May 18, 1965 H. B. EGLESTON 3,183,801

CARTON BREAKER-TUCKER APPARATUS

Filed June 11, 1962 6 Sheets-Sheet 1

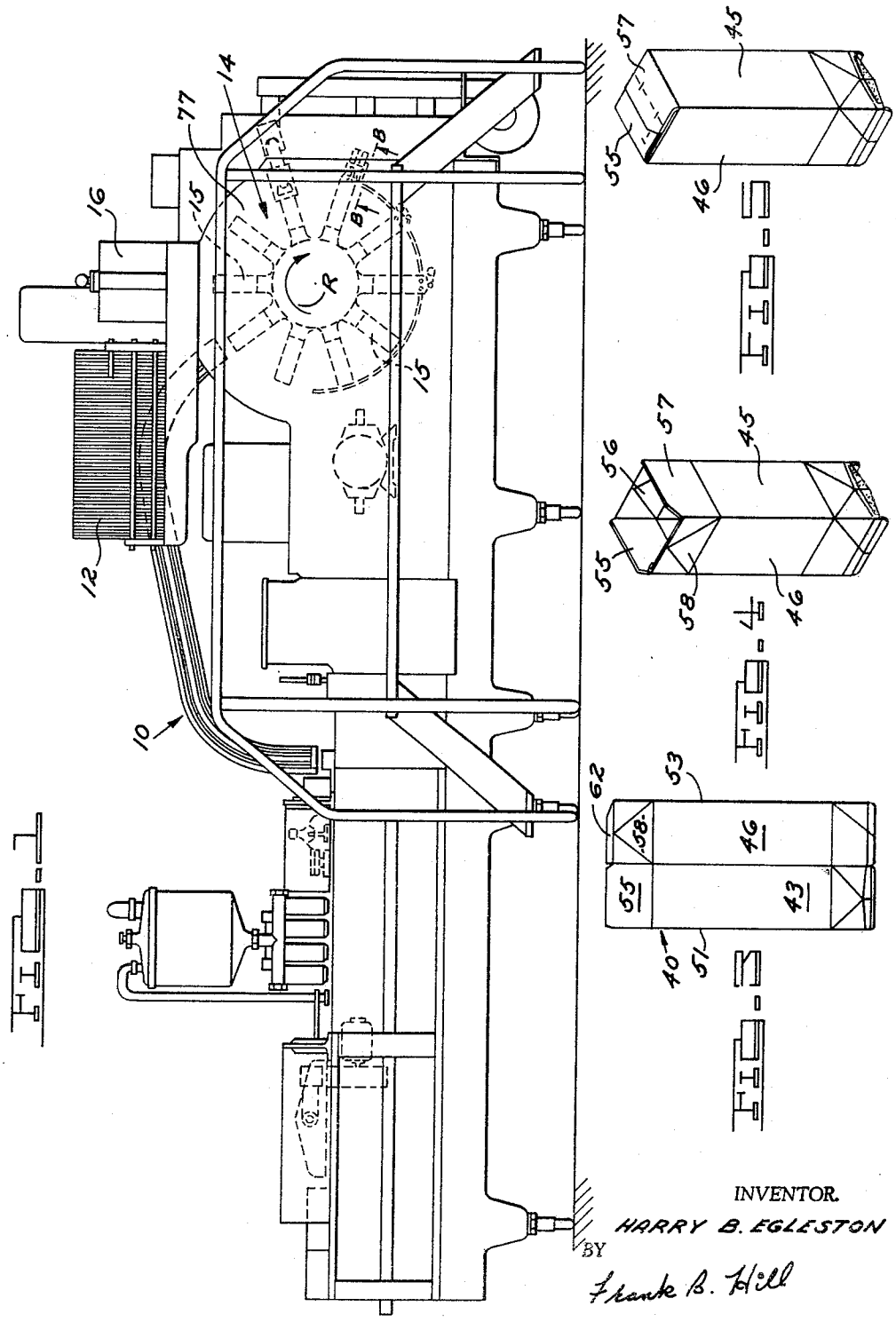


FIG. 1

FIG. 5

FIG. 4

FIG. 3

INVENTOR.
HARRY B. EGLESTON
BY
Frank B. Hill
AGENT

May 18, 1965 H. B. EGLESTON 3,183,801

CARTON BREAKER-TUCKER APPARATUS

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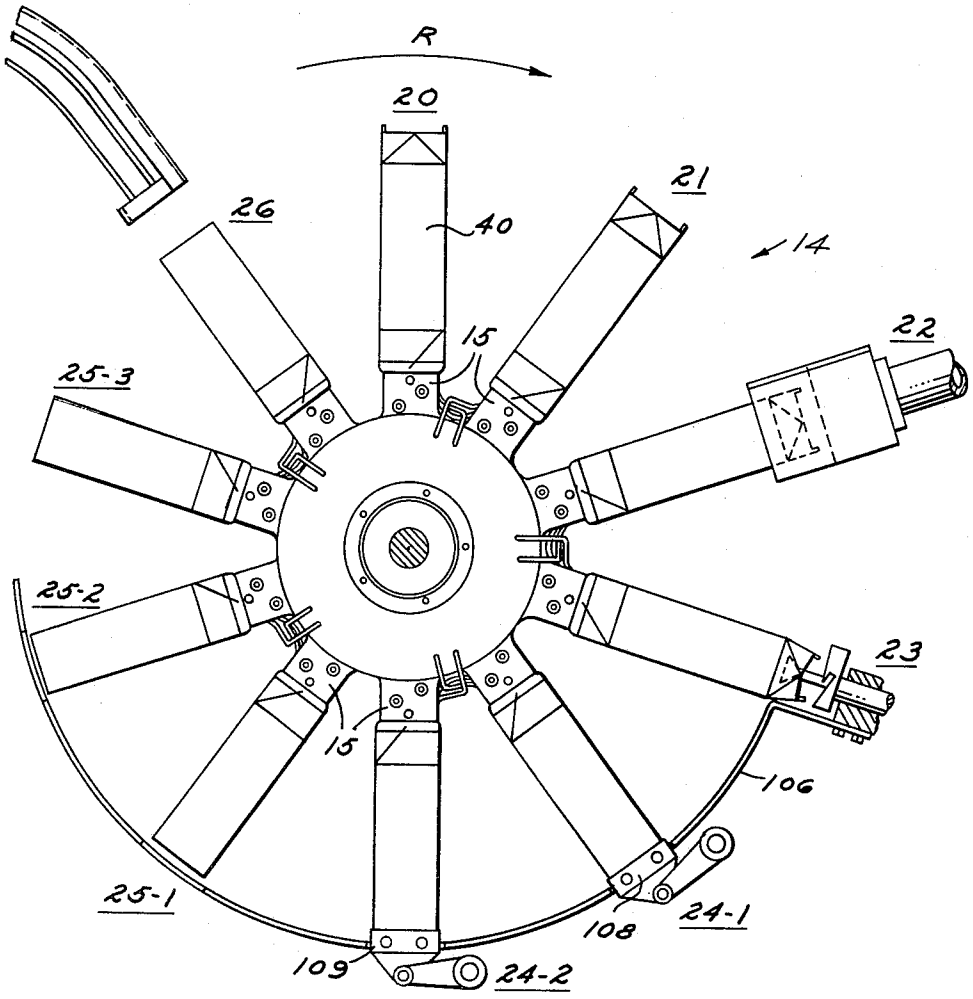


