Nov. 5, 1968 F. L. HOFF 3,408,905

CARTON FORMING APPARATUS

Filed April 11, 1966 3 Sheets-Sheet 1

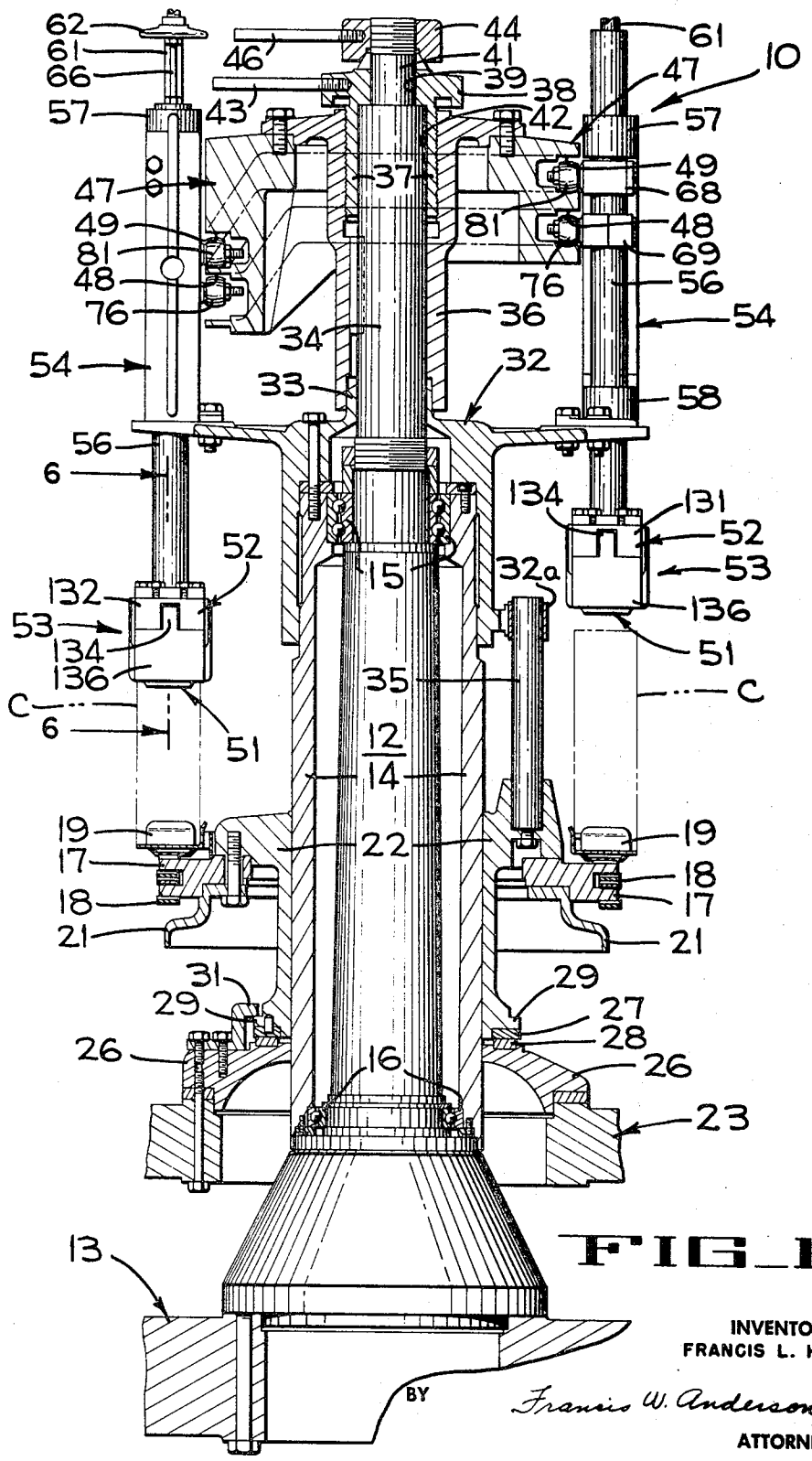


FIG_1

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FIG_2

