July 1, 1969 D. E. HARKESS 3,452,514

PACKAGING APPARATUS

Filed June 12, 1967 Sheet 1 of 6

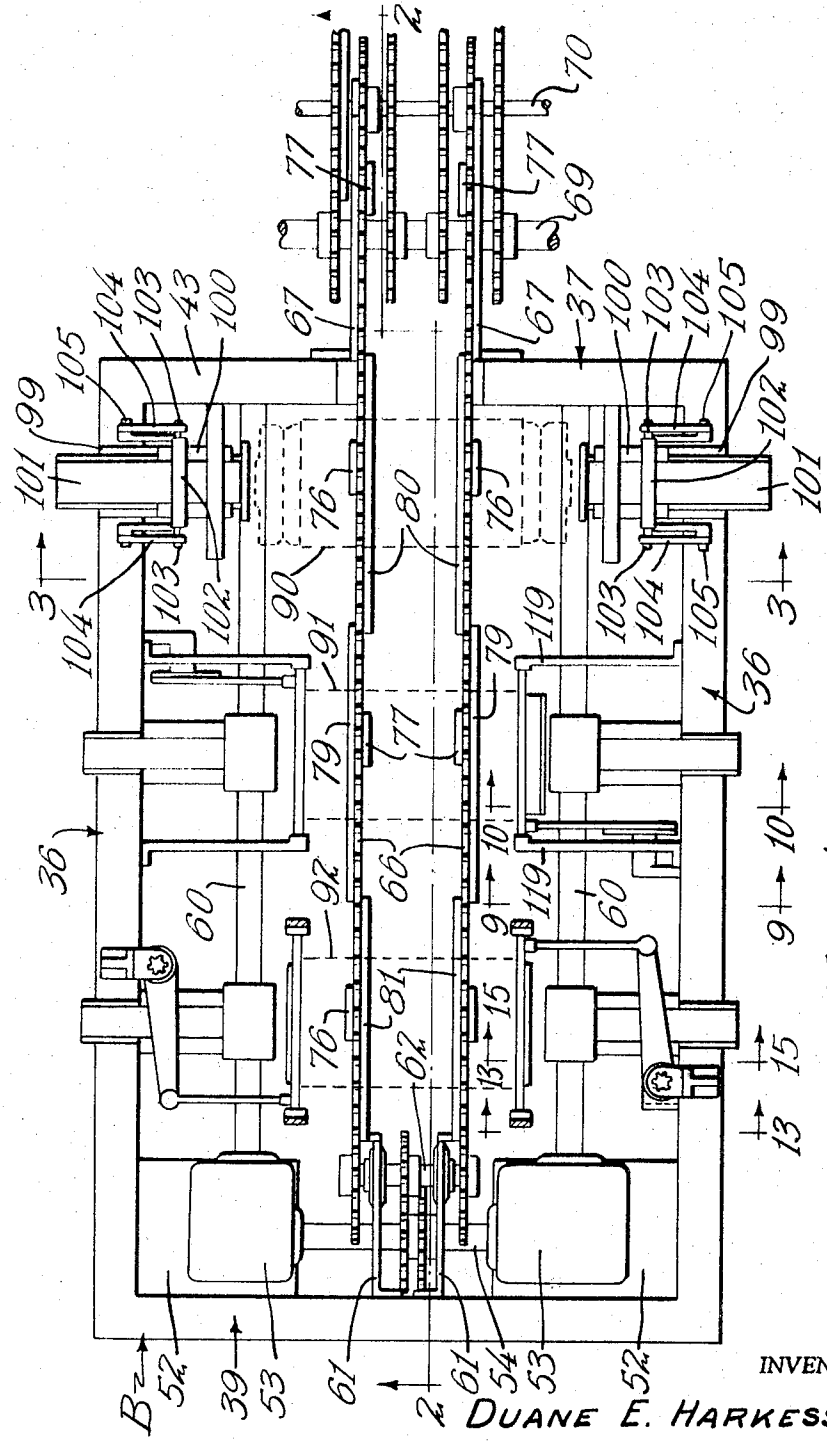


FIG. 1

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July 1, 1969 D. E. HARKESS 3,452,514

PACKAGING APPARATUS

Filed June 12, 1967 Sheet 2 of 6

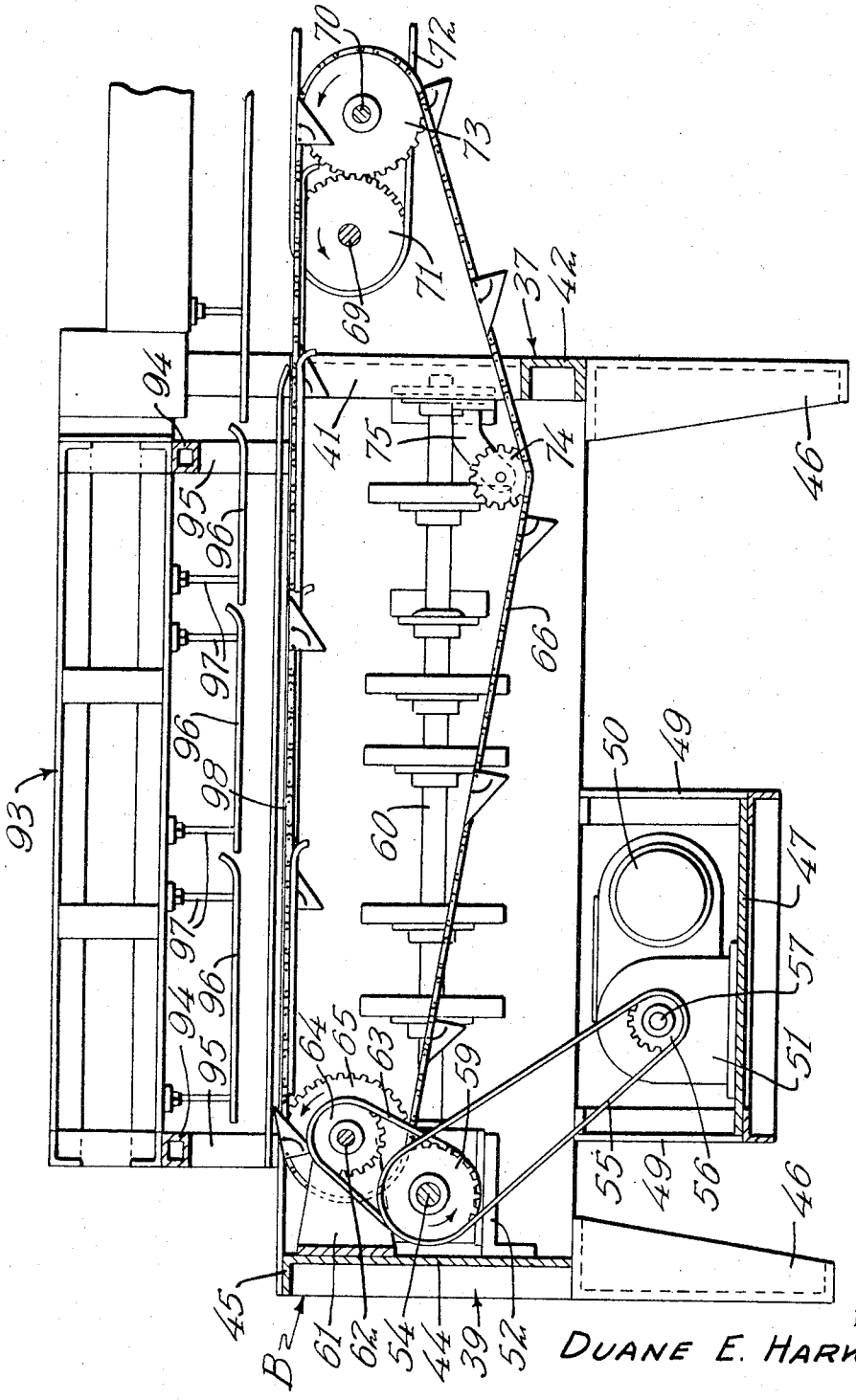


FIG. 2

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July 1, 1969 D. E. HARKESS 3,452,514

