United States Patent

[11] 3,590,434

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[45] Patented **July 6, 1971**
[73] Assignee **The American Packaging Corporation**

[54] **PACKAGE FORMING MACHINE**
24 Claims, 29 Drawing Figs.

[52] **U.S. Cl.** **18/19,** 18/2, 18/4, 53/184
[51] **Int. Cl.** **B29c 17/00**
[50] **Field of Search** ..... 18/19 F, 19, 19 D, 19 P, 4 C, 2 R; 53/184

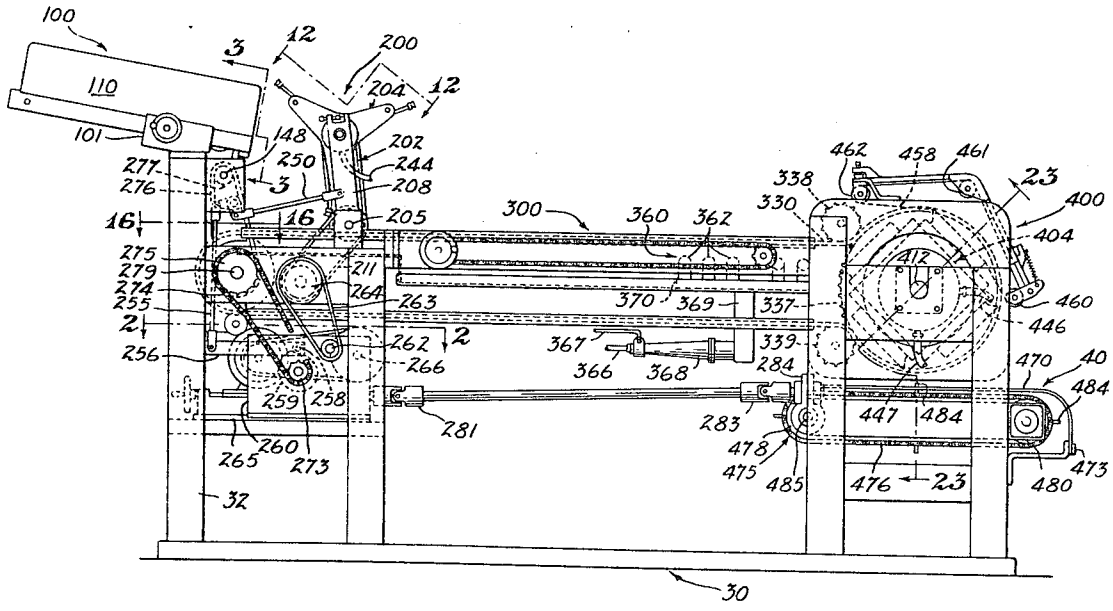
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Primary Examiner—J. Howard Flint, Jr.
Attorney—Watts, Hoffmann, Fisher & Heinke

ABSTRACT: Pockets are formed in cards with plastic windows by feeding the cards from a magazine to a conveyor, heating the plastic window while the card is conveyed, transferring the cards to forming dies on a rotatable drum and vacuum forming the pocket. The cards are fed to the conveyor by vacuum cups oscillated toward and away from the card magazine and rotated toward the conveyor. Cards are then supported by rails and moved in timed relationship with the rotatable drum and are transferred to the forming dies. Rotation of the drum sequentially controls vacuum forming of the pockets and ejection of the finished cards.