FIG. 2

INVENTOR.
HARRY B. EGLESTON
BY
Frank B. Hill
AGENT

May 18, 1965 H. B. EGLESTON 3,183,801

CARTON BREAKER-TUCKER APPARATUS

Filed June 11, 1962 6 Sheets-Sheet 3

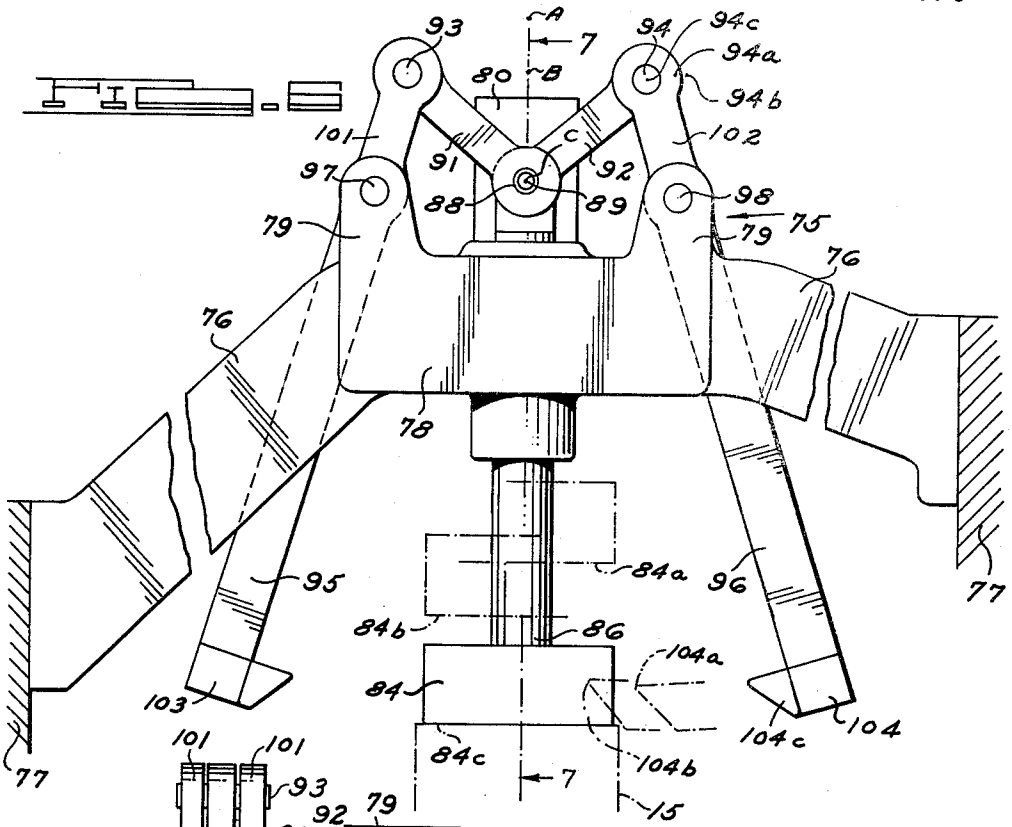
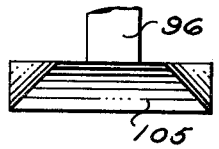