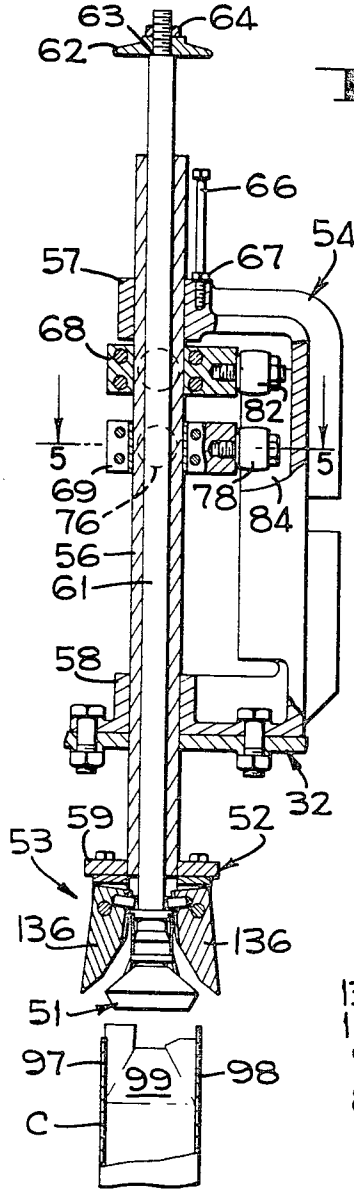


FIG_3

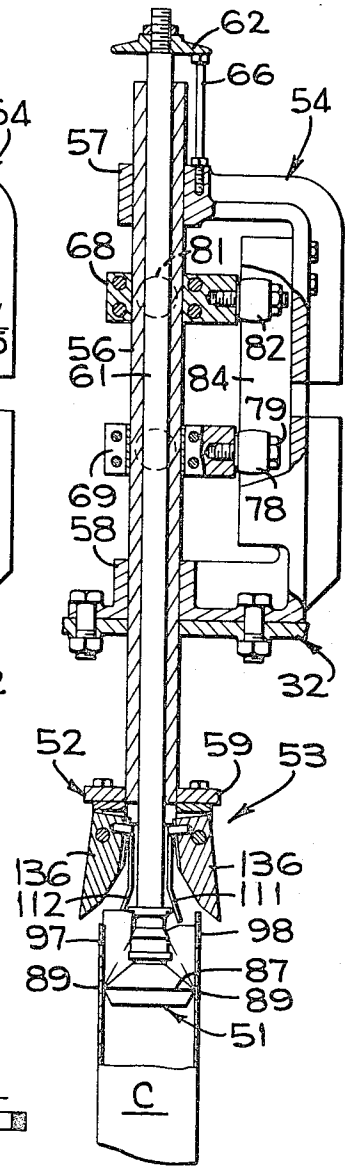


FIG_4

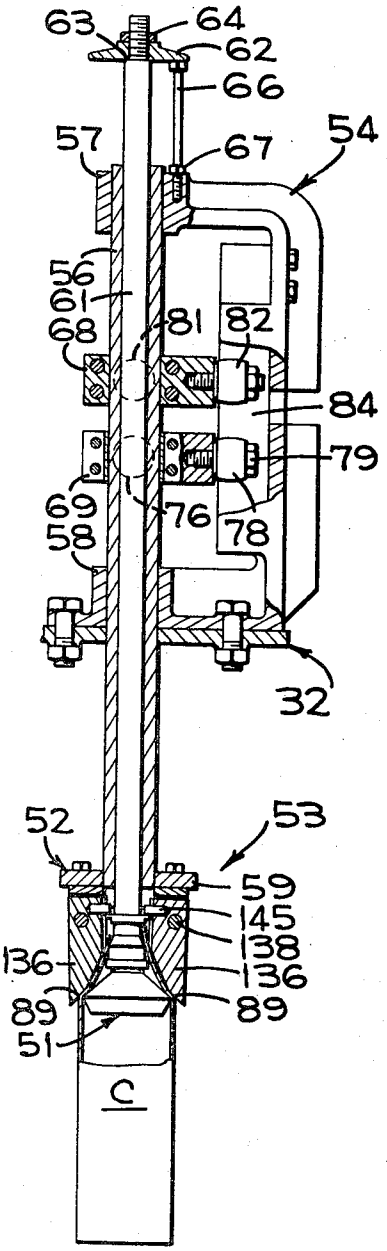
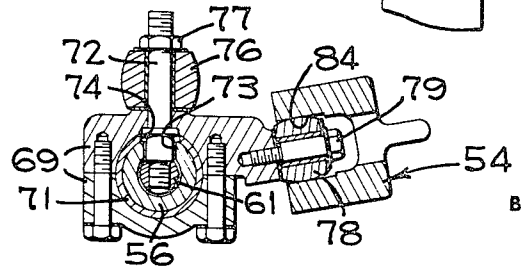


