March 21, 1967 E. J. PLOUGH 3,309,969

METHODS AND MACHINES FOR FORMING CARTONS

Filed Sept. 28, 1964 3 Sheets-Sheet 1

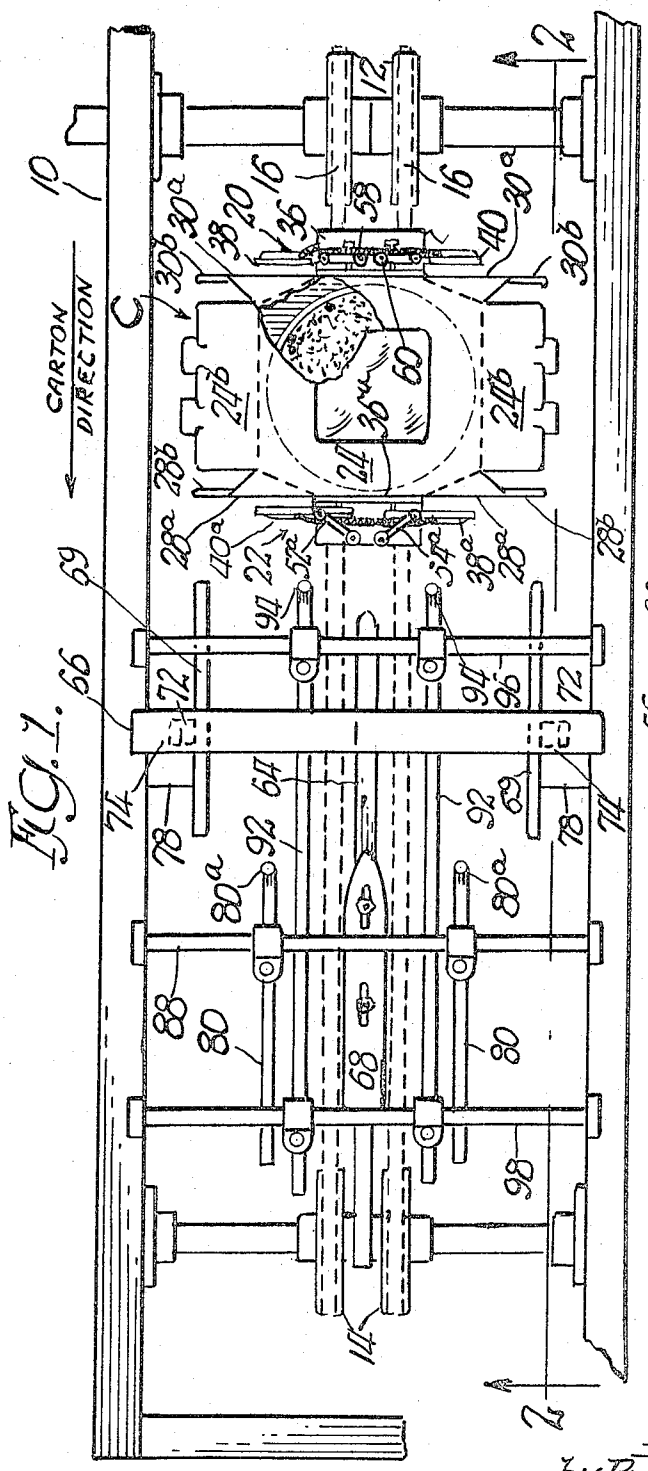


FIG. 1.

