May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 1

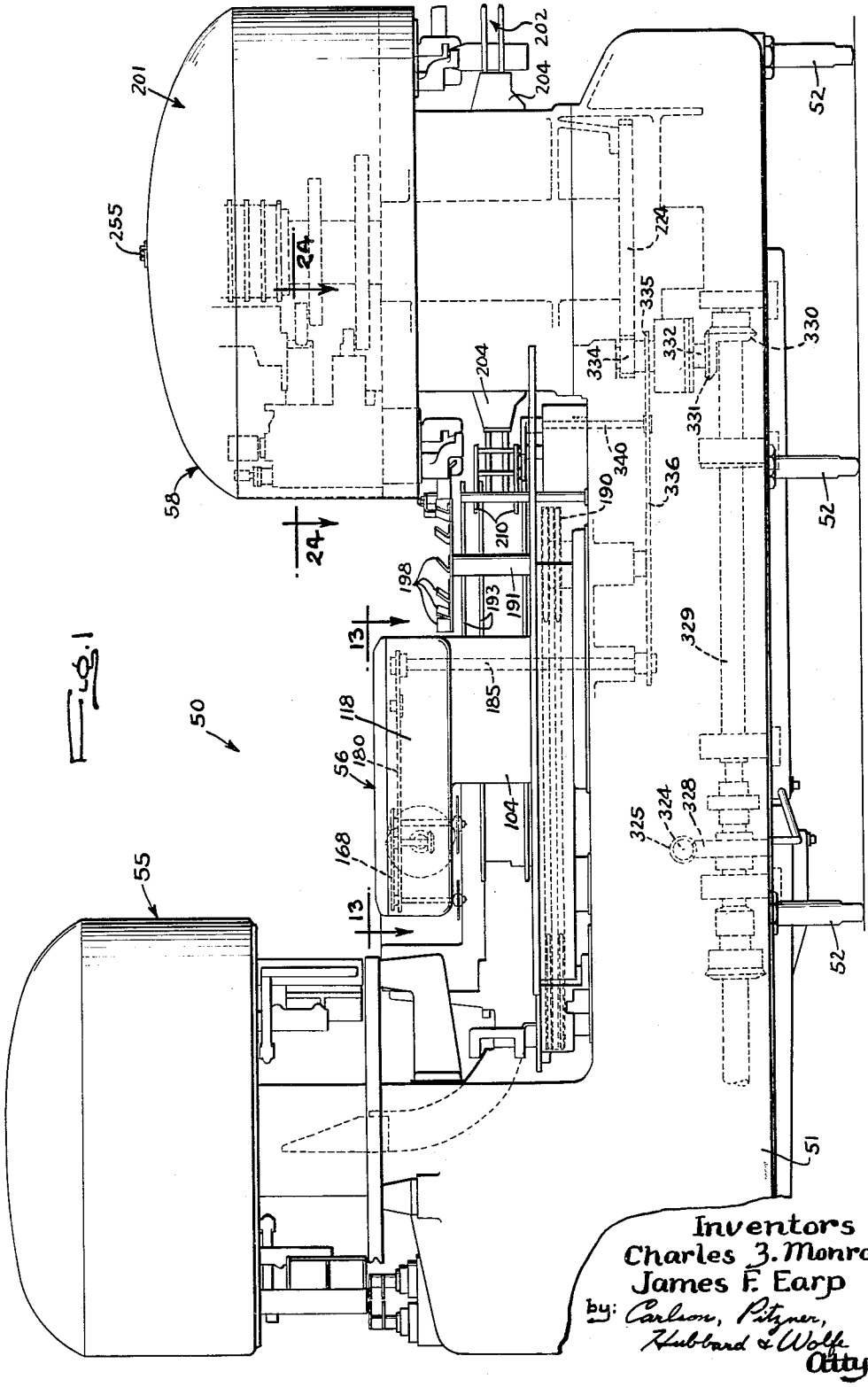


Fig. 1

Inventors
Charles Z. Monroe
James F. Earp
by: Carlson, Pitzner, Hubbard & Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 2

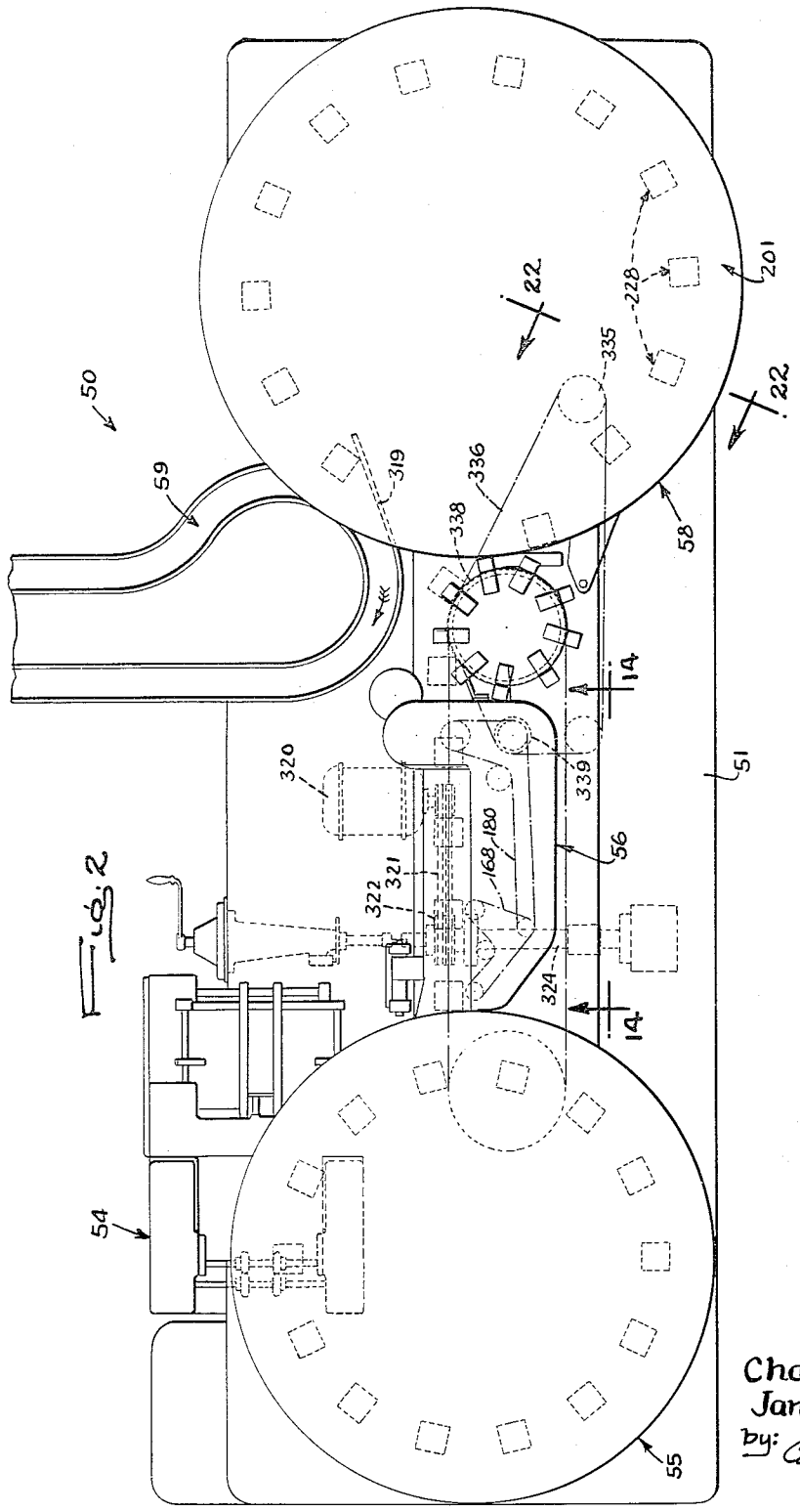


Fig. 2

Inventors
Charles Z. Monroe
James F. Earp
by: Carlson, Pitzner, Hubbard & Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 3

Fig. 3

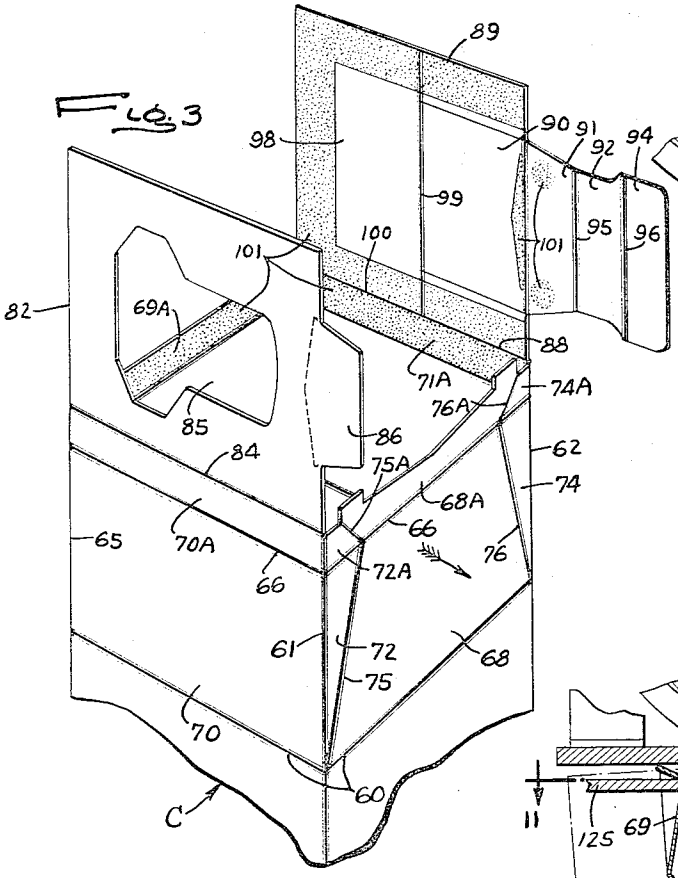


Fig. 4

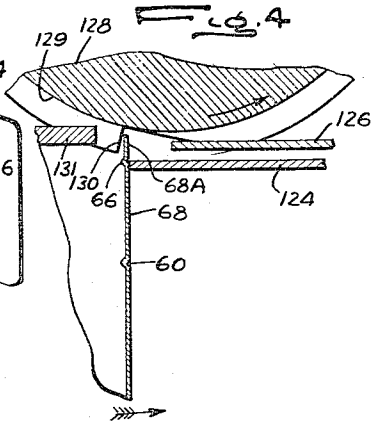


Fig. 5

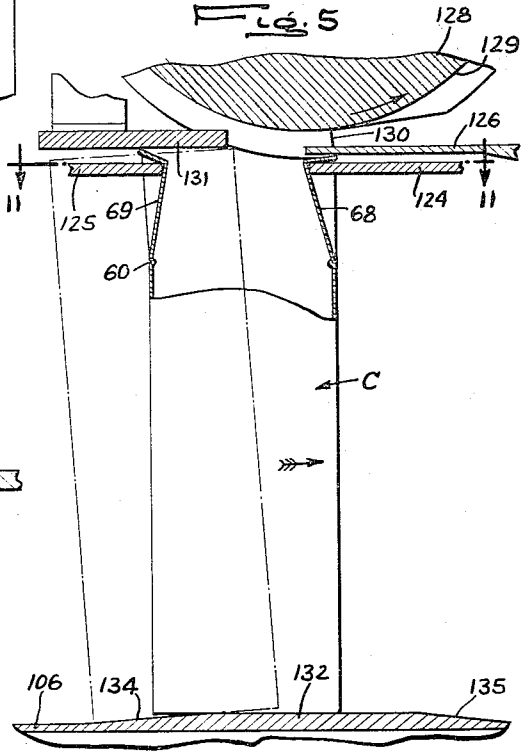
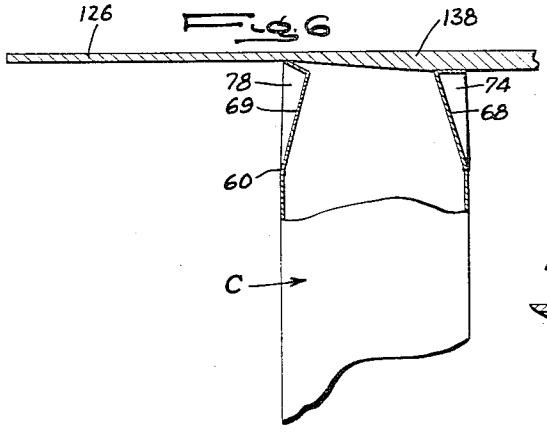


Fig. 6



Inventors
Charles Z. Monroe
James F. Earp

by: Carlson, Pitzner, Hubbard + Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 4

Fig. 7

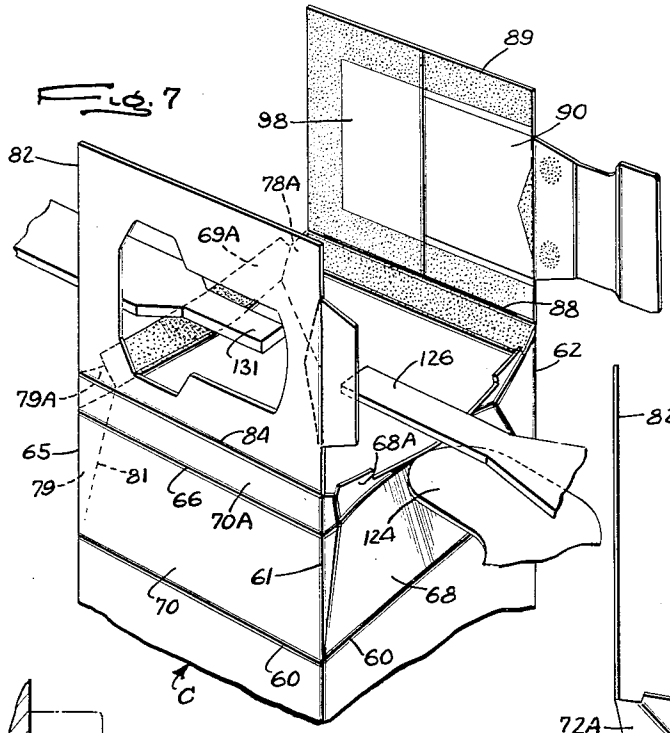
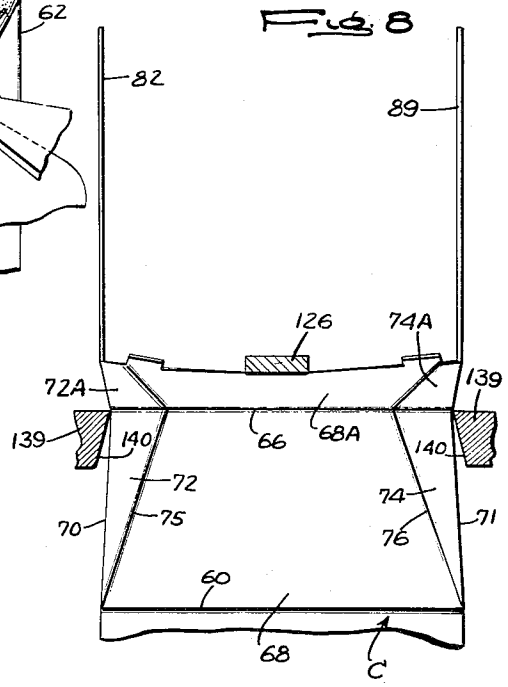