FIG_5



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CARTON FORMING APPARATUS

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FIG_6

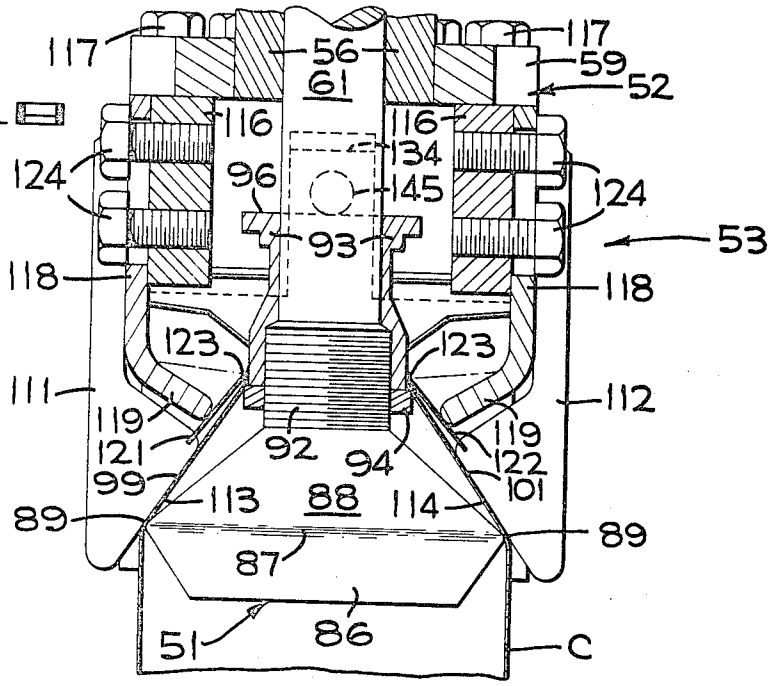


FIG_5

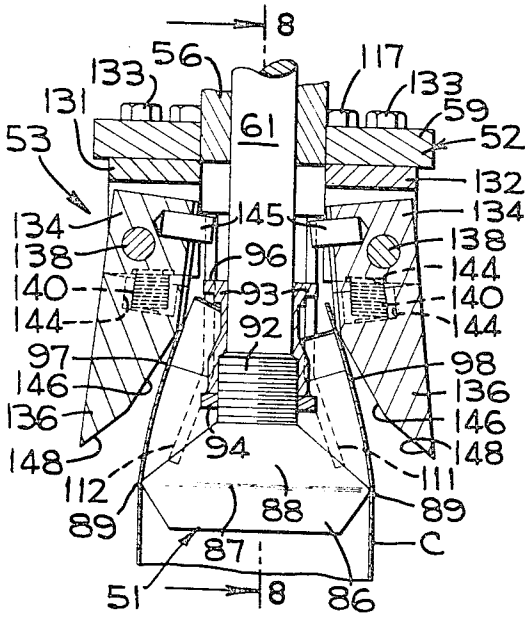
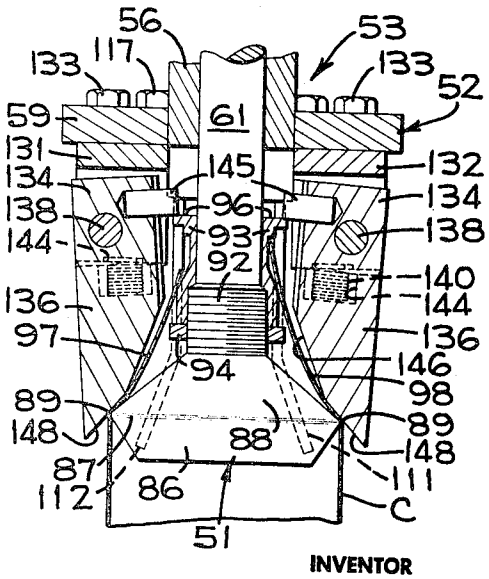


FIG_7



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United States Patent Office

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CARTON FORMING APPARATUS

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3 Claims. (Cl. 93—36.8)

ABSTRACT OF THE DISCLOSURE

A flap folding apparatus including the combination of a backup member having a circular periphery disposed at score lines within a carton, and a reciprocable head carrying an opposed pair of fixed flap folding means for engaging and assuring that trapezoidal carton flaps are folded inwardly before the flat flaps of the carton are engaged by pivotal flap folding jaws. The pivotal flap folding jaws are carried by the head and are actuated by means connected to the backup member.