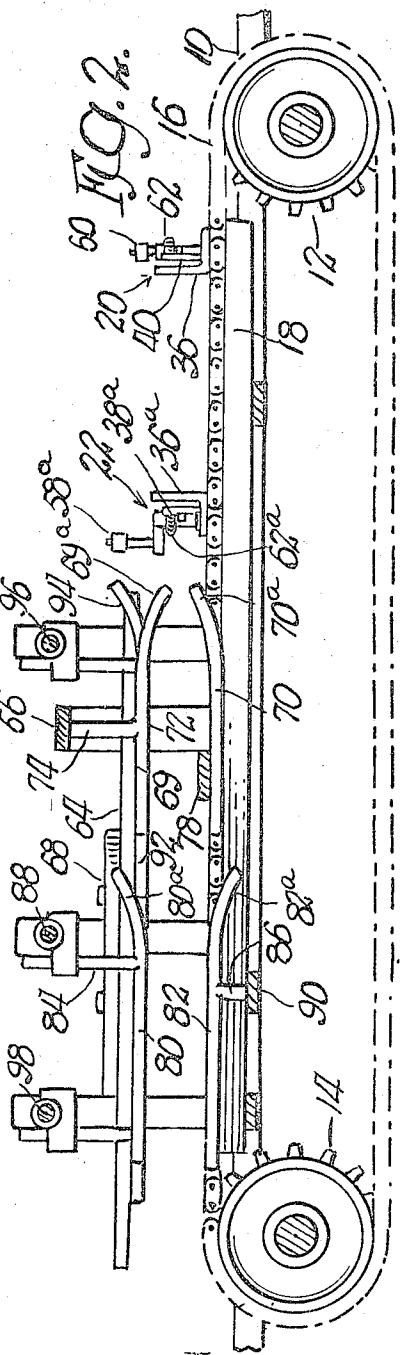


FIG. 2.

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METHODS AND MACHINES FOR FORMING CARTONS

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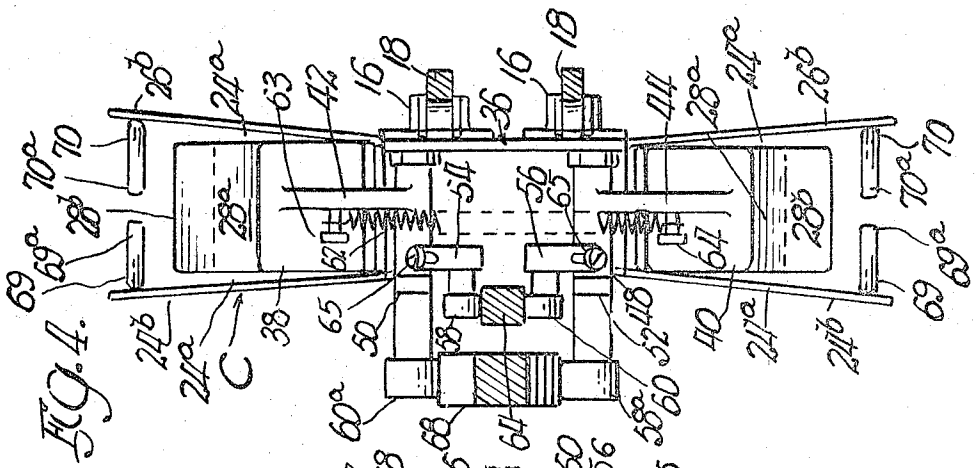


Fig. 4.