Fig. 8



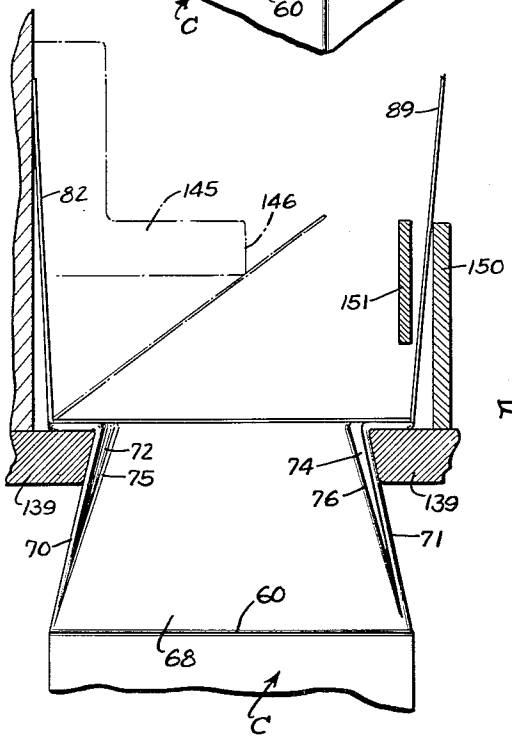


Fig. 9

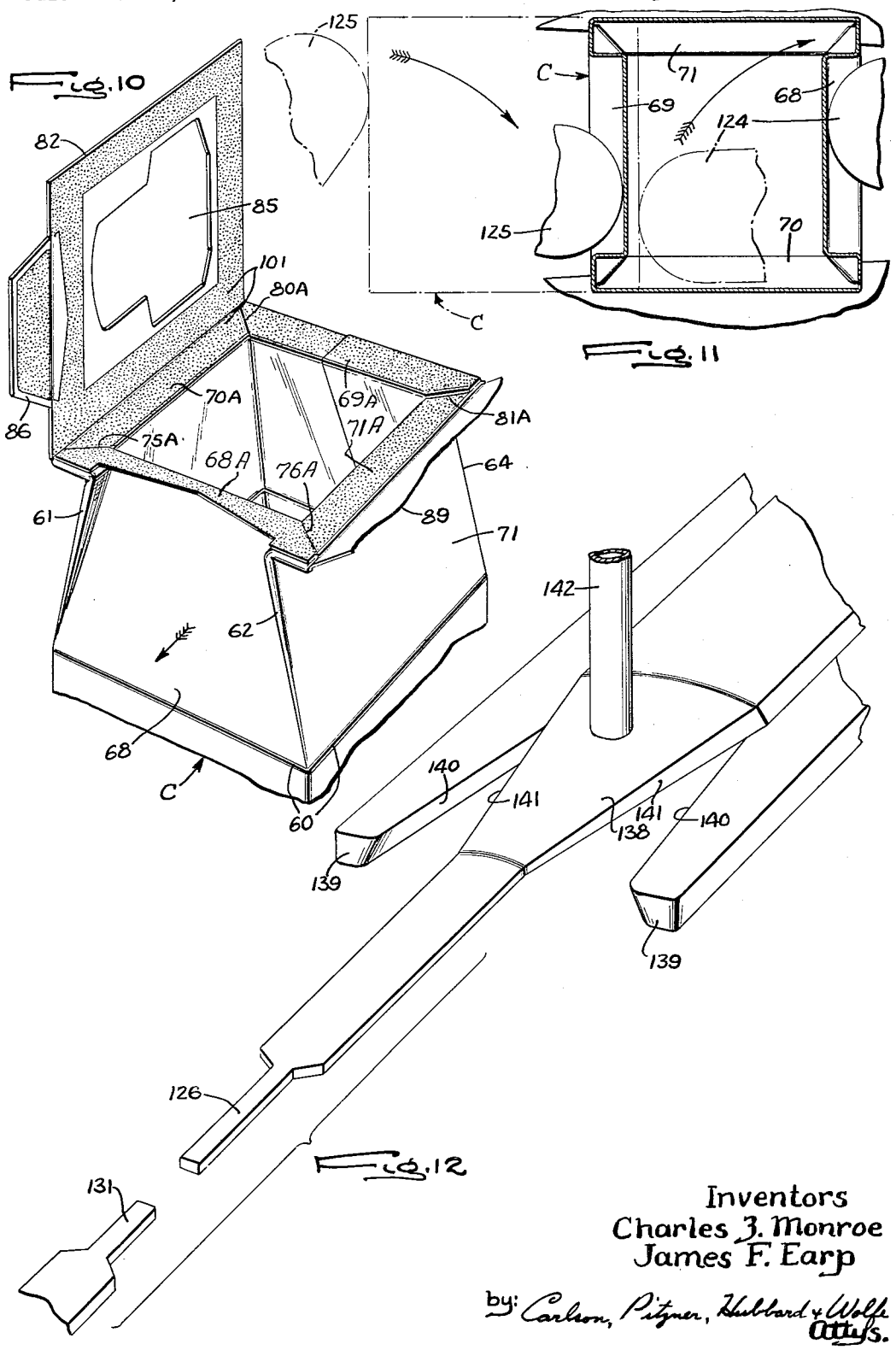
Inventors
Charles J. Monroe
James F. Earp

by: Carlson, Pitzner, Hubbard & Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 5



Inventors
Charles Z. Monroe
James F. Earp

by: Carlson, Pitzner, Hubbard & Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 6

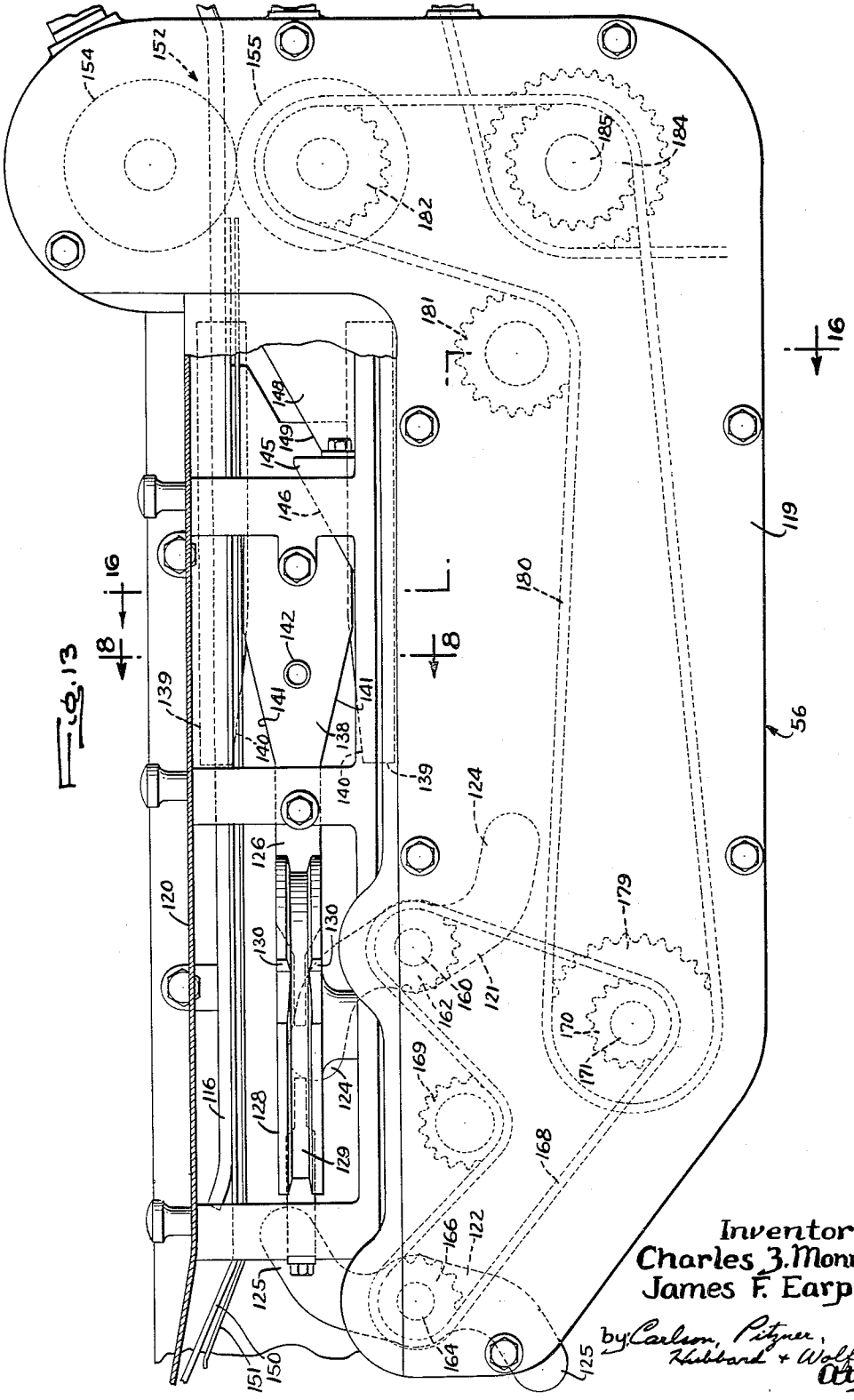


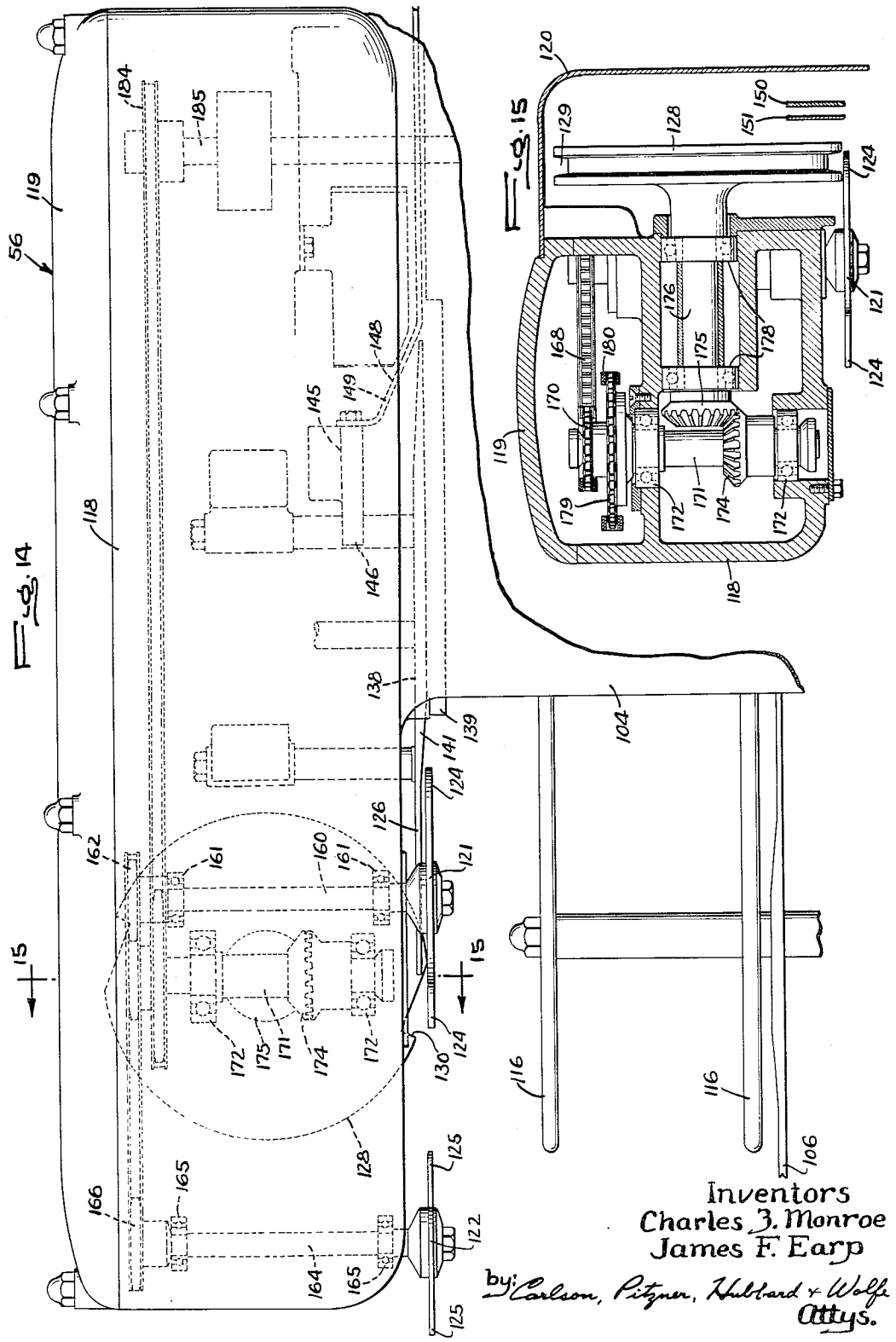
FIG. 13

Inventors
Charles Z. Monroe
James F. Earp
by Carlson, Pitzner, Hubbard + Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 7

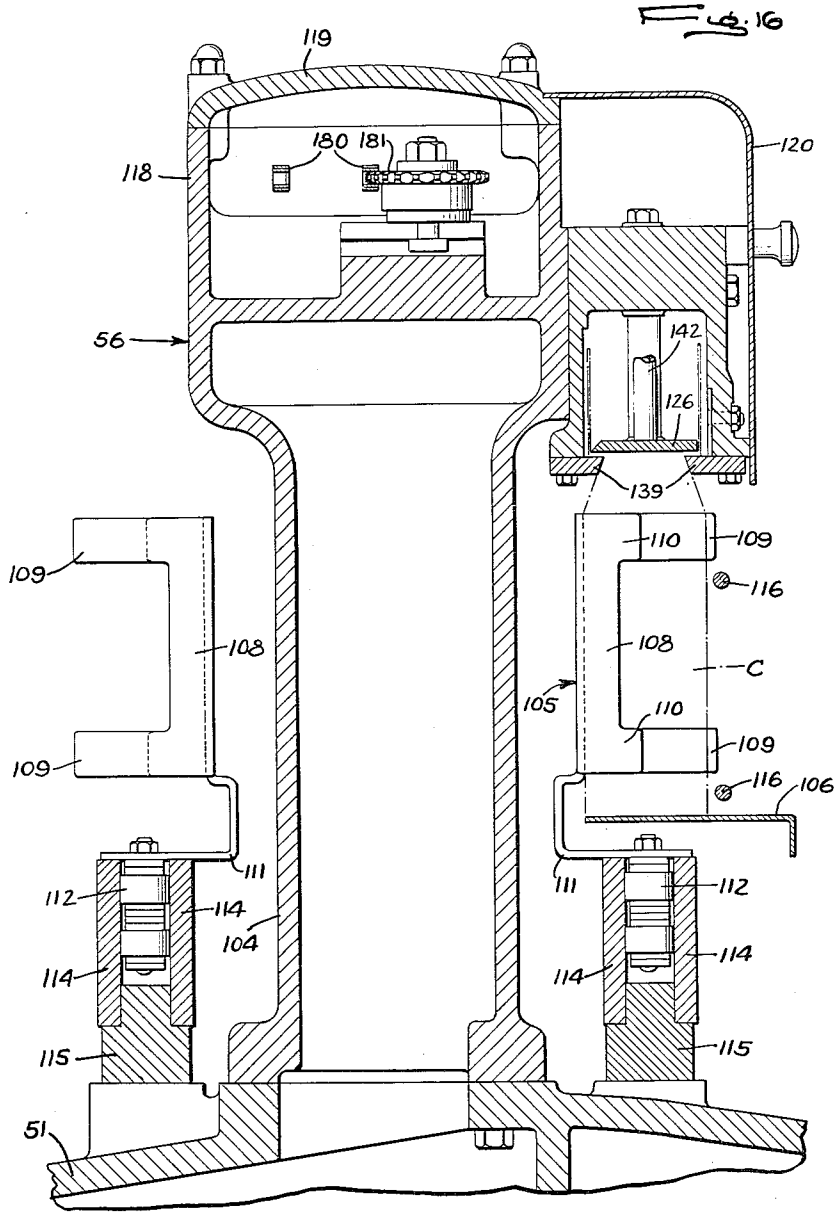


May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 8

Fig. 16



Inventors
Charles Z. Monroe
James F. Earp

by: Carlson, Pitzner, Hubbard & Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 9