The present invention pertains to packaging machines, and more particularly relates to a flap folding apparatus for bending flaps about score lines.

In carton forming and filling machines of the type disclosed in the copending application for United States Letters Patent of Vades et al., Ser. No. 461,738, filed June 7, 1965, a top forming turret is disclosed. The top forming turret turret is arranged to first insert a backup anvil into a carton opposite score lines therein and thereafter lower a forming head having rigid flap folding members into folding position so that the rigid members engage the four top closure flaps of the carton and bend them inwardly about the associated score lines. In order to provide a sealable carton, it is essential that two opposed flaps having trapezoidal score lines therein be folded inwardly before the other two opposed flat flaps can be bent inwardly.

It has been discovered that if the cartons presented to the forming head are improperly positioned in their carriers and accordingly are not accurately aligned with the forming head, one of the fixed folding members of each forming head is apt to contact one of the front flaps of an associated misaligned carton before the trapezoidal flaps are contacted and bent inwardly thereby causing the trapezoidal flaps to be bent outwardly, rather than inwardly, providing a defective carton.

In order to overcome the above difficulty and to provide a forming apparatus which will operate successfully on cartons even though they are misaligned, it is one object of the present invention to provide an improved carton forming apparatus.

Another object is to provide a carton forming apparatus having a forming head provided with a pair of folding members which are held away from the flat flaps of a carton until after the trapezoidal flaps have been engaged and have been bent inwardly.

Another object is to provide an improved carton forming head.

These and other objects and advantages of the present invention will become apparent from the following description and the accompanying drawings, in which:

FIGURE 1 is a vertical central section through the carton forming apparatus of the present invention, only two forming assemblies being illustrated.

FIGURES 2, 3 and 4 are enlarged vertical sections through one of the forming head assemblies illustrating the forming head and anvil in three operative positions.

FIGURE 5 is an enlarged horizontal section taken along lines 5—5 of FIGURE 2.

FIGURE 6 is an enlarged vertical section taken substantially along lines 6—6 of FIGURE 1 illustrating the

mandrel in forming position within a carton and illustrating the forming head with its pivotal forming jaws in open position.

FIGURE 7 is a section similar to FIGURE 5 but illustrates the jaws in their closed carton forming positions.

FIGURE 8 is an enlarged vertical section taken along lines 8—8 of FIGURE 6.

The carton forming apparatus or turret **10** (FIG. 1) of the present invention comprises a stationary column **12** which is bolted to a stationary frame **13**. A tubular drive column **14** is journalled on the stationary column **12** by bearings **15** and **16**. A drive sprocket **17** having a continuously driven chain **18** trained therearound has a plurality of equally spaced carriers **19** thereon which carriers support vertically extending, open topped cartons C therein.

The drive sprocket **17** and a splash apron **21** are bolted to a drive hub **22**, which is supported on a vertically adjustable frame **23**. The frame **23** may be adjusted vertically by means disclosed in the above referred to Vadas et al. application so as to raise or lower the carriers **19** thereby adapting the carton forming turret **10** to handle cartons of different sizes.

The hub **22** is supported on the adjustable frame **23** for movement therewith by an annular support **26** which is bolted to the adjustable frame **23** and has the stationary column **12** and tubular column **14** projecting upwardly therethrough. A pair of mating thrust bearings **27** and **28** are connected to a flange **29** on the lower end of the drive hub **22**, and to the annular support **26**, respectively, thereby permitting rotation of the hub **22** relative to the annular support **26**. An S-shaped bracket **31** is bolted to the support **26** and projects over the flange **29** to prevent undue separation from occurring between the thrust bearings **27** and **28**.

A tool supporting hub **32** is bolted to the upper end of the turret drive column **14** and has an upwardly projecting neck **33** rotatably received about a reduced diameter portion **34** of the stationary column **12**. A vertically extending drive post **35** is bolted to the drive hub **22** and projects upwardly through a suitably bushed drive block **32***a* that is rigidly secured to the tool supporting hub **32**. It will be recognized that the drive post **35** transmits rotary motion from the drive hub **22** to the tool supporting hub **32** yet permits vertical motion of the drive hub **22** and associated parts relative to the tool supporting hub **32**.