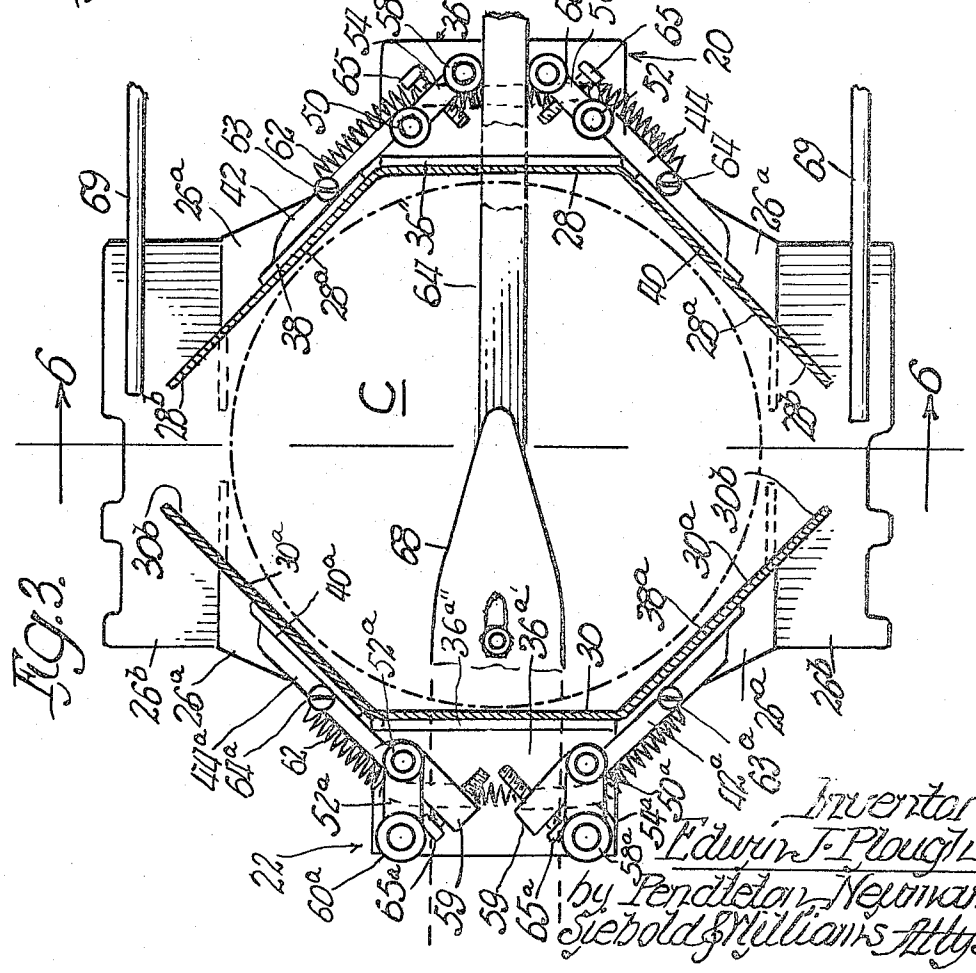


Fig. 3.

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METHODS AND MACHINES FOR FORMING CARTONS

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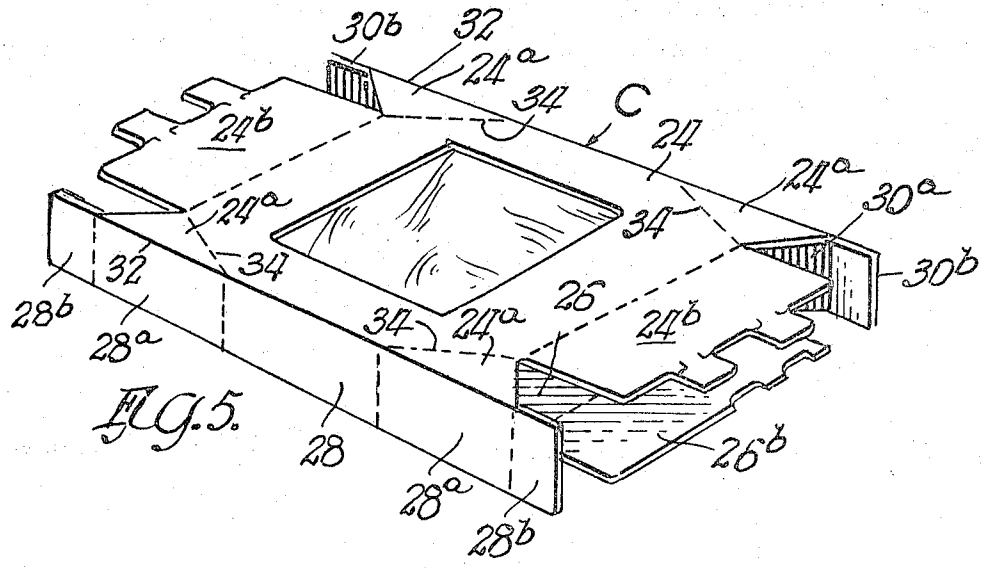


FIG. 5.

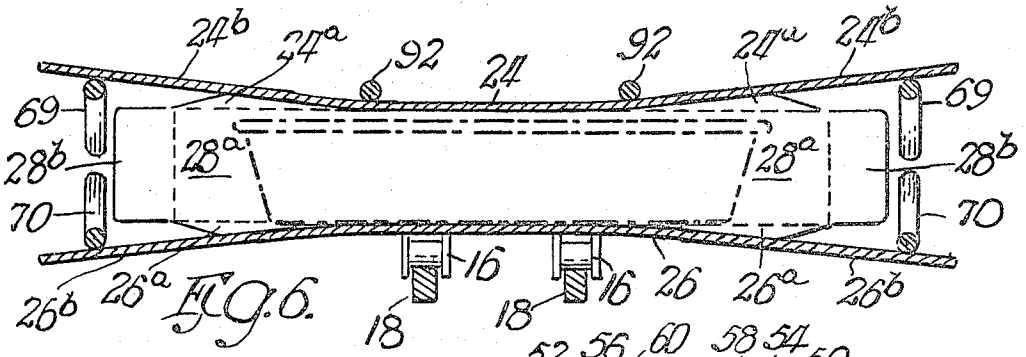


FIG. 6.