PACKAGING APPARATUS

Filed June 12, 1967 Sheet 3 of 6

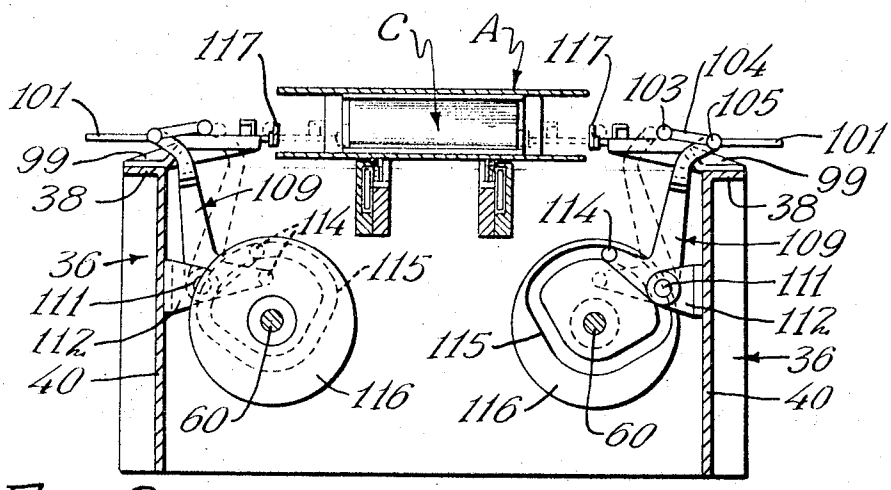


FIG. 3

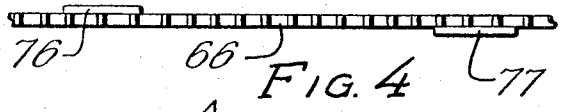


FIG. 4

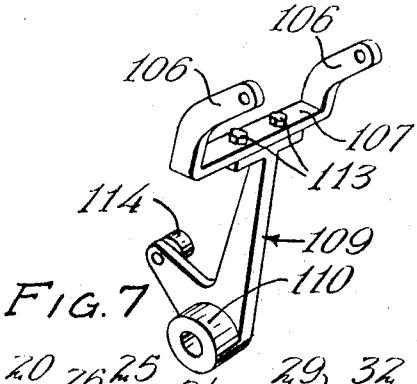


FIG. 7

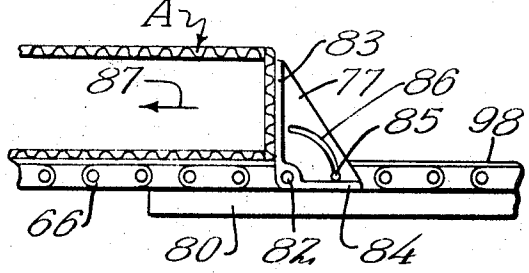


FIG. 5

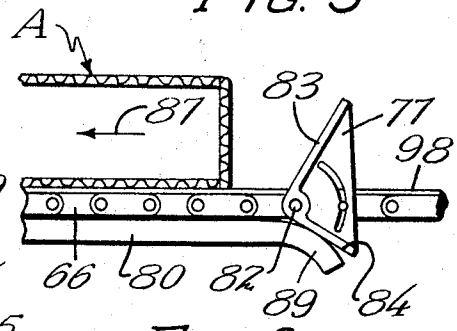


FIG. 6

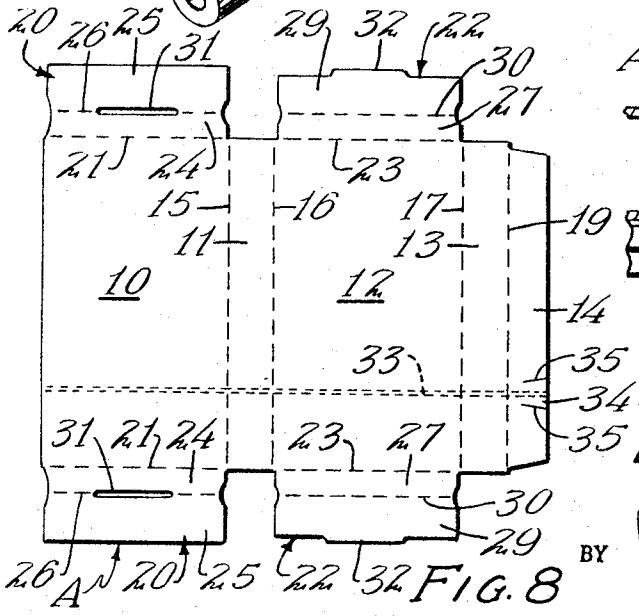


FIG. 8

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July 1, 1969 D. E. HARKESS 3,452,514