A non-rotatable cam supporting hub **36** is keyed to the reduced diameter portion **34** of the stationary column **12** and has a threaded counter bore in its upper end which receives the threaded body **37** of a height adjustment bushing **38**. The bushing **38** includes a small diameter bore **39** journalled on a small diameter portion **41** of the stationary column **12**, and a large diameter bore **42** journalled on the portion **34** of the stationary column. A handle **43** screwed into the bushing **38** provides means for rotating the bushing and thereafter raising or lowering the cam supporting hub **36** to the desired elevation. The cam supporting hub **36** is locked at the desired elevation by a threaded collar **44** which is screwed into the small diameter portion **41** of the stationary column **12**. A handle **46** is screwed into the collar **44** to provide means for readily locking the collar **44** against the bushing **38**.

An annular cam **47** having a lower continuous annular track **48** and an upper annular track **49** is bolted to the cam supporting hub **36** and causes vertical reciprocation of a conical anvil **51** and a top forming head **52** of each of a plurality of forming head assemblies **53** in timed relation with the movement of the turret **10**.

In the preferred embodiment of the invention the top

forming turret **10** comprises six forming head assemblies **53** which are equally spaced around the turret, and each assembly **53** includes one of the conical anvils **51** and one of the forming heads **52**. Since all of the assemblies **53** are identical, only one assembly will be described in detail.

Each forming head assembly **53** (FIGS. 1–4) comprises a C-shaped sub-frame **54** which is bolted to the tool supporting hub **32** and slidably receives a vertically extending tubular shaft **56** in a upper hub **57** and in a lower hub **58**. A forming head support plate **59** of the forming head **52** is welded to the lower end of the tubular shaft **56** thereby supporting the forming head for movement with the shaft. A vertically extending anvil supporting rod **61** is slidably received in the tubular shaft **56** and has the conical anvil **51** secured to its lower end. An abutment collar **62** is clamped against a shoulder **63** adjacent the upper end of the rod **61** by a nut **64** screwed on the rod. The collar **62** is disposed in position to engage the upper end of a stop screw **66** which is screwed into the upper hub **57**, and is locked in adjusted position by a locknut **67**.

In order to vertically reciprocate the shaft **56** and rod **61**, and to prevent rotation of the same relative to the C-shaped sub-frame **54**, split blocks **68** and **69** are clamped on the tubular shaft **56** and rod **61**, respectively. As indicated in FIGURE 5, the split block **69** is clamped to a sleeve **71** which is slidably received on the outer surface of the tubular shaft **56**. A shouldered lug **72** is screwed into the rod **61** and extends through a vertical slot **73** in the tubular shaft **56**, through an opening **74** in the sleeve **71**, and through an opening in the split block **69**. A cam follower **76** is journalled on the lug **72** and is held in place by a nut **77**. A cam follower **78** is disposed at substantially 90° relative to the follower **76** and is journalled on a capscrew **79** screwed into the split block **69**. Similar cam followers **81** and **82** are journalled on capscrews secured to the split block **68** and are disposed in vertical alignment with the cam follower **76** and **78**, respectively. During rotation of the forming turret **10**, the cam follower **81** rides along the upper annular cam track **49**, and the cam follower **76** rides along the lower track **48** thereby vertically reciprocating the forming head **52** and the anvil **51** in timed relation with the movement of the turret **10**. The cam followers **78** and **82** are received in a vertical cam track **84** formed in the sub-frame **54** and serve to hold the rod **61** and the tubular shaft **56** from rotation relative to the sub-frame.

The conical anvil **51** (FIGS. 6–8) comprises a lower frusto-concial lead-in portion **86** which aids in guiding the anvil into the open top closure of the carton C. The lead-in portion **86** is connected at a circumferential fulcrum edge **87** to an upper frusto-conical back-up portion **88** which is secured to the rod **61** as by welding. As indicated in FIGURES 6–8, when the conical anvil **51** is in its active position, the circumferential fulcrum edge **87** is disposed opposite horizontal closure score lines **89** formed on the rectangular periphery of the carton and connects the flaps to the body of the carton. Since the anvil is circular in cross-section, and since the carton is square in cross-section, it will be appreciated that there will be little difficulty in inserting the anvil **51** into the carton even if the carton is slightly misaligned, and that the circumferential fulcrum edge **87** will engage the carton only at the tangential points of the four walls.