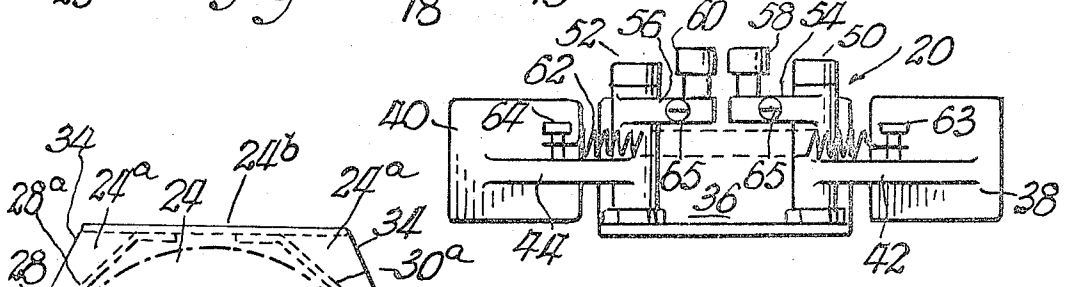


FIG. 8.

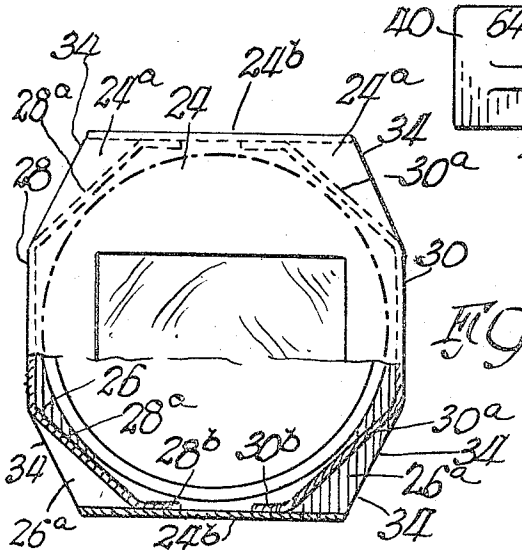


FIG. 7.

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3,309,969

METHODS AND MACHINES FOR FORMING CARTONS

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Filed Sept. 28, 1964, Ser. No. 399,778
16 Claims. (Cl. 93—49)

This invention pertains to methods and machines for forming cartons and particularly for forming cartons having bellows-type, infolded gussets at their corners.

Carton constructions have long been known wherein a tubular blank is provided with gussets at each of the four corners, and these gussets are pushed inward during the final erection and closing of the carton to form a carton having an octagonal inner enclosure. These cartons are particularly adapted for packaging disc-shaped articles, such as pies. Many products of this type are produced in large quantities at a high production rate on an assembly-line basis, thereby requiring rapid packaging operations. While certain conventional packaging steps in the use of these cartons may be performed with known machines, the gusset folding step has not previously been successfully automated. Thus, prior methods and means for erecting cartons of this type have been largely or entirely manual and have presented one or more serious shortcomings, particularly as applied to high production rate operations. Such shortcomings included slow and cumbersome operations, usually requiring time-consuming, tedious and repetitive manual operations, with resultant high unit costs. For such reasons, gusseted cartons of the type indicated above have not been put to wide usage in packaging high rate-of-production items.

It is an object of this invention to provide methods and machines for use in rapidly and mechanically forming and closing cartons having gussets in one or more walls thereof.

It is another object of this invention to provide methods and machines to facilitate efficiently forming and closing of cartons having gusseted corners.

It is another object of this invention to provide machines adapted to cooperate with other cartoning machines for automatically forming and closing cartons having corner gussets.

It is another object of this invention to provide machines for cooperating with other continuous-operation cartoning machines for conveniently and efficiently folding gussets in four corners of a tubular blank to form a partially erected carton for closing and sealing by other conventional cartoning mechanisms.

In carrying out this invention in one illustrative form, a tubular carton blank having bellows-fold gussets at the four corners is supported in squared-up condition on a moving conveyor. Spreader means move the end portions of the top and bottom walls of such blank apart to permit movement of the gussets between such top and bottom walls, whereupon folders, carried by said conveyor, push such gussets inward. The spreader means release the top and bottom walls after substantial inward movement of the folders and gussets, and presser bars press the top and bottom walls toward one another to complete the gusset folding operation. Thereafter, suitable end flaps on the blank may be closed and secured in a conventional manner and by conventional means to complete the carton.