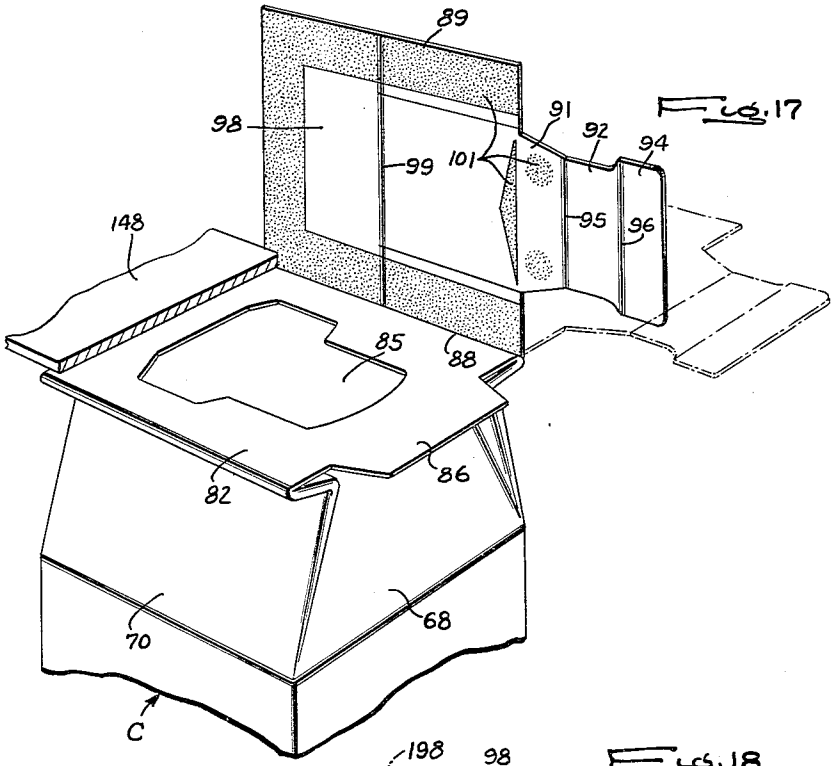


Fig. 17

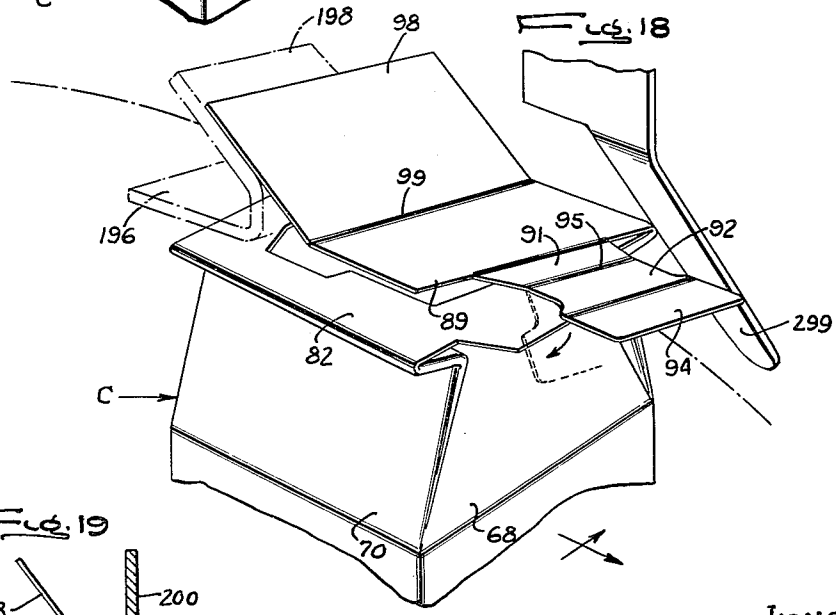


Fig. 18

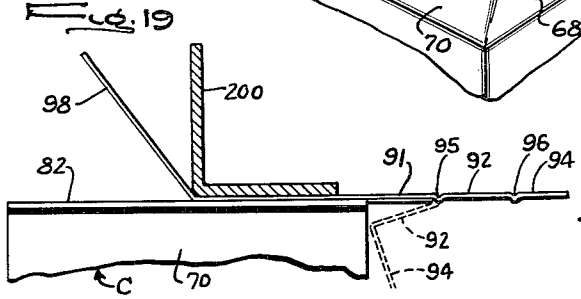


Fig. 19

Inventors
Charles Z. Monroe
James F. Earp
by:
Carlson, Pitzner, Hubbard & Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 10

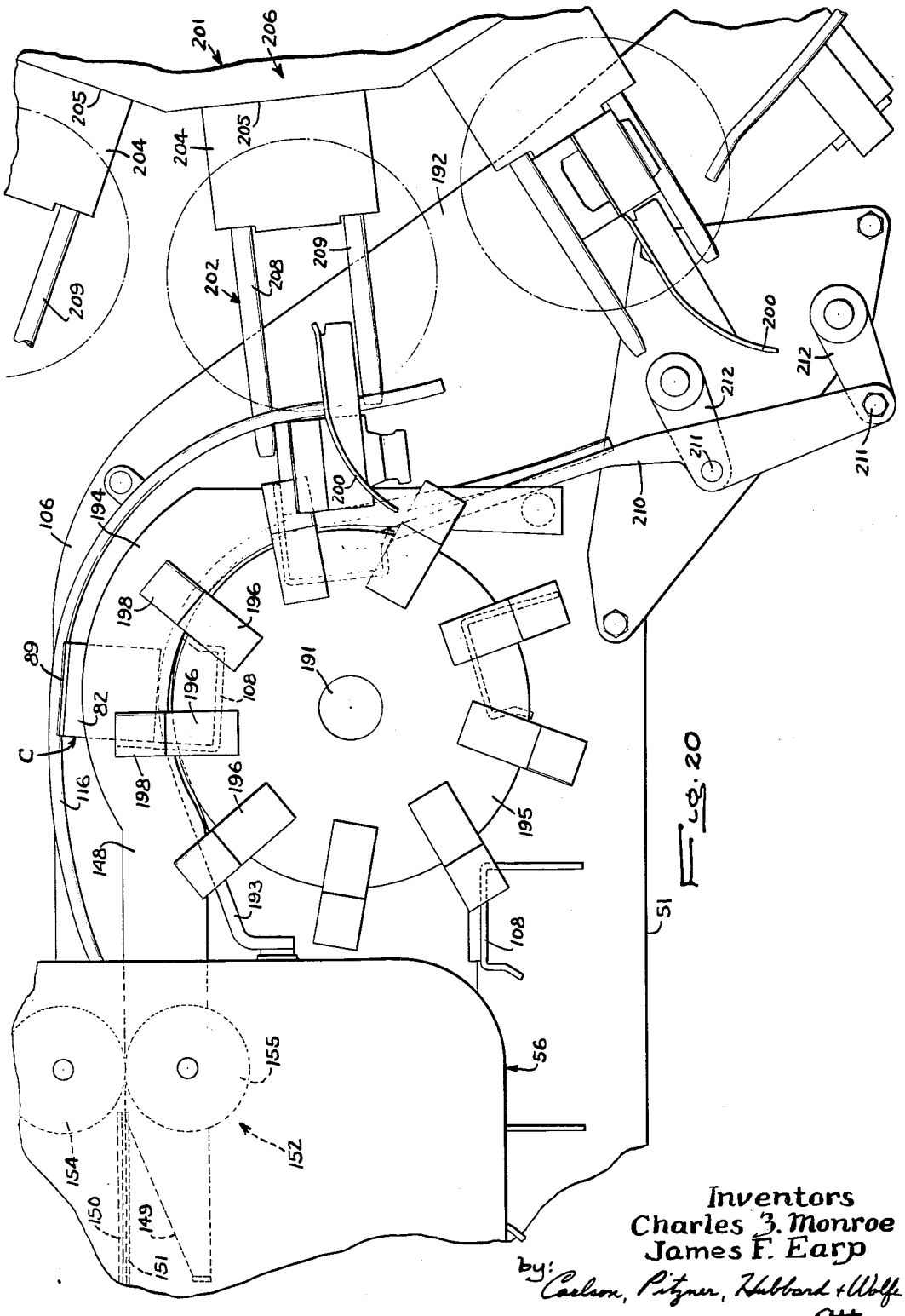


Fig. 20

Inventors
Charles Z. Monroe
James F. Earp
by: Carlson, Pitzner, Hubbard & Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 11

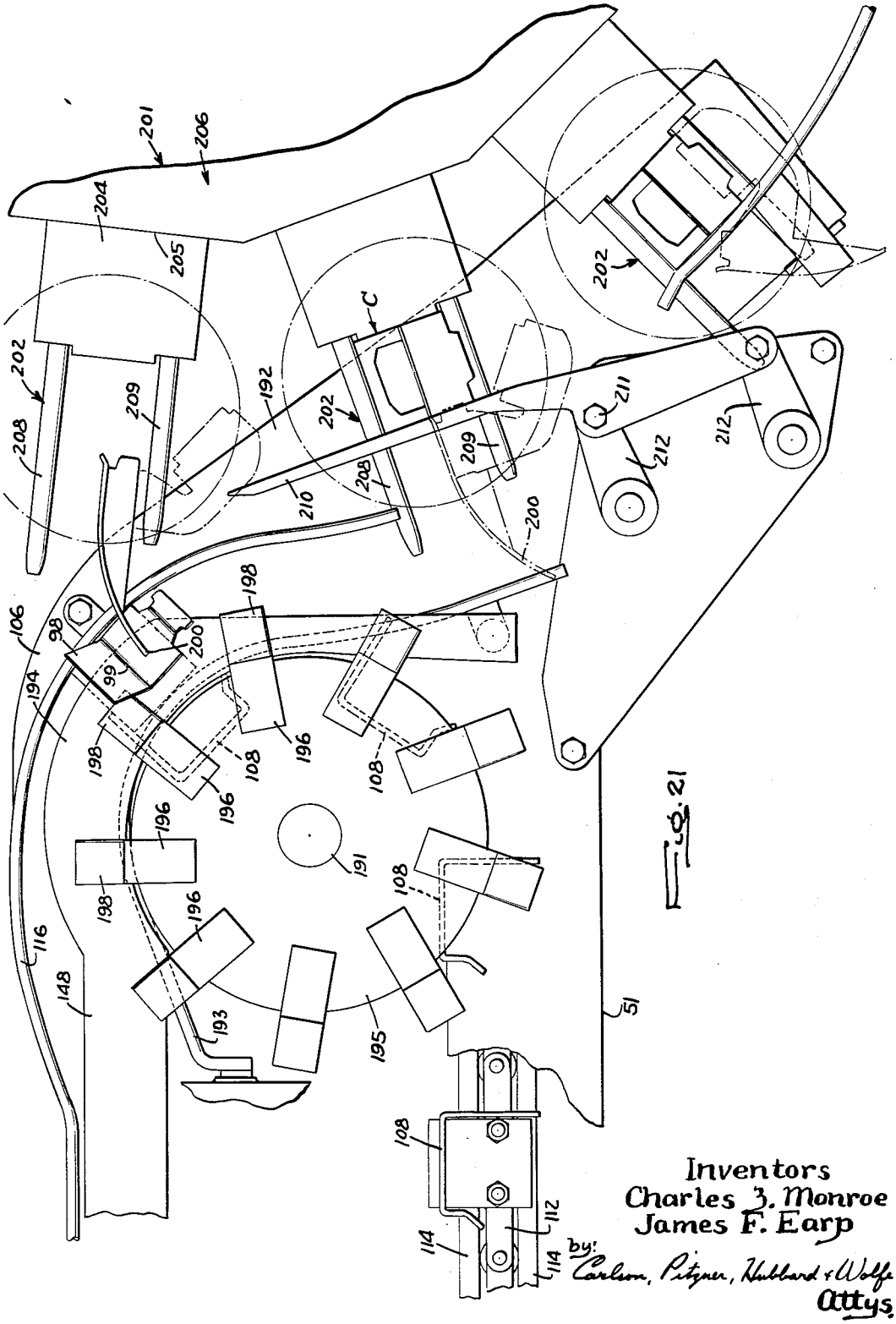


Fig. 21

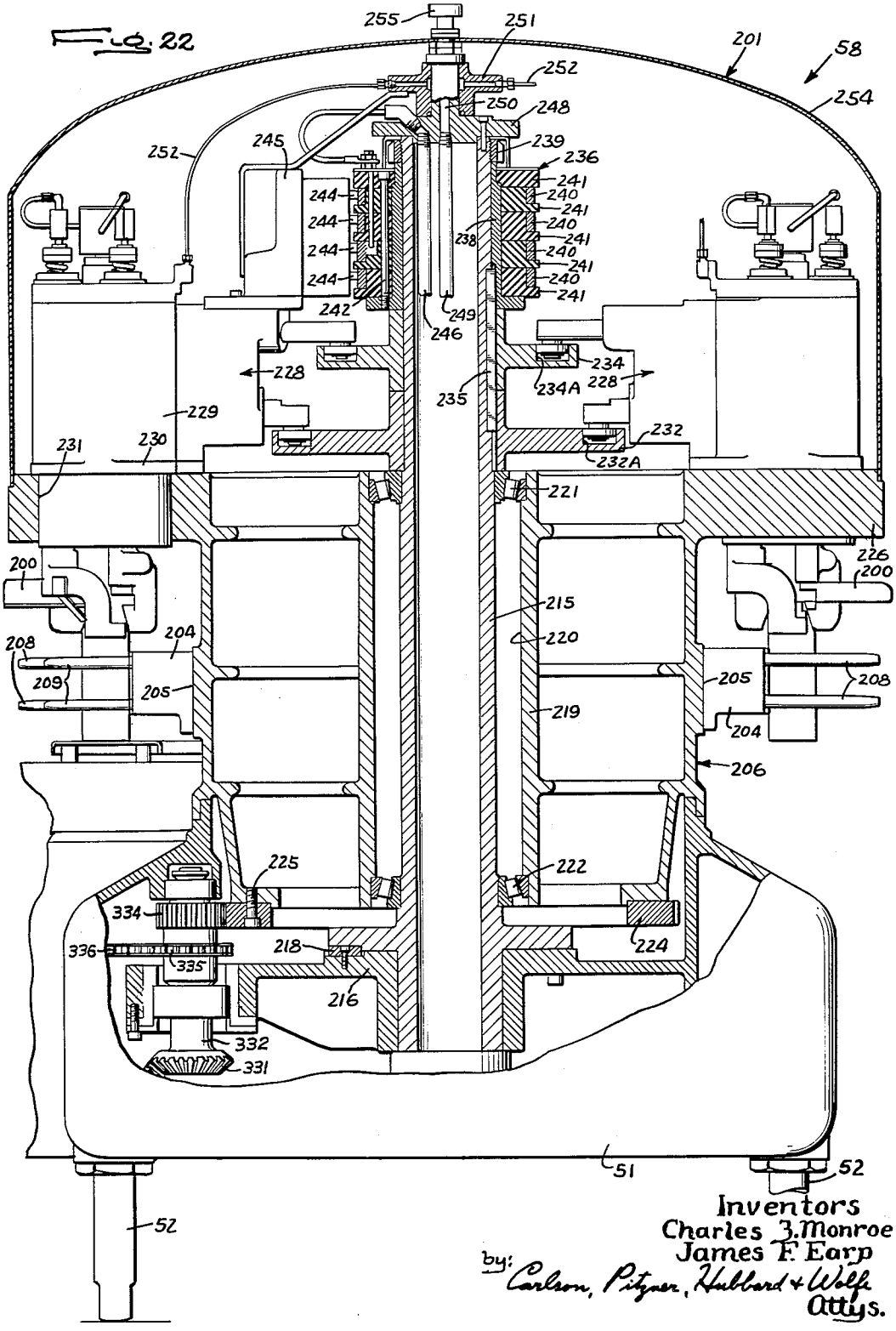
Inventors
Charles Z. Monroe
James F. Earp
by: Carlson, Pitzner, Hubbard & Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 12