FIG. 6A



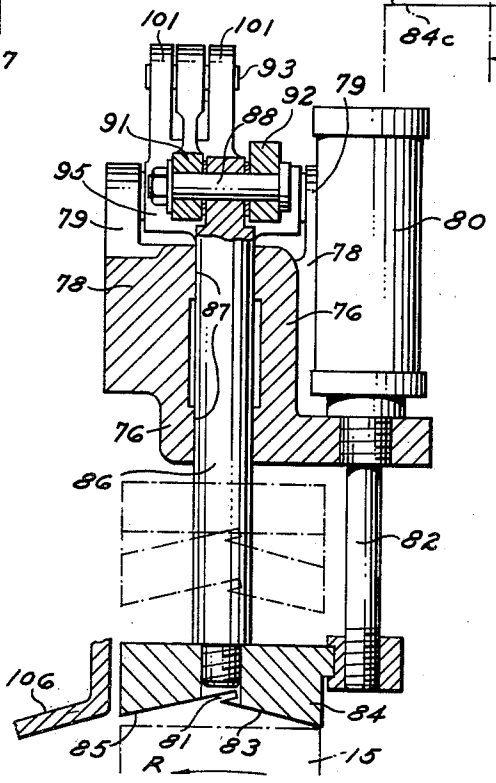


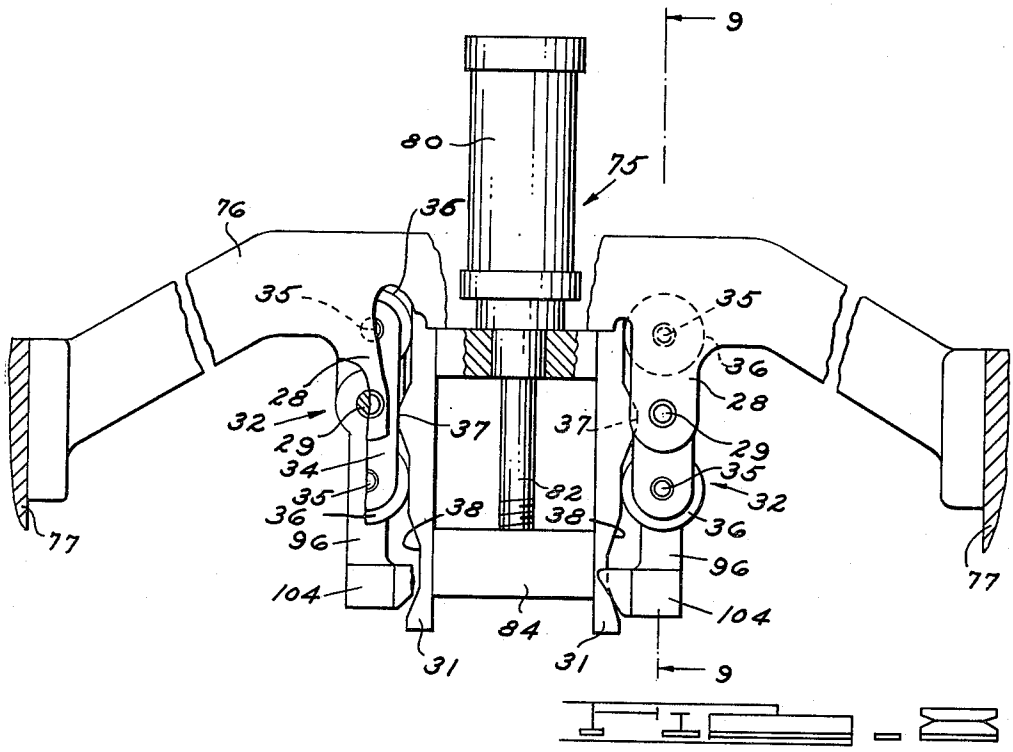
FIG. 7

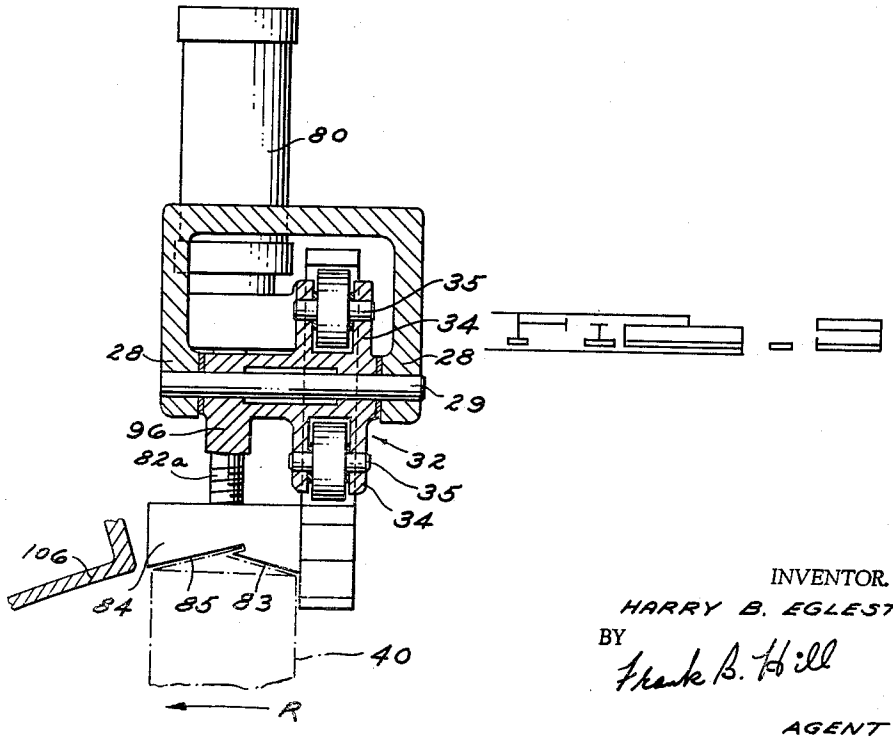
INVENTOR.
HARRY B. EGLESTON
BY
Frank B. Hill
AGENT