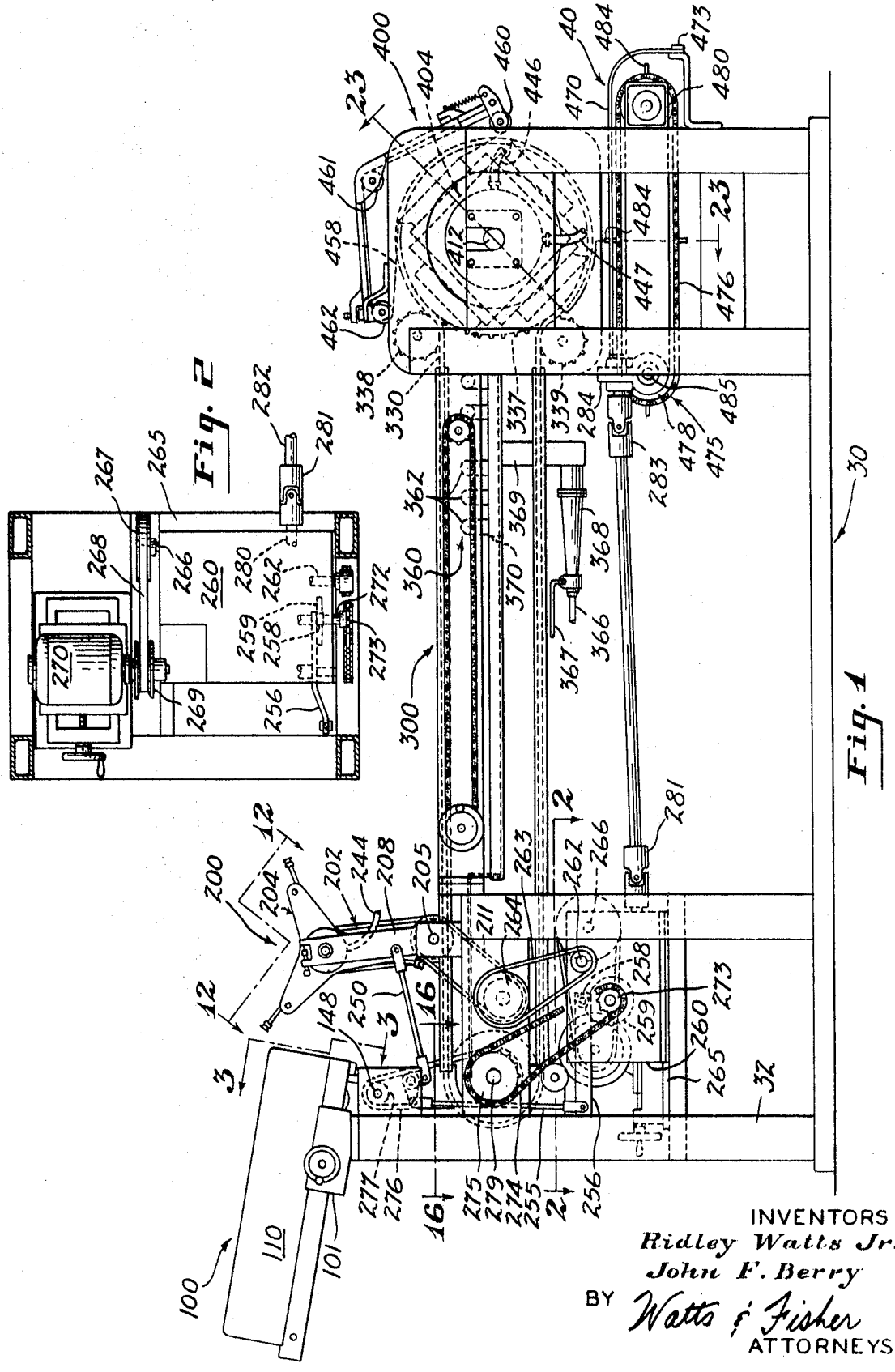


Fig. 1

Fig. 2

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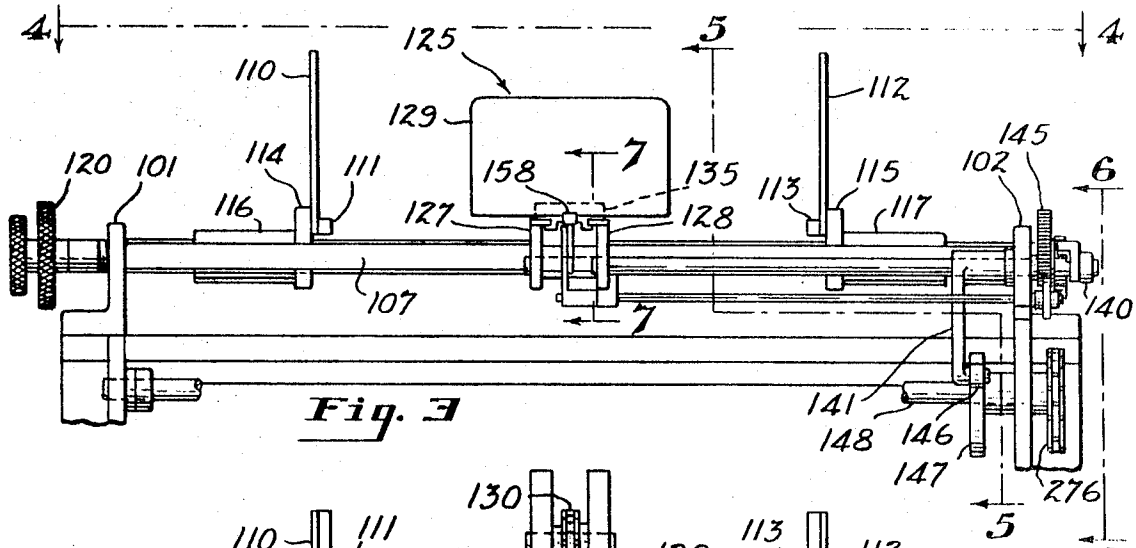