The anvil **51** also includes a threaded shank **92** which has an abutment cam **93** screwed thereon and locked in place by a locknut **94**. As will be made apparent hereinafter, the upper surface **96** of the abutment cam **93** cooperates with the forming head **52** to cause the inward folding of opposed flat flaps **97** and **98** only after the opposed trapezoidal flaps **99** and **101** (FIG. 8) have been bent inwardly.

The top forming head **52** comprises the above mentioned forming head support plate **59** which is welded to the tubular shaft **56**. Two sets of spaced fingers **111** and **112** (FIGS. 6–8) having downwardly and outwardly (FIG. 8) flaring lower carton folding surfaces **113** and **114**, which surfaces flare downwardly and outwardly relative to two perpendicular planes, are provided for folding each trapezoidal flap **99** and **101** inwardly upon downward movement of the head **52**. Each set of fingers **111** and **112** is welded to a support block **116** (FIG. 8) which is rigidly connected by cap screws **117** to the plate **59**. The upper portion of each block **116** is centrally slotted to receive the upper end of a tab bending finger **118** having an inwardly bent tab bending portion **119** which upon downward movement of the forming head **52**, engages the associated tab **121** or **122** and bends the tab sharply inward about its scored fulcrum point **123** which rests against the nut **94** as indicated in FIGURE 8. Each tab bending finger **118** is secured to the associated block **116** by cap screws **124** which extend through a vertical slot in the finger **118** and are screwed into the block **116**. Thus, downward movement of the head **52** causes the fingers **111** and **112** to bend the trapezoidal flaps **99** and **101** inwardly, and also causes the fingers **118** to bend the tabs **121** and **122** outwardly as indicated in FIGURE 8.

The forming head **52** also includes a pair of yokes **131** and **132** that are rigidly secured to opposite sides of the plate **59** by capscrews **133**. Each yoke has a centrally disposed slot which receives a tongue **134** (FIG. 1) of a side flap folding jaw **136**. Each jaw **136** is pivoted to its associated yoke by a pin **138** which is journalled in the yoke and is rigidly secured to the associated tongue **134** as by pinning. A pair of compression springs **140** are disposed between each yoke and each jaw **136** and are seated in aligned counter bores **144** in the associated yoke and jaw and urge the jaws to their open position illustrated in FIGURE 6. The jaws **136** are not moved inwardly to the flap folding position illustrated in FIGURE 7 until after the folding head **52** has moved downwardly a sufficient distance to bend the trapezoidal flaps inwardly and to enable a pin **145** secured to and projecting inwardly from the tongue **134** of each jaw **136** to engage the upper surface **96** of the abutment cam **93**. At this time the jaws **136**, which jaws include converging flap folding surfaces **146** and sharply beveled flap crimping surfaces **148**, swing radially inwardly about the axes of their pivot pins **138** thereby forcing the score line **89** of the carton against the circumferential edge **87** of the anvil **51** to crimp the same.

It will be particularly noted that the crimping force is supplied by the arcuate inward movement of the crimping surfaces **148**, rather than by a downward sliding movement of the jaws **136** relative to the anvil **51**. It has been determined that such arcuate inward movement provides a superior crimping action as compared to the crimping action achieved by downward movement of the forming head alone.

Although the anvil **51** is circular, it will be appreciated that the additional structural strength near the corners of the square cartons is sufficient to resist inward deflection of the carton body during the forming operation. Thus, it will be apparent that the carton flat flaps are inwardly bent and are crimped at the midpoints of their score lines **89**, and that these flaps will freely bend about the remaining portions of the score lines.