May 18, 1965 H. B. EGLESTON 3,183,801

CARTON BREAKER-TUCKER APPARATUS

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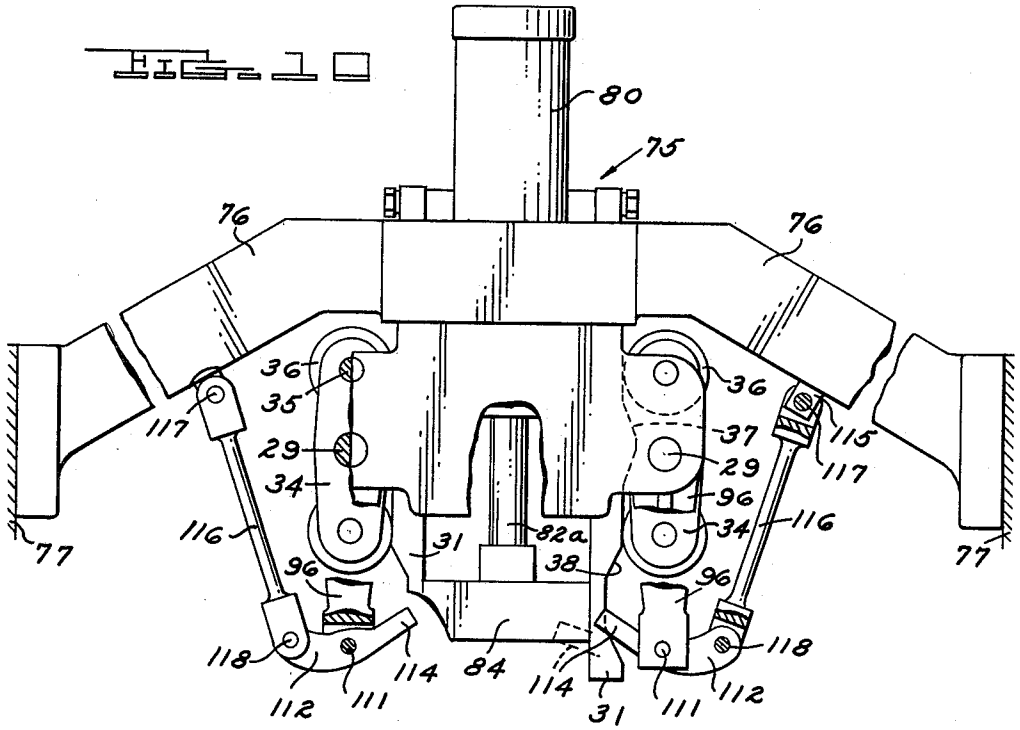


INVENTOR.
HARRY B. EGLESTON
BY
Frank B. Hill
AGENT

May 18, 1965 H. B. EGLESTON 3,183,801

CARTON BREAKER-TUCKER APPARATUS

Filed June 11, 1962 6 Sheets-Sheet 5

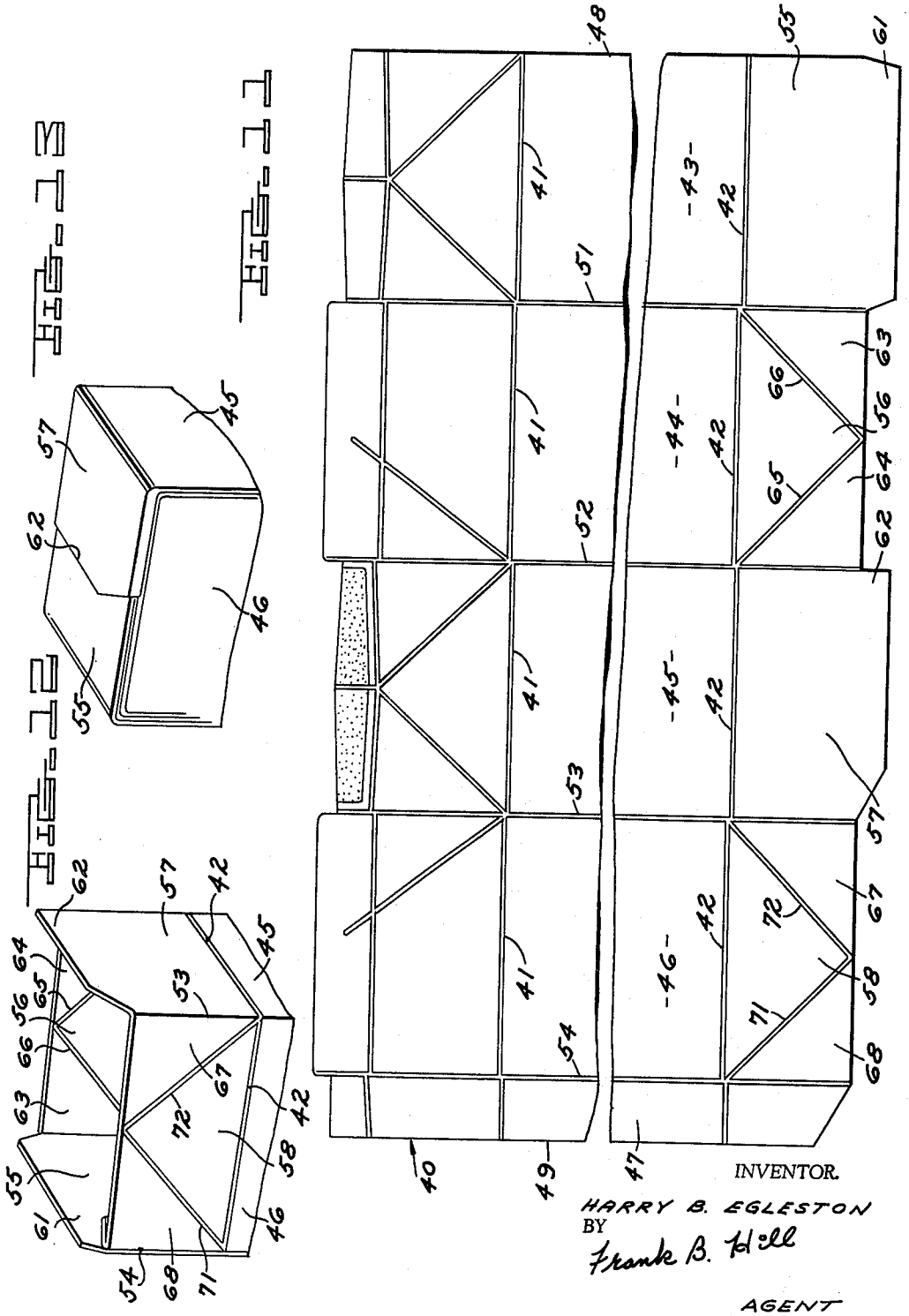


INVENTOR.
HARRY B. EGLESTON
BY
Frank B. Hill
AGENT

May 18, 1965 H. B. EGLESTON 3,183,801

CARTON BREAKER-TUCKER APPARATUS

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Patented May 18, 1965

3,183,801

CARTON BREAKER-TUCKER APPARATUS

Harry B. Egleston, Livonia, Mich., assignor to Ex-Cell-O Corporation, Detroit, Mich., a corporation of Michigan

Filed June 11, 1962, Ser. No. 201,642
6 Claims. (Cl. 93—44.1)

This invention in general relates to paperboard container forming and filling machines, and particularly to the paperboard container end breaking and tucking means on forming and filling machines as hereinafter described. This invention is more specifically directed to apparatus for closing a container bottom and putting it in such condition as to be permanently bonded together by later operations.