PACKAGING APPARATUS

Filed June 12, 1967 Sheet 4 of 6

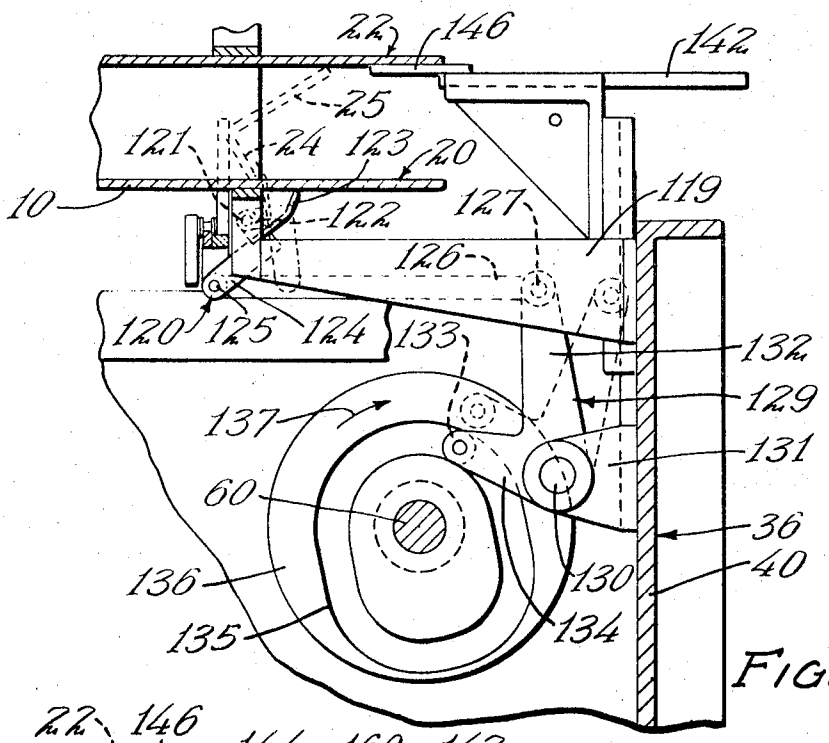


FIG. 9

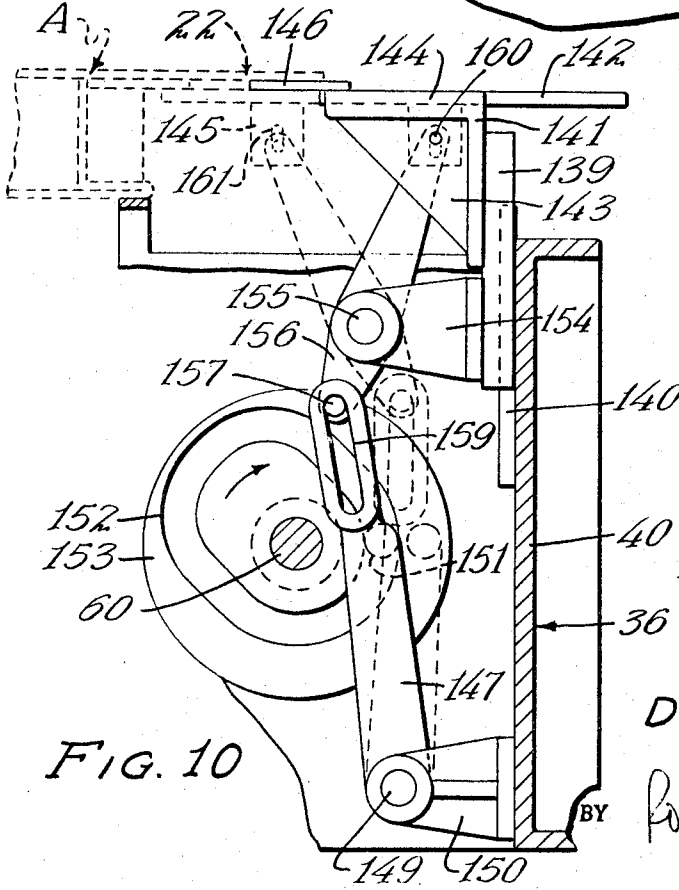


FIG. 10

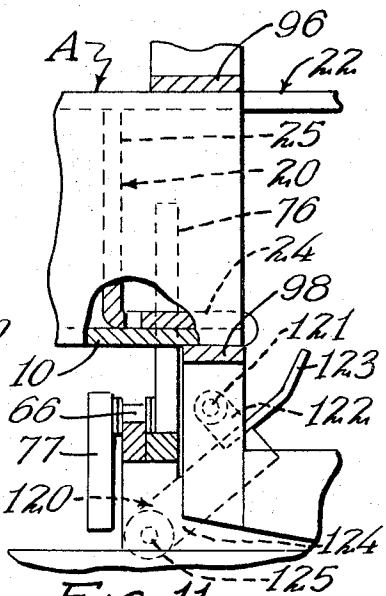


FIG. 11

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July 1, 1969 D. E. HARKESS 3,452,514

PACKAGING APPARATUS

Filed June 12, 1967 Sheet 5 of 6

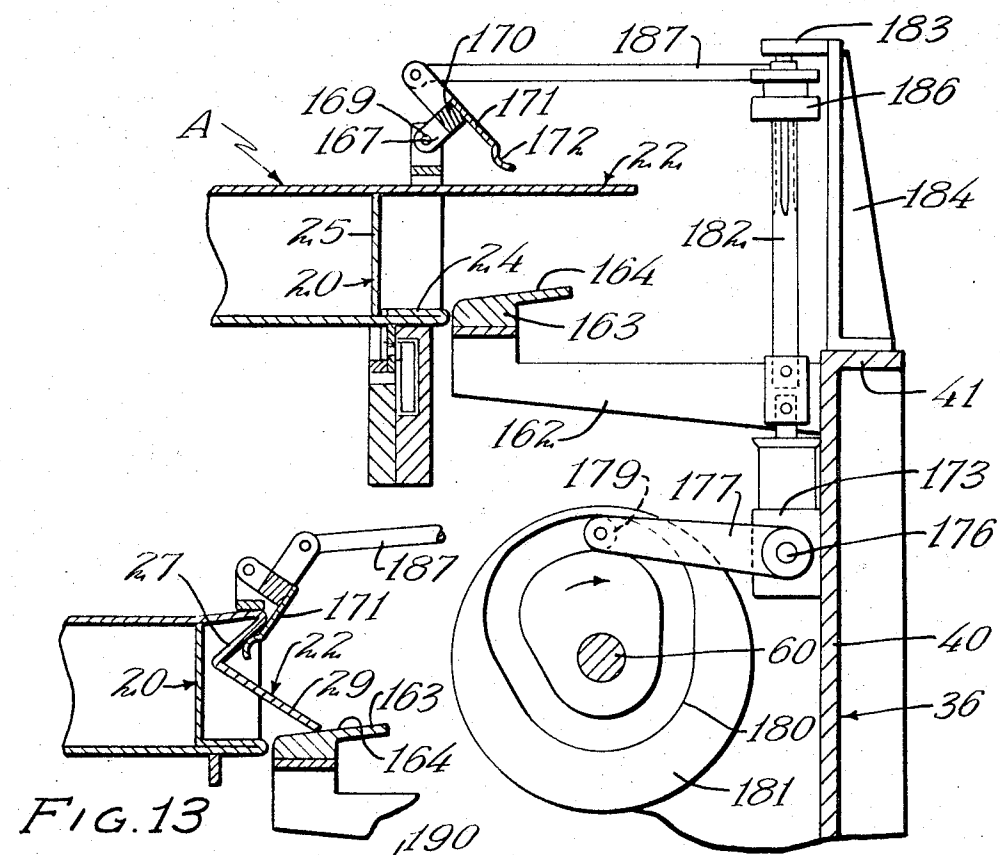


FIG. 13

FIG. 12

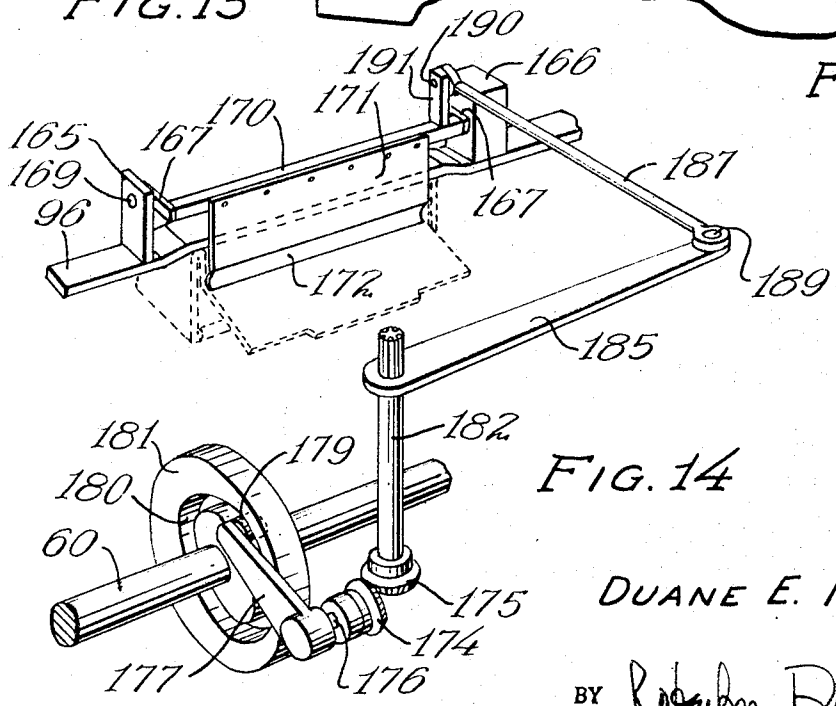


FIG. 14

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July 1, 1969 D. E. HARKESS 3,452,514

