket **143** is supported upon the base **56** of the frame member **55** and this bracket supports a bearing member **144** having an axis parallel to the longitudinal axis of the machine. A shaft **145** is supported by the bearing member **144** and a sprocket **146** is mounted upon this shaft **145**. The sprocket **146** is connected by a chain **147** to a cooperable sprocket **149** mounted upon a longitudinally extending shaft **150** supported by bearings **151** attached to the under surface of the frame member **56**. With reference again to Figure 10 of the drawings, it will be noted that the transverse shaft **136** is provided with a beveled gear **152** which is in mesh with a cooperable bevel gear **153** on the shaft **150**. Thus, the sprocket **149** and accordingly the shaft **145** is rotated in timed relation to the shaft **136**.

A hub **154** is mounted upon the shaft **145** and supports a radially extending arm **155** which in turn supports an arcuate folding horn **156**. The second hub **157** is also mounted upon the shaft **145** and supports a pair of radially extending arms **159** and **160**. The arms **159** and **160** in turn support arcuate folding horns **161** and **162** respectively. As will be noted in Figures 11, 12 and 14, as the carton A reaches a position opposite the bracket **143**, the folding horns **156** and **161** engage the tuck flap **19** on opposite sides of the lock **33** and fold this tuck flap downwardly. This action takes place while the carton cover panel **16** is confined between the blade flange **141** and the folding horn **142** so that the cover panel **16** will not fold with the flap **19**. As the lock **33** is completely disconnected from the tuck flap **19**, this lock **33** remains in the plane of the cover panel **16**.

When the carton A is moved by the lugs **81** on the chain **75** into a position opposite the bracket **143**, the curved folding horns **156** and **161** engage the tuck flap **19** on opposite sides of the lock **33** and fold this flap downwardly, leaviing the lock **33** in the plane of the cover panel **16**, the folding horns engaging the tuck flaps simultaneously. While the carton A is in movement during this time, the folding horns remain in contact with the flap a time which is insufficient to move the carton so that the folding horn **161** engages the lock. Subsequent rotation of the hub **157** causes the folding horn **162** to engage the rear half of the flap and to further guide this rear portion of the tuck flap downwardly.

A folding shoe **163** engages the tuck flap **19** to hold this flap in a downwardly inclined position as the cover panel **16** travels beyond the flange **141**. The folding shoe **163** extends partially over the carton just inwardly of the front wall **14** thereof. The folding horn **142** is bent downwardly so as to urge the tuck flap into horizontal position, and during this action the tuck flap **19** is guided down inwardly of the carton front wall **14** by the shoe **163**. This operation is indicated in Figures 16 through 19 of the drawings.

Figure 16 shows the position of the tuck flap **19** just before it starts its entry into the interior of the carton. Figure 17 shows a subsequent position in which the tuck flap has entered the interior of the carton and is in partially overlapped relation to the front wall **14**. Figure 18 shows the cover flap as it approaches its horizontal position and as it starts its movement below the upwardly inclined forward end **164** of a top guide bar **165**.

As indicated in Figure 15 of the drawings, a pair of spaced brackets **166** and **167** extend upwardly from the frame portion **56** of the channel **55** and these brackets support parallel transversely extending horizontal shafts **169** and **170**. These shafts support rollers **171** and **172** respectively which are rotatively supported on reduced diameter end portions such as **173** of these shafts. The rollers **173** are held in place by any suitable means such as the nuts **174**. Alternatively, the ends of the shafts **169** and **170** may be provided with an internally threaded socket at their extremity and the fastening means **174** may comprise terminally threaded pivot bolts which extend into these sockets.

The rollers **171** and **172** are supported at a proper level to engage the top panel **16** and to fold this panel into completely closed position. It is also indicated in Figure 15, as the carton A passes beneath the rollers **171** and **172**, a folding horn **175** engages the upper surface of the lock **33** and starts to fold this lock downwardly to overlie the outer surface of the front wall **14** of the carton A.

With reference to Figure 1 of the drawings, it will be noted that the frame is provided with oppositely disposed side plates **176** which support a pair of parallel shafts **177** and **179**. These shafts support aligned sprockets **180** and **181**. The sprockets just described support an endless chain **182** which carries a series of vertically

reciprocal plunger members 183. These plunger members and the purpose thereof will be later described in detail. These members are operated, however, by a cam 184 supported beneath the level of the frame table and which are supported in fixed relation to the frame.