Thermoplastic coated paperboard containers are being used in increasing quantities as fluid containing bottles in place of other commonly used means. The success of the new container has caused much demand for new equipment and/or the converting of existing equipment to handle its construction. In an effort to hold down the cost of new equipment and the characteristics which limit the system available for converting existing equipment, the present disclosure was invented. The considerations given to accomplish these goals were mainly governed by the limited number of positions available to perform the required operations, need for keeping all functional stations easily accessible to operators for repair and normal maintenance, limited allowable time between the heating station and the sealing station of the end closure, etc. The machines to be converted are limited as to the number of bridge support sections available for attaching new equipment to handle the new container. The older container is disclosed in U.S. Patent No. 2,750,095, issued June 12, 1956 on the application of Carroll R. Alden (Reissue No. 25,021, issued August 3, 1961). The new container's end closure is disclosed in U.S. Patent No. 3,120,335, issued February 4, 1964. The method of bonding the new container end closure is different than the method used to close the old container. To allow the existing machines to be converted, and new machines to be constructed at a reasonable material cost and time, a method of utilizing all the present bridge support members, before requiring additional members, was needed.

The major objective of the present invention is to provide a new and improved means of forming end closures of thermoplastic coated paperboard.

Another objective of the present invention is to provide an apparatus to break and tuck the end closure of a thermoplastic coated paperboard container at one station and in one operation.

Still another objective of the present invention is to provide single station for breaking and tucking the end closure of a thermoplastic coated paperboard container between the heating and bonding stations, thus limiting the amount of time given the container closing means to cool.

A further objective of the present invention is to eliminate the requirement of a prebreaking operation as a separate station or as one operation at another station.

Also, the objectives of the present invention include the provision of a structure capable of accomplishing the above objectives with a minimum of material cost and fabricating expense and, at the same time, being composed of simple and ruggedly constructed elements which are very reliable in operation.

Other objectives and advantages of the invention will be apparent from the following detailed description and claims, taken in connection with the accompanying drawings, which form part of the instant specification and which are to be read in conjunction therewith, and in which like reference numerals are used to indicate like parts in various views.

FIG. 1 is a side elevational view of an illustrative thermoplastic coated paperboard container forming and filling machine embodying the present invention;

FIG. 2 is a side elevational view of the mandrel assembly of the machine including various associated units for operating on the carton at different stations along its path of movement;

FIG. 3 is a flattened side seamed tubular blank as supplied to the forming and filling machine shown in FIG 1;

FIG. 4 is a perspective view of an opened, squared-off tubular blank;

FIG. 5 is a perspective view of a squared-off tubular blank with a sealed end closure;

FIG. 6 is a bottom plan view of the breaker-tucker apparatus taken in a plane of line B—B in FIG 1;

FIG. 6*a* is an end view of the breaker shoe;

FIG. 7 is a side view taken along line 7—7 in FIG 6 showing a partial sectional view of a breaker-tucker apparatus;

FIG. 8 is a bottom view of a breaker-tucker apparatus taken in a plane of line B—B in FIG 1;

FIG. 9 is a side view taken along line 9—9 in FIG. 8 showing a partial sectional view of a breaker-tucker apparatus;

FIG. 10 is a bottom plan view of a breaker-tucker apparatus taken in a plane of line B—B in FIG 1;

FIG. 11 is a layout view of a blank from which the the cartons are erected and showing the inside surface thereof;

FIG. 12 is a perspective view of the carton end closure in tubular form as it appears when first mounted on the mandrel assembly;

FIG. 13 is a perspective view of the carton end closure after it has been formed and bonded.

While the invention is susceptible of various modifications and alternative constructions, certain illustrative embodiments have been shown in the drawings and will be described below in considerable detail. It should be understood, however, that there is no intention to limit the invention to the specific forms disclosed but, on the contrary, the intention is to cover all modifications, alternative constructions and equivalents falling within the spirit and scope of the invention as expressed in the appended claims.

General machine descriptions

The forming and filling machine generally indicated as **10** in FIG 1 is similar as to requirements to the forming and filling machine disclosed in my copending application Serial No. 115,367, filed June 7, 1961. The present machine is adapted to receive a supply of flattened side seamed blanks similar to the one shown in FIG 3.

A flattened side seamed blank is removed from the supply **12** and loaded on a rotary mandrel assembly unit **14** by the loader system **16**. The mandrel assembly is rotated by indexing through various stations at which time one closure end, in the present case the container's bottom, is formed and bonded. Before the mandrel assembly is again at the loading position, the container is stripped from the mandrel and passes through a series of operations which prebreaks the top flaps, fills the container, and heats and seals the top closure. Then the container is ejected from the end of the machine as a completed carton and is ready for delivery to the consumer.

General loader and mandrel description

Referring generally to FIGS. 1 and 2, one blank at a time is removed from the supply **12** and loaded on a mandrel **15** by loader system **16**. The blank is loaded on the mandrel **15** when it is at load station **20**. The mandrel assembly **14** rotates in a clockwise direction as indicated by arrow R. After container **40** is loaded on mandrel **15**, the mandrel assembly **14** is rotated, moving the newly loaded mandrel to dwell station **21**, and next it indexes to heat station **22**, where the container's end is heated to a sufficient temperature to activate the thermoplastic coating of the container's end closure to allow bonding, as disclosed in U.S. Patent No. 3,120,335. The loaded mandrel **15** is then indexed to break and fold station **23**. This is the station which encompasses my present invention and will be explained in detail later in the disclosure. At this station the end closure is broken, tucked, and formed. The loaded mandrel **15** is then indexed through bonding stations **24–1–2** at which the bottom closure has a large amount of pressure applied to it for bonding the heated panels together. The loaded mandrel **15** is then indexed through idle stations **25–1, –2, –3** to stripping station **26**. At station **26** the container is removed from the mandrel, which can be accomplished by a blast of air from the end of the mandrel or by a mechanical paddle acting on the container and throwing it off, as examples, and the container continues through the other operations as covered in the general machine description. The mandrel assembly **14** continues to index, picking up container blanks at the load station **20** and repeating the cycle.