PACKAGING APPARATUS

Filed June 12, 1967 Sheet 6 of 6

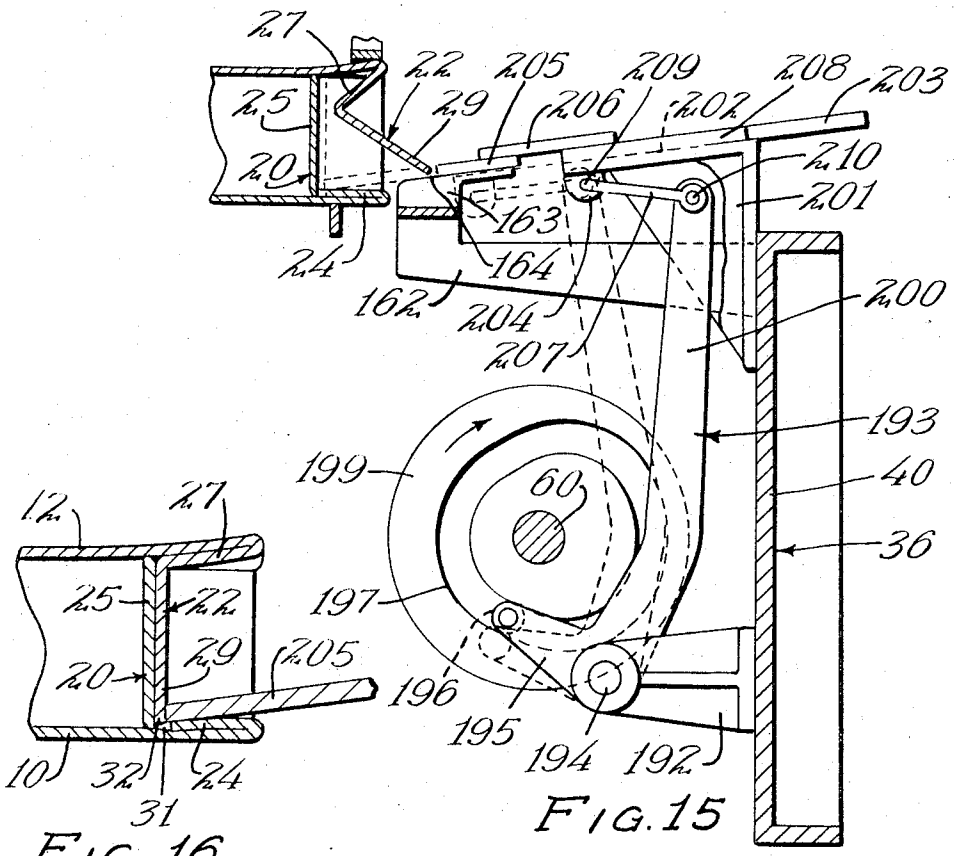


FIG. 15

FIG. 16

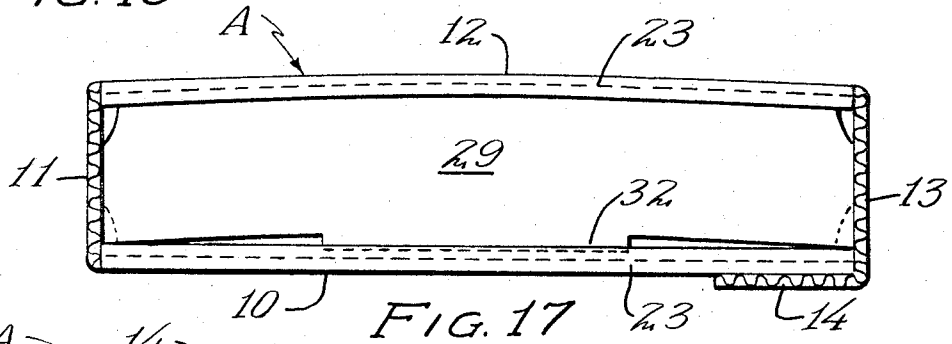


FIG. 17

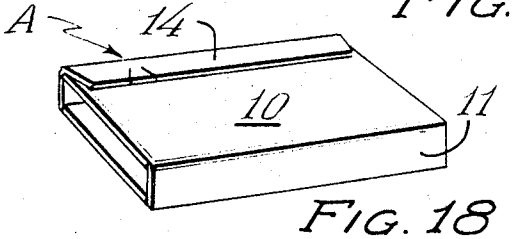


FIG. 18

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3,452,514

PACKAGING APPARATUS

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Int. Cl. B65b 7/20
U.S. Cl. 53—374 11 Claims

ABSTRACT OF THE DISCLOSURE

The present invention lies in an apparatus for closing recessed end tubular containers of the type used for shipping books and other articles. These containers have tubularly arranged main panels adapted to engage in face contact with the front and rear covers of the book and connecting side panels which are substantially equal to the thickness of the book. Closure flap structures are adapted to close at least one end of the body, these structures being hinged to the main panels. Each such structure includes a spacer flap adapted to be folded into face contact with the inner surface of the wall to which it is hinged, and a partition flap adapted to extend across the container at right angles to the container panels. The partition flaps of the two flap structures end up in face contact spaced inwardly of the ends of the wall panels.

The apparatus includes a conveyor for intermittently moving said containers through three stations, the books or other objects packed having been previously inserted in the open end of the container. In the first station, positioning means enter the container and position the book or object therein. In the second station, one flap structure is folded across the open end of the container and then forced into position with the partition panel at substantially right angles to the wall panels to form a recessed end closure. In the third station the other flap structure is folded partially across the container end and then forced into the container end with the portion flap thereof in face contact with the partition flap of the first folded flap structure.

This invention relates to an improvement in packaging apparatus and deals particularly with a device capable of closing the recessed ends of a tubular book container.

Books are usually manually packaged for individual shipment in containers of solid fibre or corrugated paperboard. Books such as law books are very expensive, and must be carefully protected during shipment as they would not be accepted by the customer if they were delivered in a damaged condition. Tubular containers made of corrugated paperboard have been commonly used for such books, the flaps forming the end closures of such containers being folded inwardly to form recessed ends which hold the book substantially spaced from the ends of the container, thus preventing damage to the book even though the corners or ends of the container are crushed or bent. Containers of this type are slow to close manually. It is the object of the present invention to provide an apparatus for mechanically closing the ends of a tubular recessed end container.

A feature of the present invention resides in the provision of an apparatus which is capable of centering the book or similar object between the open ends of the tubular container, folding a first closure flap at each end of the container to partially overlie the container open ends, forcing the first closure flap into L-shaped relation with one section of the flap folded into face contact with the inner surface of the panel to which it is hinged, and with the end portion of the flap extending at right angles

across the tubular carton to form an end closure in spaced relation to the extremity of the carton. The apparatus also includes means for folding a second closure flap, which is hinged to the panel opposite that supporting the first closure flap, partially across the end of the carton, and then forcing it inwardly to provide a first portion in face contact with the panel to which it is hinged, and an end flap portion extending at right angles across the carton in face contact with the end portion of the first closure flap. The end portion of the second closure flap normally includes a locking tongue which engages into a slot in the first closure flap to hold the closure in closed position.

A feature of the present invention resides in the provision of an apparatus of the type described which acts to intermittently move the filled packages between a series of stations. In the first station, plungers enter the open ends of the container to center the book in the package. At the second station, a first closure flap is swung partially across each open end of the package, and then a plunger engages the flap to fold it into end closing position. In the third station, means are provided to fold the opposite flaps partially across the ends of the package, and plunger means are provided which engage these second flaps to fold them into container closing position. The packaged books are then stacked to remove any bulge from the container walls.

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 diagrammatic top plan view of the apparatus showing the general arrangement of the station.

FIGURE 2 is a longitudinal sectional view through the apparatus, the position of the section being indicated by the line **2—2** of FIGURE 1.

FIGURE 3 is a diagrammatic sectional view transversely through the apparatus adjacent the first station, the position of the section being indicated by the line **3—3** of FIGURE 1.

FIGURE 4 is an elevational view of a section of the conveyor change showing book moving lugs on opposite sides thereof.

FIGURE 5 is a diagrammatic vertical sectional view showing one of the conveyor lugs.

FIGURE 6 is a view similar to FIGURE 5, showing the manner in which the conveyor chain lugs are moved into packaged engaging position.

FIGURE 7 is a perspective view of one of the bell crank levers used to actuate the object centering plunger.

FIGURE 8 is a diagrammatic view of the blank from which the container is formed.

FIGURE 9 is a vertical sectional view through a portion of the mechanism for folding the first closure flap, the position of the section being indicated by the line **9—9** of FIGURE 1.