Fig. 22



Inventors
Charles Z. Monroe
James F. Earp
by: Carlson, Pitzner, Hubbard & Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 13

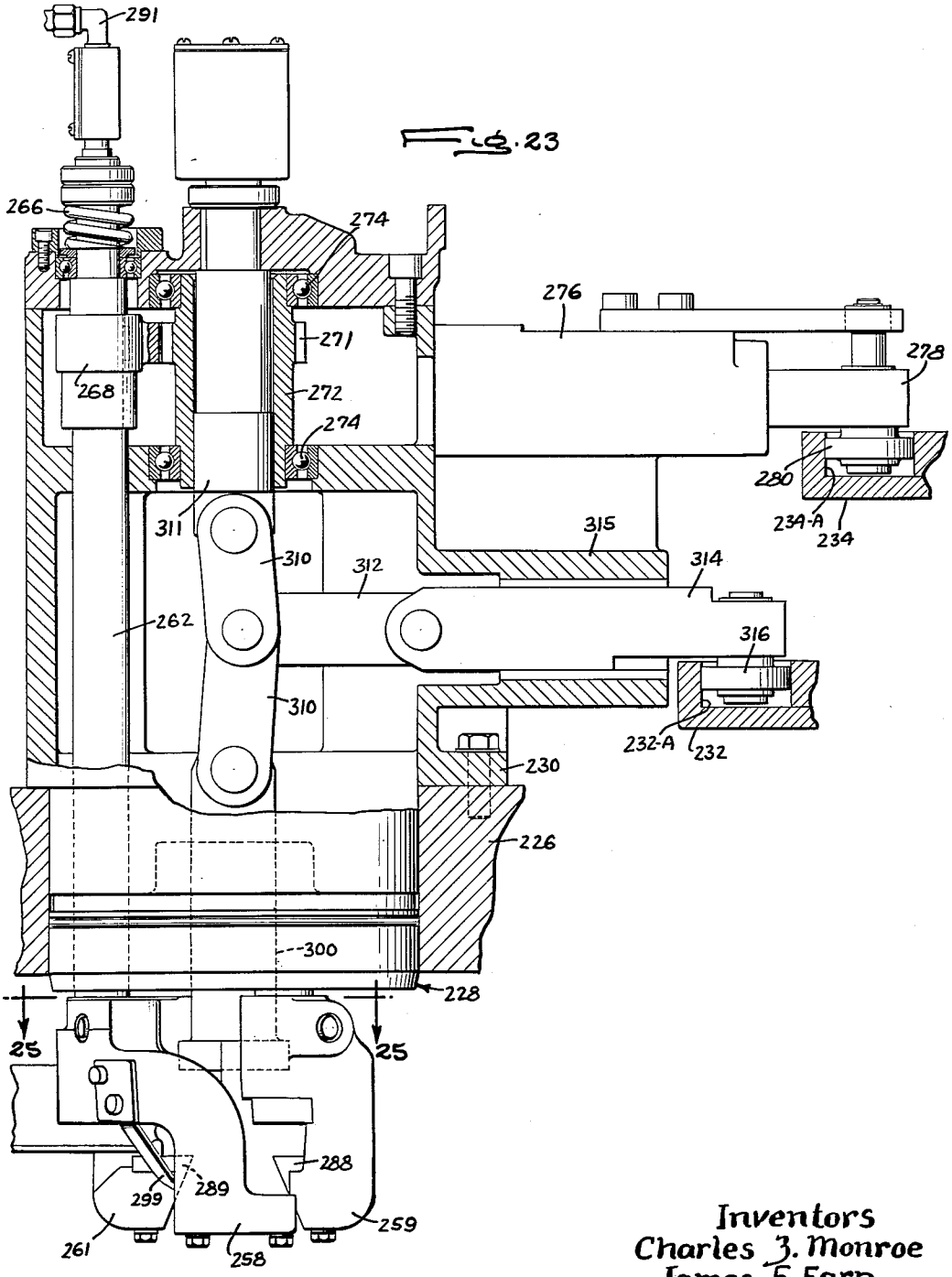


Fig. 23

Inventors
Charles Z. Monroe
James F. Earp

by: Carlson, Pitzner, Hubbard & Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 14

Fig. 25

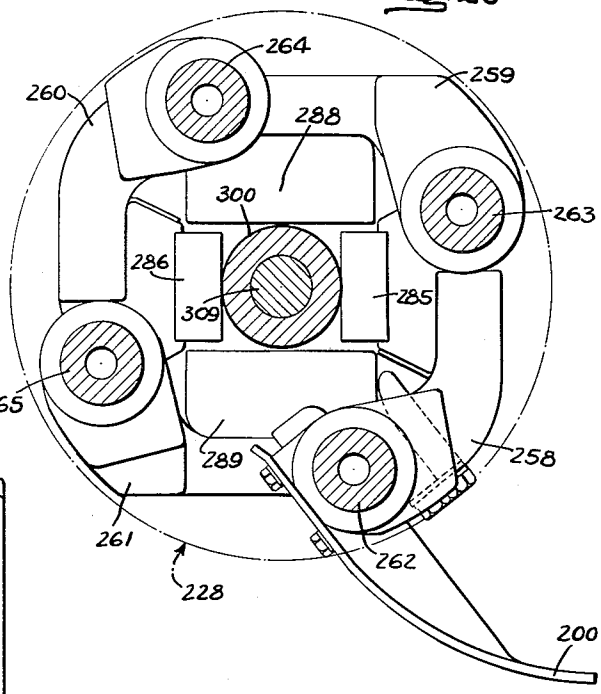
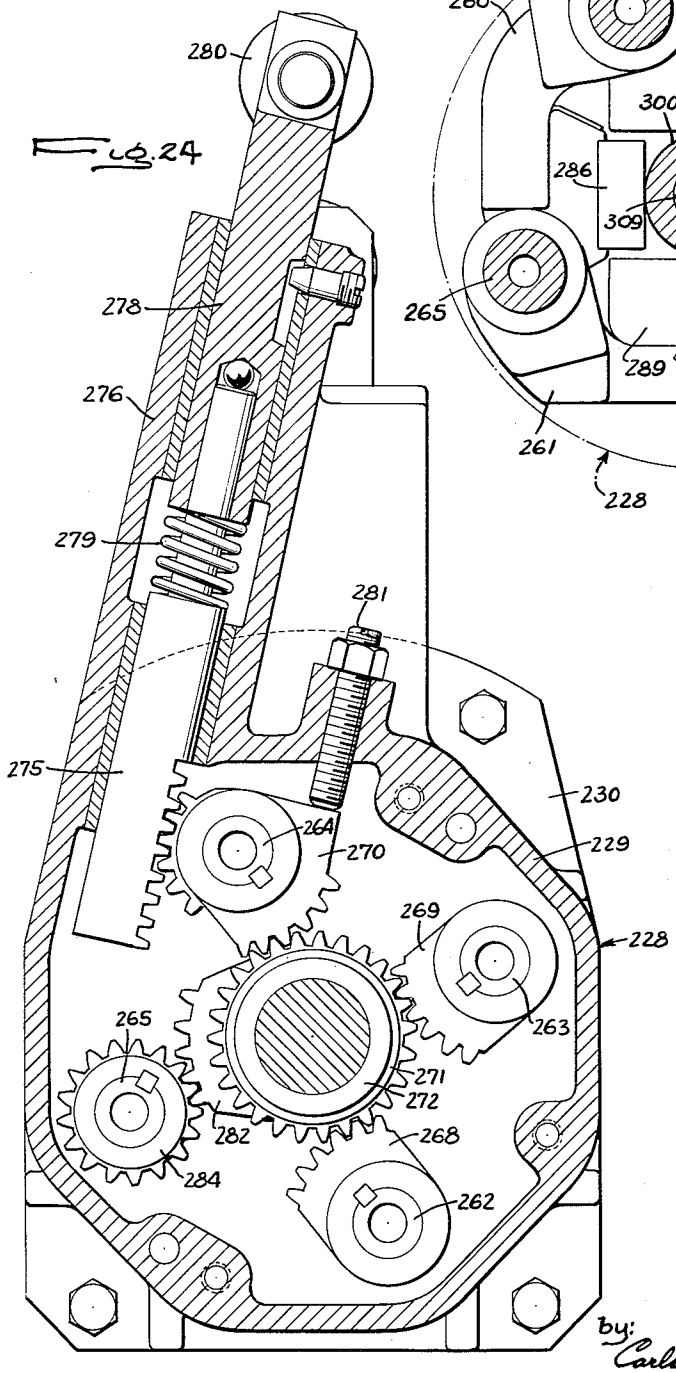


Fig. 24



Inventors
Charles Z. Monroe
James F. Earp

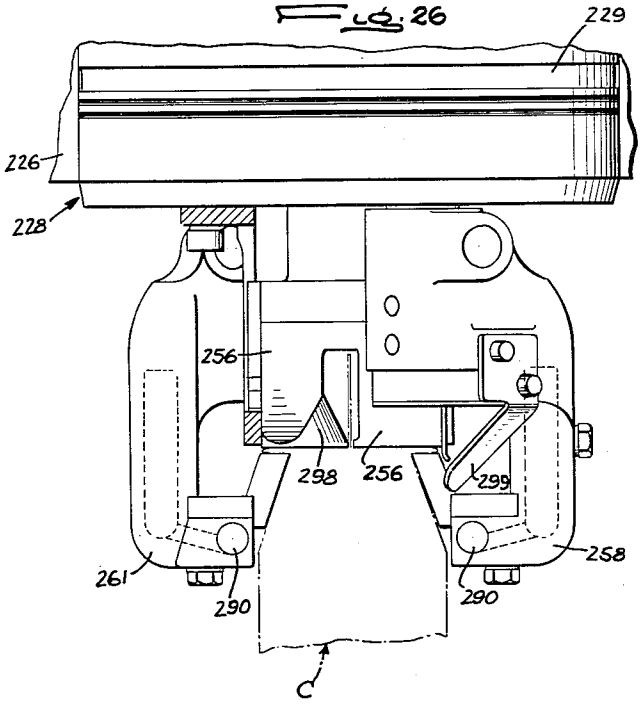
by: Carlson, Pitzner, Hubbard & Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 15

Fig. 26



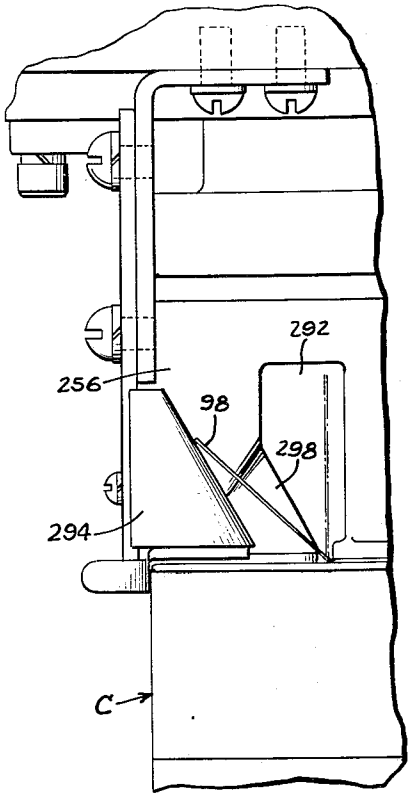
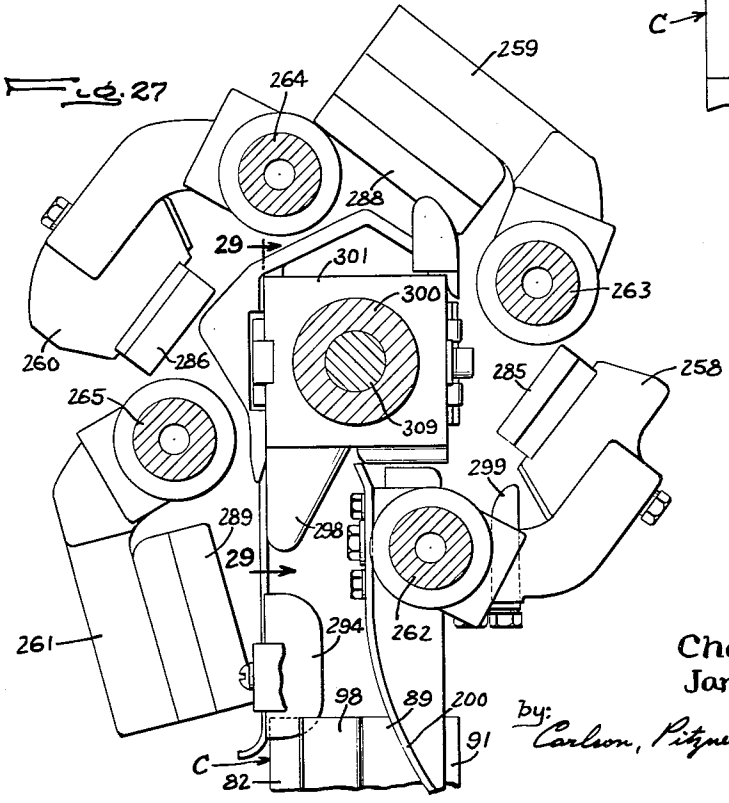


Fig. 28

Fig. 27



Inventors
Charles Z. Monroe
James F. Earp

by: Carlson, Pitzner, Hubbard & Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 16

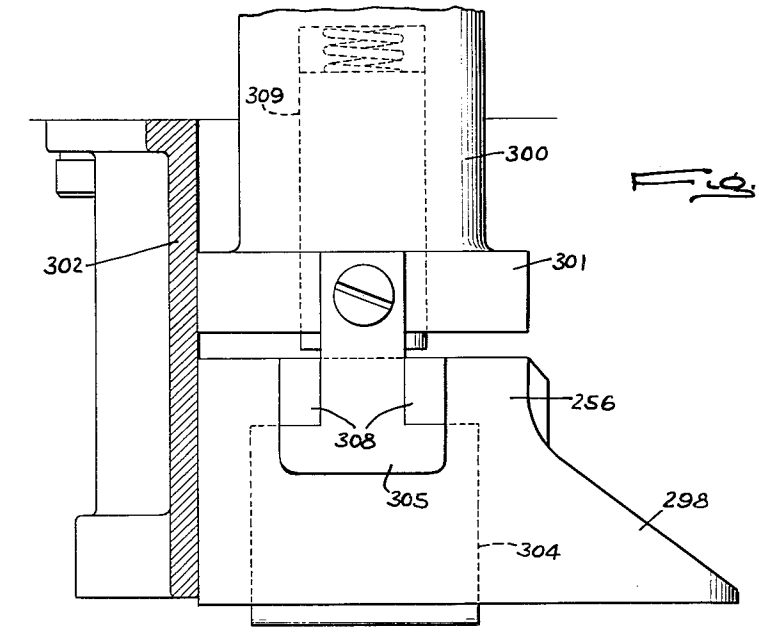


Fig. 29

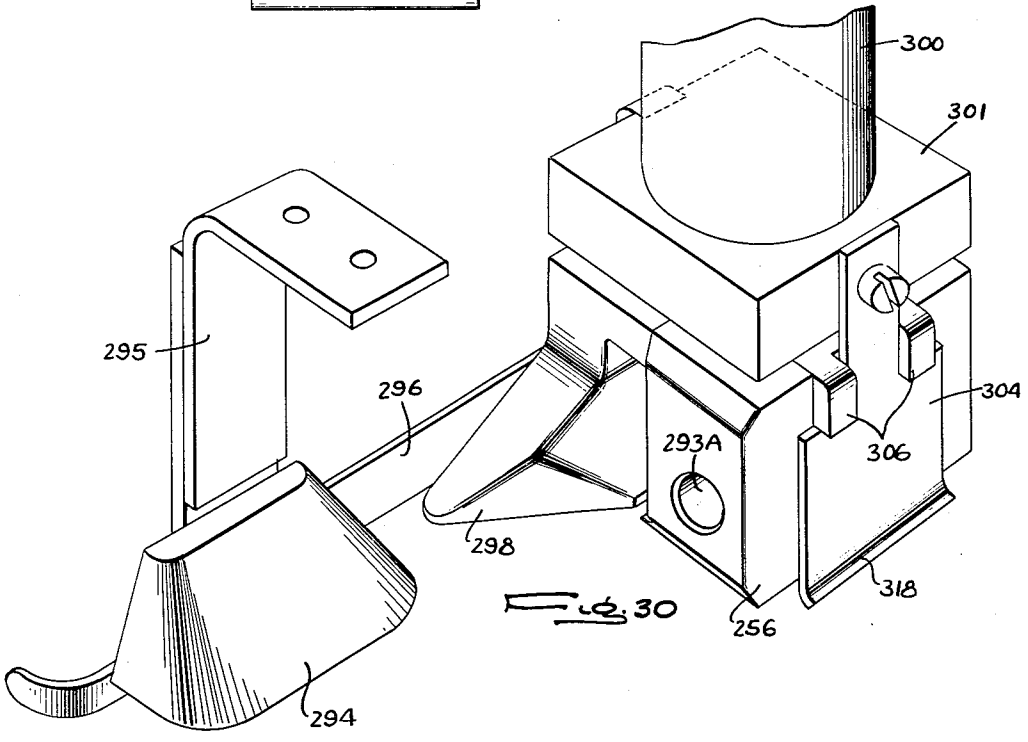


Fig. 30

Inventors
Charles Z. Monroe
James F. Earp

by: Carlson, Pitzner, Hubbard & Wolfe
Attys.