Container description

Referring more specifically to FIG. 11, where the container **40** is in flat blank form with a pattern of appropriate score lines and having the inside surface of the blank showing, the container is separated into three groups by score lines **41** and **42**. The material above score line **41** is the top closure, a discussion of which is not necessary for disclosure of the present invention; however, a complete disclosure is given in my copending application Serial No. 122,571, filed July 7, 1961. The material between score lines **41** and **42** is the body group and comprises four panels **43** through **46** and side seam flap **47**. The body group is defined on the sides by edges **48** and **49**, and with the panels being separated by score lines **51** through **54**. The material below score line **42** is the bottom closure group and comprises bottom closure panels **55** through **58** and side seam flap **47**. The bottom closure group defined on the sides by the edges **48** and **49** and the panels are separated by the score lines **51** through **54**. The bottom closure panel **55** has an extended tuck-in flap **61** and bottom closure panel **57** has an extended tuck-over flap **62**. The bottom closure panel **56** is flanked by triangular fold-back panels **63** and **64** and connected thereto by score lines **66** and **65** respectively. The bottom closure panel **58** is flanked by triangular fold-back panels **67** and **68** and connected thereto by score lines **72** and **71** respectively.

To form a flat side seamed blank as presented to the forming and filling machine **10**, the panel **46** and side seam flap **47** are folded about score line **53** until they contact panels **45** and **44** respectively. The panel **43** would be folded about score line **51** until it contacts the inside surface of panel **44** and the outside surface of side seam flap **47**. The surface along edge **48** which will meet the outside edge of the seam flap **47** will be heated to activate its coating and the outside surface of the side seam flap **47** will be heated to activate its coating so that when the two surfaces meet they will be bonded together upon cooling. Pressure is usually applied to secure the best possible bond. The edge **48** and the score line **54** now appear as one line. The flat blank container **40**, shown in FIG. 3, looks like the container after it is side seamed and as it is presented to the machine **10**.

When the container **40** is loaded on the mandrel **15**, it takes a tubular shape as seen in FIGS. 4 and 12. To form the bottom, the panels **55** and **57** are moved towards each other. Also, the panels **56** and **58** are moved toward each other. This causes fold-back panel **68** to rotate around score line **54** so that the inside surface of panels **68** and **55** are coming together, at the same time panel **68** is rotating around score line **71**; thus, the outside surfaces of panels **68** and **58** are coming together. Fold-back panels **63**, **64** and **67** make the same movments as panel **68** with panels **55–56**, **56–57** and **57–58** respectively. Bottom closure panel **55** moves toward bottom closure panel **57** just enough faster than panel **57** moves toward panel **55** so that tuck-in flap **61** is positioned between fold-back panels **64** and **67**, and panels **57** and **62**. After the bottom closure is completely formed, it appears as shown in FIGS. 5 and 13.

General description of the breaker-tucker operation

The discussion of the first embodiment of this invention will refer pricipally to FIGS. 1, 2, 6 and 7. The tucker-breaker assembly **75** is supported by bridge **76** which is mounted across side frame supports **77**. The bridge **76** has center support sections **78** on both sides with extensions **79**. Bridge **76** supports air cylinder **80** which is secured to it. The air cylinder **80** has a shaft **82** extending from it and is connected to a tucker shoe **84**. The shoe **84** is connected to one end of guide shaft **86** which passes through and is guided by bore **87** in bridge **76**. The shaft **86** is mounted on a central pin **88**, having a center axis **89**, at its opposite end. Pin **88** has shaft **86** mounted at its center section and links **91** and **92** connected to its end sections. Links **91** and **92** are connected to and rotatable about pin **88** at one end, and link pins **93** and **94** respectively at the other end.

Breaker arms **95** and **96** are supported by stationary pins **97** and **98** respectively and rotate about them. Pins **97** and **98** extend across bridge **76** and are secured in extensions **79** of support sections **78**. Arms **95** and **96** have bifurcated ends **101** and **102** respectively. The pins **93** and **94** have links **91** and **92** respectively connected to the center portion, and bifurcated ends **101** and **202** respectively connected to their end portions. At the other end of arms **95** and **96** are breaker shoes **103** and **104** respectively. As seen in FIG. 6, pins **97** and **98** are connected in close relationship to the bifurcated ends **101** and **102** respectively of breaker arms **95** and **96**; thus, a small movement of the bifurcated ends **101** and **102** of arms **95** and **96** around stationary pins **97** and **98** respectively will cause a proportionally larger movement of breaker shoes **103** and **104**.

The tucker-breaker assembly **75** is in its final position as shown in FIG. 6. Its initial position is when air cylinder **80** positions control pin center **89** at location A, which will locate link pin **94** at position **94***a*, breaker shoe **104** at position **104***a*, and tucker shoe **84** at position **84***a*. When a mandrel **15** indexes to its position aligned with the tucker-breaker assembly **75**, the air cylinder **80** is activated starts moving shaft **82** away from the bridge **76** and towards the mandrel **15**. This movement pushes the tucker shoe **84**, which is guided by shaft **86**, toward the mandrel **15** and passes central pin center **89** through position B, link pin **94** is then at **94***b*, the breaker shoe **104** is at **104***b*, and the tucker shoe **84** is at **84***b*. Then as the air cylinder continues, it moves the shaft **82** until it is completely extended, and at this time, the control pin **89** is at position C. At this position the link pin **94** is at **94***c*, the breaker shoe **104** is at **104***c*, and the tucker shoe **84** is at **84***c*. The air cylinder and the tucker-breaker assembly will remain in this position until the mandrel has indexed so that the guide rail **106** is holding the container's end closure in tucked position. Then the air cylinder **80** is activated from position C through position B to position A before the next mandrel reaches station **23**.