Fig. 3

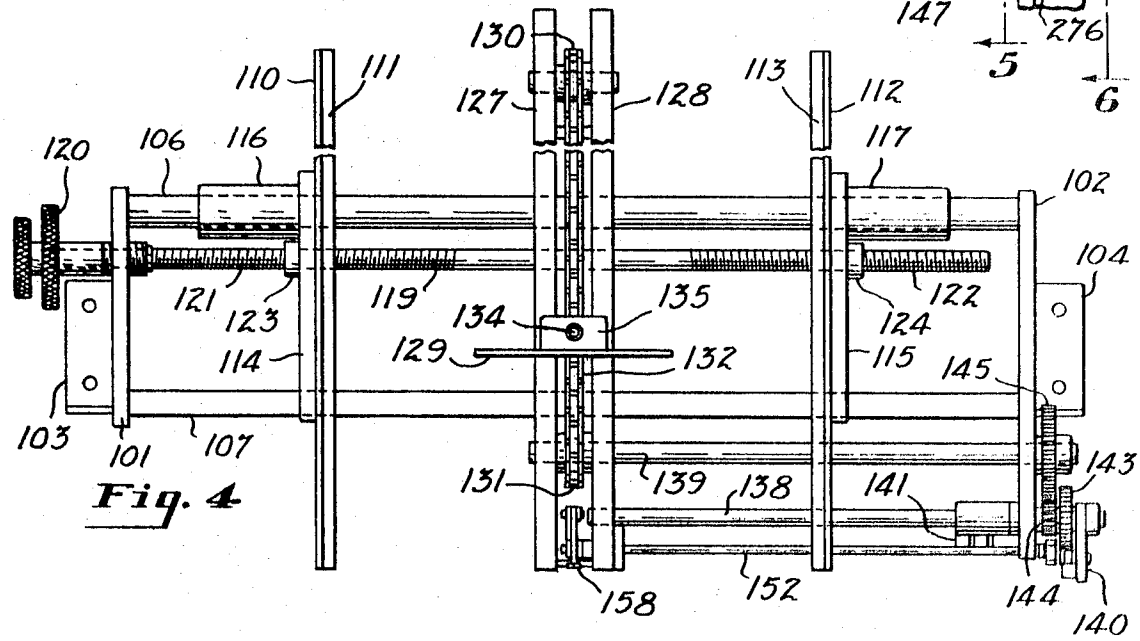


Fig. 4

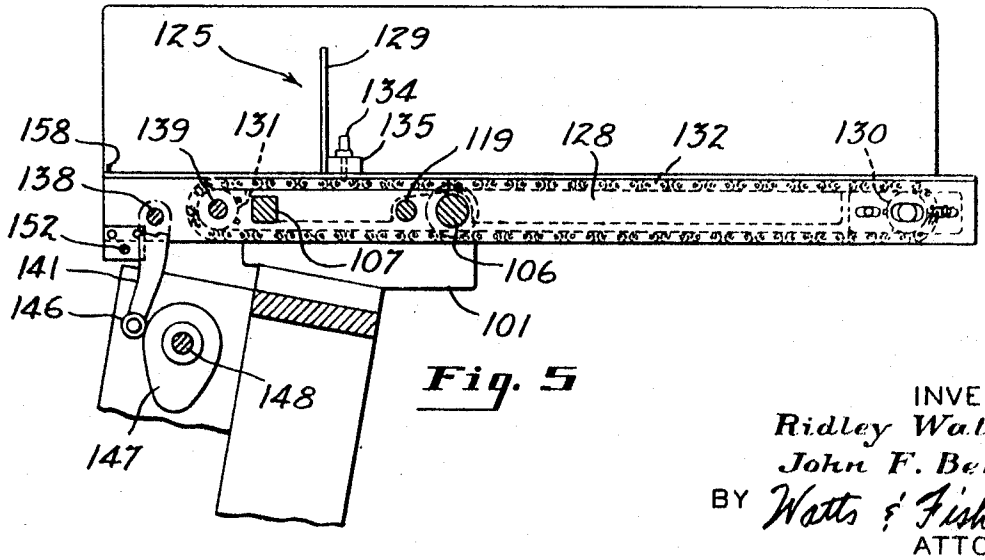


Fig. 5

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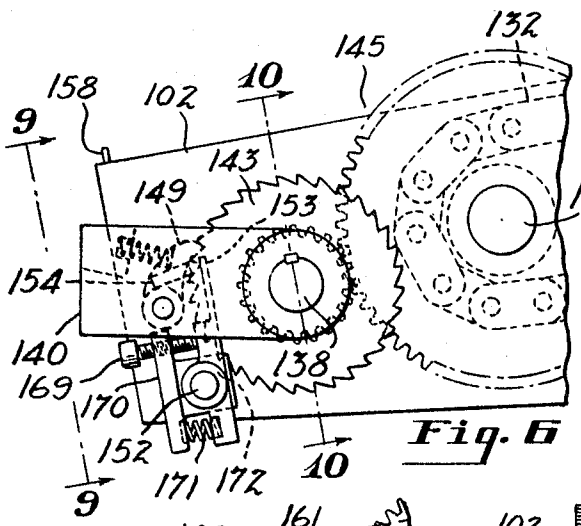