May 15, 1956 C. Z. MONROE ET AL 2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Filed Nov. 10, 1952 17 Sheets-Sheet 17

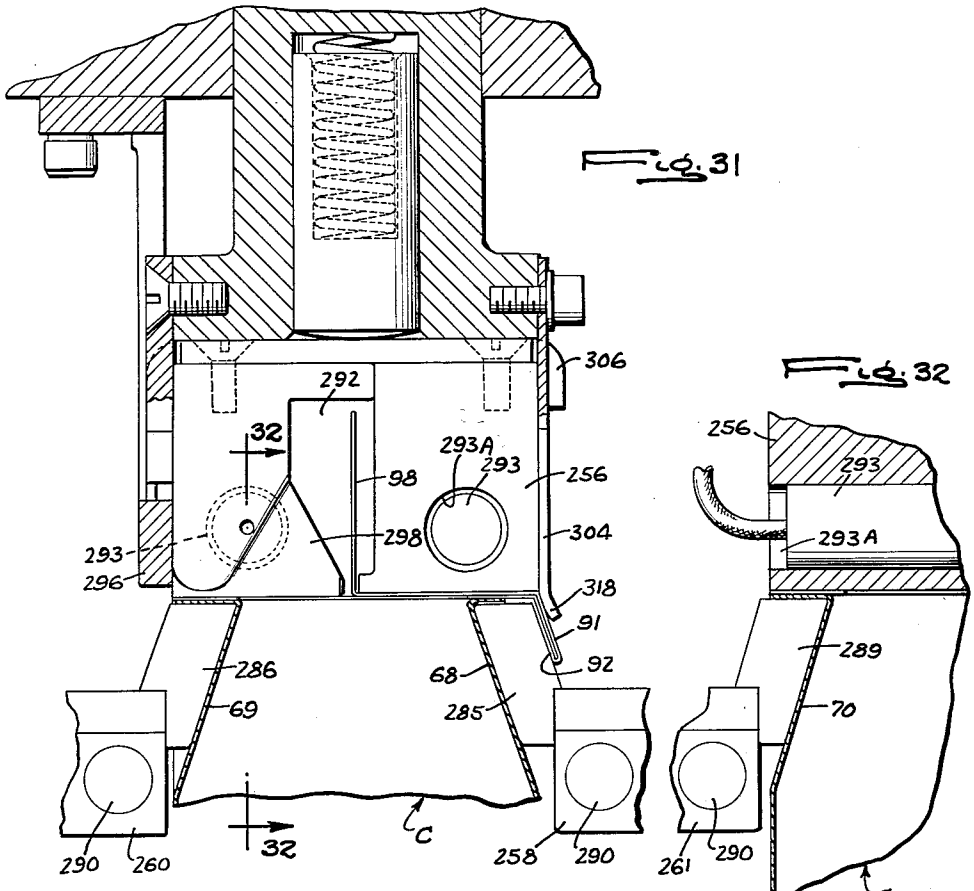


Fig. 31

Fig. 32

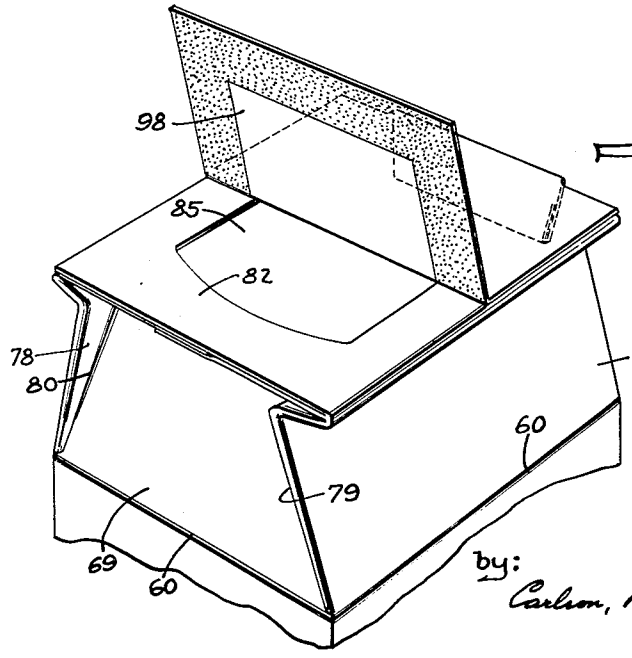


Fig. 33

Inventors
Charles Z. Monroe
James F. Earp
by:
Carlson, Pitzner, Hubbard & Wolfe
Attys.

United States Patent Office 2,745,323 Patented May 15, 1956

2,745,323

FLAT TOP CONTAINER FABRICATING MACHINE

Charles Z. Monroe and James F. Earp, Detroit, Mich., assignors to Ex-Cell-O Corporation, Detroit, Mich., a corporation of Michigan

Application November 10, 1952, Serial No. 319,684

18 Claims. (Cl. 93—36.8)

The present invention relates to container fabricating machines and, more specifically, to a machine for making disposable cartons of paperboard or other bendable sheet material.

The invention finds particular, but not exclusive, utility in a machine for forming flat-topped cartons such as the ones disclosed in copending application Serial No. 135,430 filed December 28, 1949, by Charles H. Dixon, and also in Patent No. 2,581,237 issued January 1, 1952, upon the application of Roger H. Casler. Such cartons are self-sustaining in shape and, when coated or impregnated to render them impervious, are particularly well suited for the distribution of milk and other comestibles.

The general aim of the present invention is to provide a machine of the character set forth and having novel top preforming and top closing units, such units being capable of receiving an erected carton body having a closed bottom and an open top, manipulating the upper end of the carton body to complete the forming of its top closure, and ultimately presenting the completed carton to a discharge conveyor.

Another object is to provide a high-speed, continuous motion machine of the type just mentioned, performing its operations upon a procession of blanks moving through the machine at a rapid but substantially constant rate.

A further object is to provide a machine of the character set forth and which will be easy to clean and maintain, fully conforming to the rigorous sanitary requirements that must be met for dairy equipment and similar applications.

Other objects and advantages will become apparent as the following detailed description proceeds, taken together with the accompanying drawings, wherein:

Figure 1 is a side elevation of an illustrative carton fabricating machine embodying the present invention.

Fig. 2 is a plan view of the illustrative machine of Figure 1.

Fig. 3 is an enlarged, fragmentary perspective view of the upper portion of a carton body and showing the top closure parts prior to entry of the body into the top preformer unit.

Figs. 4, 5 and 6 are stop-motion views showing sequentially the steps in outfolding of the front and rear top flange panels of the carton.

Fig. 7 is an enlarged, fragmentary perspective view of the upper portion of the carton body as its front and rear top flanges are outfolded and confined by the stationary hold down cams.

Figs. 8 and 9 are enlarged, fragmentary vertical sectional views taken through the preformer unit in the planes of the lines 8—8 and 16—16, respectively.

Fig. 10 is an enlarged, fragmentary perspective view of the upper portion of the carton body and showing the adhesive coating on the inside major top flap and the outfolded top flange.

Fig. 11 is an enlarged, fragmentary horizontal sectional view taken along the top flange hinge line and in the plane of the line 11—11 in Fig. 5.

Fig. 12 is an enlarged, fragmentary perspective view showing the hold down and squeezer cams of the preformer unit.

Fig. 13 is an enlarged plan view of the top preformer unit with one cover cut away to permit illustration of the inside details, such view being taken from the plane of the line 13—13 in Fig. 1.

Fig. 14 is an enlarged, fragmentary elevation of the top preformer unit, taken in the plane of the line 14—14 in Fig. 2.

Fig. 15 is an enlarged, fragmentary vertical sectional view through the top preformer unit taken in the plane of the line 15—15 in Fig. 14.

Fig. 16 is an enlarged, vertical sectional view through the top preformer unit and taken in the plane of the line 16—16 in Fig. 13.

Fig. 17 is an enlarged, fragmentary perspective view of the upper portion of the carton shortly after leaving the top preformer unit.

Figs. 18 and 19 are detail views showing certain steps in the downfolding of the outside major top flap and the gripping tab projection thereof.

Figs. 20 and 21 are enlarged plan views showing the terminal sheave disk and fragmentary portions of the top preformer unit and the top closing turret adjacent thereto.

Fig. 22 is a vertical sectional view through the top closing turret, taken in the plane of the line 22—22 in Fig. 2.

Fig. 23 is an enlarged, fragmentary elevation detailing certain mechanisms housed within the top closing turret of the machine.

Fig. 24 is an enlarged, fragmentary horizontal sectional view through the top closing turret taken in the plane of the line 24—24 in Fig. 1.

Fig. 25 is an enlarged, fragmentary horizontal sectional view through the top closure head taken in the plane of the line 25—25 in Fig. 23.

Fig. 26 is an enlarged, fragmentary vertical sectional view through the top closure head shown in the lower portion of Fig. 23.

Fig. 27 is a horizontal sectional view corresponding to Fig. 25 but showing the jaws in open rather than closed position.

Fig. 28 is an enlarged, fragmentary elevation detailing certain manipulating devices incorporated into the top closure head of Fig. 23.

Fig. 29 is an enlarged, fragmentary vertical sectional view through the top closure head taken in the plane of the line 29—29 of Fig. 27.

Fig. 30 is an enlarged, fragmentary perspective view detailing one of the heated pressure pads carried by the top closing turret and certain manipulating elements associated therewith.

Fig. 31 is an enlarged, vertical sectional view through one of the pressure pads carried by the top closing turret.

Fig. 32 is a fragmentary vertical sectional view taken in the plane of the line 32—32 in Fig. 31.

Fig. 33 is an enlarged, fragmentary perspective view showing a completed carton as it leaves the machine.

While the invention is susceptible of various modifications and alternative constructions, a carton fabricating machine representing an illustrative embodiment of the invention has 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 form 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 organization

Referring more specifically to Figs. 1 and 2, the invention is there exemplified in an illustrative container fabricating machine **50** which happens to be of the continuous motion type. By this is meant that the cartons being formed by the machine are moved through the latter in a continuous procession at a substantially constant rate, the forming operations being carried on while the carton blanks and bodies are in motion.

The machine **50** comprises a base **51** fashioned as a closed housing and having legs **52** which support the base a sufficient distance above the floor to permit thorough cleaning and inspection beneath the machine. Mounted on the base **51** are a blank feeder mechanism **54**, body forming unit **55**, a top preformer unit **56**, a top closing unit **58** and a conveyor **59**. The blank feeder mechanism **54**, which may be similar to the one disclosed in copending application Serial No. 50,147 filed September 20, 1948 (now Patent 2,636,733, issued Apr. 28, 1953), by Arthur J. Lewis, is adapted to hold a stack of single ply, horizontally disposed blanks and to feed them one by one up an arcuate guideway, presenting each blank in a vertical position to the body forming unit **55**. The latter is constructed and arranged to erect the blank into a tubular carton body and to complete the bottom closure of the carton body, eventually delivering the latter to the top preformer unit **56**. The preformer unit **56** is arranged to break the top closure elements of the carton body in the proper manner to facilitate the subsequent steps in the formation of the top closure. An appropriate conveying means moves each carton body through the preformer unit **56** and thereupon delivers it to the top closing unit **58**. This unit performs all the steps necessary to complete the top closure except for securing the filling flap in sealed position. The substantially completed cartons are then delivered by the top closing unit **58** to the discharge conveyor **59** which carries them to an appropriate mechanism for coating or impregnating them with a moistureproof substance such as paraffin and at the same time performing the necessary sterilization.

It is with the top preformer unit **56** and the top closing unit **58** that the present application is particularly concerned. Consequently, the description which follows will be confined primarily to these units and their operation. For additional information relating to the body forming unit, reference may be had to copending application Serial No. 318,882, filed November 5, 1952, by James F. Earp.

Top closure parts

When delivered to the top preformer unit **56**, each carton C comprises a tubular rectangular body with a closed bottom and an open top. However, the parts which ultimately define the top closure of the carton are all preformed and selected areas on them are coated with thermoplastic adhesive. Since these parts are all in the upper portion of the carton body, only such portion need be described in detail herein.

Referring in particular to Figs. 3, 7 and 10, it will be perceived that the top closure parts of the carton C are situated above a common score line **60**, which, incidentally, constitutes the top boundary of the carton body side panels. Corner score lines **61**, **62**, **64** and **65** of the carton body continue up into the top closure and divide the same into major areas coplanar with the respective side panels. A second common score line **66** cuts through the major panel areas of the top closure and defines, between itself and the score line **60**, opposed front and rear roof panels **68**, **69**, as well as opposed side roof panels **70**, **71**. Front roof panel **68** is flanked by a pair of small gusset panels **72**, **74**, connected thereto along score lines **75**, **76**, respectively. Rear roof panel **69** is similarly flanked by gusset panels **78**, **79** connected thereto along score lines **80**, **81**, respectively.

Hinged to each of the roof panels **68**, **69**, **70**, **71** along the common score line **66**, is a relatively narrow top flange comprising flange panels **68A**, **69A**, **70A**, **71A**. The flange panels **68A**, **69A** are flanked respectively by fractional panel areas **72A**, **74A**, **78A** and **79A**. The panel areas **72A**, **74A** are connected to the flange panel **68A** along score lines **75A**, **76A**, respectively. By the same token, the fractional panel areas **78A**, **79A** are connected to the flange panel **69A** along score lines **80A**, **81A**, respectively.

An inner top flap **82** of generally rectangular shape is hingedly connected to the flange panel **70A** along a score line **84**. The flap **82** has a relatively large aperture **85** which serves both as a filling opening and a dispensing opening. The flap **82** also includes a projecting portion **86** adapted to coact with other members of the top closure in initially holding down the lift tab.