During operation of the forming turret **10**, the cam tracks **48** and **49** first causes the anvil **51** to move from the inactive position illustrated in FIGURE 2 to a position within the carton with its circumferential edge **87** lying in a common plane with the horizontal closure score lines **89** as indicated in FIGURE 3. The forming head **52** is then moved from its raised position illustrated in FIGURE 3 downwardly until the two pairs of flap bending fingers **111** and **112** engage the associated trapezoidal flaps **99** and **101** and bend them inwardly. Continued

downward movement of the forming head **52** causes the pins **145** to engage the upper surface **96** of the abutment cam **93** thereby causing the jaws to pivot about their supporting pins **138** from the position illustrated in FIGURE 6 to the position illustrated in FIGURE 7. The swinging movement of the jaws **136**, as contrasted to a downward sliding movement of the jaws relative to the stationary anvil **51**, substantially eliminates any tendency of the carton to slide downwardly upon being contacted by the forming head and accordingly alleviates any danger of the bending of the flaps to occur at any point other than at the horizontal closure score lines **89**. The fact that the crimping force applied by the pivotal jaws **136** is directed tangentially at the circumferential edge **87** of the anvil **51**, rather than being applied as a sliding action downwardly relative to the stationary anvil **51**, also assures a much sharper crimping at the closure score line of the flat flaps and eliminates all tendencies of the jaws to slide over the outer surfaces of the flat flaps **97** and **98** thereby marring the apperance of these surfaces.

From the foregoing description it will be apparent that the improved carton forming apparatus of the present invention includes a crimping head having pivotal jaws which remain out of the path of movement of the flat flaps until after the trapezoidal flaps have been bent inwardly thereby assuring that all cartons will have their top closure flaps bent inwardly in the desired manner, rather than having one or more flaps bent outwardly. The forming turret also includes a crimping head which includes pivotal jaws that pivot inwardly against the score lines of carton flaps which are resisted by a circular edge of an anvil thereby resulting in sharply crimped flaps of desirable appearance.

While one embodiment of the present invention has been shown and described, it will be understood that various changes and modifications may be made without departing from the spirit of the invention or the scope of the appended claims.

The present invention and the manner in which the same is to be used having thus been described, what is claimed as new and desired to be protected by Letters Patent is:

1. A carton forming apparatus for folding end closure flaps of a carton inwardly, said flaps being connected to the body of the carton by closure score lines with two of said flaps having trapezoidal score lines therein and the other two flaps having flat faces, comprising means for supporting the carton, circular backup means having a circumferential edge insertable within the carton with the circumferential edge held in position to engage and resist inward movement of the closure score lines, an abutment cam rigidly connected to said resisting means, a reciprocable head supporting plate, opposed flap folding means rigidly secured to said plate and positioned to be moved by said plate against said trapezoidal flaps to engage and bend the trapezoidal flaps inwardly, a pair of opposed flap folding jaws pivotally supported on said plate and having flap crimping surfaces, means for reciprocating said supporting plate toward and away from the carton, means normally holding said jaws in pivotal position wherein said crimping surfaces are spaced outwardly from said flaps, and jaw actuating means operatively connected between said jaws and said abutment cam for pivoting said jaws into a closed position causing said flap crimping surfaces to engage the closure score lines of the flat flaps thereby bending the flat flaps inwardly after said opposed flap folding means has first folded both trapezoidal flaps inwardly.

2. An apparatus according to claim **1** wherein said means for normally holding said jaws spaced outwardly from said flaps are springs, said springs being disposed between said jaws and said head.

3. A carton forming apparatus for folding end closure flaps of a carton inwardly, said flaps being connected to the body of the carton by closure score lines with two of said flaps having trapezoidal score lines therein and the other two flaps having flat faces, comprising means for supporting the carton, backup means having a circular edge insertable within the carton with the circumferential edge held in position to engage and resist inward movement of the closure score lines, an abutment cam rigidly connected to said resisting means, a reciprocable head supporting plate, opposed flap folding means rigidly secured to said plate and positioned to be moved by said plate against said trapezoidal flaps to engage and bend the trapezoidal flaps inwardly, a pair of opposed flap folding jaws pivotally supported on said plate and having flap crimping surfaces, means for reciprocating said supporting plate toward and away from the carton, means normally holding said jaws in pivotal position wherein said crimping surfaces are spaced upwardly from said flaps, and jaw actuating means operatively connected between said jaws and said abutment cam for pivoting said jaws into a closed position causing said flap crimping surfaces to engage the closure score lines of the flat flap thereby bending the flat flaps inwardly after said opposed flap folding means has first folded both trapezoidal flaps inwardly, said jaw actuating means being pins rigidly secured to said jaws and disposed in position to engage said abutment cam to pivot said jaws inwardly immediately before said head supporting plate reaches the forming end of its stroke.

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