Fig. 6

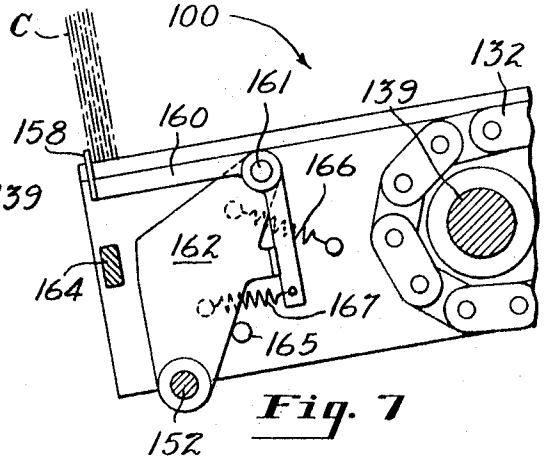


Fig. 7

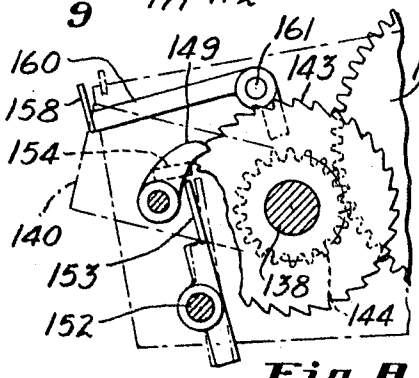


Fig. 8

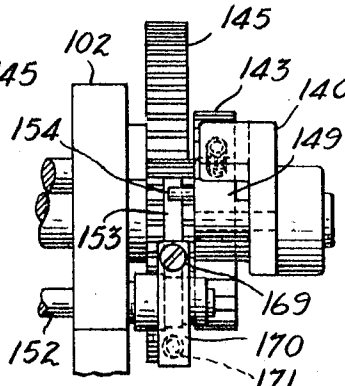


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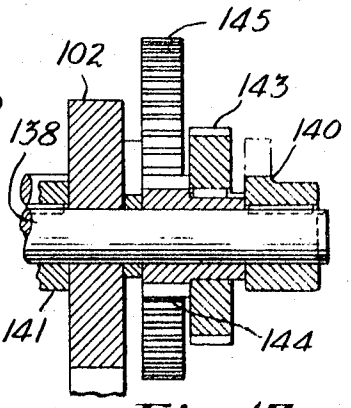


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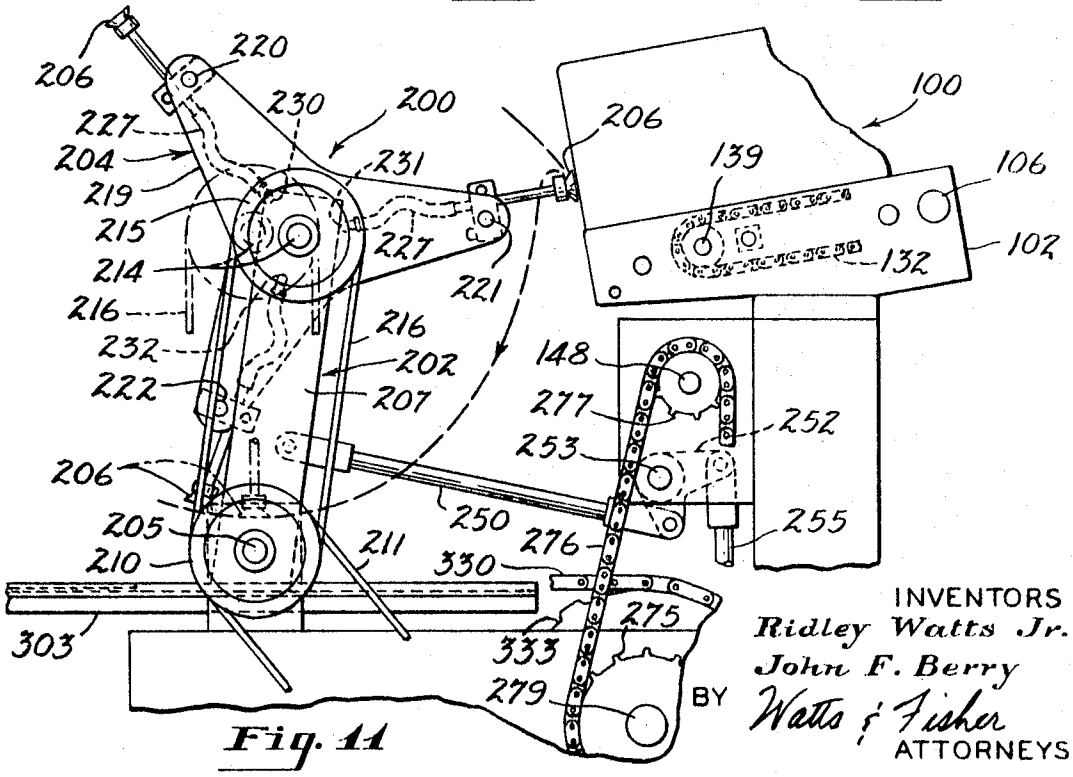


Fig. 11

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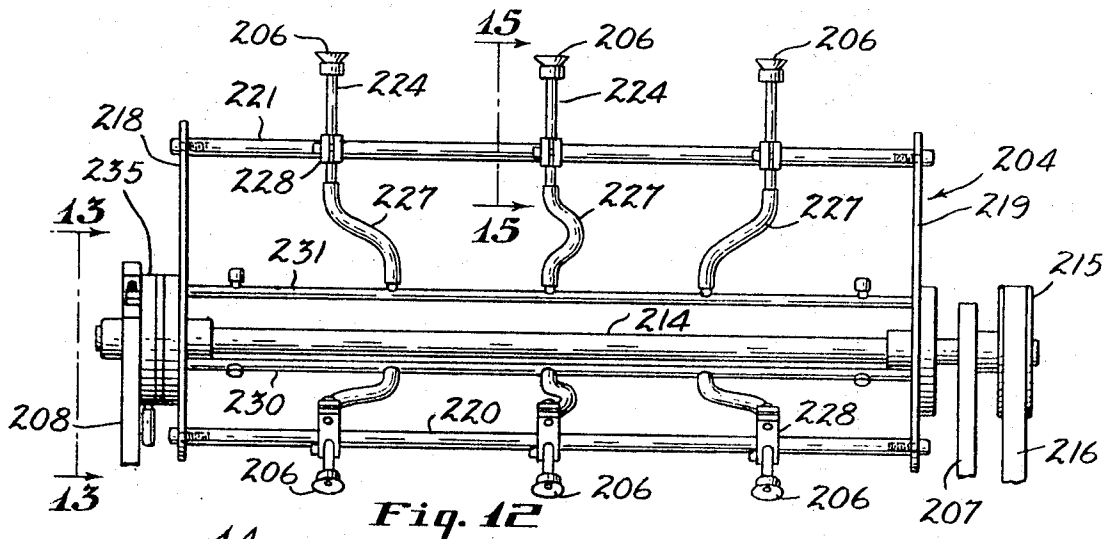