The mandrel **15** will be indexed to station **24–1** with the bottom remaining in tucked condition as just discussed.

The mandrel 15 will stop so that the container bottom is positioned adjacent the pressure pad 108, and the pressure pad 108 will act on the bottom panels forcing them together and giving them a cooling effect. The mandrel will then index to station 24–2 where we will have the same action from pressure pad 109. The bottom end closure will then be bonded together forming a leakproof bottom.

Before the container 40 reaches station 23 the bottom end closure score lines have not been pre-broken. When the mandrel 15 with the container reaches station 23, the control pin 88 is at position A. The mandrel ends just short of score line 42 so the panels 55 through 58 can be folded on score line 42 without obstruction, but close enough to give backup support at the bonding stations 24–1 and 24–2 when the pressure pads act on the bottom closure.

As discussed earlier, when the mandrel arrives at station 23, the air cylinder 80 is activated and first moves through position B. The breaker shoes 104 are moving towards each other to position 104*b*. This is the closest that the breaker shoes approach each other. As seen in FIGS. 6 and 6*a* breaker shoes 104, 103 have tip members 105 that are shaped similar to portion of closure panels 56 and 58, but formed so as to cause panels 56 and 58 to move towards each other and help prebreak the bottom end closure score lines when the breaker shoes move from 104*a* to 104*b*. As the air cylinder 80 continues, it moves center axis 89 of control pin 88 from position B to position C. As seen in FIG. 6, the breaker shoes 104, 103 are moved away from the container and from each other by movement from position 104*b* to 104*c*. At this time the tucker shoe is close enough and moving toward the end panels 55 through 58 at such a rate that shoe surfaces 83 and 85 act on the panels 55 and 57 respectively and prevent them from popping out. When the control pins center axis 89 reaches position C, the shaft 82 is at its extreme condition and will remain there until the air cylinder 80 is again activated.

At position C the link pin 94 will be a 94*c*, the center axis 89 will be at position C, the breaker shoe 104 will be at 104*c*, and the tucker shoe 84 is now at 84*c*. The tucker shoe 84 will be stationary at 84*c* until the air cylinder is again activated. The tuck-in flap 61 will be between the inside face of tuck-over flap 62 and the inside face of the foldback panels 64 and 67. The tuck-over flap will be over the tuck-in flap 61 and in the tucker shoe slot 81. The mandrel will be rotating in the direction of the arrow R in FIG. 7. This will allow bottom end closure panels to move away from the tucker shoe 84 without difficulty and as it starts its index, the shoe surface 85 will cam the bottom closure panels together as seen in FIG. 13. As the mandrel 15 moves the container 40 away from the tucker shoe 84, the container bottom will be held in the same position as shown in FIG. 13 until it reaches bonding station 24–1 where the pressure pad 108 will act on the bottom closure panels with pressure.

Just after the mandrel 15 has completely moved out of alignment from the tucker shoe 84, the air cylinder 80 will be activated, causing the system to move from position C through position B to position A. This movement will be completed before the next mandrel arrives at break and tuck station 23. When the next mandrel arrives the unit will repeat the operation as just explained.

Another embodiment for breaking and tucking the bottom end closure is shown generally in FIGS. 8 and 9. This has a bridge member 76 with an air cylinder 80 secured to it. The air cylinder has a shaft 82 which has a tucker shoe 84 secured to one end. Cam beams 31 are secured to the shoe 84 and help guide it in its movement. The beams 31 run in guide ways in bridge 76, not shown, causing the shoe 84 to move in a straight path along the axis of shaft 82. The bridge 76 has flanges 28 which extend in pairs from both sides of the bridge. Stationary pins 29 extend across the bridge 76 and have their ends supported by the flanges 29 as seen in FIGS. 8 and 9. Body members 32 are supported by pins 29 between the flanges 28 and make arcual movements around the pins as will be explained later. The body member 32 has breaker arm 96 extending from one of its ends and a pair of roller supports 34 extending from the other end. The follower rollers 36 are supported by roller support 34 through pins 35.

When a container 40 on a mandrel 15 is positioned at station 23, the air cylinder 80 is activated. At this time the shaft 82 will be moved toward the container and away from the air cylinder 80. The tucker shoe 84 and the cam beams 31 will move with the shaft 82. The cam beams have cam lobes 37 and cam surfaces 38. As seen in FIGS. 8 and 9 the air cylinder 80 is in its most extended position. In its initial position the cam lobes 37 would be on the opposite side of the upper follower rollers 36. When the beam 31 starts down the upper rollers 36 will be forced to rotate (the one on the right in a clockwise direction, and the one on the left in a counter-clockwise direction) about stationary pins 29 because of the action by the cam lobes 37 on the rollers 36. The rotation can be accomplished because the cam surface 38 allows the lower follower rollers 36 to rotate with the upper follower rollers 36. The whole body members 32 will rotate, which will include the breaker arms 96. As the arms 96 rotate towards each other their breaker shoes 104 will strike closure panels 56 and 58 forcing them toward each other. The tucker shoe 84 will act on the tuck-in flap 61 and the tuck-out flap 62 with shoe surfaces 83 and 85 respectively. As the shaft 82 continues to extend the upper follower rollers will be reversed in their rotation by the cam surfaces acting on the lower rollers 36. This reverse rotation is accomplished because the cam lobe 37 allows the upper follower rollers 36 to rotate with the lower follower rollers 36. The breaker shoe 104 will be removed from the path of the tucker shoe 84 before the tucker shoe 84 can contact the breaker shoes 104. The tucker shoe will continue on down and tuck the container 40 bottom as described earlier. After the mandrel with the container 40 starts to index to the next station and before the next mandrel arrives, the air cylinder 80 will be activated and returned to its original positions so it will be ready to tuck the next container bottom.