For a more complete understanding of this invention, reference should now be had to the example illustrated in the drawings, wherein:

FIG. 1 is a top plan view of a machine employing teachings of this invention, with an erected, partially broken away, tubular carton blank in place between a pair of folders;

FIG. 2 is a vertical cross-sectional view of the mechanism taken along lines 2—2 of FIG. 1, omitting the carton blank;

FIG. 3 is an enlarged top plan view of the folding mechanism of the machine shown in FIG. 1 as it completes folding the gussets of the carton, with the top wall of the carton and one folding cam broken away;

FIG. 4 is a right-hand end view of FIG. 3;

FIG. 5 is a perspective view of a tubular carton blank for forming a carton having bellows-type gussets at the corners to define an octagonal enclosure;

FIG. 6 is a cross-sectional view of the carton, contents and guides taken generally along line 6—6 of FIG. 3 and looking in the direction of the arrows;

FIG. 7 is a top plan view of a carton formed on the machine of FIG. 1, with a portion of the top broken away to reveal the contents; and

FIG. 8 is an enlarged elevational view of the rear folders of the machine in FIG. 1.

Referring now to the drawings and more particularly to FIGS. 1 and 2, the illustrated embodiment of the invention comprises a frame **10** on which is mounted two sets of sprockets **12** and **14** to drive a pair of conveyor chains **16**, the upper segments of which rest on bed members **18**. One pair of sprockets, for instance sprockets **12**, may be driven by any suitable means such as a motor or a positive drive connection to related machines (not shown) to insure operation of this machine in cooperative timing with such related mechanisms. A pair of folders **20** and **22** are mounted on chains **16** in appropriate spaced relation to receive a squared-up carton blank C therebetween as illustrated in FIG. 1. It is contemplated that a series of such opposed pairs of folders will be mounted on the chains **16**, however, only one set is illustrated herein for simplicity and clarity.

The illustrated folders **20** and **22** are designed to assist in the folding of gussets or bellows folds at the corners of the blank C. Referring also to FIGS. 5, 6 and 7, the blank C is a set-up, glued tubular blank including a top wall **24**, bottom wall **26**, and side walls **28** and **30**. A bellows-fold gusset construction is provided at each corner of the blank with each gusset comprising a flap portion **28***a* or **30***a* foldably connected to the respective side wall, and adjacent triangular sections **24***a* and **26***a*, each joined along one side to the respective flap portion by a foldline **32** and joined along a second side to the top and bottom walls by foldlines **34**, see FIG. 5. Suitable end closure flaps **24***b*, **26***b*, **28***b*, and **30***b* are foldably connected to the ends of the top, bottom and side walls.

In forming the final carton each gusset flap is folded inward to the position shown in FIG. 7. Each triangular section **24***a* and **26***a* is thus folded inward, about the respective foldlines **32** and **34** to a reversed position in back-to-back relation to the respective wall **24** or **26**, and provides lateral support for the gusset flaps. Assuming each foldline **34** defines an angle of approximately 22½° with the respective foldline **32**, each folded gusset will extend inward at an angle of 45° to the respective side wall **28** or **30**, see FIG. 7. Thereupon, closing of the end closure flaps completes a carton with an octagonal enclosure, see FIG. 7.

Referring now to FIGS. 1–4 and 8, the folder **20** comprises an L-shaped support **36** which has one leg **36'** thereof fixed to the chains **16**, and a pair of movable folding wings **38** and **40**. The wings are fixedly supported on arms **42** and **44** which in turn are secured to and extend laterally from sleeves **46** and **48**. The sleeves are mounted for pivotal movement on posts **50** and **52** which extend transversely from leg **36'** of support **36**. Operating levers **54** and **56** are also fixed to and extend

laterally in an opposite direction from sleeves **46** and **48** and are spaced longitudinally of the sleeves from arms **42** and **44**. The distal ends of levers **54** and **56** carry cam follower rollers **58** and **60**. Arms **42** and **44** are biased so as to assume substantially aligned relation by a tension spring **62**, the ends of which are secured by pins **63** and **64** to arms **42** and **44**, respectively. The spring **62**, in this instance, extends around sleeves **46** and **48**, as shown, to retain the wings **38** and **40** in their retracted positions as illustrated in FIG. 1. Setscrews **65** carried by levers **54** and **56** are adapted to abut the upstanding leg **36''** of support **36** and serve as adjustable stops for the retracted position of wings **38** and **40**.