Fig. 12

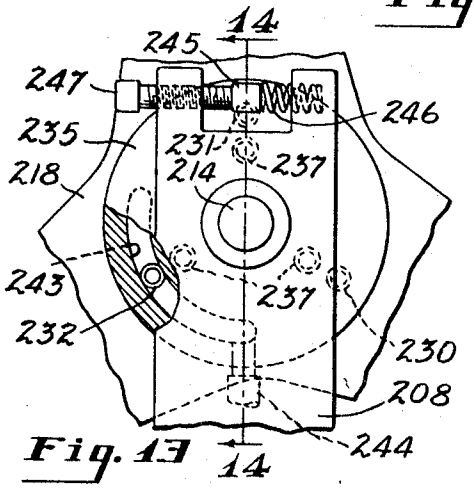


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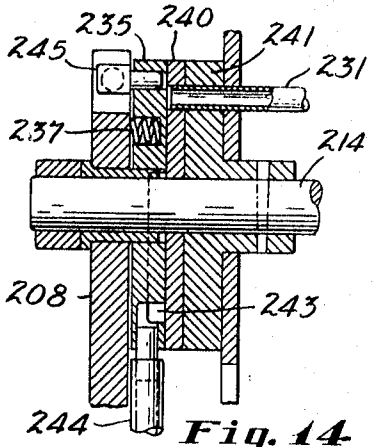


Fig. 14

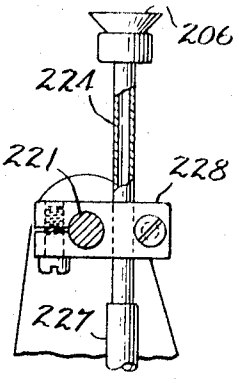


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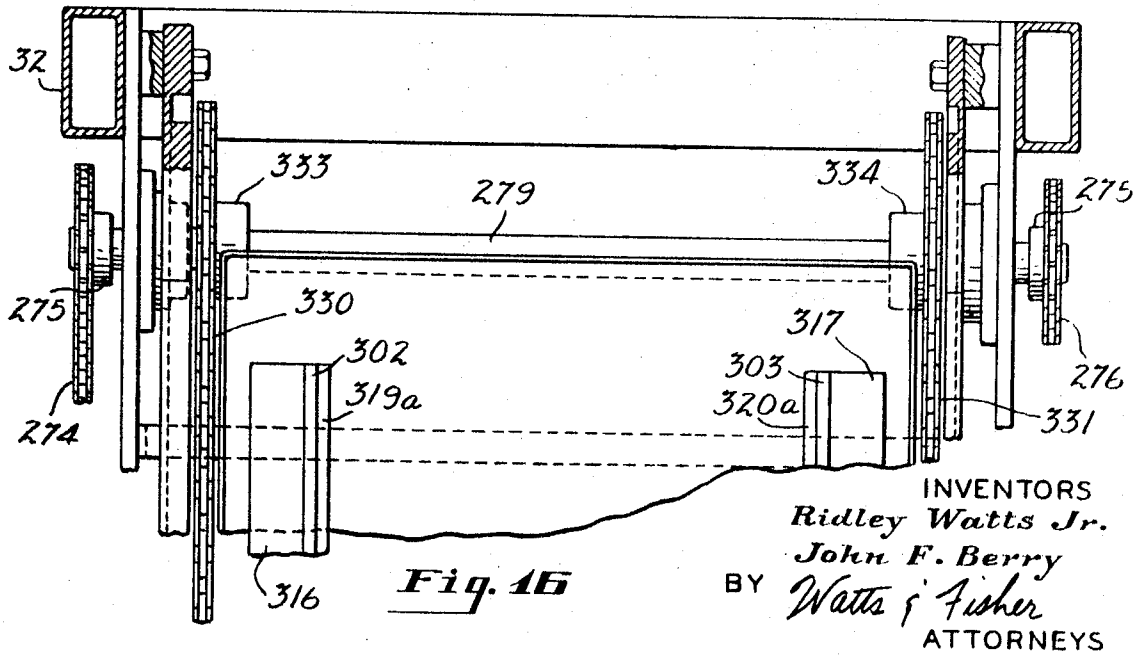


Fig. 16

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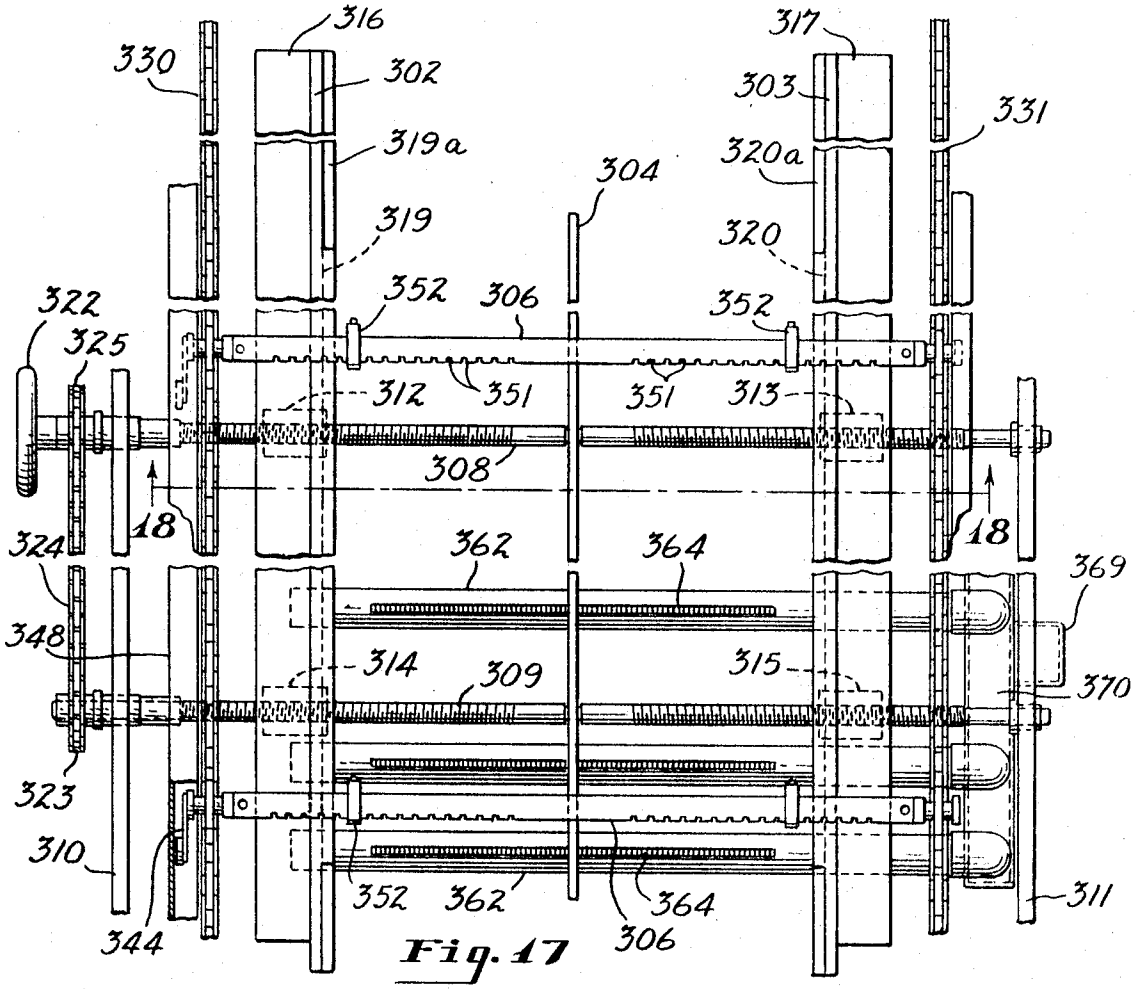


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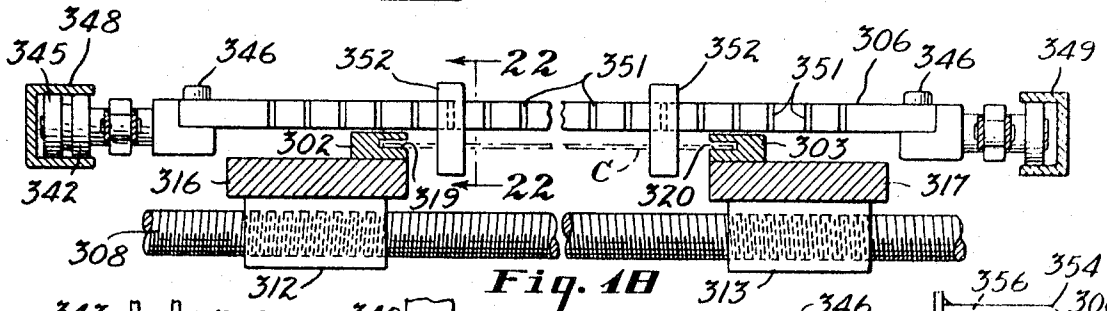


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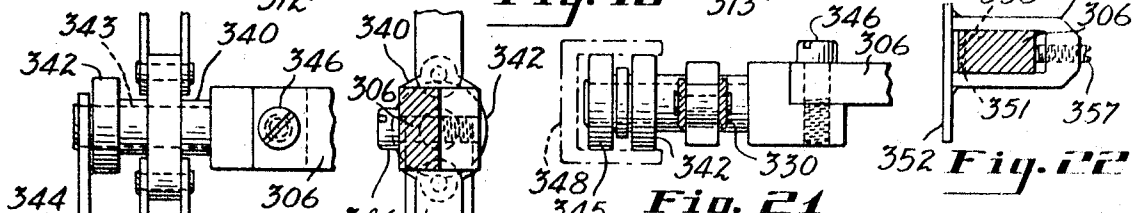


Fig. 19 Fig. 20 Fig. 21 Fig. 22

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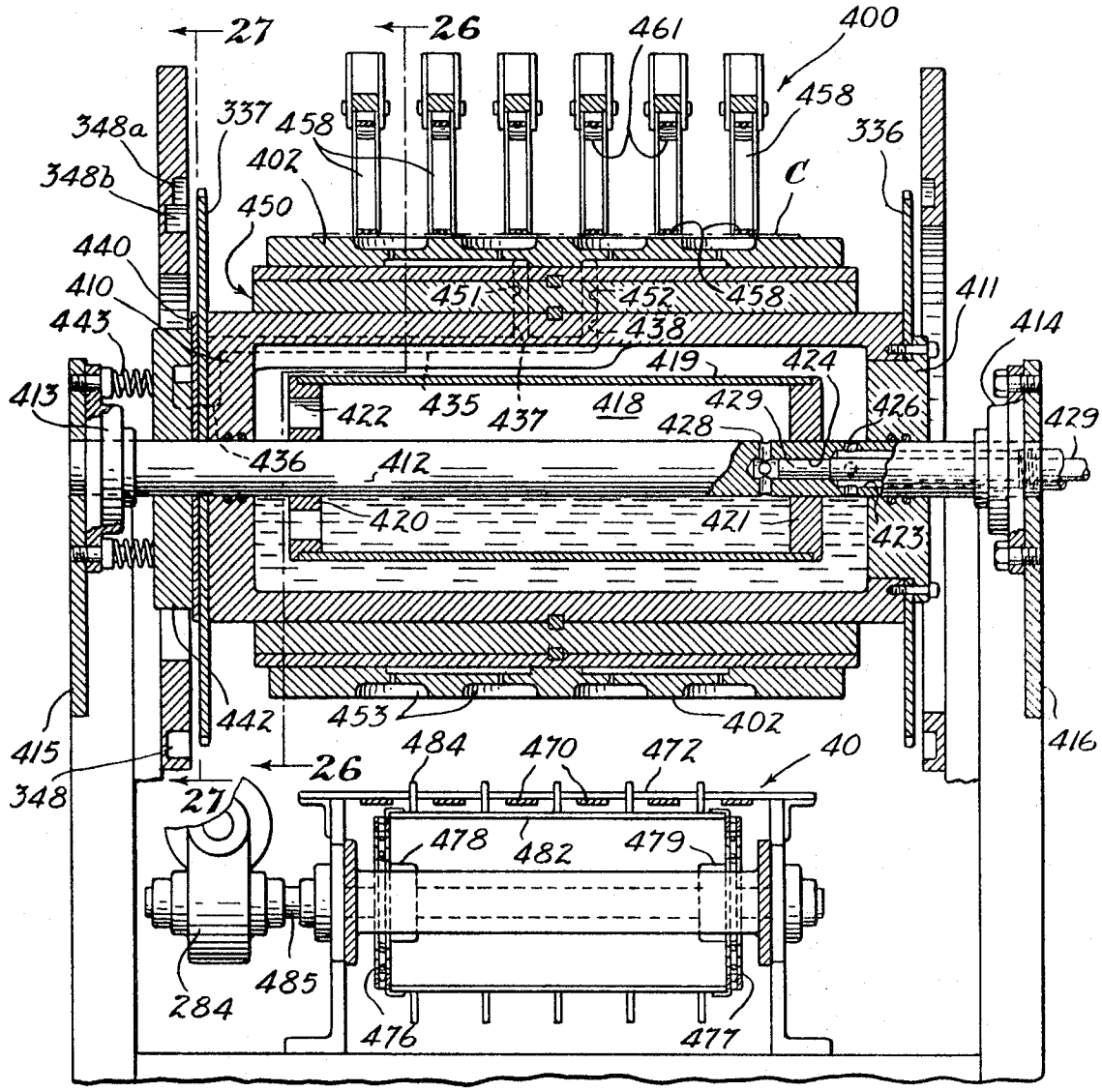


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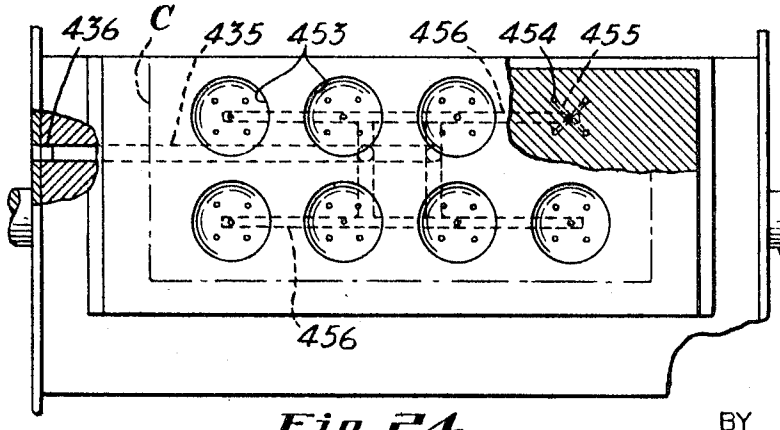