A vertical bearing 185 is supported by the frame plate 176 and supports a vertical shaft 186. Bevel gears 187 and 189 on the shaft 186 and 179 respectively cause rotation of the shaft 186 in unison with the shaft 179. Parallel vertical shafts 190, 191, and 192 are supported by suitable bearings 193, 194 and 195. The bearing 193 is adjustably supported for movement longitudinally of the machine. The shafts described all support sprockets. A sprocket 196 is supported by the shaft 186 and sprockets 197, 199 and 200 are supported by the shafts 190, 191 and 192 respectively. These sprockets support a conveyor chain 201 which supports spaced folding members 202 for movement in unison with the chain.

With reference now to Figures 20 through 23 of the drawings, the manner in which the lock 33 is engaged will be described. The plunger units 183 include bearings 203 having laterally extending mounting lugs 204 which are connected by brackets 205 to the chain 182. During the upper and lower flights of the conveyor chain 182, these bearings 203 are supported in a vertical position. A plunger 206 is slideably supported in each of the bearings 203. Each plunger 206 is provided with a bifurcated lower end 207 which is of enlarged diameter. A cam roller 209 is supported by a transverse pivot 210 in the groove 211 at the lower end of each plunger. This cam roller 209 of each plunger unit is designed to ride over the cam 184 which is in fixed relation to the machine frame. A spring 212 is interposed between the end of the bearing 203 and the enlarged diameter plunger end 207 of each unit to urge the roller 209 against the cam as the conveyor chain 182 travels along its upper flight. The upper end of each plunger 206 is provided with a smaller diameter extension 213 having a rounded lug 214 at its upper extremity. This lug 214 can probably be best seen in Figure 23 of the drawings.

The conveyor chain 182 is in proper timed relation with the conveyor chain 75 so that as each carton A travels to a position opposite the conveyor chain 182, the rounded lugs 214 are centered with respect to the cartons. During this movement, the cam rollers 209 are in engagement with the cam 184, projecting the rounded lugs upwardly in the path of folding movement of the lock 33.

Also, at this stage of the operation, the spaced folding members 202 on the conveyor chain 201 straddle the rounded lugs 214 and the pointed ends 215 of the folding members 202 engage the upper and outer surface of the lock 33 as the rounded lugs 214 engage the inner surface thereof. It will be noted that the sprocket 199 is closer to the path of travel than the sprockets 197 or 200 so that the folding members 202 are moved gradually inwardly until they actually insert the ends 41 and 42 of the lock 33 through the opening provided in the carton front wall 14 by the inward folding of the flap 53.

Figure 20 of the drawings shows the arrangement of the parts as the folding members 202 engage the ends of the flap 33 and start to bend this flap along the center fold line 43. Figure 21 shows a subsequent position in which the folding members 202 have straddled the lugs 214 to a greater extent and have bent the ends of the lock an amount sufficient to cause them to start to enter the opening in the carton front wall 14. At this stage of the operation, the height of the cam 184 is decreased to permit the plunger extension 213 and the lugs 214 to retract. This takes place after the ends 41 and 42 of the lock start their entry into the carton but before the folding members 202 have completed their travel toward the carton. Accordingly, further travel of the conveyor chain 201 moves the folding members 202 inwardly to force the ends of the lock 33 through the opening in the carton front wall.

During the time the carton A is being closed, it is confined between the guide bars 104 on one side, and a guide shoe 216 on the other side. This guide shoe 216 has been omitted in various of the views in order to more clearly illustrate the remainder of the structure. After the top panel 16 has been folded into horizontal position, the carton is held upon the track by the guide rod 164 and by a parallel guide rod 217.

With reference now to Figure 2 of the drawings it will be noted that the shaft 186 is provided with a sprocket 219 which is spaced above the chain sprocket 196. A second vertical shaft 220 projects upwardly from the machine frame near the path of movement of the cartons A and also supports a chain sprocket 221. A short conveyor chain 222 is supported by the sprockets 219 and 221 and this chain 222 supports a pair of cams 223. As the sprocket 219 rotates with the shaft 186, it is in timed relation to the previously described conveyor 201.

With reference now to Figure 24 of the drawings, it will be noted that a bracket 224 is supported by the cover plate 225 overlying the conveyor 201 and this bracket 224 supports a bell crank lever 226. A pivot 227 extends through the bracket 224 and through an intermediate part of the bell crank lever 226. In normal position, one arm 229 of bell crank lever 226 extends horizontally and supports at its outer extremity a cam roller 230. The other arm 231 of the bell crank lever 226 supports a presser plate 232 which is engageable against the lock 33 after it has been tucked into the front wall of the carton to insure the flattening of the lock against the front wall and to eliminate the possibility of having this lock catch upon some other object and be pulled open. It will be seen from Figure 24 that as the cams 223 are carried by the conveyor chain 222 over the cam roller 230, these cams will engage the cam roller and swing the bell crank lever 226 in a counter clockwise direction a distance sufficient to urge the presser plate 232 against the forward wall of the carton A. As the chain 222 is in synchronized relation to the remaining conveyors described, this presser plate acts against the lock to insure its proper closure.