Folder **22** includes the same basic components as folder **20**, and like parts of this folder are identified by the same numbers but with a suffix *a*, see FIGS. 1 and 3. In the illustrated embodiment, folder **22** differs from folder **20** in that its position on chains **16** is reversed and it is spaced from folder **20** by an amount sufficient to permit the tubular blank C to be positioned therebetween. Arms **54***a* and **56***a* are angularly oriented with respect to arms **42** and **44**, see FIG. 3, whereby rollers **58***a* and **60***a* carried on the distal ends of these arms are spaced somewhat further apart than rollers **58** and **60**, for purposes to be later noted. Furthermore, a pair of additional arms **59** extend laterally from sleeves **46***a* and **48***a* in alignment with arms **42** and **44** and receive adjustable setscrews **65***a*.

The folders **20** and **22**, as aforementioned, are secured to the chains **16** with the vertical legs **36''** of the L-shaped supports spaced an appropriate distance to support a squared-up blank C therebetween as illustrated in FIG. 1.

An elongated cam strip **64** is mounted on cross bar **66** and disposed in the path of rollers **58** and **60**. A cam plate **68** is secured to the top of cam **64** in the path of rollers **58***a* and **60***a*. These cams are of appropriate width with respect to the spacing of rollers **58** and **60**, and **58***a* and **60***a*, whereby engagement of the rollers with the cams forcibly spreads the rollers and thereby pivots the folding wings **38**, **40**, **38***a* and **40***a* to their folding positions as illustrated in FIG. 3. Rollers **58***a* and **60***a* and the posts on which they are mounted are spaced to clear cam **64**, and rollers **58** and **60** pass beneath cam **68** as the folders **20** and **22** are carried through the machine on chains **16**.

Adjacent and parallel to the paths of movement of the folders **20** and **22** are a series of guide rods. A pair of short, opposed spreader guides **69** and **70** with converging forward ends **69***a* and **70***a* are disposed at each side of the machine to intercept, pass between, and spread the respective end flaps **24***b* and **26***b*, see FIGS. 4 and 6. For this purpose, the distance between the uppermost surface of guide **69** and the lowermost surface of guide **70** is somewhat greater than the depth of carton C. Each guide **69** is supported on a plate **72** secured to a stud **74** depending from the crossbar **66**, while guides **70** are attached to the underside of plates **78** secured to the frame **10**. Another pair of short opposed guides **80** and **82**, with diverging forward ends **80***a* and **82***a*, are positioned to the rear and inwardly of guides **69** and **70**, to press the end portions of walls **24** and **26** together after the gussets are folded therebetween. The inner opposed surfaces of these guides are spaced apart a distance substantially equal to the depth of the erected carton C. Guides **80** and **82** are secured to studs **84** and **86** which are adjustably supported on crossbars **88** and **90**. The length and relative disposition of cams **64** and **68** and spreader guides **69** and **70** along the path of travel of folders **20** and **22**, is such that the top and bottom walls of a carton blank C carried between the folders are engaged on spreaders **69** and **70** to prevent collapse of these walls toward one another before the drive rollers of folders **20** and **22** engage cams **64** and **68** to fold the gussets. The spreaders then terminate to release the top and bottom walls while the cams **64** and **68** maintain the folders in the position of FIG. 3. The disposition of the presser guides **80** and **82** relative to cams **64** and **68** is such that the pressers engage the top and bottom wall of the blank C prior to release of the folders by the cams.

Two parallel presser guides **92**, provided with upwardly curved forward ends **94**, are adjustably supported on crossbars **96** and **98**. These pressers are disposed to engage the upper side of each carton blank C and retain same in a firmly seated position between folders **20** and **22** as the blank is subjected to the gusset folding operation.