Hingedly connected to the flange panel **71A** along a score line **88** is outer top flap **89**. The latter includes a lift tab **90** terminating in a projecting portion comprising the tab areas **91**, **92** and **94** and transverse score lines **95**, **96**. The top flap **89** also includes a filling flap **98** connected therewith along a transverse score line **99** and separated from the flange panel **71A** by severance line **100**.

As indicated by the stippled areas shown in Figs. 3, 7 and 10, selected areas of the top closure parts are precoated with a suitable thermoplastic adhesive **101**. In this instance, the adhesive **101** is applied to those areas of the top flange which initially face the inside of the carton. It is also applied to the inside face of the inner top flap **82** so as to surround the filling and dispensing opening **85**. A limited amount of adhesive is also applied to the inside face of the projection **86** on the inner top flap **82**. The outer top flap **89** has a band of adhesive extending around its lateral and marginal edge portions. In addition, certain small areas of the lift tab **90** and the tab panel **91** also have adhesive precoated thereon.

Top preformer unit

As shown in Figs. 1, 2, 13, 14 and 16, the top preformer unit **56** comprises a hollow upright standard **104**, together with a surrounding preformer conveyor **105** and a carton supporting table **106**.

The conveyor **105** comprises a series of open-sided buckets **108** constrained to move in an orbital path about the standard **104**. Conveyor buckets **108** are adapted to receive from the body forming unit **55** a procession of open-topped carton bodies, each in the condition illustrated in Fig. 3, and to traverse the carton bodies along the table **106** for manipulation by the top preformer unit **56**.

Each conveyor bucket **108** (Fig. 16) comprises an upstanding side panel having one or more relatively long trailing fingers **109** and one or more relatively short leading fingers **110**, being connected by means of an integral offset bracket **111** to a double roller chain **112**. In the present instance, the chain **112** is confined between laterally spaced guides **114** secured to the machine base as by blocks **115**. To insure retention in the buckets **108** as the cartons are traversed through the top preformer unit **56**, the latter may also include one or more guide rails **116** disposed in closely spaced relation with the course of the buckets **108**.

At its upper end, the standard **104** terminates in an elongated gear box **118**, closed by a cover **119**. The gear box **118** supports a plurality of top closure manipulating elements disposed in overlying relation with the carton supporting table **106** and housed within a removable protective cover **120**.

The first manipulation to take place in the top preformer unit is the infolding of front and rear roof panels **68**, **69** and the outfolding of their associated flange panels **68A**, **69A**. In furtherance of this objective, the unit **56** is provided with a pair of rotary breakers **121**, **122** of substantially identical form but opposite hand (Fig. 13). The

unit 121 has a pair of diametrically opposed retarding fingers 124 each adapted to serve as a receding abutment and to contact the leading or front roof panel 68 of the carton just beneath the score line 66 (Fig. 4). The unit 122 has a pair of diametrically opposed accelerating fingers 125 each adapted to serve as an overtaking abutment and to contact the trailing or rear roof panel 69 just below the score line 66 (Figs 5 and 11). During the interval of contact between a pair of these fingers and a given carton, the relationship of the parts is such that the finger 124 will have a linear velocity component along the path of the carton somewhat less than the carton velocity, while the finger 125 will have a similar linear velocity component somewhat greater than the velocity of the carton. Such action of course results in infolding the front and rear roof panels 68, 69, and also in infolding their neighboring triangular gusset panels 72, 74, 78, 79.

Outfolding of the leading flange panels 68A (Figs. 4, 5 and 7) at this time is accomplished by forcing the same under a hold down cam 126 fixed in overlying relation with the carton path and by the use of a notched folder wheel 128 driven in a counterclockwise direction as viewed in Figs. 4 and 5. The wheel 128 is formed with a peripheral groove 129 adapted to straddle the end of the hold down cam 126. Each of the circular rigs flanking the groove 129 of the wheel 128 has a pair of diametrically opposed, secantial notches terminating in alined pairs of radial abutments 130. As shown in Fig. 4, the abutments 130 accost the flange panel 68A and outfold it so that its free upper edge becomes confined between the upper face of the retarding finger 124 and the lower face of the hold down cam 126.

Outfolding of the trailing flange panel 69A is accomplished by the use of a hold down cam 131 also mounted in overlying relation with the carton path, the panel 69A being confined between the upper face of accelerating finger 125 and the lower face of the hold down cam 131.

In order to avoid improper rearward folding of the leading flange panel 68A against the bottom of the hold down cam 131, the latter is spaced a sufficient distance above the table 106 to give the flange panel 68A proper clearance. For the same purpose, the hold down cam 131 is spaced from the end of the hold down cam 126 and the table is provided with a lifter cam 132, the latter having an inclining ramp 134 and a declining ramp 135. The location of the lifter cam 132 is such that the carton C will tilt rearwardly as the flange panel 68A clears the end portion of the hold down cam 131, the associated conveyor bucket 108 being sufficiently oversize to permit limited tilting of the carton. Further movement of the carton onto the lifter cam 132 restores the carton to vertical position and also increases the pressure which the hold down cam 131 brings to bear against the trailing flange panel 69A. At this point, the notched wheel 128, coacting with the retarding finger 124, folds the leading flange panel 68A downwardly and outwardly in the manner already described. The carton C continues its linear advance along the table 106 and lifter cam 132, the outer periphery of the notched wheel 128 serving to hold down the trailing flange panel 69A until the latter moves into underlying relation with the hold down cam 126. As the carton C travels along the declining ramp 135 of the lifter cam 132, the undersurface of the hold down cam 126 declines proportionally so as to maintain an appropriate degree of downward deflection on the outfolded flange panels 68A, 69A (Figs. 5 and 6).

For the purpose of infolding the side roof panels 70, 71 and outfolding their respective flange panels 70A, 71A as the carton C continues through the preformer, the hold down cam 126 has a progressively widening portion 138 and its underside becomes lower, exerting an increasing downward pressure over a widening area of the flange panels 68A, 69A. A pair of squeeze cams 139 is mounted in straddling relation with the widening portion 138 of the hold down cam 126 (Figs. 8, 9, 12 and 13). The squeeze cams 139 have inside longitudinal faces 140 which, when viewed in plan as in Fig. 13, converge toward the hold down cam 126 and ultimately cross under diverging lateral edges 141 of the cam 126, straightening out in underlying relation with the marginal edge portions of the widest part of the cam 126. The converging edges 140 of squeeze cams 139 also diverge downwardly, each at an angle complementary to the desired ultimate inclination of its associated one of the side roof panels 70, 71 (Figs. 8, 9 and 12).

As the carton C moves into contact with the end portions of the squeeze cams 139, the lateral edges 140 of the cams 139 exert opposed inward thrusts on the side roof panels 70, 71 at or immediately below the score line 66. As the carton C continues its traverse through the preformer, these thrusts, coupled with the downward thrust produced by the widening portion 138 of the hold down cam, infold the side roof panels 70, 71 and at the same time outfold their associated top flange panels 70A, 71A, as shown in Fig. 9. The major top flaps 82, 89 remain upright and simply fold through an angle of about 90° about the respective score lines 84, 88 connecting them with their associated top flange panels. Such action also results in folding the fractional panel areas 72, 72A and 79, 79A against the inside faces of the side roof panel 70 and the top flange panel 70A, the fractional panels 72A, 79A simply outfolding with the top flange panel 70A. Similarly, the fractional panel areas 74, 74A and 78, 78A simply fold against the inside faces of the side roof panels 71 and its associated top flange panel 71A, the areas 74A, 78A outfolding with the top flange panel 71A. Upon completion of the foregoing manipulations, the roof panels and the top flange of the carton C are in the condition illustrated in Figs. 9 and 10.

In order to insure full breaking of the top closure parts about the proper score lines during the preforming operations just described, and also to preclude inward deformation of one or more of the carton side panels, provision is made for subjecting the inside of the carton C to a blast of compressed air during the severest part of the preforming operation. In furtherance of this objective, the hold down cam 126 is provided with an air line 142 terminating in a discharge aperture in the widening portion 138 of the cam 126. The line 142 is connected with an intermittently operated air valve (not shown) which may be opened and closed in timed relation with the motion of the preformer conveyor 105. Since the portion 138 of the hold down cam at that particular point covers the entire top opening of the carton C, it will be appreciated that the air blast from the line 142 is sufficient to place the entire carton under sufficient internal pressure to offset deformation during preforming of the top closure.

After roof panels 68, 69, 70 and 71 have been infolded and the flange panels 68A, 69A, 70A, 71A have been outfolded, the carton is traversed further until its upstanding inside top flap 82 is accosted by a stationary turn down cam 145 (Figs. 13 and 14). The latter has an abruptly tapered edge 146 which exerts a progressively increasing force on the top flap 82 tending to fold the same downwardly about the score line 84 and against the adhesive coated faces of the outfolded top flange panels 68A, 69A, 70A and 71A. Fixed to the wider end of the cam 145 is a hold down shoe 148 which also has a tapered lateral edge 149. The shoe 148 extends downwardly from the cam 145 and becomes substantially coplanar with the adjacent end of the hold down cam 126. It will be appreciated, therefore, that the edge 149 of the shoe 148 completes the downfolding of the inside top flap 82 and that the bottom face of the shoe simply maintains a downward pressure on the flap 82 and the underlying top flange. This pressure continues even after the carton C has left the preformer unit 56.

Provision is made in the preformer unit 56 for maintaining the outside flap 89 in an upstanding position clear

of the parts which manipulate the other members of the carton top closure. This is accomplished by the use of a pair of closely spaced, longitudinally disposed guide bars 150, 151 (Figs. 9 and 13) extending from the entrance of the preformer unit 56 almost to the exit thereof. The guide bars 150, 151 terminate immediately adjacent a printer mechanism 152. The latter comprises a printing roll 154, having a date or other appropriate indicia thereon, and a backup roll 155 adapted to bear against the inside face of the top flap 89 while the roll 154 applies printing to the outside face of the flap 89. The guide bars 150, 151 are so arranged that the flap 89 will be fed directly between the rolls 154, 155 as the carton C is traversed thereunder by the preformer conveyor 105.

The moving parts of the top preformer unit 56 are driven in timed relation with each other and with the preformer conveyor 105. Referring in particular to Figs. 13 and 14, it will be noted that the rotary breaker 121 is fixed to the lower end of an upright spindle 160 journaled in the gear box 118 as by means of antifriction bearings 161. At its upper end, the spindle 160 has rigidly fixed thereto a sprocket wheel 162. Similarly, the rotary breaker 122 is fixed to the lower end of an upright spindle 164 journaled in gear box 118 as by means of antifriction bearings 165. A sprocket wheel 166 is keyed or otherwise rigidly fixed to the upper end of the spindle 164. The breaker sprocket wheels 162, 166 are driven in unison as by means of chain 168 which meshes with a sprocket wheel 170 fixed to a relatively short vertical shaft 171. The latter is journaled in the gear box 118 by means of bearings 172.

Fixed to the shaft 171 intermediate the bearings 172 is a bevel pinion 174. The latter drivingly meshes with a similar pinion 175 fixed to a relatively short transverse shaft 176. The shaft 176 is journaled in the gear box 118 as by means of bearings 178 and has drivingly fixed to its outer end the notched folder wheel 128 (Fig. 15).

Power is supplied to the vertical shaft 171 through sprocket wheel 179 mounted adjacent its upper end portion and in closep roximity to the sprocket wheel 170. The wheel 179 drivingly meshes with a chain 180 which is led over an idler 181 and engages sprocket wheel 182, the latter driving the printer mechanism 152. The chain 180, in turn, is driven from a sprocket wheel 184 mounted on the upper end of a vertical shaft 185, the latter being journaled partially in the gear bov 118 and partially in the machine base 51.

Terminal sheave and transfer mechanism

Turning now to Figs. 1, 2, 20 and 21, it will be perceived that the preformer conveyor 105 passes from the discharge end of the top preformer unit 56, thence about a terminal sheave 190, and returns to the body forming unit 55 via a reverse path. The terminal sheave 190 (Fig. 1) is mounted on an upstanding shaft 191 journaled in the machine base 51. The carton supporting table 106 continues through the preformer unit 55 and terminates in a relatively wide transfer platform 192. The guide rails 116 of the preformer unit also extend beyond the discharge end thereof and describe a wide arc about the terminal sheave 191. Located inwardly from the arcuate portions of the guide rails 116 are one or more vertically alined guide rails 193. The latter are spaced to enter the carton conveying buckets 108 and are disposed so as to gradually cam each carton C out of its associated bucket after approximately 90° travel of the latter about the terminal sheave. As clearly indicated in Figs. 20 and 21, the guide rails 193, 116 together define an arcuate carton path which passes about the shaft 191 through an angle of approximately 90°, thence departing tangentially toward a terminal point. The hold down shoe 148 extends from the discharge end of the preformer unit 56 and has a curved portion 194 extending along this arcuate carton path.

Each carton C is traversed along this arcuate path with its infolded front roof panel 68 in the lead and its inner top flap 82 held down against the top flange of the carton by the shoe 148 (Fig. 17). The outer top flap 89, disposed in a vertical position as it left the printer, now cams under the outer marginal edge of the curved portion 194 of the hold down shoe 148. This folds the flap 89 into a horizontal, bottom-up position, as indicated in Fig. 17, breaking reversely about the score line 88. The flap 89 remains in this position until the carton C starts to cam out of its conveyor bucket 108, at which time the flap 89 moves out from under the shoe portion 194 and the natural spring of the paperboard restores it to approximately a vertical position.

Fixed to the upper end of the terminal sheave shaft 191 is a disk 195. The latter carries a series of projecting spokes 196 each having a rearwardly inclined abutment 198 adjacent its projected end. These parts are so proportioned that one of the abutments 198 will be brought into overlying relation with the trailing portion of the inner top flap 82 of each carton as it starts to cam out of its conveyor bucket 108 (see Fig. 20). With further movement of the carton C along its arcuate path, a finger 200 carried by top closing turret 201 accosts the outer face of the upstanding outer top flap 89 and folds the same downwardly about the score line 88 and into overlying relation with the previously downfolded inner top flap 82. During such action, the rearwardly inclined abutment 198 arrests the filling flap 98 and the finger 200 sweeps along the top flap 89 up to the transverse score line 99, such action serving to break it upwardly about the transverse score line 99 (Fig. 21).

The top closing turret 201 is provided with a plurality of carton cages 202 each adapted to receive a carton as it departs from its tangential path about the terminal sheave. Each cage 202 comprises a base block 204 rigidly fixed to a suitable flat 205 on the outer surface of the turret body 206. Projecting outwardly from the block 204 are a pair of vertically alined, trailing abutment pins 208 and a pair of similarly spaced leading abutment pins 209 of somewhat shorter length, the pins 208 and 209 being spaced apart horizontally a distance slightly greater than the cross-sectional dimension of the carton C.

To achieve positive transfer of each carton C across the transfer platform 192 and thence into an associated one of the cages 202, a pusher bar 210 is provided. This bar, which may actually be constructed as two or more vertically alined bars, is pivotally connected as at 211 to a pair of twin cranks 212. The latter are driven in unison and move the bar 210 in an orbital path, causing it to sweep each carton laterally from its tangential path about the terminal sheave and into the adjacent one of the carton cages 202 on the top closing turret. To facilitate such transfer, the end portions of the guide rails 116 which partially define the tangential carton path terminate substantially before the ends of the rails 193 and the end of such path. The pusher bar 210 is of course situated so that it will clear both the guide rails 116 and 193.

Top closing turret

The top closing unit 58 comprises the top closing turret 201, together with its supporting and driving means. Referring in particular to Fig. 22, it will be noted that the turret 201 is journaled on the machine base 51 for rotation about a generally upright axis. Accordingly, a hollow upstanding column or pintle 215 is secured to an appropriate footing 216 within the machine base 51 and constrained against rotation as by means of a key 218. The turret body 206, which is of barrel-like form, has a central internal sleeve 219 integral therewith, the bore 220 of the sleeve being substantially larger in diameter than the outer diameter of the pintle 215. The body 206 is rotatably supported from the pintle 215 by means of a pair of vertically spaced antifriction bearings 221, 222 adapted to withstand both radial and axial loading, such bearings being positioned by suitable locating shoulders in both

the pintle 215 and the sleeve 219. Power to rotate the turret 201 is transmitted thereto by ring gear 224, the latter being secured to the bottom of the turret body 206 as by means of a series of cap screws 225.

Adjacent its upper end, the turret body 206 has a relatively heavy head flange 226 which carries a plurality of circumferentially spaced closure heads 228, each of the latter comprising a heater and jaw assembly for activating the adhesive of the carton top closure. Each closure head 228 has an upper housing 229 with a mounting flange 230 adapted to be secured to the upper face of the head flange 226. Each housing 229 has a lower portion which fits snugly into a bore 231 running vertically of the head flange 236.

Mechanical actuation of each closure head 228 is accomplished by the use of a pressure cam 232 and a jaw cam 234. Both of these cams are of annular shape, being fixed to the upper portion of the pintle 215 and constrained against rotation as by means of key 235. In this instance, the jaw cam 234 is somewhat smaller in diameter than the pressure cam 232 and situated in vertically spaced relation overlying therewith. The cam 232 has a cam track 232A in its upper face, while the cam 234 has a cam track 234A in its upper face.

For the purpose of supplying electric power to the heater elements of the closure head 228, a slip ring and brush assembly 236 is interposed between the fixed upper end of the pintle 215 and the mechanism which rotates with the turret 201. In the present instance, a sleeve 238 is keyed on the upper end of the pintle 215 and retained thereon as by means of a nut 239. The sleeve 238 carries a plurality of slip rings 240 separated by annular insulators 241, all such members being held together as by machine screws 242. The slip rings 240 are electrically connected to the rotary turret 201, and to the electrical parts movable therewith, by means of a plurality of brushes 244 carried by brush head 245, the latter being rigidly secured to the housing 229 of one of the closure heads 228. Electrical power is supplied to the slip ring and brush assembly 236 via a conduit 246 running axially of the pintle 215 and terminating in a cap fitting 248 secured to the top of the pintle 215.

Lubricant for the mechanisms mounted at the top of the pintle 215 and in the upper portion of the turret 201 is supplied via an oil line 249 also running axially of the pintle 215 and terminating in the cap fitting 248. The latter has a central bore 250 which communicates with a rotary lube oil distributor cap 251, the latter being adapted to feed pressurized lubricant to the various mechanisms in the upper portion of the turret as by means of lines 252.

All of the members mounted on the upper portion of the pintle 215 and the head flange 226 of the turret 201 are housed within a convex protective cover 254 detachably secured in place as by means of a knob fitting 255 having threaded engagement with the lube oil distributor cap 251.

Turning now to the closure heads 228 (Figs. 23–32), it will be perceived that each of the same has a heated pressure pad 256 centrally mounted in depending relation below the turret head flange 226, together with four heated, pivotally mounted jaws 258, 259, 260 and 261 disposed in surrounding relation with the presure pad 255. As indicated in Figs. 25 and 27, the jaw 258 carries the finger 200 which downfolds the outside flap 89 in the manner described earlier herein.

Referring primarily to Figs. 23, 24, 25 and 27, it will be noted that the jaws 258, 259, 260 and 261 are fixed respectively to the lower depending ends of hollow jaw spindles 262, 263, 264 and 265 journaled in suitable bearings within the closure head 228 for oscillation about a substantially vertical axis. Each of these spindles may be susceptible of a limited amount of yieldable vertical movement in opposition to a coiled compression spring 266 surrounding its upper end portion.

Provision is made for effecting controlled oscillation of the jaws 258, 259, 260, 261 in timed relation to the rotation of the body closing turret 201 and the movement of the procession of cartons C being transferred to the latter. In furtherance of such objective, the spindles 262, 263, 264 have keyed or otherwise rigidly fixed to their respective upper ends a series of gear segments 268, 269, and 270. The latter mesh with a common pinion 271 integral with a sleeve 272 which is journaled in antifriction bearings 274 located in the upper central portion of the closure head 228 (Figs. 23 and 24). The foregoing members are oscillated in unison by means of a cam actuated rack 275 meshing with a second set of teeth on the gear segment 270. The rack 275 is slidably mounted in a guideway 276 integral with the housing 229. A cam follower 278 also slidably mounted in the guideway 276 has a yieldable connection with the rack 275 through a coiled compression spring 279, the follower 278 being adapted to displace the rack outwardly from the center of rotation of the top closing turret and in opposition to a yieldable biasing means tending to maintain the jaws in an open position. At its end remote from the rack 275, the follower 278 carries a follower roller 280 which rides in the track 234A of the jaw cam 234 (Figs. 22, 23 and 24). The extent of oscillatory movement imparted by the rack 275 to the gear segments 270, 269, and 268 may readily be adjusted by means of a set screw 281 which bears against one face of the gear segment 270.

The jaw 261, as shown particularly in Figs. 25 and 27, must oscillate through a greater angle than other jaws to permit a carton C to be received in its associated cage 202 and to move into underlying relation with the pressure pad 256. This is accomplished in the present instance by the use of a step-up segment 282 integral with or fixed to the sleeve 272 below the pinion 271, the segment 282 being of somewhat greater diameter than the pinion 271. The segment 282 drivingly meshes with a pinion 284 fixed to the upper end of the body spindle 265. Due to the mechanics of the gearing, the spindle 265 and its associated jaw 261 are moved through a substantially greater angle than the remaining spindles and jaws in response to a given displacement of the rack 275.

When swung inwardly, the jaws 258, 259, 260 and 261 are adapted to grip the carton C under its top flange and to hold such flange against the heated pressure pad 256 to effect activation of the thermoplastic adhesive of the top closure. To this end, the jaw 258 is equipped with angular shoe 285 adapted to bear complementally against the front roof panel 68 and the top flange panel 68A. The opposite jaw 260 is provided with a similar shoe 286 adapted to bear against the rear roof panel 69 and the underside of the top flange panel 69A. In like manner, the jaw 259 is equipped with a shoe 288 which abuts against the side roof panel 70 and its associated top flange panel 70A, while the jaw 261 has a shoe 289 adapted to abut against the side roof panel 70 and associated top flange panel 70A. Due to the structure of the carton top closure, it will be noted that the shoes 288, 289 are substantially longer than the shoes 285, 286 (Figs. 25, 27 and 31).

Provision is made for heating the jaw shoes 285, 286, 288 and 289 to speed up the adhesive activation process. This is accomplished by the use of a plurality of thermostatically controlled electrical heaters 290, one located in each jaw. Electric power for the respective jaw heaters 290 may readily be supplied thereto from a conduit 291 terminating at the top of each jaw spindle. The wiring from the conduit may readily be led to the associated heater 290 via the hollow of the jaw spindle and a passage in the jaw.

Turning now to the pressure pad 256, it will be noted upon reference to Figs. 26, 28, 30 and 31 that the pad 256 is electrically heated by a pair of thermostatically controlled heaters 293 housed within respective bores 293A.

The pad 256 has a bottom face corresponding in area to the top of the carton but is constructed so as to avoid heating and downward pressure on the carton filling flap 98 with resultant activation of the adhesive coating thereon. This is accomplished by forming the pad 256 with a relatively large central recess 292 adapted to receive the filling flap 98 and to maintain the same in upstanding relation out of contact with the surrounding portions of the pad 256.

To insure proper entry of the filling flap 98 into the recess 292 as the carton C is transferred under the pad 256, an upwardly tapering, rounded off cam block 294 is mounted in radially projecting relation from the pressure pad 256, being supported as by means of brackets 295, 296. The cam 294 is proportioned so as to catch the open filling flap 98 as the carton is pushed into its associated turret cage 202 and to present the flap 98 in an open condition to an adjacent tapered nose 298 also projecting radially from the pressure pad 256. The nose 298 cams the filling flap 98 into substantially a vertical position and thus guides it between the closely spaced walls at the lower end of the recess 292.

As the carton is transferred into the cage 202, steps are taken to fold the fractional panels 91, 92, 94 about their associated score lines to define the gripping tab and reclosure latch of the carton. This is accomplished by the use of a downwardly inclined finger 299 mounted on the jaw 258 (Figs. 18 and 26). Thus as the carton moves into the cage 202, the projecting tab panels 92, 94 are accosted by the finger 299 and are broken downwardly about the score line 95. When the carton has reached its position of underlying relationship with the pressure pad 256, the jaw 258 closes along with the others and the free lower end of the finger 299 exerts a sort of tucking action, forcing the panels 92, 94 up against the adhesive coated underside of the projection 86 and the underside of the front flange panel 68A.

In order to facilitate activation of the thermoplastic adhesive and formation of a top closure of adequate strength, provision is made for yieldably pressing the pressure pad 256 downwardly so as to squeeze the carton top flange against the infolded jaw shoes 285, 286, 288 and 289. In furtherance of such objective, the pressure pad 256 is supported from a central plunger 300 which is capable of a limited amount of vertical sliding movement in the top closure head 228. The plunger terminates at its lower end in a rectangular flange 301 adapted to bear against and to slide along a vertical guide 302 (Fig. 29). The flange 301 has a lost motion connection with the pressure pad 256 which, incidentally, is also constrained to move along vertical guide 302. Such lost motion connection comprises a pair of opposed, inverted T-plates 304, 305 which respectively engage abutments 306, 308 projecting laterally from the pad 256. A relatively short, spring-loaded plunger 309 housed within the lower end of the central plunger 300 bears against the top of pressure pad 256 and maintains the latter in slightly spaced relation with respect to the flange 301.

After closure of the jaws 258, 259, 260 and 261, the central plunger 300 is given a rigorous downward thrust, pressing the pad 256 against the top flange of the carton with a correspondingly rigorous, although yieldable, thrust. This is accomplished by a pair of toggle links 310 (Fig. 23) connected between the upper end of the plunger 300 and a central compression strut 311 anchored in the upper portion of the top closure head 228. The toggle links 310 are actuated by means of a thrust link 312, the latter being pivotally secured to a cam follower 314 slidably mounted in a guide way 315 in the housing 229. At its free end, the follower 314 is provided with a follower roller 316 which engages track 232A of pressure cam 232.

To insure completion of the gripping and relatching tab associated with the lift flap of the carton, the inverted T-plate 304 is made with a downwardly extending lower edge portion 318 which is bent outwardly at a small angle. As the downward squeeze of the pressure pad 256 against the top flange and the underlying jaw shoes occurs, the overlapping plies defining the gripping tab of the carton are bent in unison from a substantially horizontal position to a downwardly inclined position lying almost in the plane of the leading side panel of the carton (Fig. 31).

After about 270° of rotation on the top closing turret 201, the adhesive in the top flange in each carton has been thoroughly activated and the top closure of the carton has been completed except for sealing down the filling flap 98. As the cartons approach the discharge conveyor 59, the jaws 258, 259, 260 and 261 open and the bottom of each carton is brought into contact with a discharge platform (not shown) which raises each carton through a slight distance to break any possible adhesion it might have with the jaws. Each succeeding carton is brought into contact with a pair of guide rails 319 which cam it out of the carton cage 202 on the turret and transfer it to the discharge conveyor 59. The latter receives each carton in the condition shown in Fig. 33 and transports the same to a suitable coating and sterilizing machine.

Main drive

Referring now to Figs. 1 and 2, the machine 50 is powered by a main drive motor 320 housed within the base 51. The motor 320 is connected by means of belts 321 and pulley 322 to a high-speed shaft 324 journaled in the machine base 51. The shaft 324 carries a worm 325 which meshes with worm wheel 328, the latter being drivingly mounted on a line shaft 329. The line shaft 329 has a bevel pinion 330 fixed adjacent one end thereof and disposed in meshed engagement with a similar bevel pinion 331. The latter is fixed to the lower end of a relatively short vertical shaft 332 journaled in the machine base (Fig. 22). At its upper end, the shaft 332 carries a drive pinion 334 which meshes with the ring gear 224 of the top closing turret 201.

The shaft 334 has fixed thereto a sprocket 335 which drives a horizontal loop of chain 336. The chain 336 meshes with a sprocket 338 which drives the conveyor terminal sheave shaft 191, and also meshes with a sprocket 339 fixed to the lower end of the preformer unit drive shaft 185. The chain 336 also drives the pusher bar 210 via an appropriate sprocket (not shown) and an upright shaft 340.

Synopsis of operation

In view of the detailed description presented earlier herein, it is believed that the operation of the machine 50 will be obvious at this point to those skilled in the art.

To recapitulate briefly, however, it will be noted that the top preformer unit 56 receives a procession of formed carton bodies with closed bottoms and open tops, each in the condition shown in Fig. 3. The preformer conveyor 105 moves each carton through the top preformer unit 56. Rotary breaker fingers 124, 125 coact with notched wheel 128 and hold down cams 126, 131 to infold the front and rear roof panels 68, 69 and outfold their respective top flange panels 68A, 69A. The hold down cam 126, cooperating with a pair of stationary squeeze cams 139, subsequently infolds the side roof panels 70, 71 and outfolds their respective top flange panels 70A, 71A, the carton being pressurized internally at this time by a blast of air from air line 242. As each carton nears the end of the top preformer unit, the inner top flap 82 is downfolded due to contact with a fixed turn down cam 145 and a hold down shoe 148. The carton subsequently passes under a printer mechanism 152 which dates or otherwise marks the outside face of its upstanding outer top flap 89.

Upon leaving the top preformer unit 56, the outer top flap 89 of each carton is reversely broken about its hinge line and then permitted to spring back to upstanding position. The carton progresses along an arcuate

path about the conveyor terminal sheave and at the same time gradually cams out of its associated conveyor bucket 103. A finger 200 carried by the top closing turret 201, coacting with a rearwardly inclined abutment carried by the terminal sheave disk 195, downfolds the outer top flap 89 but leaves the filling flap 98 in an open condition.

Each carton is thereupon transferred to a receiving cage 202 fixed to the top closing turret 201, being traversed across transfer platform 192 by pusher bar 210. Cam elements 294, 298 guide the filling flap 98 into protective recess 292 in a heated pressure pad 256 carried by an associated top closure head 228 on the turret. At the same time, the gripping tab and reclosure latch projections on the top flap 89 are folded inwardly by a downwardly inclined finger 299 also carried by the top closure head 228. After this has occurred, a plurality of heated jaw shoes 285, 286, 288 and 289 are brought to bear against undersides of the top flange panels and a toggle actuated plunger 300 exerts a yieldable downward thrust on the pressure pad 256 so as to squeeze the top flange panels against the jaw shoes.

After about 270° of revolution of the top closing turret 201 the jaws commence to open and the carton is raised slightly upwardly and cammed then out of its cage 202 by guide rails 319. The carton, in the condition shown in Fig. 33, is thereupon presented to the discharge conveyor 59.

We claim as our invention:

1. In a machine for making flat-topped cartons of paperboard or the like from preformed bodies having top closure parts defined therein and selectively coated with thermoplastic adhesive, each said body having roof panels, top flange panels, an inner top flap having a filling and pouring opening therein, and an outer top flap having a filling flap therein, the combination of a base, a body forming unit mounted on said base, a conveyor adapted to receive preformed carton bodies in a procession from said body forming unit, a top preformer unit adapted to infold the roof panels and to outfold the top flange panels of carton bodies traversed therethrough by said conveyor, said preformer unit also being adapted to fold down said inner top flap of each carton, a top closing turret mounted on said base for rotation about a generally upright axis, means on said turret for receiving successively a plurality of carton bodies, means for transferring the cartons successively to said turret, means for downfolding the outer top flap of each carton as an incident to transfer to said turret but without closing the filling flap thereof, a plurality of top closure heads fixed to said turret and each adapted to apply heat and pressure to the top flange panels and downfolded top flaps of an associated carton body to activate the thermoplastic adhesive thereon, and means in each said closure head for precluding application of heat and pressure to the filling flap of the carton associated therewith.