FIGURE 10 is a vertical sectional view diagrammatically illustrating a means for actuating the plunger for closing the first flap, the position of the section being indicated by the line **10—10** of FIGURE 1.

FIGURE 11 is an enlarged detail through a portion of the first closure flap folding means illustrated in FIGURE 9.

FIGURE 12 is a vertical sectional view through a portion of the apparatus showing the means of partially folding the second closure flap.

FIGURE 13 shows a portion of the folding means illustrated in FIGURE 12 in flap folding position.

FIGURES 14 is a diagrammatic perspective view of the second flap folding apparatus detached from the remainder of the apparatus.

FIGURE 15 is a diagrammatic vertical sectional view showing the apparatus for operating the second flap closing plunger.

FIGURE 16 is an enlarged detail of the portion of the structure shown in FIGURE 15 and in a different position thereof.

FIGURE 17 is an end elevational view of the closed package as it leaves the apparatus.

FIGURE 18 is a perspective view of the completed and closed container.

To some extent, the drawings show the apparatus diagrammatically in that the various operating mechanisms are shown individually and by themselves omitting the mechanism which would normally be visible in the background. It should further be noted that FIGURES 4, 5 and 6 disclose a continually operable conveyor chain structure capable of moving the package intermittently. This arrangement is only typical of a means of intermittently moving the package, and no claim to this form of conveyor is made herein.

In actual practice, the apparatus includes a hopper for containing the flat carton blanks, a means of feeding the blanks onto a conveyor, and a means of squaring up the blanks into rectangular tubular form. The feed section and the container erecting section have been omitted from the drawings as they form no part of the present invention. It should also be understood that the conveyor conveys the open ended containers past a feed table where books are slid into the containers either manually or automatically. The apparatus illustrated accepts the open-ended containers having the book positioned therein. Obviously, while the apparatus has been designed for closing book containing packages, the containers could hold other forms of objects if it is desired.

The blank from which the container A is formed is best illustrated in FIGURE 8 of the drawings. The blank includes a first rectangular panel **10** which is slightly wider than the width of the book to be contained and somewhat longer than the length of the book, a second panel **11** which is of a width slightly greater than the thickness of the book, a third rectangular panel **12** which is of similar dimensions to the panel **10**, and a fourth rectangular panel **13** which is approximately equal in size to the panel **11**. A glue flap **14** is attached to the panel **13** and is adhered in face contact with the outer surface of the panel **10**. When folded into tubular form, the tube snugly encircles the book or other object. The panels described are hingedly connected along parallel fold lines **15**, **16**, **17** and **19**.

First closure flap structures **20** are hingedly connected to the ends of the panel **10** along parallel fold lines **21**, and similar flap structures **22** are hingedly connected to the ends of the opposite panel **12** along fold lines **23** which are substantially aligned with the fold lines **21**. The two flap structures differ slightly in dimension due to the fact that the first flap structures **20** are located inwardly of the second flap structures **22**.

The flap structures **20** include spacer panels **24** which are connected to the panel **10** along the fold lines **21**, and includes partition flap portions **25** which are connected to the flap portions **24** along fold lines **26** which are parallel to the fold lines **21**. The partition flap portions **25** are of an area similar in shape and size to the cross-section of the tubular carton. The flap portions **24** may be described as spacer portions as they are designed to fold into face contact with the end portions of the panel **10** and to space the partition flaps **25** inwardly from the container ends.

The flap structures **22** similarly include spacer flaps **27** hinged to the ends of the panels **12** along the fold lines **23**, and partition flaps **29** hinged to the spacer flaps **27** by the parallel fold lines **30**. The partition panels **25** of the flap structures **20** are provided with slots **31** adjacent to the fold lines **26**, and the partition flaps **29** are provided with short locking tongues **32** which are engageable in the slots **31** in closed position of the container.

In order to simplify the opening of the package, a reinforcing member such as a strip of filament tape **33** extends across the inner surface of the blank so as to encircle the book or other contents. A tab **34** is defined by spaced cut lines **35** on opposite sides of the tape **33** extending into the edge of the glue flap **14**, so that the portion of the glue flap overlying the tape may be grasped and pulled to tear the container into two parts.

In actual practice, the flap closing apparatus B is adjustable to accommodate book containers of different sizes. To simplify the showing, the adjustment feature has been eliminated. The apparatus includes a generally rectangular box-like frame including parallel sides **36**, an inlet frame end **37** and an outlet from end **39**. As indicated in FIGURE 3 of the drawings, the frame sides **36** include vertical panels **40** and coplanar top flanges **38**. As is indicated in FIGURE 2, the inlet end **37** includes a pair of spaced vertical panels **41** connected by a cross connecting frame portion **42**. The vertical panels **41** terminate in top flanges **43** as shown in FIGURE 1. The outlet end frame member **39** includes a vertical panel **44** terminating in a horizontal flange **45** which is coplanar with the flanges **38** and **43**. The box-like frame is supported by suitable legs **46** at the corners of the frame.

As indicated in FIGURE 2, a shelf **47** is suspended beneath the frame by suitable hanger brackets **49** and serves to support a drive motor **50** and attached gear reduction unit **51**. A pair of shelves **52** are supported by the vertical members **40** and **44** of the frame to support a pair of transversely spaced gear boxes **53** connected by a connecting shaft **54** extending horizontally and transversely of the frame. As indicated in FIGURE 2, a chain **55** connects a drive sprocket **56** on the drive shaft **57** of the gear reduction unit **51** with a cooperable sprocket **59** on the shaft **54**. The gear boxes **53** include suitable gears to connect the transverse shaft **54** with longitudinally extending parallel shafts **60** on opposite sides of the transverse center of the apparatus. The shafts **60** are cam shafts and support cams which will be later described and which operate the various flap folding members as will be explained.

A pair of spaced brackets **61** extend inwardly from the frame end **39** and act to support a countershaft **62** spaced above and parallel to the transverse shaft **54**. A chain **63** connects a sprocket **64** on the shaft **62** to a cooperable sprocket on the shaft **54**. The shaft **62** supports a pair of spaced sprockets **65** about which conveyor chains **66** extend as will be further described.

A pair of parallel bracket plates **67** are secured to the inlet end **37** of the frame and support a pair of transversely extending parallel shafts **69** and **70**. As indicated in FIGURE 2 of the drawings, the shaft **69** supports sprockets **71** about which the input feed conveyor chains **72** extend. The shaft **70** supports sprockets **73** which support the conveyor chains **66** designed to convey the containers through the machine. The conveyor chains **66** are maintained at the proper tension by idler sprockets **74** mounted upon adjustable brackets **75** on the inlet end **37** of the machine. The input feed conveyors **72** overlap the conveyor chain **66** so that the containers will be transferred from one conveyor to the next.

Means is provided for moving the container A intermittently through the apparatus. Obviously, the conveyor chains may be moved intermittently if it is so desired. In the particular arrangement illustrated in FIGURES 4, 5 and 6 of the drawings, the conveyor chain **66** is provided with a series of generally triangular lugs **76** secured to one side of the chain **66**, and an alternate series of similar lugs **77** pivoted to the opposite side of the chain. As it is indicated in FIGURE 1 of the drawings, the apparatus includes a pair of centrally located bars **79** which are engageable with the lugs **76** on the outer sides of the conveyor chains **66**. A second pair of rails **80** are provided extending along the inner surfaces of the conveyor

chains **66** near the inlet end of the apparatus, and a third set of rails **81** are provided near the outlet end of the machine. The upper surfaces of the bracket plates **67** are engageable with the outer conveyor chain lugs **76**.