In operation, a squared-up carton blank C is positioned between folders **20** and **22** either by hand or by suitable mechanism, for instance by automatic feed from a hopper, or by other suitable mechanism in the packaging system. The product is normally positioned within the squared-up blank prior to placement of the blank between the folders but may be inserted later. As the chains **16** are driven, the folders and blank are moved through the machine (to the left in FIGS. 1 and 2). Presser guides **92** engage the upper surface of the blank and hold same firmly in position on chains **16** between the folders, as guides **69** and **70** engage and spread the end closure flaps **24***b* and **26***b*, see FIGS. 4 and 6. These guides support and insure spreading of the walls **24** and **26** from one another as the drive rollers **58** and **60**, and **58***a* and **60***a* engage the cams **64** and **68**, respectively, and drive the folding wings inward to fold-in the four-corner gussets. The carton blank C then disengages from guides **69** and **70**, and passes between presser guides **80** and **82** which press the end portions of walls **24** and **26** together to complete the bellows-type folding of the gussets, and to retain the carton in the resulting folded condition, with the end closure flaps protruding as in FIG. 3. Thereafter, the closure flaps may be closed and secured in any suitable manner to complete and retain the carton in final erected condition as in FIG. 7. This final closing and securing may be performed by conventional machines in accordance with the type of end closure desired and the type of flaps provided. This may be by use of glued flaps, or locking tabs, for instance of the type illustrated, or other known means. This machine may be conveniently integrated with conventional carton end closure apparatus by extending the runs of chains **16** through such apparatus, or by passing the blanks C onto another conveyor, while maintaining the end portions of walls **24** and **26** under compression to retain the gusset folds, for instance by extending pressers **80** and **82**.

The method of the present invention is deemed apparent for the aforedescribed operation of the illustrated machine. However, for clarity, it will be appreciated that this method comprises supporting the erected blank C in squared-up condition, spreading and supporting the ends of the walls **24** and **26** to prevent their collapse toward one another as the gussets are pressed inward, then substantially simultaneously pressing in the four gussets from the opposing sides of the carton blank. After the gussets have been folded in a substantial distance, the walls are released from the spreaders, and after the gussets have been folded in sufficiently to move the bellow folds past dead-center (the triangular portions **24***a* and **26***a* are past positions normal to walls **24** and **26**) the ends of the side walls are pressed toward one another to complete the folding of the gussets and to retain the carton in the resulting partially erected state. The gusset folds are permanently retained by subsequently securing the top and bottom walls together. This is accomplished in closing and securing the end closure flaps of of the blank C.

It will thus be seen that a method and machine have been provided which facilitate rapid automatic folding of cartons having corner gussets. The inventive machines are well adapted to receive carton blanks in a conventional cartoning line, to fold gussets in the cor-

ners of the blanks, and to present the resulting partially erected blanks in a manner and form well suited for closure by conventional types of end closure mechanisms. While these machines may comprise separate units, they are well adapted for use in cooperative relation with other cartoning machines, and may be in the nature of an attachment to known cartoning machines, or a supplemental unit to be integrated with other machines. The inventive machines are well suited for use with continuous operation cartoning equipment, and for conveniently and efficiently folding gussets in the corners of tubular blanks.

While particular embodiments of the invention have been shown, it will be understood, of course, that the invention is not limited thereto since modifications may be made by those skilled in the art in light of the foregoing teachings. Therefore, it is contemplated by the appended claims to cover any such modifications as fall within the true spirit and scope of the invention.

I claim:

1. A machine for folding gussets disposed adjacent one end of a tubular carton blank, comprising a conveyor for supporting and moving such blank in one direction, said direction of movement being angularly disposed with respect to the blank gussets, first means operative at a station of travel of the conveyed blank for spreading opposite sides of the blank adjacent the one end thereof, and second means operative at said station for folding the gussets between the spread sides of the blank.

2. A machine as in claim 1 and wherein said first means comprises stationary members having diverging cam surfaces for engaging and spreading such opposite sides of the blank while the latter is being moved in said one direction by said conveyor.

3. A machine for folding gussets disposed adjacent one end of a tubular carton blank, comprising a conveyor for supporting and moving such blank in one direction, said direction of movement being angularly disposed with respect to the blank gussets, first means operative at a first station of travel of the conveyed blank for spreading opposite sides of such blank, folders carried by said conveyor for folding the blank gussets inward between the spread sides, and second means for pressing such spread sides toward one another after release of such sides by said first means and prior to retraction of said folders.

4. A machine for folding gussets disposed adjacent one end of a tubular carton blank comprising a conveyor for supporting and moving such blank in one direction, first means disposed at a station of travel of the conveyed blank for spreading opposite sides of such blank while being moved by said conveyor, and second means carried by said conveyor and operative subsequent to spreading of the sides for folding the gussets inward between such spread sides as such blank is moved by said conveyor.