The manner in which the machine B is driven may of course be varied. In the particular arrangement illustrated, a platform 233 is suspended beneath the top of the machine frame by hangers such as 234, one end of the platform being pivotally supported on a horizontal pivot 235 to the leg 58 on each side of the frame. A motor 236 is supported upon the platform 233 and acts through a coupling 237 to drive a reduction gear unit 239 which is provided with a driven shaft 240. A pulley 241 is mounted on one end of the shaft 240 and acts through a belt or chain 242 to drive a cooperable pulley mounted upon the shaft 72. Rotation of the shaft 72 causes the movement of the main conveyor chain 75 which acts to move the cartons through a major portion of the length of the machine.

The driven shaft 240 is also provided with a second sprocket 243 which is connected by a chain 244 to a cooperable sprocket 245 on the transverse shaft 179. Thus, movement of the chain 244 acts to move the conveyor chain 182 in properly timed relation with the conveyor chain 75. This movement is also transmitted through the bevel gears 187 and 189 to drive the vertical shaft 186. Rotation of the shaft 186 acts to move both the conveyor chain 201 and the conveyor chain 202 in properly timed relation.

During the travel of the chain 75, it also drives a sprocket 249 mounted upon the transverse shaft 125. A gear 250 is mounted upon this shaft 125 which is in mesh with an idle gear 251 on a parallel shaft 252. The gear 251 is also in mesh with a gear 253 on the shaft 63. The belt conveyor 67 rotates over the pulley 66 on this shaft 63 and accordingly, the slip belt conveyor 67 is

moved in a desired speed ratio relative to the conveyor chain **75**.

Rotation of the shaft **125** also acts to drive the parallel shaft **113** of the current member **116** through the series of bevel gears and the vertical shaft **120** as was previously described.

Rotation of the gear **250** also acts to rotate an idle gear **254** on a parallel transverse shaft **255** and this gear **254** is also in mesh with a gear **256** on the transverse shaft **136**. Rotation of the shaft **136** acts to operate the flap folding blade **130** and also acts through the longitudinal shaft **150** to operate the tuck flap folding mechanism best shown in Figure 11 of the drawings.

A cam **257** is mounted upon the shaft **71** supporting one end of the conveyor chain **75** and this cam operates at timed intervals to close a normally open switch **259**. The limit switch **70** is mounted at the end of the slip belt **67** as was previously described. An additional pair of normally open switches **260** and **261** are mounted on the machine frame along the path of movement of cartons upon the slip belt **67**. These normally open switches are closed when cartons are in opposed relation thereto on the slip belt. It is normally advisable to have at least three cartons on the slip belt while the machine is in operation as the weight of the cartons on the slip belt tends to insure the proper registry of the foremost carton with the transfer apparatus which moves the cartons from the slip belt **67** to the conveyor chain **75**.

With reference now to Figure 28 of the drawings, it will be noted that the three phase line from the power source includes the line wires **262**, **263** and **264**. When in operation, these line wires are connected through switch blades **265**, **266**, and **267** to the line wires **269**, **270**, and **271** extending to the motor **236**. The starting switch which includes the switch blades **265**, **266** and **267** also includes a fourth switch blade **272**.

The line wires **263** and **264** are connected by conductors **273** and **274** to the primary coil **275** of a transformer **276**. The remaining transformer coil **277** is connected by conductors **279** and **280** to a suitable motor starting and controlling switch indicated in general by the numeral **281**. The conductor **280** is connected through an overload switch **282** to the magnetic coil **283**. The other terminal of the starting coil **283** is connected by a conductor **284** to one terminal of a starting switch blade **285** which forms a part of the starting switch **281**. The starting switch **281** includes two blades **285** and **286** which operate individually and also include a single pull switch **287** which may be independently operated between two terminals. One terminal of each of the switch blades **285**, **286** and **287** are connected by a conductor **289**.

The line wire **279** extends through the pressure actuated switch **70** at the end of the slip belt **67** to one terminal of the stop switch **286**. This line wire **279** also is connected by a conductor **290** through the cam operated switch **259** and the normally open switches **260**, **261** and **258** which are in series. The conductor **290** then extends to one end of the coil **291** of a relay **292**.