FIG. 10 shows a tucker-breaker assembly 75 similar to the unit shown in FIGS. 8 and 9. However, this assembly does not have a breaker shoe 104. It has breaker flaps 112 with tip members 114 that are shaped similar to portion of closure panels 56 and 58. The flaps 112 are rotatably secured to breaker arms 96 by pins 111. The brackets 115 are secured to bridge 76 and have one end of connecting rod 116 rotatably attached to them by pins 117. The other ends of the connecting rods 116 are attached to breaker flaps 112 by pins 118 which allow relative rotation of the parts.

As shown in FIG. 10, the shaft 82 is in its extended position. The follower rollers 36 and the cam beams 31 and their associated parts function as explained with reference to FIGS. 8 and 9. The movement of the connecting rod 116 and breaker flap 112 will be explained with reference to the parts on the right hand side of FIG. 10, and this will also be true for the left hand side but in reverse. As the shaft 82 is activated towards the mandrel 15, the breaker arm 96 will be rotating in a clockwise direction about stationary pin 29, which will cause the connecting rod 116 to rotate in a clockwise direction about pin 117. The rod 116 has a fixed length; therefore, it will cause the breaker flap 112 to rotate in a counter-clockwise direction about pin 111. The total result of these movements will be to move the tip member 114 into contact with the closure panel 56 due to the rotation of the arm 96 and to move the tip member 114 toward the end of mandrel 15 due to the rotation of the connecting rod 116. The tucker shoe will start acting on the tuck-in

and tuck-out flaps and the breaker flap 114 will be removed from its path due to continual movement of shaft 82 as previously discussed.

While the embodiments of the present inventions as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted.

I claim the following:

1. A breaking and tucking assembly station for a high-speed carton fabricating machine and adapted to operate on the end closure panels of each carton produced by said machine, said assembly comprising:

(*a*) two side support members,

(*b*) a rotatable mandrel assembly supported by said side supports,

(*c*) a bridge member supported by said side supports,

(*d*) an air cylinder secured to said bridge member and having an extendable shaft,

(*e*) a tucker shoe supported by said extendable shaft,

(*f*) a pair of breaker shoes driven and controlled by the said air cylinder,

(g) a mandrel connected to said mandrel assembly having a container mounted on it and said mandrel assembly rotating in timed relationship with said breaker shoes and said tucker shoe,

(*h*) said breaker shoes acting on a pair of opposed end closure panels of said container and said tucker shoe acting on the remaining pair of opposed end panels to form a tucked closure end, and

(*i*) said breaker shoes moving away from said end closure panels before said tucker shoes arrives at its closest position.

2. A breaking and tucking assembly as set forth in claim 1 having:

(*a*) a pair of break arms rotatably attached to the bridge member,

(*b*) two cam beams secured to the tucker shoe,

(*c*) two pairs of follower rollers and each connected to one of the break arms and rotatably with it, and

(*d*) the said breaker shoes connected to one end of the breaker arms.

3. A breaking and tucking assembly as set forth in claim 2 having one cam lobe and one cam surface on each of said cam beams.

4. A breaking and tucking assembly as set forth in claim 3 having:

(*a*) said breaker shoe rotatably attached to the breaker arm,

(*b*) brackets and connecting rods,

(*c*) the brackets are secured to the bridge member and rotatably attached to one end of the connecting rods, and

(*d*) said breaker shoe rotatably attached to the other end of the connecting rod.

5. A breaking and tucking assembly station for a high-speed carton fabricating machine and adapted to operate on the end closure panels of each carton produced by said machine, said assembly comprising:

(*a*) two side support members,

(*b*) a rotatable mandrel assembly supported by said side supports,

(*c*) a bridge member supported by said side supports,

(*d*) an air cylinder secured to said bridge member and having an extendable shaft,

(*e*) a tucker shoe supported by said extendable shaft,

(*f*) a pair of breaker shoes driven and controlled by the said air cylinder,

(*g*) a mandrel connected to the mandrel assembly and adapted to carry cartons received by said machine, said mandrel assembly rotating in timed relationship with the breaker shoes and the tucker shoe,

(*h*) said breaker shoes adapted to act on a pair of opposed end closure panels of a carton received by the mandrel and said tucker shoe adapted to act on the remaining pair of opposed end panels of the carton to form a tucked carton closure end,

(*i*) said breaker shoes moving away from said end closure panels before said tucker shoe arrives at its closest position,

(*j*) a pair of breaker arms rotatably attached to the bridge member,

(*k*) a guide shaft secured to the tucker shoe at one end,

(*l*) a pair of links having one end rotatably connected to the guide shaft and the other end rotatably connected to one end of a break arm, and

(*m*) the said breaker shoes connected to the opposite end of the breaker arms.

6. A breaking and tucking assembly station for a high-speed carton fabricating machine and adapted to operate on the end closure panels of each carton produced by said machine, said assembly comprising:

(*a*) a breaking and tucking assembly station support means,

(*b*) a rotatable mandrel assembly with a support means,

(*c*) an actuating means and a tucker shoe supported by said actuating means,

(*d*) a pair of breaker shoes driven and controlled by said actuating means,

(*e*) a rotatable mandrel connected to the mandrel assembly and adapted to carry cartons received by said machine, said mandrel assembly rotating in timed relationship with the breaker shoes and the tucker shoe,

(*f*) said breaker shoes adapted to act on a pair of opposed end closure panels of a carton received by the mandrel and said tucker shoe adapted to act on the remaining pair of opposed end panels of the carton to form a tucked carton closure end,

(*g*) said breaker shoes moving away from said first pair of end closure panels before said tucker shoe arrives at its external positon,

(*h*) a pair of breaker arms being part of said breaker shoes and rotatably mounted,

(*i*) a guide means secured to the tucker shoe and the breaker arms, and

(*j*) said guide means is positioned by said actuating means.

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FRANK E. BAILEY, *Primary Examiner.*