5. A machine as in claim 4 wherein said folders include a support portion mounted on said conveyor, a pair of wing members pivotally mounted on said support portion and engageable with the blank gussets, and actuatable means for pivoting said wing members to fold such gussets inward.

6. A machine as in claim 5 and wherein said actuatable means for pivoting said wing members comprises stationary cams along said conveyor, and follower members mounted on said wings and positioned to engage said cams.

7. A machine for folding gussets in carton blanks each having a gusset flap in one wall thereof with bellows panels foldably joined to such gusset flap and to spaced opposed side walls, comprising means for folding such gussets inward between such opposing side walls, and means for preventing collapse of such spaced opposed side walls toward one another, while such gusset flaps are folded between such side walls.

8. A machine for folding gussets in carton blanks each having a gusset flap in one wall thereof with bellows panels in spaced opposed side walls and foldably joined to such gusset flap, comprising means for folding such gussets inward between such opposing side walls, and means for insuring spreading of such side walls relative to one another as such gussets are folded inward between such side walls.

9. A machine for simultaneously folding gussets in opposed side walls of a tubular carton blank between opposing top and bottom walls of such blank, comprising a pair of opposed folders adapted for supporting such a blank squared-up therebetween, each folder including a pivotally mounted member for folding a gusset inward of such blank, first means for pivoting said members, and second means for preventing collapse of the top and bottom walls of such blank toward one another adjacent such gussets as said members fold such gussets.

10. A machine for folding gussets in four corners of a carton blank provided with a gusset flap is in a side wall at each such corner thereof and bellows panels in opposing top and bottom walls foldably joined to each such gusset flap, comprising a pair of opposed folders adapted for supporting such a blank therebetween, each folder including a pair of pivotally mounted members for pushing such gussets inward, means spreading such opposing top and bottom walls adjacent such gussets as such gussets are pushed therebetween and releasing such top and bottom walls after substantial inward movement of said members, and means for pressing such top and bottom walls toward one another to retain such gussets in their inwardly folded position.

11. A machine as in claim 10, and including means for actuating said opposed folders substantially simultaneously.

12. A method of forming a carton from a tubular blank having gussets at the corners thereof capable of being folded inwardly between the top and bottom of the blank, said method comprising squaring-up such tubular blank whereby the top and bottom thereof are in spaced substantially registered relation and at least one end of the carton is open, spreading apart the top and bottom of said blank adjacent the corners thereof, folding the gussets inward between the spread top and bottom of said squared-up blank, releasing the spread top and bottom after inward folding movement of the gussets, pressing the blank top and bottom toward one another after such gussets are folded inward past their dead center position, and closing the open end of the resulting carton.

13. A method of forming a carton by machine from an erected, generally rectangular tubular blank having a bellows fold gusset at each corner to be folded inward of such blank between opposing side walls comprising, supporting such blank in squared-up erected form, spreading such opposing side walls, pressing inwardly on all of said gussets of such carton substantially simultaneously to fold such gussets between said opposing sides, and pressing said opposing sides toward one another to retain such gussets in their in-folded position.

14. A machine for folding a gusset provided in a carton blank, comprising a first means for supporting a squared-up carton blank, an adjustably mounted folder positioned to register with a gusset of a blank supported on said first means, and means for effecting adjustment of said folder to fold a registering gusset in a blank so supported.

15. A machine for folding gussets provided in each of four corners of a tubular carton blank, comprising first means for supporting a squared-up tubular carton blank, two pairs of opposed, pivotally mounted, folding members, each of said members being positioned to register with a gusset of a blank supported on said first means, and means for pivoting said folders to substantially simultaneously fold such gussets in the four corners of a blank so supported.

16. A machine for folding gussets provided in each of four corners of tubular carton blanks, comprising a conveyor, a pair of folders mounted on said conveyor for supporting a squared-up tubular carton blank therebetween, each folder including a pair of pivotally mounted folding members, each of said members being positioned to register with a gusset of a tubular blank supported between said folders, and means for pivoting said folding members as said conveyor carries said folding members and a carton blank along the path thereof to fold such gussets in such blank.

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BERNARD STICKNEY, *Primary Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,309,969 March 21, 1967

Edwin J. Plough

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Colum 4, line 50, for "for the" read -- from the --: line 69 strike out "of"; column 6, line 19, strike out "is".

Signed and sealed this 26th day of December 1967.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents