Sept. 2, 1969 H. B. EGLESTON 3,464,326

CONTINUOUS MOTION MACHINE FOR HEATING, FORMING, AND SEALING CONTAINER CLOSURES

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FIG. 1

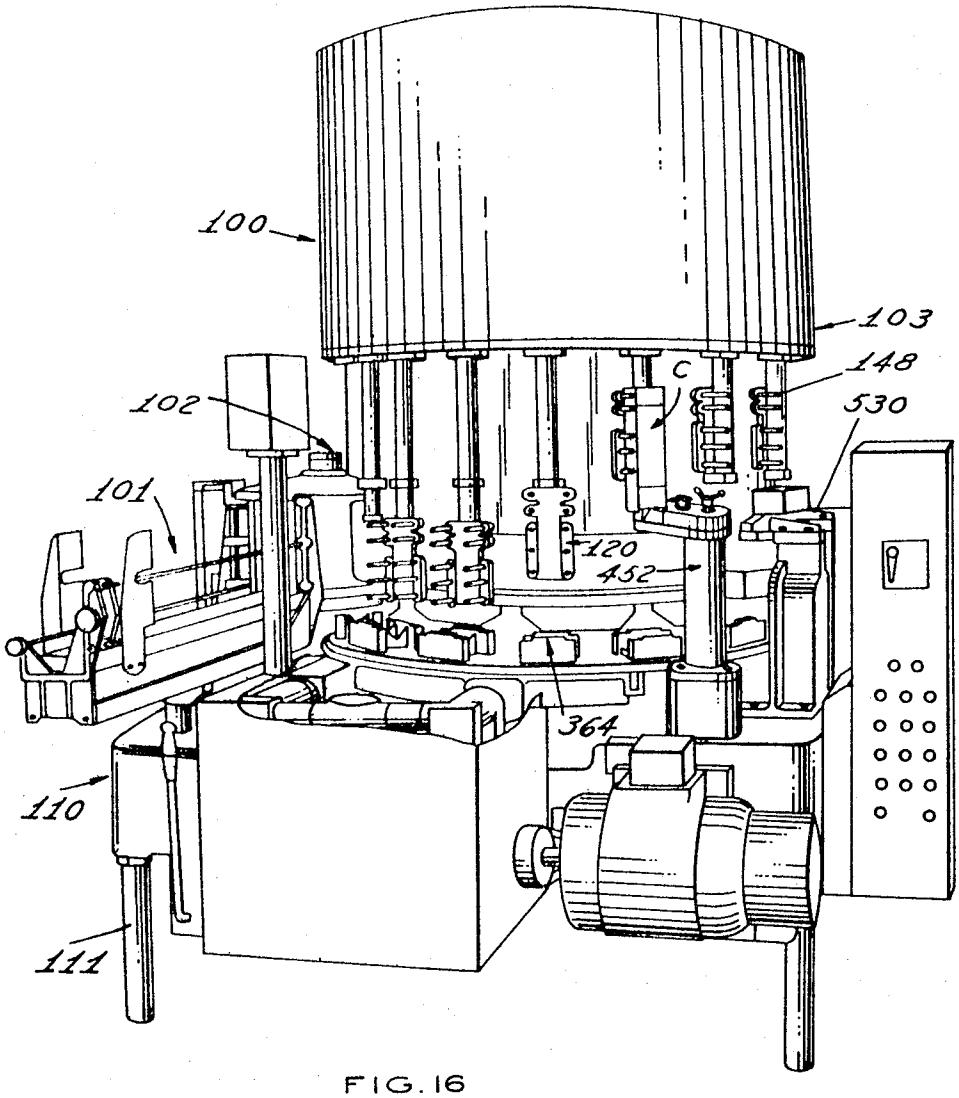
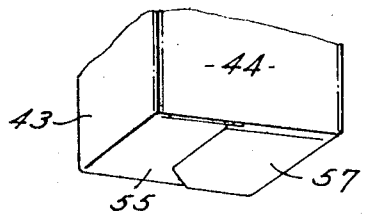


FIG. 16



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CONTINUOUS MOTION MACHINE FOR HEATING, FORMING, AND SEALING CONTAINER CLOSURES

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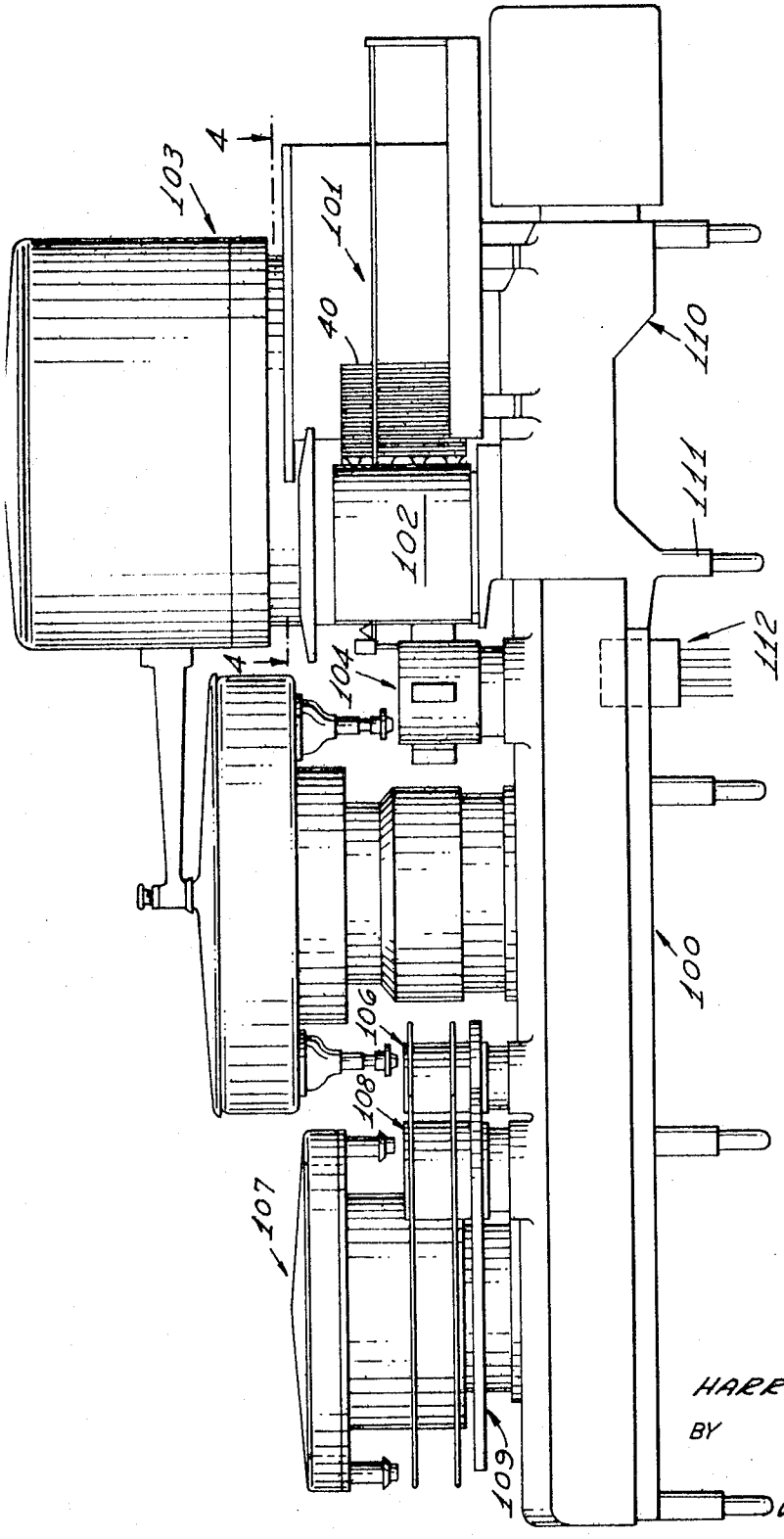


FIG. 2

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CONTINUOUS MOTION MACHINE FOR HEATING, FORMING, AND SEALING CONTAINER CLOSURES

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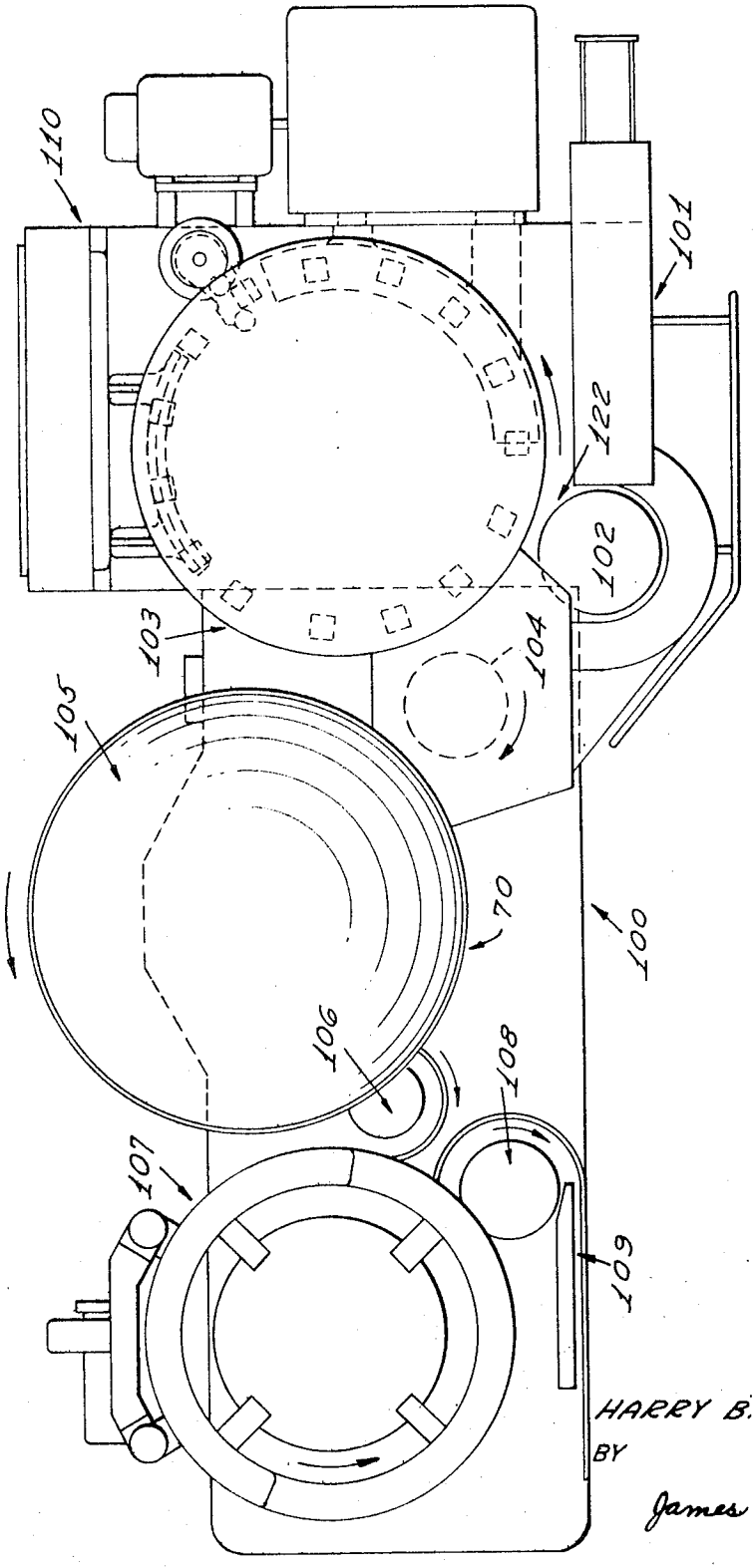


FIG. 3

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FIG. 4

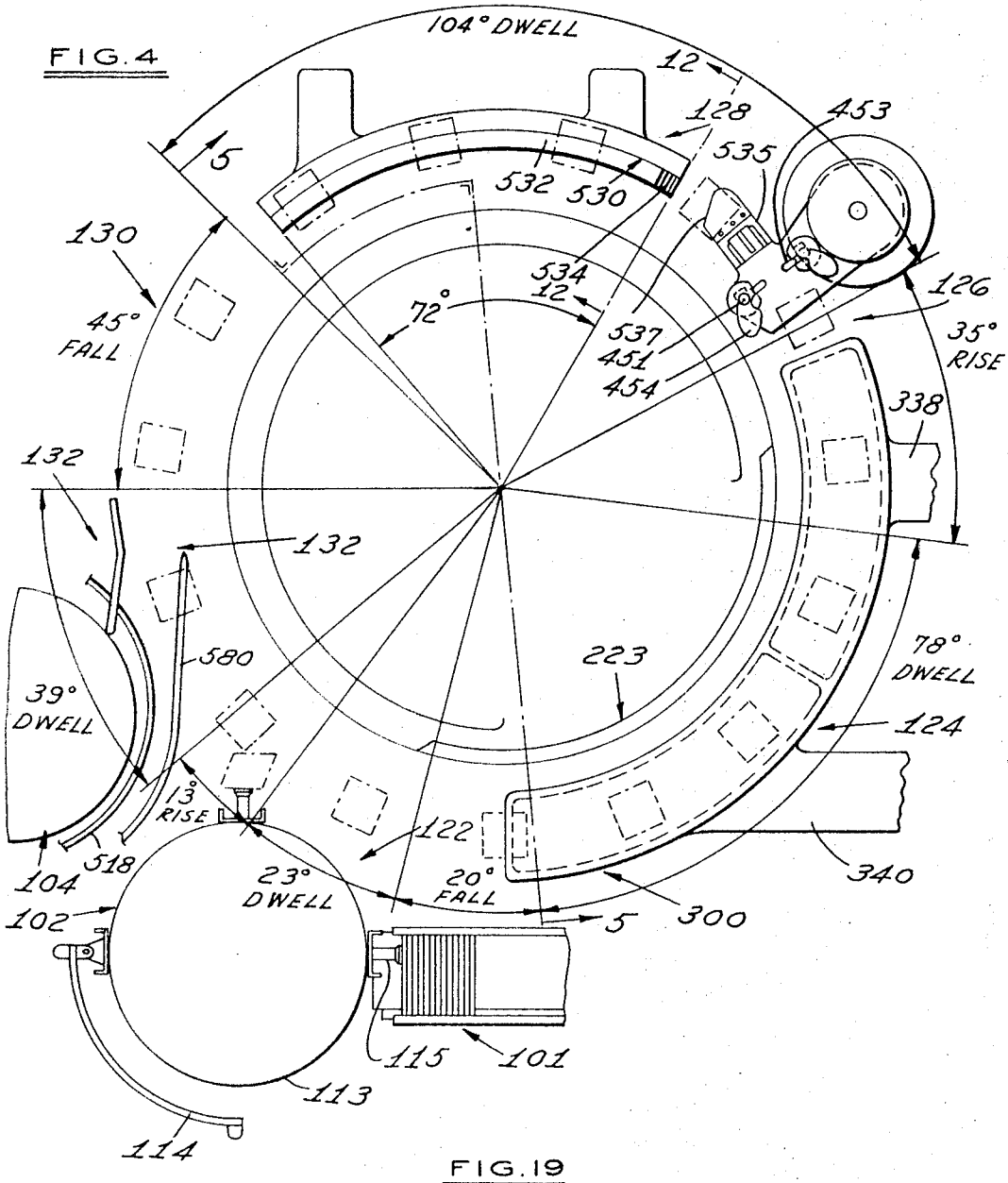
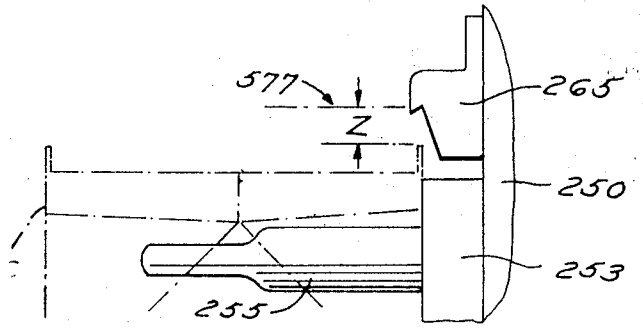


FIG. 19



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CONTINUOUS MOTION MACHINE FOR HEATING, FORMING, AND SEALING CONTAINER CLOSURES

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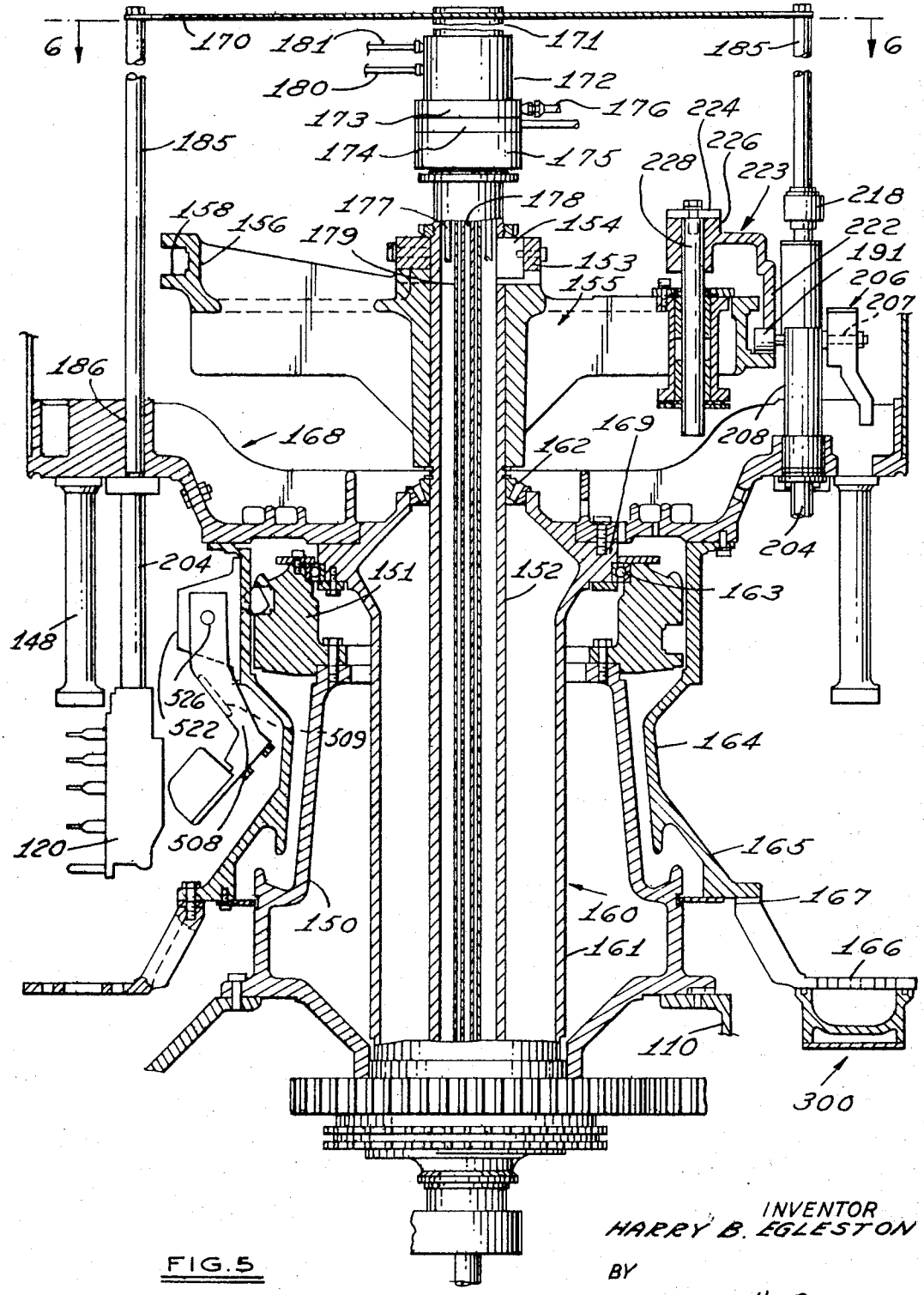
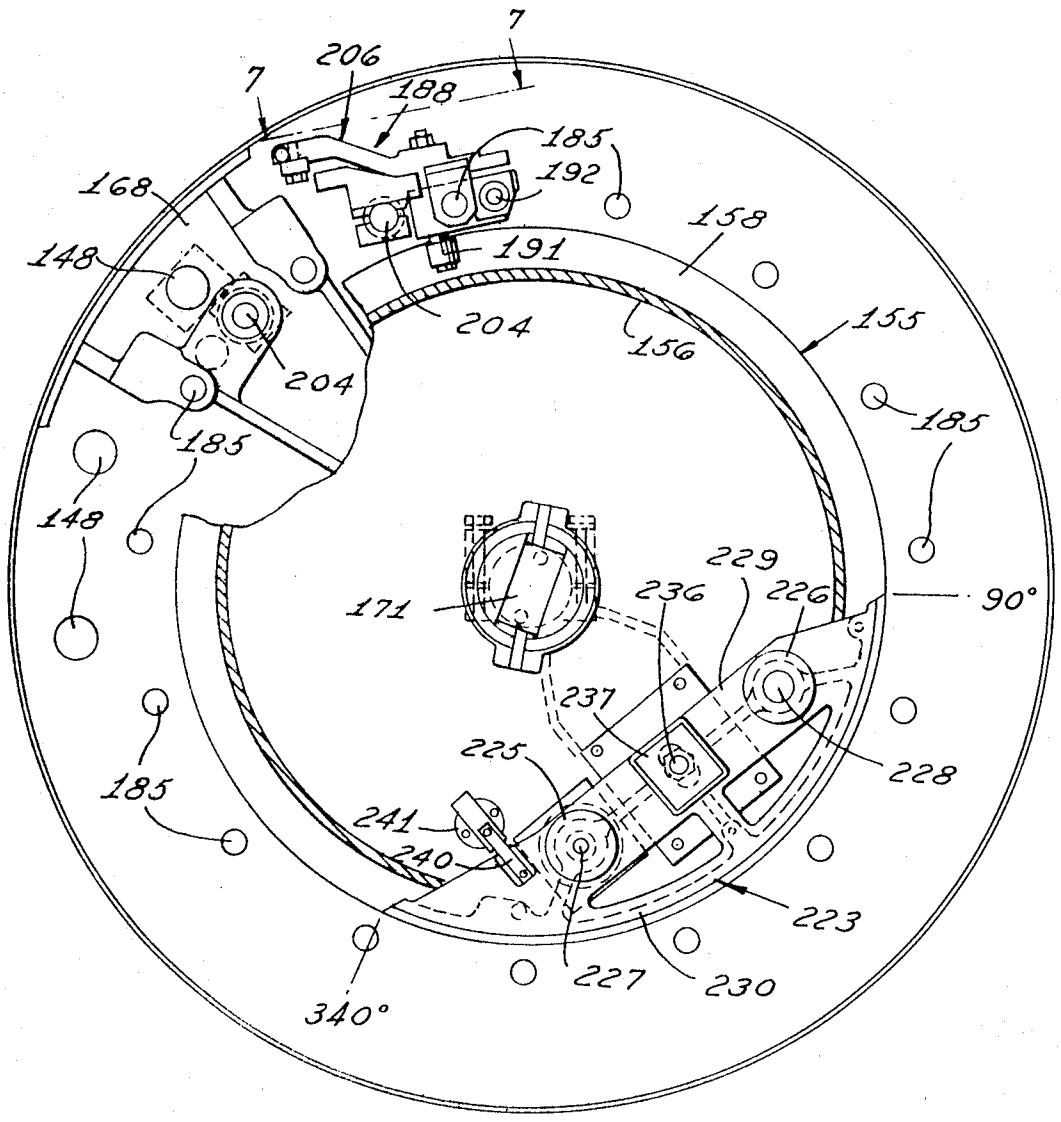


FIG. 5

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FIG. 6



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CONTINUOUS MOTION MACHINE FOR HEATING, FORMING, AND SEALING CONTAINER CLOSURES

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FIG. 7

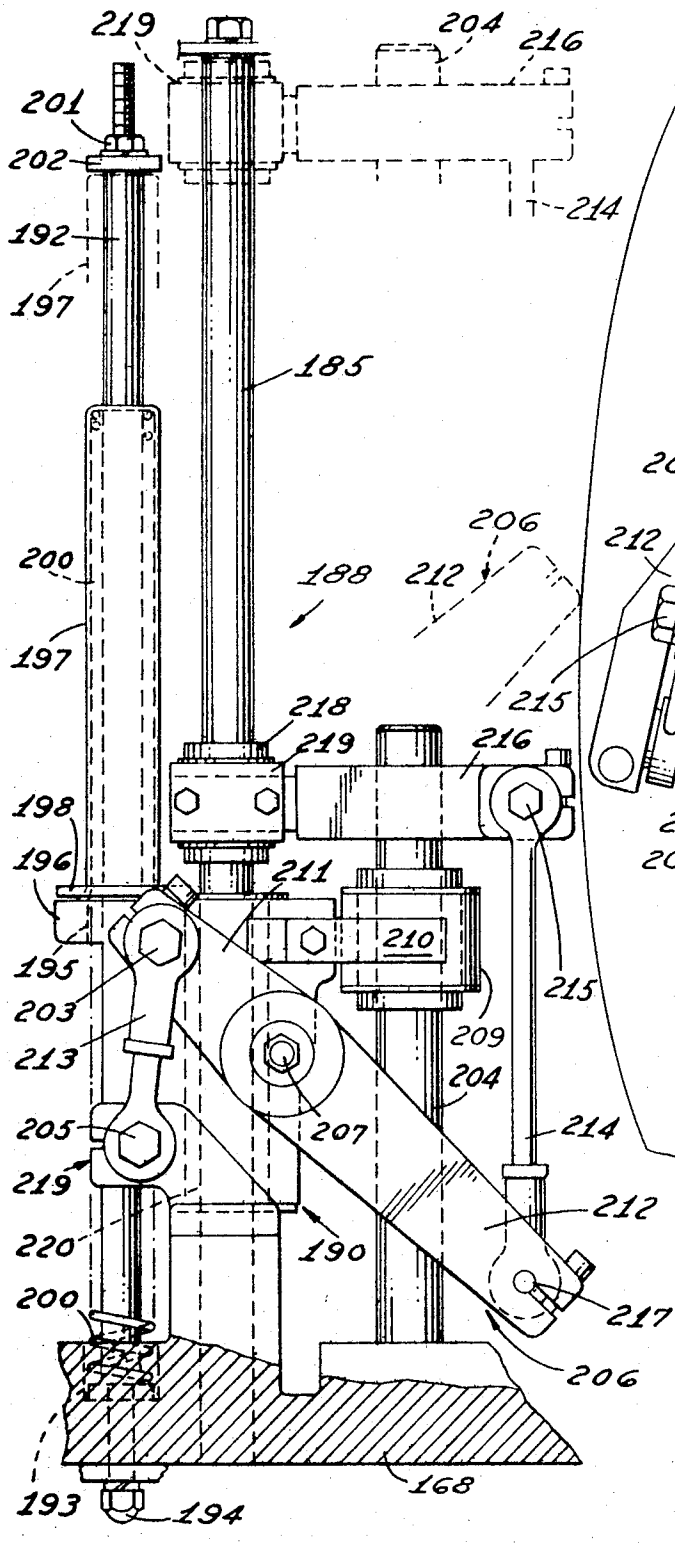
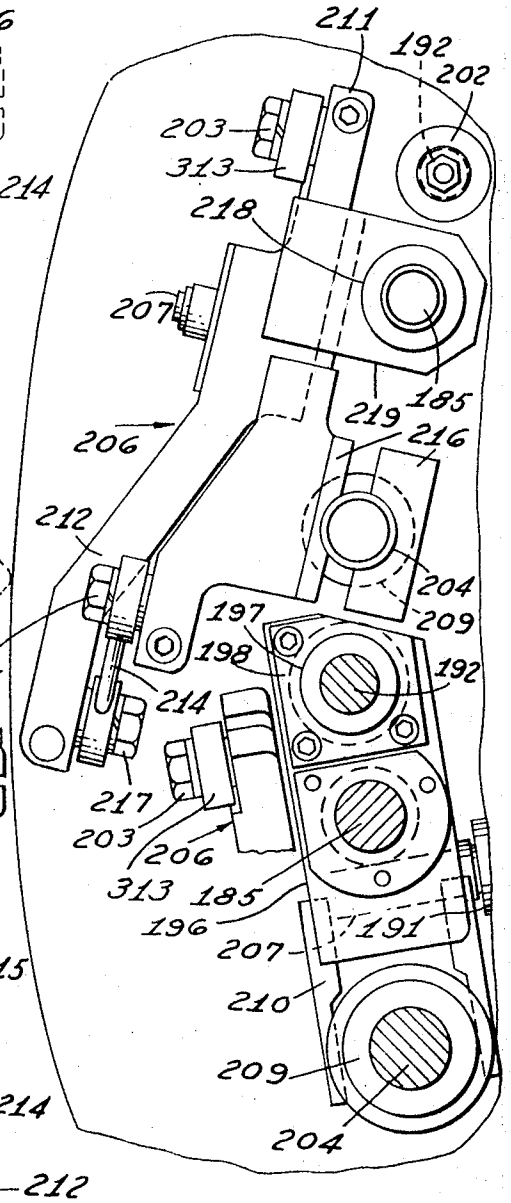


FIG. 8



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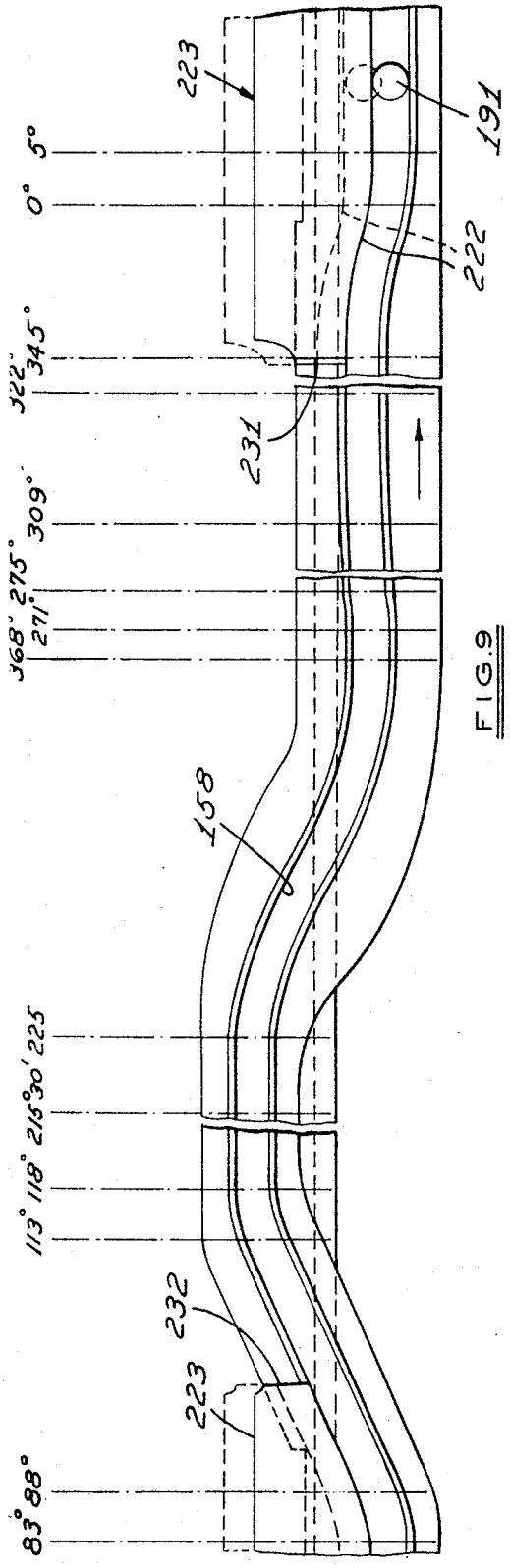


FIG. 9

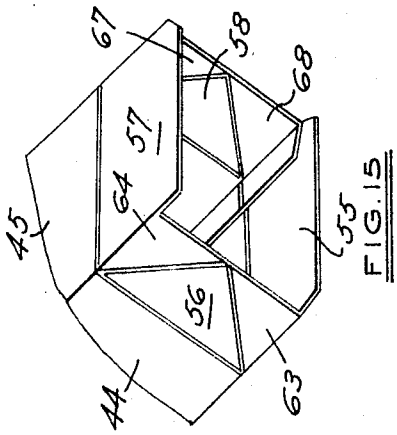


FIG. 15

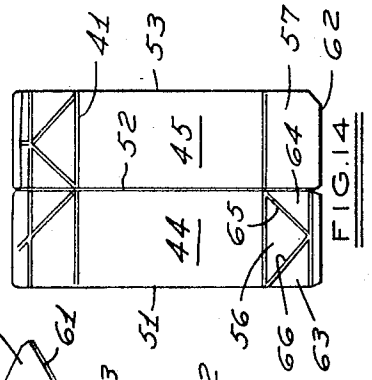


FIG. 14

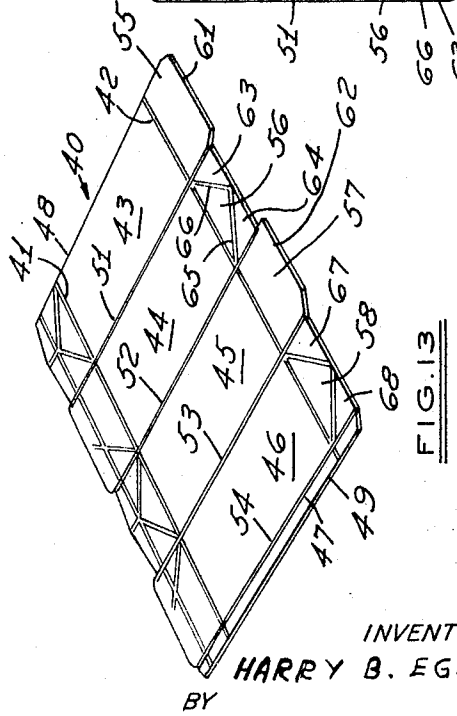


FIG. 13

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FIG. 10

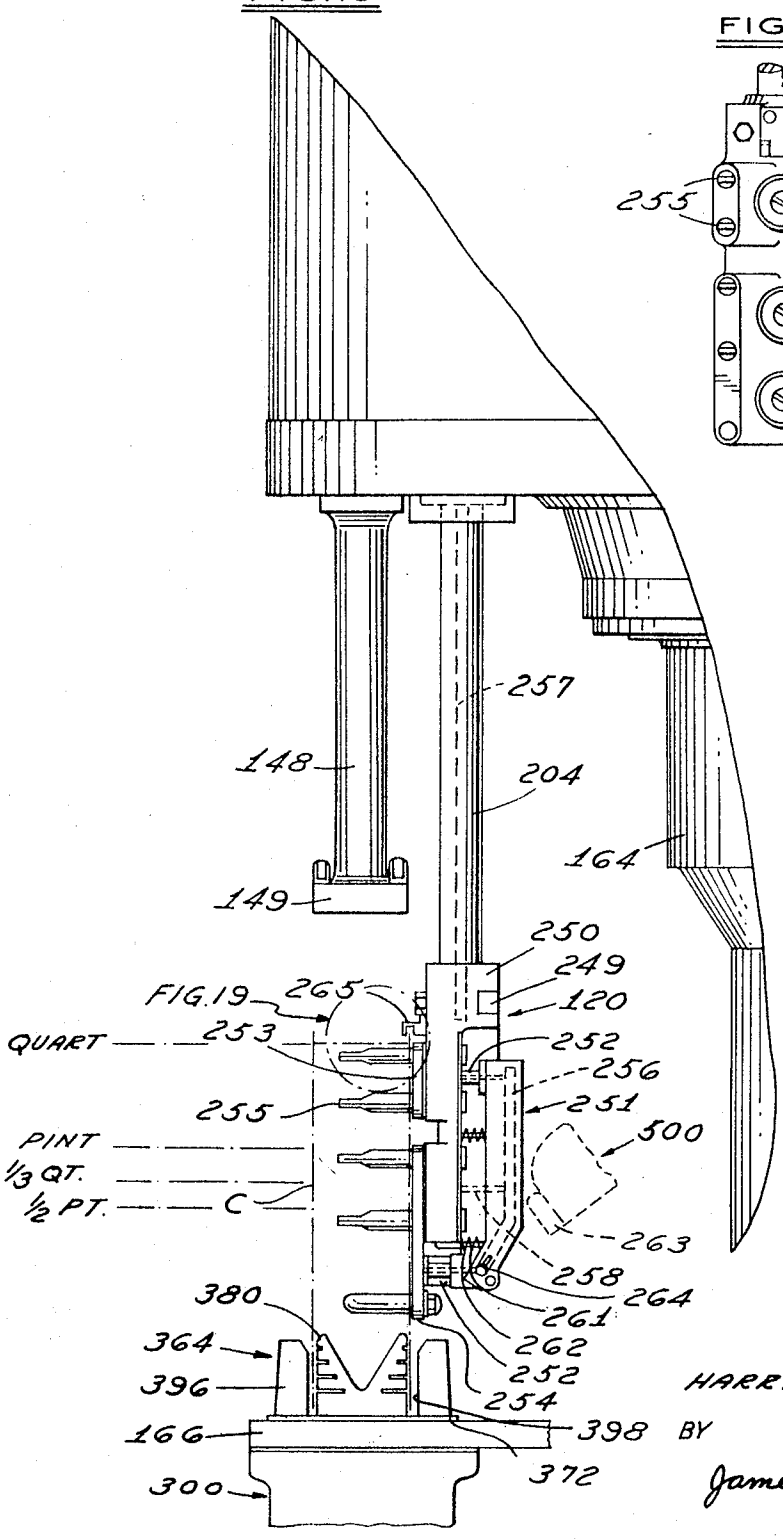
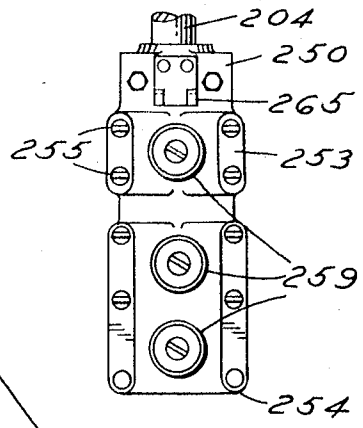


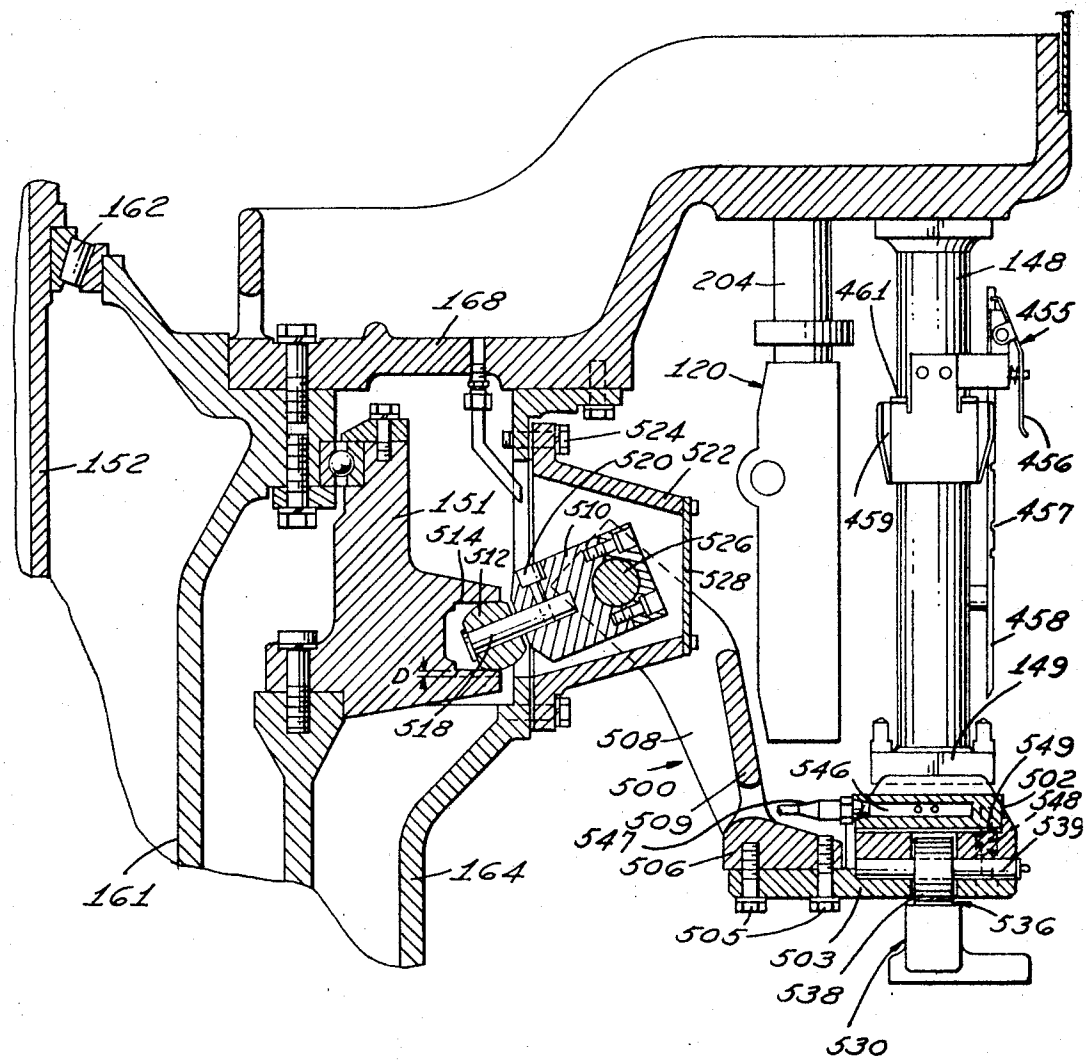
FIG. 11



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FIG. 12



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CONTINUOUS MOTION MACHINE FOR HEATING, FORMING, AND SEALING CONTAINER CLOSURES

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FIG. 17

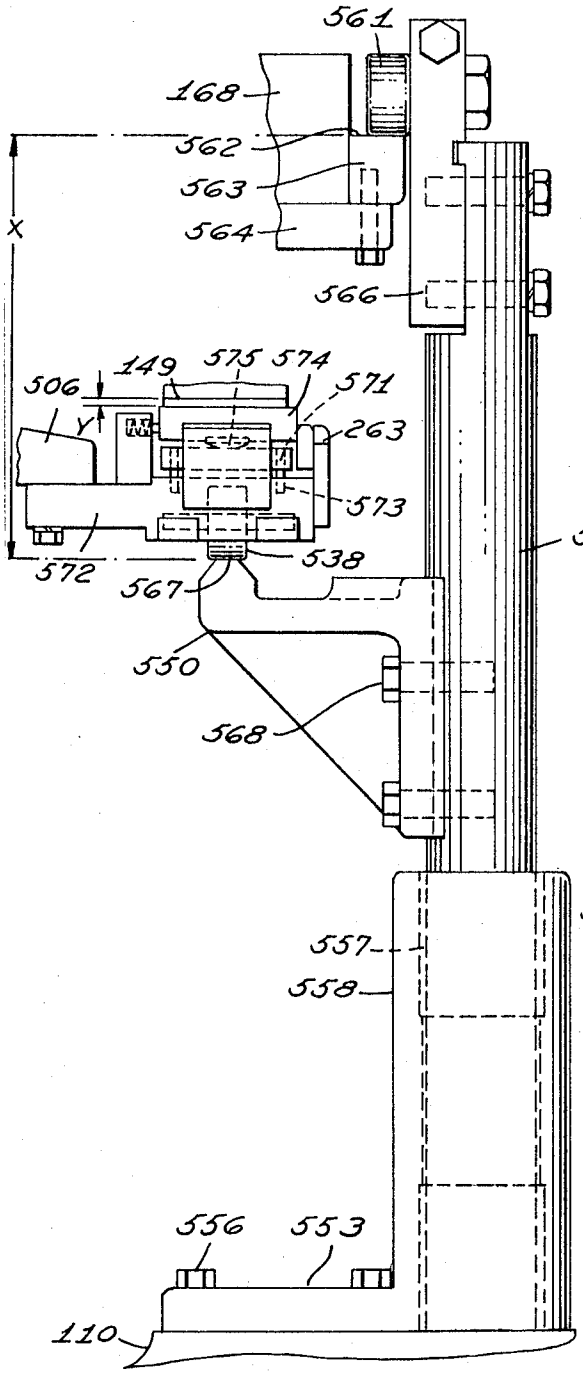
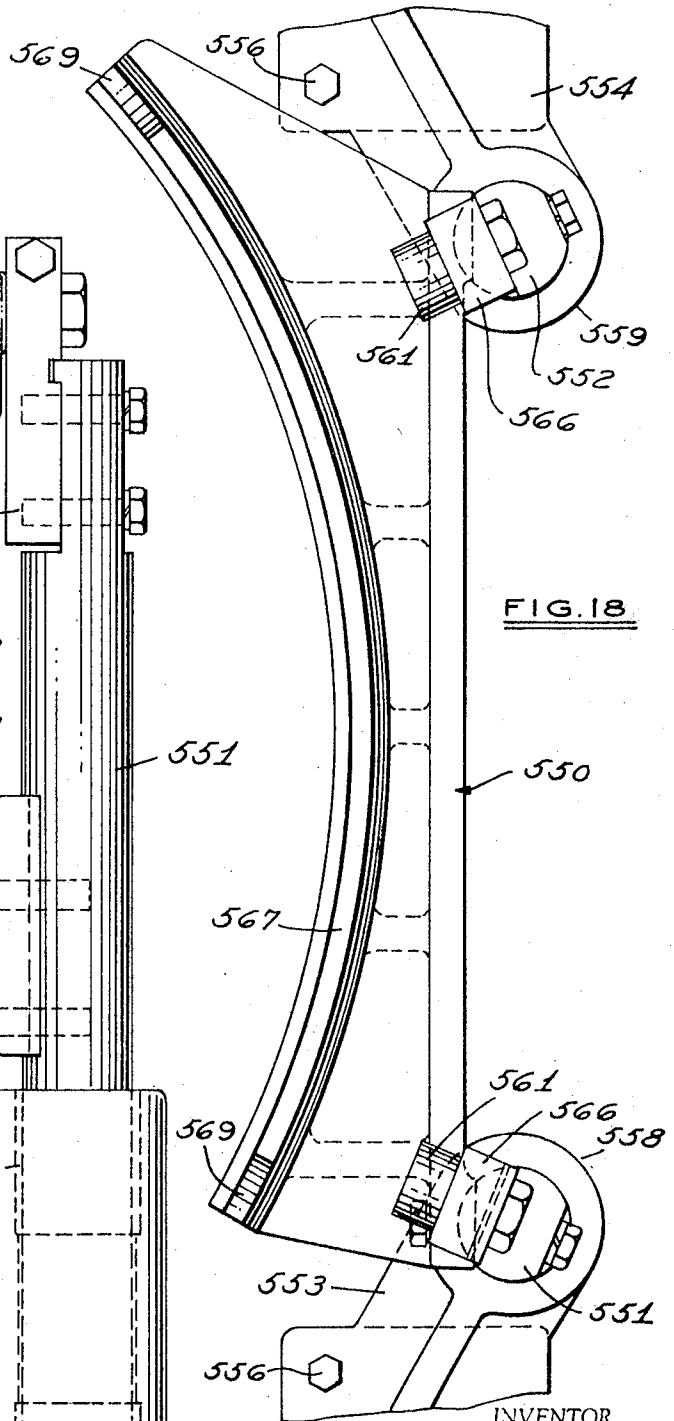


FIG. 18



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United States Patent Office 3,464,326
Patented Sept. 2, 1969

3,464,326

CONTINUOUS MOTION MACHINE FOR HEATING, FORMING, AND SEALING CONTAINER CLOSURES

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Filed May 16, 1967, Ser. No. 640,444
Int. Cl. B31b 1/06, 1/64
U.S. Cl. 93—44.1 31 Claims

ABSTRACT OF THE DISCLOSURE

A container bottom forming apparatus having a reciprocating container carrier for receiving series of containers of different capacities wherein their bottom closures are at a uniform working level for treatment by the apparatus and transferring the containers from the apparatus with their top closures at a uniform working level. The containers are moved on the apparatus in continuous motion between aligned vertically spaced heating and pressure sealing units and a folding unit wherein the folding unit is operative on each container between the heating and sealing operations.

The present invention relates in general to container packaging machines, and more particularly to a novel and improved continuous motion rotary heating, forming, and sealing machine for the bottom closure of thermoplastic coated paperboard containers. The machine finds particular, but not exclusive utility when used in cooperation with a filling and top sealing machine for gable top container such as the machine disclosed in copending patent application of No. 448,545 of Harry B. Egleston, now Patent No. 3,370,399, issued Feb. 27, 1968, and assigned to the same assignee as the instant application. By machines of the continuous motion type it is meant that the containers being formed by the machine are moved through the latter in a continuous procession at a substantially constant rate, the various operations being carried on while the container blanks are in motion rather than while they are momentarily halted. One machine of this general type is disclosed in U.S. Patent 2,770,175, issued Nov. 13, 1956, in the name of James F. Earp. However, machines of this type were designed for containers that required coating with paraffin or wax after being formed and have no prior art application to the machine of the instant disclosure for forming plastic coated paperboard containers employing fold-in type bottom closures.

A disadvantage of the prior art paperboard containers forming machines is that they operate with an intermittent motion which limits the speed of operation and the number of containers which can be formed by such machines. A further disadvantage of such prior art bottom forming machines is that when they are adaptable to produce a series of containers on common mandrels, such as the half-pint through quart series having the same cross-section but varying heights, it has not heretofore been possible to maintain the tubular container blank in an upright vertical position during the entire operation. The prior art machines which use other means, such as the spider wheel arrangement shown in U.S. Patent 3,249,025, for example, require additional time, space and equipment to orientate the container into an upright-vertical position prior to delivery to the filling unit of the machine.

In view of the foregoing, it is an important object of the present invention to provide a novel and improved combined heating, forming and sealing machine for paperboard container bottom closures which operates with a continuous motion and perform the heating, forming and sealing operations at high speeds.

It is another object of the present invention to provide novel and improved rotary heating and sealing machine for forming the bottom closure of paperboard containers which operates with a continuous rotary motion so that the tubular container blank is vertically oriented during the entire operation.

It is another object of the present invention to provide a novel and improved combined heating, forming, and sealing machine for thermoplastic coated containers which heats, forms and seals the bottom closure of the containers more quickly than the corresponding prior art machines so that the time interval between heating and sealing is shortened, and the heating operation is carried out at one elevation of the container while the forming and sealing operations are carried out at a second higher elevation such that the difference between the two elevations is constant for a series of containers having common cross-sections but variable heights.

It is still another object of the present invention to provide a novel and improved heating, forming and sealing machine for paperboard container bottom closures which functions to selectively heat only the sealing areas of the container bottom end closure panels prior to the folding or pre-breaking any of the score lines of the closure.

It is still a further object of the present invention to provide a novel and improved forming machine for paperboard container bottom ends which may be used for containers of different capacities that have the same cross-section, such that the bottom closures follow a common path throughout the forming cycle while the containers are transferred from the machine with their top ends positioned at a constant elevation for continuous delivery to a container filling machine.

It is still another object of the present invention to provide a novel and improved forming machine for paperboard container bottom ends which embodies a novel pressure sealing assembly that moves continuously during a sealing operation whereby it is actuated by a pair of cooperating cam means for precisely controlling the amount and direction of sealing pressure.

The combination continuous heating, folding, sealing and stripping machine of the present invention includes a rotary assembly which is provided with a plurality of stations each having paired vertically spaced heating and sealing units and a single folding unit. The rotary assembly is constructed and arranged to coact with any suitable container filling and top sealing machine. A plurality of vertically reciprocable container carriers mounted on the rotary assembly each pick up a tubular blank during a first or load cycle and continue to rotate while reciprocating downwards to carry the squared tubular blanks through a bottom closure heating cycle and then upwards to carry the heated closures through a folding and sealing cycle, after which the carriers are moved downward where the containers are discharged without stopping the rotary assembly. When the container carrier on the rotary assembly picks up a tubular container at the loading cycle, the container is disposed automatically in vertical alignment above the container bottom end heater means such that when the carrier is cammed downwardly the closure panels are lowered between opposed walls of the heater means. Simultaneously, the heater means are rotated into communication with a fixed arcuate plenum chamber which delivers heated air under pressure to the heater means. The container carrier holding the tubular container is moved through a predetermined distance along a circular path at the end of which the carrier is reciprocated upwardly from the heater means and the container is loaded on a mandrel depending from the assembly in

vertical alignment with the heater means. The rotary assembly carrying the loaded mandrel is moved through a next predetermined distance along the circular path over a closure breaking, folding and tucking apparatus fixed on the machine base. Each station on the assembly is provided with a pressure sealing arm which is pivoted radially outwardly, by first camming means, after its associated loaded mandrel passes the folding apparatus. Second arcuate shaped cammed means, commencing past the folding apparatus, engages a pressure pad extension on the arm and solely by means of a pressure pad follower applies controlled sealing pressure normal to the closure surface. Pressure is applied through a predetermined distance along the circular path of the arcuate cam at the end of which the first camming means is again actuated to pivot the pressure arm inwardly. The container carrier is next cammed downwardly to strip the formed container from the mandrel such that containers having different capacities can be discharged from the machine with their top closures at a common level. All the container carriers positioned over the heating plenum are retracted automatically in the event that vacuum air pressure is lost, or the machine stops, in order to prevent overheating of the containers.

Other objects, features and advantages of this invention will be apparent from the following detailed description, appended claims, and the accompanying drawings.

In the drawings:

FIG. 1 is a perspective view of a forming machine for container bottom closures made in accordance with the principles of the present invention.

FIG. 2 is a reduced side elevational view of an illustrative container erecting, filling and closing machine embodying the present invention.

FIG. 3 is a plan view of the illustrative machine of FIG. 2.

FIG. 4 is an enlarged, horizontal diagrammatic view taken partially in the plane of line 4—4 in FIG. 2 and detailing certain elements adapted to cooperate with the bottom forming turret.

FIG. 5 is a vertical sectional view through the bottom forming turret, taken in the plane of the line 5—5 in FIG. 4.

FIG. 6 is a fragmentary plan view of the bottom forming turret with its cover removed.

FIG. 7 is an enlarged fragmentary, vertical sectional view taken along line 7—7 of FIG. 6 showing the carrier mechanism.

FIG. 8 is an enlarged, fragmentary plan view detailing the carrier mechanism of FIG. 7.

FIG. 9 is a developed view of the container carrier cam track shown in FIG. 5.

FIG. 10 is an enlarged, fragmentary elevation showing one of the mandrels carried by the bottom forming turret together with its associated container carrier and bottom heating unit.

FIG. 11 is a fragmentary elevation showing the outer face of the container carrier of FIG. 10.

FIG. 12 is an enlarged vertical sectional view detailing the pressure sealing members of the turret, taken along line 12—12 in FIG. 3.

FIG. 13 is a perspective view showing the inside face of the container blank.

FIG. 14 is a plan view of a flat collapsed side seamed container blank in the form in which it is presented to the machine of FIG. 1 for processing.

FIG. 15 is an enlarged fragmentary perspective view showing the bottom closure elements of the blank and container of FIGS. 13 and 14.

FIG. 16 is a perspective of the container end closure after it has been formed and heat sealed.

FIG. 17 is a modification of the pressure sealing means of FIG. 12.

FIG. 18 is a top elevation view of the apparatus of FIG. 17.

FIG. 19 is an enlarged view showing the containers stripping clip indicated as FIG. 19 in FIG. 10.

The packaging machine of the present invention is particularly adapted to heat, form and seal the bottom end closure panels of cartons or containers of the type shown in United States Patent No. 3,120,335 and 3,270,940 which issued on Feb. 4, 1964 and Sept. 6, 1966, respectively an application of H. B. Egleston and C. Z. Monroe. These applications are assigned to the assignee of the subject application, and the disclosures thereof are incorporated herein by reference. For a complete description of a container which may be heated and sealed by the machine of the present invention reference should be made to the aforementioned patents. The container described in this application is made from paperboard having a polyethylene coating thereon, but it should be understood that any suitable thermoplastic coating may be employed as a coating for the container.

Before proceeding with the description of the heating and sealing machine of the present invention, the bottom end closure panel structure of an illustrative container C (FIG. 1) will be briefly and generally described. As shown more particularly in FIG. 13, the container C is in flat blank form **40** pressed with a pattern of appropriate score lines and having its inside surface showing. The blank is separated into three sections by score lines **41** and **42**. The material above score line **41** is the top closure described in the aforementioned U.S. Patent 3,270,940. The material between the score lines **41** and **42** is the body group and comprises four panels, **43** through **46**, and side seam flap **47**. The body group is defined on the sides by edges **48**, **49** and with the panels being separated by score lines **51** through **54**. The material below score line **42** is the bottom closure group and comprises the major bottom closure panels **55**, **57** fold-in panels **56**, **58** fold-under or gusset panels, **63**, **64**, **67**, **68**, flaps **61**, **62** and side seam flap **47**. The bottom closure group of panels defined on the sides by the edges **48**, **49** are separated by score lines **51** through **54**. The major bottom closure panel **55** has the extended tuck-in flap **61** and major bottom closure panel **57** has the extended tuck-over flap **62**. The bottom fold-in panel **56** is flanked by the triangular gusset panels **63**, **64** are connected thereto by score lines **66**, **65** respectively. Similarly, the bottom fold-in panel **58** is flanked by the triangular gusset panels **67**, **68** that are connected thereto by score lines **72**, **71** respectively.

To form the flat side seam blank of FIG. 14, that is presented to the forming machine, the panel **46** and side seam flap **47** are folded about score line **53** until their inside surfaces contact the inside surfaces of panels **45** and **44** respectively. The panel **43** is folded about score line **51** until it contacts the inside surface of panel **44** and the outside surface of side seam flap **47**. The surface along edge **48**, which will meet the outside edge of the side seam flap, will be heated together with the outside surface of the side seam flap **47** to activate their thermoplastic coating so that the two surfaces will be bonded together when pressed together and cooled. The edge **48** and the score line **54** now appear as one line. The bottom closure portion of flat container blank **40** now looks like the side seam container blank as shown in FIGURE 14.

When the container C is loaded on a machine carrier, it takes a tubular shape, as seen in FIG. 15. To form the bottom initially the triangular panels **56**, **58** are moved inward toward each other, after which the major panels **55** and **57** are also moved inward toward each other. This causes gusset panel **68** to rotate around score line **71** so that the inside surface of panels **68** and **55** are coming together. At the same time panel **68** is rotating about score line **71** the outside surfaces of panel **68** and **58** are approaching each other. Fold-under panels **63**, **64** and **67** make the same movements as panel **68** with the panels

55–56, 56–57, and 57–58 respectively. Bottom closure panel 55 moves toward bottom closure panel 57 just enough faster than panel 57 moves toward panel 55 so that tuck-in flap 61 is positioned between fold-under panels 64, 67 and panel 57. After the closure is completely formed and sealed it appears as shown in FIG. 16.

General machine description

Referring more particularly to FIGS. 1, 2 and 3, the illustrative packaging machine 100 is adapted to receive a supply of flat folded tubular blanks such as the ones illustrated in FIG. 14 and described earlier herein. The blanks are stacked, top up, in a magazine 101 from which they are successively withdrawn by means of a rotary feeder 102, erected into open ended tubular form and loaded onto the continuously rotating bottom forming apparatus 103 which heats, folds and seals the container bottom closure. After being transferred by rotary transfer unit 104 and filled by the rotary turret filler 105 the filled and partially completed containers, open at the top, are presented by transfer unit 106 to a rotary heating and top sealing turret 107. The filled and sealed containers are then conveyed by means 108 and delivered to the conveyor 109 for discharge in a continuous procession from the machine. It is to be understood that the bottom forming apparatus 103 of the present invention may be used with any suitable container filling and sealing machine. While in the present instance the bottom forming apparatus 103 is shown in conjunction with the Container Top Sealing Apparatus as shown and described in copending United States patent application No. 448,545 of H. B. Egleston, filed Apr. 15, 1965, it is to be understood that other suitable container filling and sealing machines could operate with the disclosed apparatus. The application No. 448,545 is assigned to the assignee of the subject application, and the disclosure thereof is incorporated herein by reference.

The apparatus 103 comprises a console or base 110 supported on legs 111 and supplied with utilities such as electric power, compressed air and cooling water from appropriate external sources 112. The magazine 101 is mounted on top of the base at the front end of the machine 100 and operatively associated with the magazine is the rotary feeder mechanism 102 of the general type shown and described in United States Patent 2,936,681, issued May 17, 1960, on an application of J. F. Earp. This patent is assigned to the assignee of the subject application, and the disclosure thereof is incorporated herein by reference.

As indicated diagrammatically in FIG. 4 the feeder mechanism 102 operates so that the foremost side seamed blank is pulled from the magazine 101 and carried to the squaring and discharge stations by means of a continuously rotating turret 113. There the container blank is advanced into contact with rails 114 which square the container along its pre-scored lines and apply reverse bends to the scores so that the container retains its shape when it is introduced into the bottom forming mechanism. The feeder is provided with a plurality of suction devices 115 spaced approximately 90° apart around its periphery so that as the feeder rotates, the suction devices are brought into contact with the forwardmost blank in the magazine.

The feeder 102 delivers the blank to a container carrier 120 (FIG. 1) of the bottom forming apparatus 103 at the load station generally indicated by the numeral 122 in FIG. 4. The squared tubular containers are reciprocated vertically by their individual carriers 120 as they are revolved in a circular travel period during which time the containers go through a bottom closure heating operation 124, a bottom folding operation 126, a pressure sealing operation 128, and a mandrel stripping operation 130. As indicated in FIG. 4, the bottom formed containers are discharging from the apparatus at station 132 at which point they are transferred to the rotary transfer unit 104 and the containers are ready to be filled and sealed.

The bottom forming turret

The bottom forming unit 103 comprises a pedestal 150 (FIG. 5) fixably mounted on the machine base 110 and supporting a pressure pad cam track member 151 thereon. Supported in the base 110 is a vertically disposed stationary tubular shaft 152 having fixed upon its upper end, by means of spacer clamp 153 and key 154, carrier lifter cam 155. Cam 155 has a thickened periphery 156 which has formed therein an outwardly opening slot 158, this slot forming the cam track. Mounted upon the shaft 152 so as to be freely rotatable about the vertical axis of the shaft 152 is a rotary assembly 160 including a center column 161, the mounting means for which preferably comprising bearings as indicated at 162 and 163. The rotary assembly includes a housing turret 164 provided with a tapered web 165 the lower edge fixably supporting annular heater carrier 166 and which is insulated therefrom by air baffles 167. The housing turret 164 is supported from center column 161 by means of the upper housing ring 168 secured, as by bolts, upon center column flange 169 such that it rotates as part of rotary assembly 160.

The uppermost portion of the rotary assembly 160 comprises a circular plate 170 together with water manifold 172 and vacuum manifold 173 which are secured to the plate 170 by means of clamping blocks 171. A stationary vacuum control plate 174 and vacuum feeder plate 175 are positioned on the shaft 152 such that control plate 174 is in abutting engagement with the lower surface of the vacuum manifold 173. Two spaced arcuate recesses are formed in the vacuum control plate upper surface and communicate with suction devices on each carrier 120 through individual radiating flexible conduits only one of which is being shown at 176. The vacuum control plate is in communication with a suitable vacuum pump and either an atmospheric or greater than atmospheric pressure source by means of supply pipes 177. Coolant water is conveniently withdrawn via a control discharge line 178 running longitudinally of the stationary support shaft 152 and introduced via a supply conduit 179 also housed in the support shaft in spaced surrounding relation with the discharge line. The water manifold 172 is connected via flexible line 180 to portions of the apparatus and back via flexible return line 181. The latter communicates with discharge line 178.

Around the outer periphery of plate 170 are fixably mounted a plurality of round vertical guide bracket posts 185, there being fifteen such posts in the embodiment shown (FIG. 6). The lower ends of the post 185 extend into the aligned sockets 186 located in the housing ring 168. For the purpose of raising and lowering each container carrier 120 as required during the bottom forming operation, there are provided quick-acting lever assemblies 188, only one of which is shown in FIG. 6.

Carrier lifting assemblies

As best shown in FIGS. 7 and 8, a carrier lifting bracket 190 is slidably mounted on each post 185 for vertical reciprocation thereon. Rotatably mounted on the inner side of each bracket 190 is a cam follower wheel 191, which rides on the stationary cam 155. The lever assemblies 188 are each provided with an upwardly extending spring rod 192 having its lower threaded end located in sockets 193 in housing ring 168 and anchored thereto by nut 194. The spring rod 192 extends through opening 195 formed in the flange 196 of bracket 190. A vertical spring guide sleeve 197, secured to the upper face of flange 196 by means of retainer 198, encircles the spring rod. Lifter helical spring 200 is carried on the spring rod so that it bottoms in socket 193 while extending upwardly into sleeve 197 to abut at the top of the sleeve and retained in compression thereby. The upper end of rod 192 is threaded to receive a nut

201 which secures a stop disc 202 to limit the upward travel of bracket 190.

The lifter shaft 204 is linked to the lever 206, which is pivotally secured on the bracket 190 for oscillation about its pivot pin 207. As shown in FIG. 5, the shaft 204 is guidably journaled for reciprocation in upper housing ring 168 by means of housing bushing 208; and aligned bushing collar 209 supported on bracket 190 by means of a pair of aligning arms 210 so as to retain bushing collar 209 in fixed relation to bracket 190. The lever 206 has its short arm 211 pivotally secured by pin 203 to one end of short rod link 213. The opposite end of link 213 is pivoted on pin 205 carried on housing bracket 219 fixed on upper housing ring 168. Carrier lifter arm 216 is fixably secured to the upper end of carrier shaft 204 while the long rod link 214 is connected by pivot pin 215 to one end of the lifter arm 216. The opposite end of the link 214 is pivoted by means of pin 217 to the long arm portion 212 of the lever 206. Upwardly extending guide post 185 has journaled thereon ball slide collar 218 and, by means of collar bracket 219, is secured to the left-hand end of lifter arm 216 so that it is concentric with guide bushing 220 in guide bracket 190.

Each carrier shaft 204 is thus free to move vertically on its associated guide rod 185. The radially inner end of lever pin 207 rotatably supports a cam follower 191 that rides on the cam track 158 of fixed cam member 155. As a result of the foregoing arrangement of elements, each of the guide brackets 190, together with its oscillating lever 206, moves upwards and downwards in response to the configuration of cam track 158 as assembly 160 revolves about tubular shaft 152; and in so doing, each lifter arm 216 urges its associated carrier shaft 204 and container carrier element 120 to move in the same direction. In this manner a multiplication factor of the order of three to one is achieved as indicated by the dashed line uppermost position of carrier arm 216 and shaft 204 when lever 206 is at its dashed line position shown in FIG. 7.

An important feature of the present invention is the provision for automatic vertical movement of each container carrier 120 and the means employed to effect that movement in response to machine stoppage or loss of sufficient air pressure to operate the pneumatic portions of the machine such as the suction cup container holding means. The rotary motion of the turret, as described in the preceding paragraph, normally permits the lever arm 206 to pivot downwardly and to move its associated carrier 120 toward its aligned heater unit. In accordance with this invention, when a loss of air pressure occurs, the carrier 120 is raised so that its container will be raised vertically away from its heater unit to prevent overheating of the containers. The means for raising the carriers will now be described.

As best seen in the developed view of FIG. 9, the upwardly biased cam follower 191 is cammed downwardly during the 20° angular travel between the 345° and 5° positions by the cam track 222 of a retractable heater cam insert 223. When this cam insert is in its normal position, cam track 222 presents to follower 191 an effectively unbroken upper cam surface that forms a continuation with the upper surface of cam track 158. When insert cam 223 is retracted from the carrier cam track 158, as hereinafter explained, the contour is altered as shown by the broken-line position of insert cam 223.

The heater segment cam 223 is provided with a pair of spaced apart bosses 225 and 226 for slidable mounting of the same on the vertical posts 227 and 228, respectively (FIGS. 5 and 6). The posts 227, 228 extend through boss members 225, 226 on the segment cam, and are bolted thereto by means of plates 224. As shown in FIG. 6, the bosses 225, 226 are interconnected by the integral brace portion 229 of the segment cam 223. The cam 223 further includes an arcuately shaped body 230 which is integrally formed with the brace member 229. The numerals 231 and 232 in FIG. 9 indicate the entrance and exit ends of the cam track 222 formed by the arcuate depending flange of the segment cam. The follower 191 is held in a dwell position for a cycle of 78° (5°–83°) during which period the container closure panels are positioned in close proximity to a heater unit 364 (FIG. 10) for heating the same in a selective manner as will be explained later. When the follower 191 reaches the position shown by the 83° line, the follower is biased upwardly during the next 14° angular movement whereupon it rolls from the upwardly slanting portion of cam track 222 back to cam track 158.

The retraction of cam segment 223 from its normal position on cam member 155 is responsive to means that operate during the absence or partial loss of compressed air. This operating means includes a vertically positioned air cylinder rod 236 (FIG. 6), secured to the cam segment brace 229 by means of plate 237 and is operatively mounted in a suitable air cylinder (not shown) fixedly positioned on upper housing ring 168. During normal machine operation the air cylinder is operated by suitable control means to move the cam segment downwardly together with the engaged followers 191 a distance of approxixately ⅞ inch, in the instant embodiment of the invention, to its solid line location in FIG. 9. In this regard it should be noted that a plurality of followers 191 will be in operative engagement with the came segment 223 at any one instant of time and the air cylinder will be of a size to exert sufficient downward pressure on the cam segment to overcome the combined coil springs 200 associated with each follower 191 engaging the cam. The instant the compressed air pressure drops below a predetermined amount or fails the air cylinder will be unable to hold down the cam segment and the segment will, under the urging of springs 200, raise the containers away from the heater units. In the instant form of the invention the containers are raised approximately 2⅜ inches or a sufficient amount to safely clear the selective heaters 364. It will thus be noted that by means of applicant's unique carrier lifter assemblies 188 a multiplication factor of approximately 2.7 is attained to insure quick positive movement of the containers away from the heaters. Also, the compact assemblies allow for an optimum number of working stations on the turret to thereby increase production without increasing the machine to an uneconomic size.

Also, as seen in FIG. 6, by virtue of the upward movement of the cam segment 223 a horizontal arm 240 fixedly attached thereto, has its other end attached to a vertical plunger of a microswitch 241. The retraction of the cam 223 causes a breaking of the microswitch circuit with the resultant loss of electrical power to the main drive motor and stoppage of the entire machine. It should be noted that the slot portion of the cam track 158 underlying the heater segment cam 223 is higher to allow for positive stoppage of the vertical movement of the followers 191 by the upper surface of the track 158. Thus relatively small, controlled vertical travel of the followers 191 is multiplied by means of the unique carrier lifting assemblies to accurately and quickly reciprocate the containers to their various working levels in a reliable manner.

Synopsis of operation

Outlining briefly the bottom forming means for continuously processing the containers and their order of operation, a tubular container blank is loaded onto the container carrier 120 during a 23° dwell loading cycle indicated at 122 in FIG. 4. The squared tubular blanks are lowered by the carriers during a 20° fall period at which time the bottom closures are subjected to a heating cycle 124 of approximately 78 degree angular travel by means of individual heating assemblies 364, carried by an annular plate secured to the turret, for each of the fifteen working stations. The heating assembly (FIG. 10)

is particularly described and claimed in the copending application Ser. No. 636,061, filed May 4, 1967, now Patent No. 3,392,458, issued July 16, 1968, by Eric A. Braun and assigned to the assignee of the present invention.

After the container closure is heated to activate its thermoplastic coating the carrier **120** is cammed upwardly and rises during the next 35° angular movement to load the container on its individual mandrel fixed in spaced relation on the rotating turret **103** for each working station. When the carrier has reached its elevated position at the end of the 35° rise the container closure is at the position C shown in FIG. 1 where the closure is next closed by the breaking, folding and tucking apparatus **126** positioned at the beginning of the 104° dwell cycle. The folding means is particularly described and claimed in the copending application Ser. No. 634,633, filed Apr. 28, 1967, now Patent No. 3,398,659, issued Aug. 27, 1968, by Harry B. Egleston and assigned to the assignee of the present invention.

After the closure is folded the container remains at its elevated position during the remainder of the 104° dwell cycle. Within this 104° dwell cycle there is a pressure sealing operation **128** that commences at approximately 30° of elevated angular travel and continues during substantially a 72° angular travel period.

The containers are finally stripped from the mandrels during the 45° fall cycle **130** of the carriers after which the container continues around the turret in an approximate 39° dwell cycle until it is delivered to the rotary transfer unit **104** by discharge rails which delivers the container to the rotary filler **105** (FIG. 3).

Container carrier loading description

Referring generally to FIGS. 4 and 10 the containers loading operation during cycle **122** will now be described. The suction devices **115** are advanced and retracted as described in the aforementioned U.S. Patent 2,936,681, as the rotary feeder **113** functions to engage a collapsed tubular blank in the magazine **101** and to draw the blank towards the turret **113** to withdraw it from the magazine. The nozzles remain retracted until the turret has been turned to the position for discharging the tubular container C into a carrier **120** (FIG. 10) which is rotating on turret **103** in timed relation to the rotation of the feeder **113**. At this point the nozzles **115** are again advanced and retracted and cam mechanism causes the nozzles to move outwardly thereby positioning the containers between the container guides **255** of the carrier assembly **120**.

As will be noted in FIG. 4 the carrier assembly **120** is elevated to the 23° dwell period during the loading cycle. The carrier assembly **120** includes a container carrier indicated generally at **250** in FIG. 10, keyed at **249** to shaft **204**, having a movable bracket **251** mounted thereon. The bracket **251**, which comprises a plurality of suction devices **252**, is advanced and retracted radially from the turret **103**, being advanced to engage the tubular container and thereafter retracted to draw the blank against the upper and lower container rests **253** and **254**, respectively.

The aforesaid suction devices comprise, in the instant embodiment, top, center and bottom carrier nozzles threadably or otherwise secured in the bracket **251** and communicating with a vertical bore **256** in said bracket. A suitable passage **257** in shaft **204** and carrier **250** communicates with the bore **256** through a flexible conduit (not shown) to establish sub-atmospheric pressure in each suction device and the reestablishment of atmospheric or greater than atmospheric pressure in the devices at precisely timed periods in the cycle of operation of the vacuum manifold **173**. The suction devices **252** of the instant embodiments are three nozzles and each communicate with the central bore **256** by means of feeder bores **258**. To obtain a seal between the surfaces of the blank and the nozzle **252**, a flexible suction cup **259** (FIG. 11) is secured at the outer end of each nozzle.

The suction cups **259** of the nozzles are advanced so as to extend approximately 1/16 of an inch past the working surface of the upper and lower container rests when the assembly **120** is at a container pick-up position opposite feeder nozzles **115**. The bracket **251** is spring biased in its retracted position shown in FIG. 10, by means of coil springs **261** positioned around rod members **262** having one end fixedly attached to carrier **250** and their other end slidably mounted in bracket **251**. The cam **263** for operating the carrier nozzles **252** is located on the end of the pivotal bottom pressure sealing apparatus (FIG. 12), generally indicated at **500** whose operation will be described later. Suffice to say that the cam **263** moves into timed engagement with bracket **251** in response to the pressure cam **151** to extend vacuum nozzles **252** to pick up the container at the same time that the feeder nozzles **115** vacuum releases the container to the carrier nozzles **252**. This occurs when both nozzles **115** and **252** are on an exact radial centerline to each other. The cam **263** can be adjusted to change the dimension of the vacuum discs **259** past the surface of the container rests by moving the cam up on the member **500** for an increase in the dimension and down for a decrease in dimension.

It will thus be seen that by means of applicant's unique carrier assembly **120** a series of containers having the same cross-section but varying side panel heights, as shown by the quart through ½ pint series in FIG. 10, can be loaded on the carrier in operative position. In the case of the full quart container all three suction cup discs **259** will be used while the full pint container will engage only the lower two discs and the one-third quart and one-half pint containers will be retained only by the lowermost vacuum disc. A valve member **264** is located to cut-off the upper two discs during the forming of the one-half pint containers and thereby increase the holding ability of the lowermost vacuum disc. A stripper clip **265** is bolted to the outer face of carrier **250** to engage the upper edge of a container during the mandrel stripping operation to be described. To summarize, the bottom closure for any container of a preselected series of containers of uniform cross-section having different capacities will be at a common working level to allow proper closure formation by the machine of the present invention.

Heating section

The heating section **124** is described in the related copending application of Eric A. Braun mentioned in a prior paragraph, and to which reference may be had for detailed description. Very briefly, it includes a center hot air distributor head **380** and a pair of side heaters **396** mounted by means of plate **372** on the rotating annular manifold **166** (FIG. 10). Hot air is fed under pressure from the burners into inlet extensions, indicated generally at **338** and **340** in FIG. 4 into an arcuate shaped plenum chamber **300**, fixedly mounted on base **110** which communicates with the heater unit **364** by means of openings in manifold **166**. As explained in the Braun application the plenum chamber **300** is mounted on the base **110** by means of studs that spring load the upper edges of the plenum in fixed contact to the underside of the rotating manifold plate **166**. FIG. 10 shows a one quart container held by the vacuum disc **259** against the vertical container rests **253**, **254** and guides **255** to form and hold a near true rectangular or square cross-section. This is important to insure that the unbroken container closure is equally spaced from the heater side plates and the center distributor. It should be noted in this regard that the sides of the rectangular head **380** and the vertical heater walls **398** are maintained in a paralled predetermined distance from each other. The result is that when the container closure is moved down over the center distributor head applicant is able to employ a minimum of

heated air pressure while attaining accurate selective heating of the thermoplastic coating on the closure panels.

Folding section

The breaking, folding and tucking section **126** is described in the related copending application of Harry B. Egleston referred to above, and to which reference may be had for a detailed description. However, applicant does not intend to limit the instant application to the specific tucking apparatus of the above application and other types of apparatus, such as disclosed in U.S. Patents 3,166,994 and 3,187,647, for example, could be used without departing from the scope of the instant invention. As seen in FIG. 4 the disclosed apparatus comprises a pair of relatively short, upstanding spindles **451** mounted on column **452**, and arranged in laterally spaced and radially aligned position relative to the rotational axis of the turret **103**. The spindles are adapted to rotate in unison but in opposite directions with the outboard spindle rotating in a clockwise direction while the inboard spindle rotates in a counterclockwise direction. The spindles carry on their lower portion breaker fingers **453** adapted to operate on gusset panels **56** and **58** of the bottom closure and adjacent their upper ends follower blades **454** to operate on the tuck-in flap panels **55**. As explained in the copending application the follower blades have pitch-angles such that the blades are inclined toward the camming shoe member **535** which operates on the tuck-out flap panel **57**.

In this manner the heat activated closure panels are broken, folded and tucked immediately after being raised by its carrier assembly **120** to an upper working level where the tubular container is loaded on its associated mandrel **148**. In order to insure good container closure forming and sealing on mandrel caps **149** each mandrel is provided with adjustable mandrel container stops **455** (FIG. 11). Each stop has a spring loaded clip **456** the upper flange thereof is being positionable in one of a series of horizontal slots **457** in bar **458** to correctly locate the container in relation to the bottom face of the mandrel cap. The position of the stop in FIG. 12 of the instant embodiment correctly locates the full quart container with the progressively lower slots **457** arranged to accommodate the remainder of the series of containers. Diagonal ears **459** are provided to engage the interior corners of the container. Stop tabs **461** on both the leading and trailing side of the mandrel engage the upper edges of the container and can be adjusted to insure good container bottom forming and squareness.

Pressure sealing assembly

For the purpose of completing the bottom closure after the closure has been folded and tucked to the form shown in FIG. 16, the cycle **128** is provided with a pressure arm sealing assembly **500** at each of the working stations as best seen in FIG. 12. The assembly includes a pressure pad **502**, of the general type disclosed in U.S. Patent 3,207,049, issued Sept. 21, 1965 on an application of C. Z. Monroe. This application is assigned to the assignee of the subject application, and the disclosure thereof is incorporated herein by reference.

The pressure pad **502** is resiliently mounted on the support plate **503** which is secured by bolts **505** to the foot portion **506** of pressure sealing arm **508**. As seen in FIG. 5 the arm **508** is of the fork or clevis type, held rigid by brace **509**, wherein each brace is keyed to an outer end of pivot pin **526**. The central portion of pin **526** is keyed to a roller cam arm **510** extending radially through a rectangular opening **511** in housing **164**. The cam arm **510** is fixably retained to pin **526** by clamping block **513**, while its inner end is provided with an anti-friction cam roller **512** which rides in a grooved continuous cam track **514** formed in the face of fixed pressure pad cam member **151**. The cam **512** is adjustably secured to arm **510** by means of the pin **518** and lock pin **520** arrangement. A box type support **522**, having a cover plate **528**, is mounted over opening **511** on rotatable housing **164** by bolts **524**, such that the pin **526** is journably supported in aligned openings through the side walls of the box support.

The above described parts form a bell crank lever arrangement such that the assembly **160** revolves, cooperation of the cam track **514** and cam follower **512** causes swinging movement of the bell crank assembly **500** in a radial plane from the position in which it is shown in FIG. 5 to the position in which it is shown in FIG. 12, and vice versa, the pressure pad being moved into and out of registry with the mandrel **148** at the beginning and end respectively of its travel through the arc of cam **530**. As seen in FIG. 1, the cam **530** is rigidly affixed to the machine base **110**; and its track **532** is provided with an initial short inclined portion that merges with the horizontal track face **532** to smoothly receive the cam roller **538** of the roller assembly **536** mounted on the underside of pressure pad **502**. The single roller wheel **538** is rotatably supported on pin **539** journalled in support plate **503**.

As soon as the container bottom closure folding is completed by the assembly **126** and while being retained in closed position by means of the cantilevered plate **537**, the closure is contacted by the upwardly pivoting pressure pad **502**. At this same time the cam roller **538** engages and rolls on the inclined lead-in face **534**, and during this initial portion of the pressure cycle, the cam follower **512** reaches a horizontal portion on the cam track **514** that is formed by being relieved on its lower surface a sufficient amount, as shown by dimension D in FIG. 12. The result is that pressure pad **502** is completely supported on fixed cam **530** which is aligned with the path of the principal axis of the mandrel **148**.

Referring to FIG. 4, it will be noted that the cam **532** has an arcuate extent, shown by the trace lines defining the 72° arc, wherein the cam track **532** will support the pressure sealing assembly **500** and the cam track **514** will be inactive. The cam follower wheel applies an upward pressure normal to the working surface of the mandrel cap **149** and pad **502** to seal the heated and folded panels of the bottom closure as described and shown in the aforementioned Patent 3,207,049. Each pad has fluid coolant circulating therethrough via inlet and outlet passages, indicated at **546**, and connected by means of flexible tubes to the central water manifold **172**. As previously mentioned the pressure pads are floatably mounted in their support plates by suitable means, such as by vertical pins **538** having compression springs **549** therearound for example, to upwardly bias the pads into correct sealing contact with the closure wherein they can accommodate to the variations in paperboard caliper and machine tolerances.

In this regard FIGS. 17 and 18 represent a modification of the pressure sealing assembly discussed above, wherein a floating hold down assembly is used to mount the sealing cam **550** on vertical front **551** and back **552** pressure cam posts. In the following description like numerals represent corresponding elements of the basic machine. The lower end of the posts are received in front **553** and back **554** foot brackets secured to the machine base **110** by suitable means, such as bolts **556**. Bearings means **557** are mounted in vertical race members **558**, **559** to enable the pressure cam posts to be slidably displaceable. Each of the upper ends of the posts has rotatably mounted thereon a cam follower **561** adapted to ride on the cam track **562** of hold down rail **563**, bolted or otherwise secured on the periphery of upper housing ring **168** and supported by member **564**. The cam followers **561** are eccentrically mounted in holders **566** secured to the pressure cam posts to allow for exact positioning of arcuate cam track **567**.

By virtue of the floating cam **550** being rigidly affixed at each end to posts **551** and **552**, such as by bolts **568**, it will be appreciated that the vertical distance X measured between the horizontal plane of arcuate cam track **567** and the horizontal plane of upper cam track **562** will have

constant value, for all practical purposes. The importance of this fact can be seen when contrasted with the previously described embodiment of the invention wherein the arcuate cam **530** is mounted directly on base **110** as shown in FIG. 1. The result is that due to the thermal expansion of the machine and in particular the unsymmetrical expansion caused by the excess heating of the fixed portions of the machine adjacent plenum chamber **300** produced gapping to occur between the working faces of the mandrels and pressure pads with subsequent inadequate pressure sealing and ultimate failure of the container closures.

In the embodiment of FIGS. 17 and 18 this problem has been uniquely eliminated by the floating cam **550** which is allowed to expand and contract in relation to the base and with the rotating assembly **160**. In this manner the cam follower **561** and cam track **567** act to positively hold the pressure pad face in correct spaced relationship as indicated by the clearance dimension Y in FIG. 17, of the order of .012 thousandth of an inch for the instant case. It should be noted that an inclined leadin and exit faces **569** are provided to function in the same manner as inclined face **534** shown in FIG. 4.

The pressure pad assembly in FIG. 17 represents an embodiment similar to the one of FIG. 12 with the addition of a rocker plate member **571** floatingly positioned on pressure pad support **572** by spring biasing means, indicated by spring mounting pins **573**. The underside of pressure pad **574** is provided with a central dome shaped rocker button **575** which allows the pad to rock in a 360° manner to insure that the pressure pad bears evenly across the container bottom.

Mandrel stripping operation

As the container loaded mandrel approaches the stripping stage **130** the pressure pad is moved out of registry with the mandrel, to its position shown in FIG. 5, and the carrier suction discs **259** are broken of their vacuum preparatory to the 45° fall cycle of the carrier **120**. At this point the container is held on the mandrel by the frictional force of the diagonal ears portions **459** of the retainer shoe **455** long enough for the carrier stripper clip **265** to make contact with the top of the container. It should be noted that the retainer shoes **455** also prevents the pressure pad from pulling the container off of the mandrel as it is released by the arcuate pressure cam **530**.

The carrier **120** is reciprocated downwardly at the start of the fall cycle **130** but the container does not move until the stripper clip **265** contacts the top of the container. In the case of quart size containers shown in FIG. 10 the carrier would move the small distance Z, shown in the enlarged view of FIG. 19, before the clip **265** engages the upper edge of the container. For smaller size containers the distance of travel Z would, of course, progressively increase. As the carrier continues down the container also starts down the mandrel whereby the container's top edge is now located exactly on the trace line **577** at an upper position on the carrier in contradistinction to the carrier loading operation where the bottom closures are located at a lower uniform position on the carrier. The fact that all sizes of containers will be located with their top edges on line **577** means that, because of the constant vertical travel of the carrier, all size containers will arrive at the beginning of the 39° dwell cycle with their top closures at the same uniform elevation. The carrier **120** will continue to rotate in a horizontal plane to the container pick-off guide rails **580**, which operates to transfer the container from the carrier **120** to conveyor guide rails **518** of transfer unit **104** for delivery to the filling machine.

What is claimed is:

1. In a continuous motion machine for receiving, treating and discharging a container, the combination comprising:

(a) a support means;

(b) a rotary turret carried on said support means and being provided with container carrier means for receiving, transporting and discharging containers while on said turret; and

(c) said carrier means operative to receive containers of different capacities with their bottom closure at a uniform level for treatment on said turret and operative to discharge the containers from said turret with their top closures at uniform level.

2. The machine on claim **1**, wherein:

(a) said container carrier means includes a plurality of vertically reciprocable container carrier assemblies disposed in spaced apart positions about said turret.

3. The machine on claim **2**, including:

(a) means for reciprocating each carrier assembly between container receiving, treating and discharging positions at predetermined intervals.

4. The machine of clam **3**, wherein:

(a) said means for moving the carrier assemblies comprises a cam operated means.

5. The machine of claim **4**, wherein said cam operated means includes:

(a) a stationary barrel cam mounted on said support means;

(b) a multiple lever-link apparatus connected to said container carrier, and

(c) a cam follower connected to the pivot pin of said lever-link apparatus and being disposed in operative engagement with said barrel cam.

6. The machine of claim **5**, wherein:

(a) said multiple lever-link apparatus operative such that the vertical travel of said carrier is a multiple of the vertical travel of said cam follower by a ratio of substantially three to one.

7. The machine of claim **4**, including:

(a) means for disabling said cam operated means to raise selected ones of said container carriers to a fail-safe position in the event of loss of power supplied to the machine.

8. The machine of claim **7**, wherein said means for disabling said cam operated means including:

(a) a stationary barrel cam mounted on said support means,

(b) an upwardly biased cam follower disposed in operative engagement with said barrel cam for controlling the elevation of the container carriers, and

(c) said barrel cam having a retractable cam segment for altering the contour of said barrel cam.

9. The machine of claim **8** wherein:

(a) air pressure operative means to override said upwardly biased cam followers engaging said cam segment to prevent retraction thereof, and

(b) said cam segment engaging followers operative to retract said segment when the air pressure supplied to said machine drops below a predetermined value.

10. The machine of claim **9**, including:

(a) sensing means operable solely in response to retraction of said cam segment for stopping the rotation of said turret.

11. In a container treating machine,

(a) a support means;

(b) a rotary turret carried on said support means and being provided with a plurality of pressure sealing means for pressure sealing the container bottom closures while on said turret;

(c) first means operative to position said pressure sealing means adjacent the container closure subsequent to being heated and formed; and

(d) second means operative to override said first means to position said pressure sealing means into registry with the container closure wherein controlled symmetrical pressure is applied to the container closure.

12. The machine of claim **11**, wherein:

(a) said second means being floatable on said machine

wherein it is unaffected by variations in expansion and contraction between said support means and said turret.

13. In a container treating machine,
(a) a support means,
(b) a rotary turret carried on said support means having containers positioned thereon,
(c) a plurality of sealing pressure pads mounted on said turret by radially pivoting arms,
(d) a first cam means for pivoting said arms during each rotation of said turret to raise each said pressure pad to a position adjacent to container closure subsequent to being heated and formed, and
(e) a second cam means operative sequentially on each pressure pad overriding the action of said first cam means to move said pad into registry with the container closure wherein symmetrical pressure is applied to the container closure.

14. The machine of claim 13, wherein:
(a) said second cam means being floatable on said machine wherein it adjusts automatically to variations in expansion and contraction between said support means and said turret.

15. The machine of claim 13 wherein:
(a) said second cam means being supported by an external cam on said turret by eccentrically mounted followers such that the distance between the faces of said external cam and said second cam means can be adjusted for proper container closure sealing pressure.

16. The machine of claim 13 wherein:
(a) said second cam means having an inclined cam track lead-in portion to engage a cam follower on said pressure pad prior to said second cam means overriding said first cam means.

17. The machine of claim 15, wherein:
(a) said second cam means is supported by parallel vertical posts suspended from said external cam followers; and
(b) said vertical posts having their lower ends slidably supported in race members fixedly mounted on the support means.

18. The machine of claim 13 wherein:
(a) each said arm is in the form of a bell-crank lever having a cam follower connected to its radially inner arm portion and being disposed in operative engagement with said first cam means.

19. The machine of claim 13 wherein:
(a) said first cam means is a barrel cam, and
(b) said second cam means is an arcuate cam segment concentric with said barrel cam and aligned with the circular path of the containers.

20. The machine of claim 19 wherein:
(a) said barrel cam has its lower portion relieved along the arc of said arcuate cam to thereby inactivate said barrel cam during the pressure sealing operation.

21. In a continuous motion machine for heating, forming and sealing the bottom end closure panels of thermoplastic coated containers and combination comprising:
(a) a support means;
(b) a rotary assembly carried by said support means and being provided with a plurality of vertically spaced heating and sealing means for sequential heating and sealing operations on the bottom end closure panels of a thermoplastic coated container;
(c) forming means carried on said support means for forming the bottom end closure panels; and
(d) container carrier means carried on said assembly and associated with each pair of said heating and sealing means for receiving and moving a container between said heating and sealing means and wherein said forming means is operative on each container between the heating and sealing operations.

22. The machine as defined in claim 21, wherein:
(a) each said heating means being disposed at a first lower working level and said sealing means being disposed at a second upper working level; and
(b) said forming means being disposed at said second upper working level.

23. The machine as defined in claim 21, wherein said container carrier means includes:
(a) means for receiving containers of different capacities with their bottom closures at a uniform level; and
(b) means for discharging containers of different capacities with their top closures at a uniform level.

24. The machine as defined in claim 21, wherein said sealing means includes:
(a) first cam means responsive to the rotation of the assembly to move said sealing means from an inoperative position to a position for engagement with second cam means; and
(b) said second cam means also responsive to the rotation of the assembly operative on said sealing means in its second position overriding said first cam means for applying sealing pressure to the container closure.

25. The machine as defined in claim 21, wherein each said sealing means includes:
(a) radially pivoting arms on said rotary assembly having pressure pads on the outer portion thereof;
(b) a first cam means for pivoting said arms to a position adjacent the closure subsequent to the heating and forming operations; and
(c) a second cam means operative on each pressure pad overriding the action of said first cam means to raise said pad into sealing registry with the closure.

26. The machine as defined in claim 25, wherein said first cam means includes:
(a) a stationary barrel cam mounted on said support means, and
(b) each said arm is a bell-crank lever having a cam follower connected on its radially inner arm portion and being disposed in operative engagement with said barrel cam.

27. The machine as defined in claim 26, wherein said second cam means includes:
(a) an arcuate cam track mounted on said support means in alignment with the path of the containers, and
(b) a cam follower on each said pressure pad and being disposed in operative engagement with said arcuate cam track during the pressure sealing operation.

28. The machine as defined in claim 21, wherein said container means includes:
(a) a plurality of vertically reciprocable container carrier assemblies disposed in spaced apart positions about said assembly, and
(b) means for reciprocating each carrier assembly between said heating and sealing means.

29. The machine as defined in claim 28, wherein:
(a) said means for moving said carrier assembly comprise cams operated means.

30. The machine as defined in claim 29, wherein said cams operated means includes:
(a) a stationary cam mounted on said support means,
(b) a multiple lever-link apparatus connected to said container carrier, and
(c) a cam follower connected to the pivotal means of said lever-link apparatus and being disposed in operative engagement with said stationary cam.

31. In a continuous motion machine for heating, forming and sealing the bottom end closure panels of thermoplastic coated containers the combination comprising:
(a) support means;
(b) rotary feeding means carried on said support means for feeding tubular container blanks successively onto a rotary turret;
(c) said rotary turret carried on said support means and being provided with vertically spaced heating and sealing means;

(d) single forming means carried on said support means;

(e) container carrier means carried on said rotary turret for successively receiving and delivering a container to said heating, forming and sealing means; and

(f) said container carrier means operative to deliver the containers to discharging means wherein the containers are maintained in an upright positon during the entire operation.

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