2. In a machine for making flat-topped cartons of paperboard or the like from preformed bodies having top closure parts defined therein and selectively coated with thermoplastic adhesive, each said body having roof panels, top flange panels, and a pair of opposed top flaps, the combination comprising a base, a body forming unit mounted on said base, a conveyor adapted to receive preformed carton bodies in a procession from said body forming unit, a top preformer unit adapted to infold the roof panels and to outfold the top flange panels of carton bodies traversed therethrough by said conveyor, said preformer unit also being adapted to fold down one of the opposed top flaps of each carton, a top closing turret mounted on said base for rotation about a generally upright axis, means on said turret for receiving successively a plurality of carton bodies, means for transferring the cartons successively to said turret, means for downfolding the other one of said top flaps of each carton as an incident to transfer to said turret, a plurality of top closure heads fixed to said turret and each adapted to apply heat and pressure to the top flange panels and downfolded top flaps of an associated carton body to activate the thermoplastic adhesive thereon, and means for leading the cartons in a procession to a discharge conveyor upon release of successive cartons by said top closure heads.

3. In a machine for making flat-topped cartons from preformed bodies of paperboard or the like selectively coated with thermoplastic adhesive, each said body having roof panels, top flange panels and a pair of opposed top flaps, the combination of a machine base, a carton conveyor, means for infolding opposed pairs of roof panels and outfolding corresponding opposed pairs of top flange panels of cartons traversed by said conveyor, means for infolding certain other opposed pairs of roof panels and outfolding certain other opposed pairs of top flange panels of cartons traversed by said conveyor, means for downfolding one of said opposed top flaps of each carton traversed by said conveyor, a top closing turret rotatably mounted on said machine base, cage means on said turret for receiving individually a plurality of cartons from said conveyor, a plurality of top closure heads on said turret for activating the thermoplastic adhesive on said top flange panels and said top flaps by application thereto of heat and pressure, and a finger carried by said turret for downfolding the other one of said top flaps in each carton as an incident to transfer of the carton to said turret.

4. In a machine for making flat-topped cartons from preformed bodies of paperboard or the like selectively coated with thermoplastic adhesive, each said body having roof panels, top flange panels and a pair of opposed hinged top closure flaps, the combination comprising a machine base, a carton conveyor and means for continuously moving the same, a top preformer unit mounted on said base and traversable by said conveyor, said top preformer unit having means to infold the roof panels and to outfold the top flange panels of each carton traversed therethrough by said conveyor, said preformer unit also having stationary means to downfold one of said opposed top closure flaps of each carton continuously traversed therethrough by said conveyor, a top closing unit including means for activating the thermoplastic adhesive on said top flange panels and said top flaps of the carton as it is continuously advanced by application of heat and pressure, means for transferring each carton from said conveyor to said top closing unit, and means stationary with respect to each carton at the time of its transfer for downfolding the other one of said top closure flaps in each carton as an incident to the transfer motion of the carton to said top closing unit.

5. In a machine for making flat-topped cartons from preformed bodies of paperboard or the like selectively coated with thermoplastic adhesive, each said body having roof panels, top flange panels and a pair of opposed hinged top closure flaps, the combination comprising a carton conveyor, rotary breaker means for infolding a first opposed pair of roof panels and hold down cam means for outfolding a corresponding opposed pair of top flange panels of cartons while they are being traversed by said conveyor, stationary squeeze cam means for infolding a second opposed pair of roof panels and outfolding a corresponding opposed pair of top flange panels of cartons while they are being traversed by said conveyor, means for downfolding one of the opposed top closure flaps of each carton traversed by said conveyor, means for activating the thermoplastic adhesive on said top flange panels and said top closure flaps by application thereto of heat and pressure, means for transferring the cartons from said conveyor to said activating means, and means for downfolding the other one of said top closure flaps in each carton as an incident to the movement of such carton as it is transferred to said activating means.

6. In a machine for making flat-topped cartons from preformed bodies of paperboard or the like each having roof panels, top flange panels and a pair of opposed hinged top closure flaps, a top preformer unit comprising the combination of a carton conveyor, means including a pair of rotary breakers for infolding a first opposed pair of roof panels and means including a pair of hold down cams for outfolding a first corresponding opposed pair of top flange panels of cartons while they are being and as a result of their being traversed by said conveyor, means including a pair of converging stationary squeeze cams for infolding certain other opposed pairs of roof panels and outfolding other corresponding opposed pairs of top flange panels of cartons while they are being and as a result of their being traversed by said conveyor, and stationary means for downfolding one of the opposed top flaps of each carton as a result of the latter being traversed by said conveyor.

7. In a machine for making flat-topped cartons of paperboard or the like from preformed bodies having open tops with closure parts defined therein, a top preformer unit comprising, in combination, a carton conveyor, a pair of rotary breakers, one of said breakers having a retarding finger and the other of said breakers having an accelerating finger, a pair of longitudinally spaced hold down cams disposed in overlying relation with said breakers, a wheel rotatable in a plane lying at right angles to the plane of rotation of said breakers, said wheel having at least one radial abutment therein and disposed for coaction with one of said hold down cams and said retarding finger in manipulating a top closure element of each carton passing thereunder, means for driving said rotary breakers and said folder wheel in timed relation with each other and with said carton conveyor, a pair of stationary squeeze cams disposed in straddling relation with one of said hold down cams, and a turn down cam fixed adjacent the end of said one hold down cam remote from said wheel.

8. In a machine for making flat-topped cartons of paperboard or the like from preformed bodies having open tops with closure parts including an outer top flap defined therein, a top preformer unit comprising the combination of a carton conveyor, a pair of rotary breakers, one of said breakers having a retarding finger and the other of said breakers having an accelerating finger, a pair of longitudinally spaced hold down cams disposed in overlying relation with said breakers, a folder wheel rotatable in a plane transverse to the plane of rotation of said breakers, said wheel being disposed for coaction with one of said hold down cams and said retarding finger in manipulating a top closure element of each carton passing thereunder, means for driving said rotary breakers and said folder wheel in timed relation with each other and with said carton conveyor, a pair of stationary squeeze cams disposed in straddling relation with one of said hold down cams, a turn down cam fixed adjacent the end of one of said hold down cam, a printing mechanism driven in timed relation with said conveyor, and a pair of laterally spaced guide bars extending longitudinally of said preformer unit, said bars being constructed and arranged to maintain said outer top flap in upstanding condition and to channel the same into said printing mechanism.

9. In a machine for making flat-topped cartons from preformed bodies of paperboard or the like, a top preformer unit comprising, in combination, a table, a conveyor adapted to traverse individual cartons in a procession along said table, a pair of hold down cams fixed in overlying relation with said table, said cams being longitudinally spaced from each other, a rotary breaker having a pair of diametrically opposed retarder fingers each adapted to be swung in closely spaced relation below one of said hold down cams, a second rotary breaker having a pair of diametrically opposed accelerating fingers each adapted to be swung in closely spaced relation beneath the other of said hold down cams, a folder wheel having a peripheral groove adapted to straddle said hold down cams, said folder wheel having alined radial abutments on either side of said peripheral groove, a lifter cam fixed to said table beneath said folder wheel and said rotary breakers, and means for driving said rotary breakers and said folder wheel and said carton conveyor in timed relation with each other.

10. In a machine for making flat-topped cartons from preformed bodies of paperboard or the like, each said body having front and rear roof panels respectively connected with front and rear top flange panels, each said body also having side roof panels respectively connected with associated top flange panels, a top preformer unit comprising, in combination, a carton conveyor, a hold down cam mounted in overlying relation with said conveyor, said hold down cam having a progressively widening portion, means for infolding the front and rear roof panels and forcing said front and rear top flange panels under said hold down cam in outfolded relation, and a pair of squeeze cams having converging inner surfaces situated adjacent the widening portion of said hold down cam, said squeeze cams and said hold down cam being adapted to infold said side roof panels and simultaneously outfold their associated top flange panels.

11. In a machine for making flat-topped cartons from preformed bodies of paperboard or the like, each said body having front and rear roof panels respectively connected with front and rear top flange panels, each said body also having side roof panels respectively connected with associated top flange panels, a top preformer unit comprising, in combination, a carton conveyor, a hold down cam mounted in overlying relation with said conveyor, said hold down cam having a progressively widening portion, means for infolding the front and rear roof panels and forcing said front and rear top flange panels under said hold down cam in outfolded relation, a pair of squeeze cams having converging inner surfaces situated adjacent the widening portion of said hold down cam, said squeeze cams and said hold down cam being adapted to infold said side roof panels and simultaneously outfold their associated top flange panels, an air discharge aperture in said progressively widening portion of said hold down cam, and means for periodically discharging a blast of air from said aperture into an underlying carton to preclude deformation of its body.

12. In a machine for making flat-topped cartons of paperboard or the like from preformed bodies having top closure parts defined therein and selectively coated with thermoplastic adhesive, each said body having roof panels, top flange panels, and a pair of opposed top flaps, the combination comprising a base, a top closing turret mounted on said base for rotation about a generally upright axis, means on said turret for receiving successively a plurality of carton bodies with the roof panels folded inwardly, the flange panels folded outwardly, and one of the top flaps folded down over the flange panels, means for transferring the cartons successively to said turret, means for downfolding the other one of said top flaps of each carton as an incident to transfer to said turret, a plurality of top closure heads fixed to said turret and including jaw means engageable with the undersides of the flange panels together with means for applying heat and pressure to the downfolded top flaps of an associated carton body to activate the thermoplastic adhesive thereon, and means for leading the cartons in a procession to a discharge conveyor upon release of successive cartons by said top closure heads.

13. In a machine for fabricating flat-topped cartons from preformed bodies of paperboard or the like having top closure elements selectively coated with thermoplastic adhesive and including inwardly slanted roof panels and outfolded flange panels together with top flaps overlying the flange panels, the combination comprising a base, a

hollow upstanding pintle fixed to said base, a top closing turret journaled on said pintle for rotation about a generally upright axis, a plurality of cages mounted on said turret for receiving carton bodies and rotatably translating the same, a plurality of top closure heads mounted on said turret in superposed relation to respective ones of said cages and having shoes movable axially of the carton bodies for applying heat and pressure to the top flaps of cartons engaged thereby, said heads each further including a plurality of jaws rotatable about vertical axes into backing relation beneath the flange panels when pressure is applied to the top flaps, means for applying power to said turret to rotate the same, and cam means fixed to said pintle for axially actuating said top closure shoes and rotatably actuating said jaws in timed relation with the rotation of said turret.

14. In a machine for fabricating flat-topped cartons of paperboard or the like from preformed bodies which have inwardly slanted roof panels and outfolded flange panels together with top flaps overlying the flange panels, the combination comprising a base, a hollow upstanding pintle fixed on said base, a top closing turret body, bearing means interposed between said turret body and said upstanding pintle, a head flange at the upper end of said turret body and integrally fixed thereto, a plurality of top closure heads mounted in said head flange and having heated pressure elements depending in axially slidable relation therefrom below said flange for engagement with the top flaps of each carton, said heads each further including a plurality of jaws rotatable about vertical axes into backing relation beneath the flange panels when pressure is applied to the top flaps, a series of carton receiving cages mounted on said body and each associated with one of said top closure heads, a pair of cams fixed to the upper portion of said pintle, means connecting said cams and said top closure heads for actuation of said heated pressure elements and said jaws, respectively, and a brush and slip ring assembly having one portion fixed on the upper end portion of said pintle and another portion fixed on a member bodily rotatable with said head flange, electrical conduit means running through said hollow pintle for connecting said one slip ring assembly portion to an electrical power source, and means electrically connecting said other slip ring assembly portion to the heated pressure elements of said top closure heads.

15. In a container fabricating machine of the character set forth and adapted to complete a succession of cartons each having inwardly inclined roof panels, outfolded top flange panels together with a pair of top flaps downfolded thereon, a top closure head comprising, in combination, a centrally disposed pressure pad adapted to bear against the top flaps of the carton, thermostatically controlled heating means in said pressure pad, a plurality of jaws swingable about spaced axes perpendicular to the plane of the flange panels, said jaws being swingable into positions adjacent the respective inclined roof panels and thus into backing engagement with the undersides of said outfolded flange panels, said jaws each further having means adapted to bear against the underside of the carton top flange panels, means for oscillating said jaws in unison about their respective axes including means for moving one of said jaws through a greater angle than the others to permit entry of a carton laterally between the jaws, thermostatically controlled heating means in each of said jaws, and means for applying a resilient squeeze of the top flaps against the flange panels of said carton by relative axial pressure between said pressure pad and said jaws.

16. In a container fabricating machine of the character set forth and adapted to complete a succession of cartons each having a top flange with a pair of top flaps downfolded thereon, a top closure head comprising the combination of a housing, a plurality of jaw spindles journaled in spaced parallelism with the axis of the head in said housing, a plurality of carton flange engaging jaws fixed to respective ones of said spindles, a common actuating means for oscillating said spindles about their longitudinal axes to open and close said jaws in a plane transverse to said axes, gear connections between certain ones of said spindles for oscillating the same through a uniform angular displacement, and a gear connection between said common actuating means and a remaining one of said jaw spindles for oscillating the same through a substantially greater angular displacement to thereby permit transverse entry of a carton into embraceable relation with all of said jaws.

17. In a machine for closing the top of an erected carton body having four roof panels, four upstanding flange panels and two opposed top flaps, the combination of a table surface for supporting the body, means for continuously advancing the carton body in a lateral direction parallel to the planes of its upstanding top flaps, a first hold down cam superposed above the table a distance leaving clearance between its underside and the upstanding carton flange panels, a second hold down cam spaced from the first cam in the direction of carton body movement and spaced above the table surface a distance to hold the carton flange panels folded downwardly from the roof panels, a lift cam surface on the table surface between the two hold down cams for elevating the carton body after its leading flange panel but before its trailing flange panel has passed the first hold down cam, a rotary wheel having a non-circular periphery for outfolding the leading flange panel forwardly and tucking it beneath the second hold down cam, said wheel being formed to clear the trailing flange panel as it advances so that the latter is outfolded rearwardly by the two cams.

18. In a machine for closing the top of an erected carton body having two flange panels upstanding from and connected by foldlines to opposite sides of the carton body, the combination comprising means for continuously moving the carton body in a direction at right angles to the planes of the upstanding panels, a first hold down cam spaced above the path of carton movement to leave slight clearance from the upstanding panels, a second hold down cam spaced apart from the first cam in the direction of carton movement and spaced above the path of such movement a distance to hold the panels downturned about their foldlines, means for elevating the carton body slightly after the leading panel has cleared but before the trailing panel has cleared the first hold down cam, means for outfolding the leading panel in the direction of carton movement while such panel is between said two cams and without disturbing the trailing panel, so that the leading and trailing panels are outfolded forwardly and rearwardly, respectively, as the carton is moved beneath the second hold down cam.

References Cited in the file of this patent

UNITED STATES PATENTS

2,032,343	Arthur	Mar. 3, 1936
2,059,403	Scott	Nov. 3, 1936
2,071,247	Benoit et al.	Feb. 16, 1937
2,200,276	Hothersall et al.	May 14, 1940
2,217,784	Bennett et al.	Oct. 15, 1940
2,316,867	Howard	Apr. 20, 1943
2,357,535	Monroe	Sept. 5, 1944
2,370,757	Spurr	Mar. 6, 1945
2,625,778	Wood	Jan. 30, 1953
2,663,981	Sanford	Dec. 29, 1953