As indicated in FIGURES 5 and 6 of the drawings, the lugs such as **76** and **77** are pivotally connected to the chain **66** as indicated at **82**, adjacent to the apex between two right angularly arranged lug sides **83** and **84**, and the lugs are further held to the chain by means of headed fastener **85** which is slidable in an arcuate slot **86** in each lug, the arcuate slot **86** having its center of actuation coaxial with the pivot **82** and permitting the lug to pivot through an angle of approximately 90°. As will be evident, from FIGURES 5 and 6 of the drawings, the lugs are held in an upright position by the rails such as **80** on the corresponding side of the chain which engage the sides **84** of the lugs. When the conveyor chains **66** move in the direction of the arrow **87** until the side **84** of the lug reaches the end of the rail **80**, the lug **77** will rotate in a clockwise direction and the lug side **77** will swing to a horizontal position out of engagement with the container A and the container A will come to a stop. The container will then remain stationary until it is engaged by the next set of lugs **76** which are in the outer sides of the chain. As indicated in FIGURE 6, the leading ends of the rails such as **80** are curved downwardly as indicated at **89** to swing the lugs upwardly into container engaging position. With this arrangement the books are carried from one station to the next by the lugs, and when released by one set of lugs will remain stationary until advanced by the next set of lugs.

With reference to FIGURE 1 of the drawings, as the conveyor chain **66** travels longitudinally of the apparatus, the outer lugs **76** are engaged by the upper surfaces of the brackets **67** to engage an open ended book folder carried onto the conveyor chains **66** by the input feed conveyor **72**. The conveyor lugs **76** carry the folder to a first stage position indicated by the broken line outline **90**. After a suitable interval of time in the position **90**, a pair of inner lugs **77** are erected into package engaging position by the rails **80**, and the folders are carried to the position shown by the broken lines **91**. The lugs **77** swing out of package engaged position, and the package remains stationary at the second station indicated by the broken lines **91** until a subsequent pair of lugs **76** engage the leading edges of the rails **79** and push the container to a third station position indicated by the broken lines **92**. At this point, the conveyor lugs **76** swing out of engagement with the container, and the container remains stationary until a pair of opposed inner lugs **77** engage the leading edges of the rails **81**, and the rails support the sides **83** of these lugs in upright position until the book is discharged from the outlet end of the apparatus.

As is diagrammatically illustrated in FIGURE 2 of the drawings, an elongated frame **93** is supported by cross members such as **94** which are held spaced above the conveyor chains by suitable uprights **95**. The frame **93** supports a series of longitudinally spaced blades **96** which are suspended by suitable adjustable hangers **97**. The purpose of the blades **96** is merely to hold the containers in position upon the slide rails **98** adjoining the conveyor chains **66** upon which the containers slide in their travel through the apparatus.

The first stage of operation is accomplished by the mechanism illustrated in FIGURES 1, 3 and 7 of the drawings. At this first stage or station **90**, the book is centered within the open ended folder. This is accomplished by plungers entering the open ends of the container, the plungers engaging the book and moving it to the center of the container.

As indicated in FIGURE 3, a pair of brackets **99** are mounted in opposed relation on the top flanges **41** of the frame sides **36**. These brackets **99** support opposed channel-shaped rails or ways **100** which support slides **101** for reciprocatory movement transversely of the movement of the conveyor chains **66**. Each slide **101** is provided with a transverse bracket **102** having aligned pivots **103** at its outer ends. The pivots **103** are connected by links **104** to pivots **105** extending through the parallel arms **106** of a generally U-shaped bracket **107** on the end of a bell crank lever **109** best illustrated in FIGURES 3 and 7 of the drawings. Each bell crank lever **109** is provided intermediate its ends with a hub **110** pivotally mounted on a pivot **111** supported by a bracket **112**. The bracket **112** is attached to the vertical flange **40** of a corresponding side **36**. The U-shaped bracket **107** is secured to one end of the bell crank lever **109** by bolts or other suitable means **113**. A cam roller **114** is mounted on the other end of each bell crank lever, and each cam roller **114** is engaged in the track **115** of a cam **116**. The cams **116** are mounted on the parallel longitudinal shafts **60** on either side of the container conveyor as illustrated.

The slides **101** are provided at their inner opposed ends with plunger plates **117** which are spaced apart a distance substantially equal to the length of the book C when the slides **101** are at their inner extreme position. The cam **116** on each shaft **60** oscillates the corresponding bell crank lever **109**, first in one direction and then the other, moving the plunger ends of the slides inwardly into the corresponding open end of the folder A and then outwardly to their outer extreme position. The slides **101** are shown in their outer extreme positions in full lines in FIGURE 3, and are shown in their inner extreme position in dotted outline in this figure. The book is thus centered in the folder while the container remains stationary at the first station of the apparatus.

The second station of the apparatus is illustrated in FIGURES 9, 10, 11 of the drawings. While in this position the flap structures **20**, which are on opposite ends of the lowermost panel **10** are first folded upwardly to partially overlie the ends of the container, and then plungers enter the container to complete the folding operation. When complete, the spacer flange **24** at each end of the container is folded against the inner surface of the bottom panel **10**, and the partition panel **25** is hinged across the end of the container at right angles to the panel **10**. FIGURE 11 of the drawings shows one flap structure **20** at the completion of the folding operation.

As is indicated in FIGURE 9 of the drawings, brackets **119** extend inwardly from the vertical flanges **40** of the frame sides **36**, there being two longitudinally spaced brackets **119** on either side of the frame, the brackets on opposite sides being in opposed relation. In view of the fact that the folding means on both sides of the apparatus is essentially the same, FIGURES 9 through 11 show one side only of this structure. A flap folding mechanism which is indicated in general by the numeral **120** is supported between each pair of brackets **119**, the flap folding means being foldably supported upon a longitudinal pivot shaft **121**. The flap folder includes a pivot bar **122** having an angular blade **123** projecting therefrom, the upper end of the blade **123** being just below the level of the flap structure **20** on the panel **10** as the container A moves into position at the second station. An arm **124** is provided on the bar **122**, and normally inclines downwardly and inwardly therefrom. The arm **124** is pivotally connected at **125** to a link **126**, the other end of whch is pivotally connected at **127** to a bell crank lever **129**. The intermediate portion of the bell crank lever **129** is pivotally supported by a pivot **130** on a bracket **131** extending inwardly from the frame side wall **40**. The pivot connection **127** is at the upper end of the lever arm **132**. A cam roller **133** is mounted upon the lever arm **134** and is engageable in a cam groove **135** in a cam **136** mounted upon the cam shaft **60**. As will be understood, a duplicate structure is provided at each side of the frame.

When the flap folder **120** is in the position illustrated in full lines in FIGURE 9 of the drawings, the folding blade **123** is beneath the level of the container A as illustrated. Rotation of the cam **136** in the direction of the

arrow 137 will swing the bell crank lever 129 in a clockwise direction, swinging the flap folder mechanism 120 in a counterclockwise direction. The blade 123 engages the flap structure 20 and folds the portion of the structure which is hinged to the bottom wall 10 into the position shown in dotted outline in FIGURE 9. In other words, flap structure is folded through somewhat more than 90°. The engagement of the end of the partition wall with the upper flap structure 22 causes the spacer flap 24 and partition flap 25 to flex into substantially right angular relation.

The apparatus for completing the folding of the flap structure 20 is indicated in FIGURE 10 of the drawings. A bracket plate 139 is adjustably mounted upon a vertical slide 140 on each frame side 40 in alignment with the container A when the container is at the second station indicated at 91. The bracket plate 139 supports an angle bracket 141 having ways or slide guides grooved in the upper surface thereof to slidably accommodate a plunger slide 142. Gusset plates 143 are provided to reinforce the angle bracket 141. The upper horizontal arm 144 of the angle bracket 141, the upper surface of which is grooved to accommodate the slide 142, is centrally slotted to accommodate a vertical lug 145 projecting downwardly from the undersurface of the slide 142. A plunger plate 146 is secured to the inner end of the slide 142 to form an extension thereof.

A lever arm 147 is mounted upon a pivot 149 supported by a bracket 150 mounted on the inner surface of each frame wall 40. The lever arm 147 is provided with a cam roller 151 which is engaged in the cam slot 152 of a cam 153 mounted on a corresponding shaft 60. The bracket plate 139 supports a second bracket 154 which supports a pivot 155 extending through an intermediate part of a lever arm 156. The lower end of the lever arm 156 supports a pivot 157 slidable in a longitudinal slot 159 in the lever arm 147. The upper end of the lever arm 156 supports a pivot 160 which extends through a slot 161 in the lug 145. The purpose of this arrangement is to provide a vertically adjustable means of reciprocating the slide 142. By raising the bracket plate 139 the lever arm 156, the slide 142 and all of the associated mechanisms may be raised or lowered within necessary limits.

When the structure is in the position indicated in full lines in FIGURE 10 of the drawings, the slide 142 is retracted and the plunger 146 is slightly below the upper flap structure 22 of the carton A. When the structure is in the position indicated in broken lines in FIGURE 10, the plunger 146 is in the proper position to complete the folding of the flap structure 20. The purpose of the structure shown in FIGURE 10 of the drawings may be seen from an examination of FIGURES 9 and 10 of the drawings. When the structure shown in FIGURE 9 is in the dotted line position, the spacer flap 24 and partition flap 25 are in the position indicated in dotted outline in this figure. As the slide 142 is moved to the left from this position, the end of the plunger 146 engages the flap 25 and pushes this flap inwardly until it is at right angles to the panel 10. The slide 142 is then returned to its original position, leaving the partition panel 25 in the position indicated in FIGURES 10 and 11 of the drawings.

FIGURES 12, 13, and 14 of the drawings show the first step of the final folding operation which takes place at the third station when the container is in the position indicated by the broken lines 92 in FIGURE 1 of the drawings. A pair of longitudinally spaced brackets 162 extend inwardly from each frame wall 40 of both of the sides 36, one of the structures being indicated in FIGURES 12 and 13, it being understood that a similar structure is provided on the opposite side of the frame. The brackets 162 support a folding plate 163 having a flat upper surface 164 which inclines upwardly and outwardly from each end of the container A, the inner extremity of the surface 164 being slightly above the level of the spacer flange 24 of the previously folded flap section 20.

The means for folding the flap structure 22 downwardly across the ends of the container A is perhaps best illustrated in FIGURE 14 of the drawings, which shows the mechanism apart from the remainder of the apparatus. The structure shown in FIGURE 14 is for folding the flap structure at one end of the carton. A similar mechanism, in reverse of that illustrated, is provided on the opposite side of the apparatus for closing the other container end.

As indicated, a pair of bearing lugs 165 and 166 are supported by the hold down blade 96 overlying the third station position. A pair of arms 167 are pivoted to the bearing lugs 165 and 166 by aligned pivots 169. The arms 167 support a cross arm 170 parallel to the axes of the pivots 169. A folding blade 171 is bolted or otherwise secured to the cross arm 170, the blade 171 having a concavely curved and extremity 172 which engages the flap structure 22, and presents a rounded folding surface thereto.

The cross arm 170 and the folding blade 171 are oscillated between the two extreme positions indicated in FIGURES 12 and 13 by cam operated means diagrammatically illustrated in FIGURE 14. A gear housing 173 containing a pair of bevel gears 174, 175 is secured to the inner surface of the frame side 40 as shown in FIGURE 12. A horizontal shaft 176 extends from a side of the gear housing 173 and supports a cam arm 177 having a cam roller 179 on its end extremity. The cam roller 179 is supported in the cam groove 180 of the cam 181 mounted upon a corresponding shaft 60. The cam groove 180 is arranged to oscillate the arm 177, thereby oscillating the connected bevel gear 174.

The bevel gear 175 is mounted upon a vertical shaft 182, the upper end of which is supported by a horizontal flange 183 on the upper end of a bearing bracket 184 mounted upon the horizontal flange 41 at the top of the frame side wall 40. A crank arm 185 is supported upon the shaft 182, the crank arm 185 and its supporting collar 186 being splined to the shaft 182 to permit vertical adjustment. A link 187 is pivotally connected at 189 to the end of the crank arm 185, and the link 187 is pivotally connected at 190 to a crank arm 191 extending upwardly from the bar 170 of the folding mechanism.

The arrangement is such that when the cam arm 177 is in its upper extreme position indicated in FIGURES 12 and 14 of the drawings, the folding blade 171 is swung above the level of the flap structure 22 permitting the container to move into and out of its proper position. As the cam arm 177 swings in a counterclockwise direction as viewed in FIGURE 12, the link 187 is swung to the right, pivoting the folding blade 171 into the position indicated in FIGURE 13 of the drawings.

As indicated in this figure, the folding blade 171 engages the spacer flap 27 of the flap structure 22, permitting the partition flap 29 to fold relative thereto. As the flap structure 22 is swung downwardly, the end edge of the partition flap 29 strikes the folding plate 163 and causes the flaps 27 and 29 to fold somewhat beyond right angular relation as indicated in FIGURE 13.

The mechanism for completing the folding of the flap structure 22 is indicated in FIGURES 15 and 16 of the drawings. A bearing bracket 192 is mounted on each wall 40 of the frame sides 36, one such mechanism being shown in FIGURE 15. It should be understood that a similar mechanism is provided on the opposite side wall of the frame. A bell crank lever 193 is supported by a longitudinal pivot 194 mounted on the bracket 192, the pivot supporting the lever intermediate its ends. One end 195 of the bell crank lever 193 is provided with a cam roller 196 engaged in a slot 197 in a cam 199 mounted upon the corresponding shaft 60. The other or upper end 200 of the bell crank lever 193 is connected to a flap folding plunger as will be described.

A bracket **201** is attached to the frame side **40**, and the upper flange **208** of each bracket **201** is parallel to the plane of the flat upper surface **164** of the folding blade or plate **163**. The flange **208** is grooved to provide ways **202** or slide guides to support a plunger body **203**. The flange **208** is slotted to accommodate a downwardly projecting lug **204**. A plunger head **205** is connected by a bridging strip **206** to the upper surface of the plunger body **203**.

A connecting link **207** is pivotally connected at one end **209** to the lug **204**, and is pivotally connected at its other end **210** to the upper extremity of the arm **200** of the bell crank lever **193**. The bell crank lever is slidable between the position shown in full lines in FIGURE 15 and the projected position shown in dotted outline therein.

As the plunger head **203** is reciprocated to the left as viewed in FIGURE 15 the plunger head **205** engages the end of the partition flap **29** of the flap structure **22** and forces the flap structure **22** inwardly until the spacing flap **27** is in face contact with the upper container wall **12** to which it is hinged, and the partition flap **29** is in face contact with the partition panel **25** of the first folded flap structure **25**. As the flap structure **22** completes its folding operation, the tongue **32** engages in the slot **31** of the flap structure **20** holding the end assembled.

If additional flap retaining means is required, the panels **25** and **29** may be glued together in face contact. This is accomplished by merely applying adhesive to the undersurface of the flap **29** as the container moves from station **2** which is indicated by the broken lines **91** in FIGURE 1 to station **3** which is indicated in FIGURE 1 by the broken outline **92**. As glue applying means is conventional, it is not shown in the drawings.

As will be understood, the various views of the drawings are somewhat diagrammatic in order to better illustrate the construction. For example, the flap plunging mechanism illustrated in FIGURE 15 of the drawings has been omitted from FIGURES 12 and 14 in order that the mechanism shown in the latter figures be more readily apparent. By showing the structure in this manner, the various operations of the machine are believed more clearly apparent.

As indicated in FIGURE 17 of the drawings, there is a tendency for the upper panel **12** of the carton A to bow upwardly during the plunging of the flap structure into the position shown in FIGURE 16 of the drawings due to the projecting tongue **32**. However, as soon as the tongue **32** registers with the slot **31**, the bow is removed from the top panel. This operation is assisted by the fact that after leaving the apparatus the books are stacked one above the other, and the weight of the books tends to remove any remaining bow in the container panels.

In accordance with the patent statutes, I have described the principles of construction and operation of my packaging apparatus; and while I have endeavored to set forth the best embodiment thereof, I desire to have it understood that obvious changes may be made within the following claims without departing from the spirit of my invention.

I claim:

1. A container closing apparatus for use in combination with a container including parallel relatively wide main panels and parallel relatively narrow connecting panels secured in tubular relation, and a recessed end closure means on at least one end thereof and including flap structures hinged to said main panels and each including a spacer flap hinged to the main panel and a partition flap hinged to said spacer flap and adapted to extend across said tubular panels to form a recessed end closure, the apparatus including

a frame,

a conveyor or means supported by said frame for conveying said containers intermittently into and out of a plurality of stations with an open end of said containers at right angles to the direction of movement of said conveyors, first folding means supported by said frame at one of said stations engageable with the spacer flap of one of said flap structures for folding said one spacer flap inwardly across the end of said tubularly arranged panels to which said one spacer flap is connected,

first plunger means on said frame engageable with said inwardly folded flap structure to force said one spacer flap into face contact with the main panel to which it is hinged and to fold the one partition panel attached thereto into substantially right angular relation to said panels to form a first recessed closure,

means moving said conveyor means to transfer said partially closed container to a second station,

second folding means on said frame at said second station engageable with the other spacer flap for folding said other flap structure across the end of said tubularly arranged panels outwardly of said one closure means,

second plunger means on said frame engageable with said inwardly folded other flap structure to force the spacer panel of said second flap structure into face contact with the panel to which it is hinged and forcing the partition flap secured thereto into face contact with the partition flap of said one flap structure,

means for moving said conveyor means to move said closed container from said second station, and

means for actuating said first and second folding means, said first and second plunger means, and said conveyor means in timed relation.

2. The structure of claim **1** and in which said one spacer flap includes an aperture therein adjacent to the line of fold connecting said one spacer flap to its partition panel, and in which the partition flap of said other flap structure includes a tongue engageable in said aperture when said partition panels are in face contact.

3. The structure of claim **1** and including a cam shaft, cams on said cam shaft, and cam level means engaging said cams and connected to each of said first and second folding means and connected to each of said plunger means forming the means for actuating said folding means and said plunger means in timed relation.

4. A container closing apparatus for use in combination with a container including, parallel relatively wide main panels and, parallel relatively narrow connecting panels secured in tubular relation, and a recessed end closure means on the ends of said panels, and including, flap structures hinged to the ends of each of said main panels, each flap structure including a spacer flap hinged to the main panel, and a partition flap hinged to the spacer flap along a fold line parallel that connecting the spacer flap to the main panel and adapted to extend across said tubular panels to form a recessed end closure, the apparatus including,

a frame,

conveyor means supported by said frame for conveying said containers intermittently into and out of a plurality of stations with the open ends of the containers at right angles to the direction of movement of said conveyors,

a first folding means supported by said frame at one of said stations engageable with the spacer flaps of one of the flap structures at each end of said tubular panels for folding each said one flap structure inwardly across the end of said tubularly arranged panels to which each said one spacer flap is connected,

plunger means slidably supported by said frame engageable with each of said inwardly folded flap structures to force each said one spacer flap into face contact with the main panel to which it is hinged and to fold each said partition flap attached thereto into substantially right angular relation to said panels to form a first recessed closure at each end thereof,

means for moving said conveyor means to transfer said partially closed container to a second station,

second folding means on said frame at said second station engageable with the other flap structure at each end of said tubularly arranged panels for folding each said other flap structure across the end of said tubularly arranged panels outwardly of said one flap structure,

second plunger means slidably supported by said frame engageable with said inwardly folded other flap structure at each end of said tubularly arranged panels to force the spacer panel of said second flap structure into face contact with the panel to which it is hinged and forcing the partition flaps secured thereto into face contact with the partition flap of each said one flap structure,

means for moving said conveyor means to move said closed container from said second station, and

means for actuating said first and second folding means, said first and second plunger means, and said conveyor means in timed relation.

5. The structure of claim **4** and including a preliminary station in advance of the two stations described, and including object positioning plunger means on said frame, means on said frame slidably supporting said last named plunger means for movement into and out of the open ends of said container to center an object in said container, means for reciprocating said last named plunger means, and means for moving said conveyor means for moving said container from said preliminary station to said one station.

6. The structure of claim **4** and in which said first plunger means and said second plunger means engage the partition flaps of said one flap structure and said second flap structure, respectively, near the end extremities thereof.

7. A container closing apparatus for use in combination with a container including, parallel relatively wide main panels and, parallel relatively narrow connecting panels secured in tubular relation, and a recessed end closure means on the ends of said panels, and including flap structures hinged to the ends of each of said main panels, each flap structure including a spacer flap hinged to the main panel, and a partition flap hinged to the spacer flap along a fold line parallel that connecting the spacer flap to the main panel and adapted to extend across said tubular panels to form a recessed end closure, the apparatus including,

a frame,

a pair of parallel cam shafts supported by said frame,

a conveyor extending parallel to said cam shafts and between vertical planes through the axes of said cam shafts,

drive means connected to said cam shafts and said conveyor to drive the same,

said conveyor including means for intermittently moving said containers into and out of a plurality of stations,

a first folding means on said frame at one of said stations engageable with one of said flap structures at each end of said container for folding said one flap structures inwardly across the corresponding end of said tubularly arranged panels,

a first folder cam on each of said cam shafts,

first folder lever means pivoted on said frame engaging a corresponding first folder cam and connected to a corresponding first folding means to actuate the same,

a first plunger means slidably supported by said frame engageable with each of said inwardly folded flap

structures to fold each said one spacer flap thereof into face contact with said main panel to which it is hinged and to fold each one partition flap secured thereto into substantially right angular relation to said panels to form a first recessed closure at each end thereof,

a first plunger cam on each said cam shaft,

first plunger lever means pivoted on said frame engaging corresponding plunger cam and connected to a corresponding plunger means to reciprocate the same,

a second folding means on said frame engageable with the other flap structure at each end of said panels to fold other flap structures across the ends of said tubularly arranged panels outwardly of said one flap structures,

a second folder cam on each said cam shaft,

a second folder lever means pivoted on said frame engaging a corresponding second folder cam and connected to a corresponding second folding means to actuate the same,

a second plunger means slidably supported on said frame for engaging said inwardly folded other flap structure to fold each spacer flap into face contact with the main panel to which it is hinged and to fold the partition flaps thereon into substantially face contact with the corresponding partition flaps of said one flap structures,

a second plunger cam on each said cam shaft, and

second plunger lever means pivotally supported by said frame and engaging a corresponding second plunger cam and attached to a corresponding second plunger means to reciprocate the same.

8. The structure of claim **7** and including a preliminary station in advance of said one station, a pair of object positioning plungers slidably supported by said frame for movement into and out of the open ends of said container for locating an object therein, an object positioning cam on each said cam shaft, and object positioning lever means hingedly supported by said frame, each object positioning lever means engaging a corresponding object positioning cam and attached to a corresponding object positioning plunger to reciprocate the same.

9. The structure of claim **8** and in which said object positioning plungers extend into the ends of said container an equal distance to center an object relative to said container.

10. The structure of claim **7** and in which said first folding means engages the spacer flap of said one flap structure to swing this spacer flap through an angle of more than ninety degrees, and said second folding means engages the spacer flap of said other flap structure to swing the spacer flap through an angle of more than ninety degrees.

11. The structure of claim **7** and in which said first plunger means engages the partition flap of said one flap structure near the end extremity thereof and said second plunger means engages the partition flap of said other flap structure near the end extremity thereof.

References Cited

UNITED STATES PATENTS

2,849,846	9/1958	McGihon	53—374
2,937,486	5/1960	Ackley	53—374

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