A rectifier **293** is connected to the line wires **279** and **280** by the conductors **294** and **295** respectively. The output terminals of the rectifier **293** are connected by conductors **296** and **297** to relay switches **299** and **300** forming a part of the relay **292**. The other terminals of the switches **299** and **300** are connected by conductors **301** and **302** to the solenoid **102**. Accordingly, when the relay **292** is actuated, the solenoid **102** will be energized to transfer a carton from the slip belt **67** to the chain conveyor **75**.

The second terminal of the relay coil **291** is connected by a conductor **303** to the line wire **280**. A conductor **304** leads from the conductor **284** to one terminal of the switch blade **272**. The other terminal of this switch blade is connected by a conductor **305** to a terminal **306** of the control switch **281**. This completes the circuit.

In operation the rectifier **293** remains energized at all times when the main switch is closed providing a potential source of direct current to the relay contacts **299** and **300**. Cartons A are placed upon the slip belt **67** in sufficient number to close the normally open switches **260**, **261** and **258** and also to close the pressure actuated slip belt switch **70**. If the control switch **281** is in the position illustrated and if it is desired to jog the machine, the switch blade **287** remains in position to open the circuit from the switch conductor **289** to the holding circuit conductor **305**. The start switch **282** is then closed and a circuit is closed from the line wire **279**, through the closed pressure actuated switch **70**, through the normally closed stop switch **286**, through the closed switch **285** and the conductor **284** to one terminal of the starting coil **283**. The other terminal of this starting coil **283** is connected through the overload switch **282** and the conductor **280** to the other side of the transformer coil **277** thus completing the circuit.

The completion of the circuit energizes the starting coil **283** and moves all of the switch blades **265**, **266**, **267** and **272** into closed position. The motor **236** is then in operation and all of the various conveyors are set into motion.

As long as the start switch **285** is held closed, the machine continues to function but as soon as pressure on the starting switch is released, the circuit to the starting swich coil **283** is broken and the motor will stop.

At a predetermined point in the cycle of operation, the cam **257** closes the normally opened switch **259** thus closing a circuit to the relay coil **291**. This circuit extends from the line wire **279** through conductor **290**, the cam operated switch **259** and the normally open switches **258**, **260** and **261** which are being held closed by the cartons on the slip belt. The circuit leads through the relay coil **291** and the conductor **303** to the other line wire **280**. When the relay **292** is actuated, the solenoid **102** is energized acting to transfer the foremost carton on the slip belt into position over the conveyor chain **75** where it is subsequently picked up by the lugs **81** and moved through the remainder of the machine.

The cam operated switch **259** is only momentarily closed and as soon as the circuit is opened, the relay coil **291** is again deenergized opening the circuit from the rectifier **293** to the solenoid **102**. The spring **103** then returns the pusher plate **87** to its normal retracted position and the cartons A on the slip belt **67** move forwardly until the foremost carton again closes the pressure actuated switch **70**. This return operation of the pusher plate **87** normally causes the cartons A to advance to close the pressure operated switch **70** prior to the time the cam actuated switch **259** is again actuated. Thus, as long as the infeed line remains properly filled, the machine will function at regular intervals.

When it is desired to run the machine continuously, the switch plate **287** is moved into contact with the switch terminal **306** actuating a hold circuit for the coil **283** of the starting switch. This circuit extends from the line wire **279** through the pressure actuated switch **70**, the stop switch **286**, conductor **289**, the start switch **285**, the conductor **284**, conductor **304**, switch blade **272**, conductor **305**, switch **287** which is also connected to conductor **289**. In other words, the starting coil **283** may either be closed through the starting switch **285** or the switch **287** so that once the starting switch **285** is momentarily closed to actuate the coil **283**, the circuit to this coil continues through the switch **272**.

Thus it will be seen that once the main switch of the apparatus is in place to close the circuit and there is a proper supply of cartons on the slip belt, the apparatus will function automatically to transfer each successive carton from the slip belt to the chain conveyor. While on this chain conveyor the carton moves through the successive steps of prebreaking the lock in the carton front wall, folding the tuck flap relative to the cover panel, folding the cover panel into closed position while

tucking the tuck flap inside the carton, this operation taking place after the flaps on the end walls have been folded down, folding the T shaped lock downwardly and inserting the ends of this lock into the carton, and pressing the outer surface of the lock to straighten it and insure its insertion. The filled and closed carton is then taken from the machine and is in readiness for packing.

In accordance with the patent statutes, the principles of construction and operation of the apparatus for closing cartons has been set forth, and while an endeavor has been made to set forth the best embodiment thereof, it is desired to be understood that obvious changes may be made within the scope of the following claims without departing from the spirit of the invention.

I claim:

1. An apparatus for closing a carton having a hinged cover provided with a locking tab, and a front wall including a locking slot, the apparatus including a carton conveyor, means engageable with said cover for folding the cover downwardly, a projectable and retraction member movable with said carton inwardly of said locking tab, means engageable with said tab as it moves on said conveyor for folding said tab over said projection, means movable with said conveyor engaging said tab on opposite sides of said projection for bending the side edges of the tab toward said carton front wall and into said locking slot and means for retracting said projectable means when the side edges of said tab extend through said slot.

2. An apparatus for closing a carton having a box-like body having a front wall provided with a locking slot, a cover hinged to the panel opposite said front wall, a tuck flap hinged to said cover, and a generally T-shaped locking tab hinged at its base end to said cover and cut from said tuck flap, the apparatus including a carton conveyor, means engageable with the carton cover during movement of the conveyor to fold the cover into carton closing position, means guiding the tuck flap inwardly of the carton front wall while leaving the locking flap in the plane of the carton cover, a projectable and retractable member movable with said carton beneath said tab, means engageable with the tab for folding the tab over said projectable member, means engageable with the tab on opposite sides of said projectable member to force the ends of the cross member of the tab toward said front wall and into said locking slot, and means retracting said projectable member.

3. The structure of claim 2 and in which said means engageable with the tab on opposite sides of the projectable member travels in unison with said conveyor and moves toward said front wall gradually as the cartons are conveyed.

4. The structure of claim 2 and in which the means engageable with the carton cover comprises folding horn means.

5. The structure of claim 2 and in which the means for folding the tab over the projectable member comprises a folding horn.

6. An apparatus for closing a carton having a box-like body having a front wall provided with a locking slot, a cover hinged to the panel opposite said front wall, a tuck flap hinged to said cover, and a generally T-shaped locking tab hinged at its base end to said cover and cut from said tuck flap, the apparatus including a carton conveyor, a guide member inwardly of said cover adjacent to the fold line connecting said cover to said tuck flap, means folding said tuck flap into angular relation while engaging said guide member, means folding said cover downwardly and means guiding said tuck flap inwardly of said front wall, said locking tab remaining in the plane of said cover, means folding said locking tab downwardly, and means inserting said locking tab into said locking slot.

7. The structure of claim 6 and in which the means folding the tuck flap comprises means engaging the tuck flap simultaneously during movement of the carton on opposite sides of said locking tab.

8. The structure of claim 6 and in which the means folding the tuck flap comprises a pair of spaced curved folding horns rotatably supported on an axis parallel to the direction of travel of the conveyors, and means rotating said horns in timed relation to said conveyor.

9. The structure of claim 6 in which the carton includes flaps hinged to the upper edges of the walls adjoining said front wall, and including means engageable with said last named flaps folding the same downwardly and inwardly before the closing of said cover.

10. The structure of claim 6 and in which the carton includes flaps hinged to the upper edges of the walls adjoining said front wall, and including folding horn means engaging the flap at the leading edge of the carton, and a rotatable blade engaging the flap at the trailing edge of the carton to fold these flaps into horizontal position prior to the folding of the cover into closed position.

11. A carton closing apparatus for closing cartons having a bottom panel, front and rear wall panels, and wall panels, a cover panel hinged to said rear wall panel, a tuck flap hinged to said cover panel along the forward edge thereof, a generally T-shaped locking tab hinged at its base to said cover panel and cut from said tuck flap, a lock slot in said front wall panel, and flaps hinged to the upper edges of the end walls, the apparatus including a slip belt, a parallel conveyor including spaced carton engaging members thereon, means engageable with the foremost carton on said slip belt for transferring said foremost carton to said parallel conveyor between said carton engaging means, means operable during movement of said cartons on said parallel conveyor for sequentially folding down said flaps on said end walls, means folding said tuck flap relative to said cover panel while leaving said locking tab in the plane of the cover panel, folding the cover into closed position while inserting said tuck flap inwardly of said front wall, means folding said locking tab downwardly, and means bending said T-shaped locking tab intermediate its ends and inserting the ends of said tab into said locking slots.

12. The structure of claim 11 and including a motor connected to said conveyors to operate the same, and motor controlling means including a motor starting circuit including switch means actuated by the presence of cartons on said slip belt adjoining said transfer mechanism.

13. The structure of claim 11 and in which the transfer mechanism includes a solenoid actuated pressure plate.

14. The structure of claim 11 and in which the transfer mechanism includes a pressure plate having an end shoulder engageable with the second carton on the slip belt while the first carton is being transferred.

No references cited.