Fig. 24

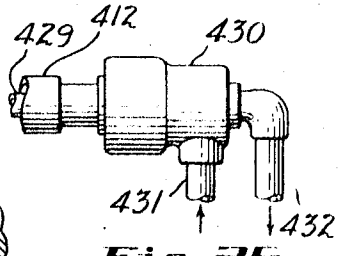


Fig. 25

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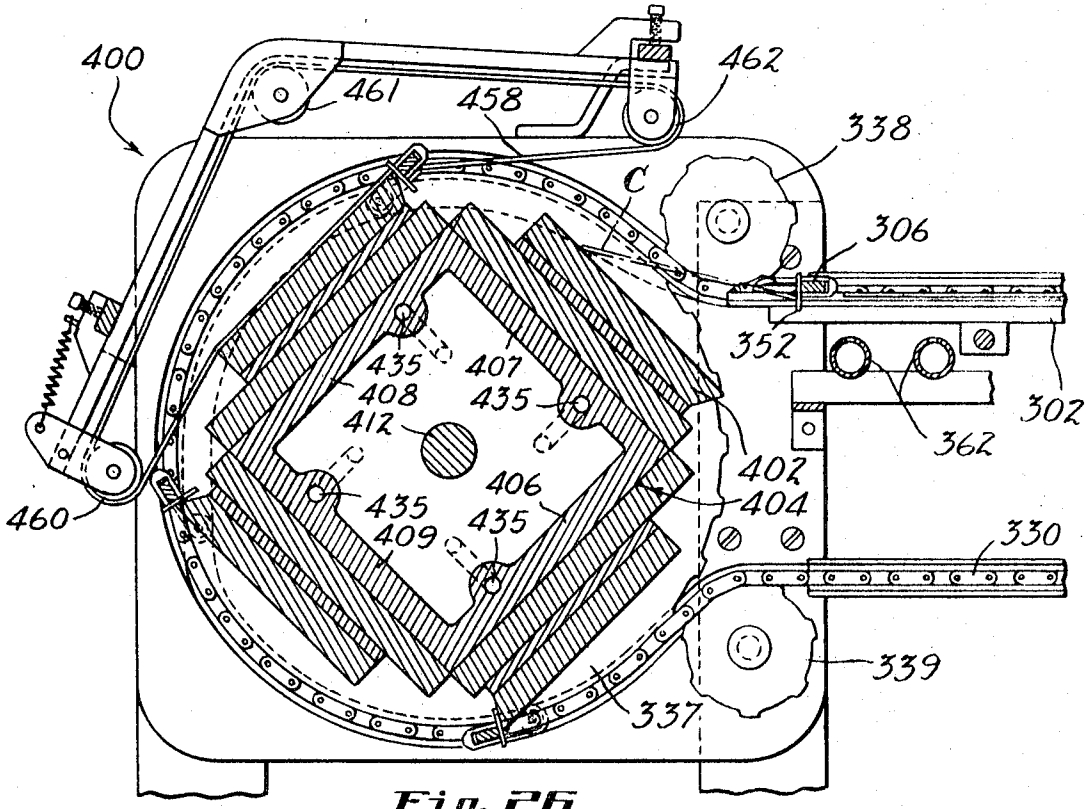


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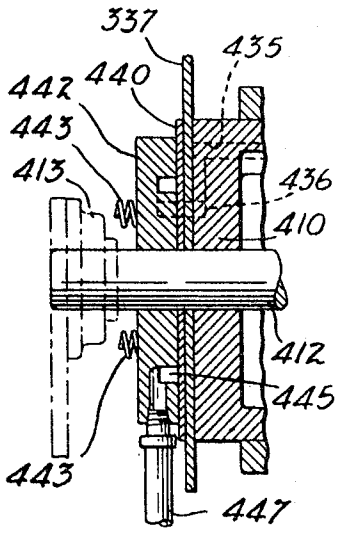


Fig. 28

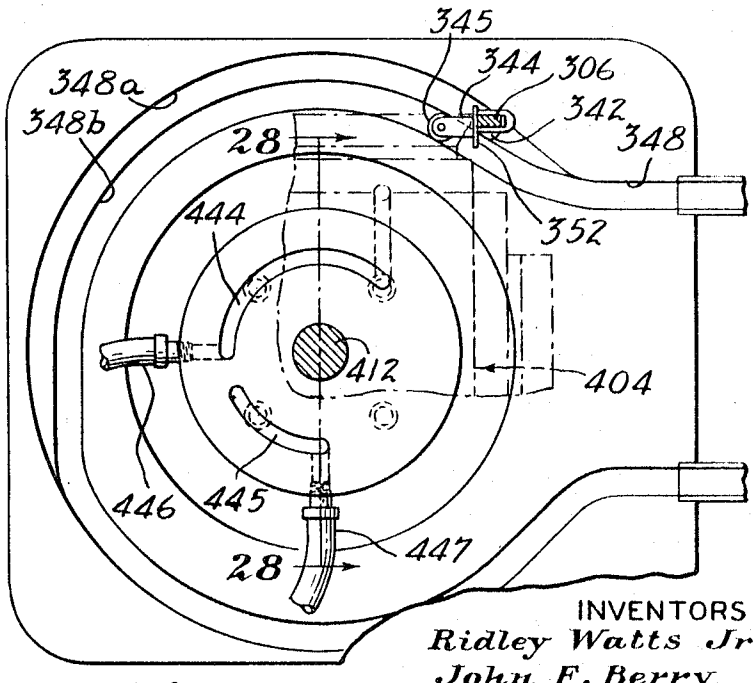


Fig. 27

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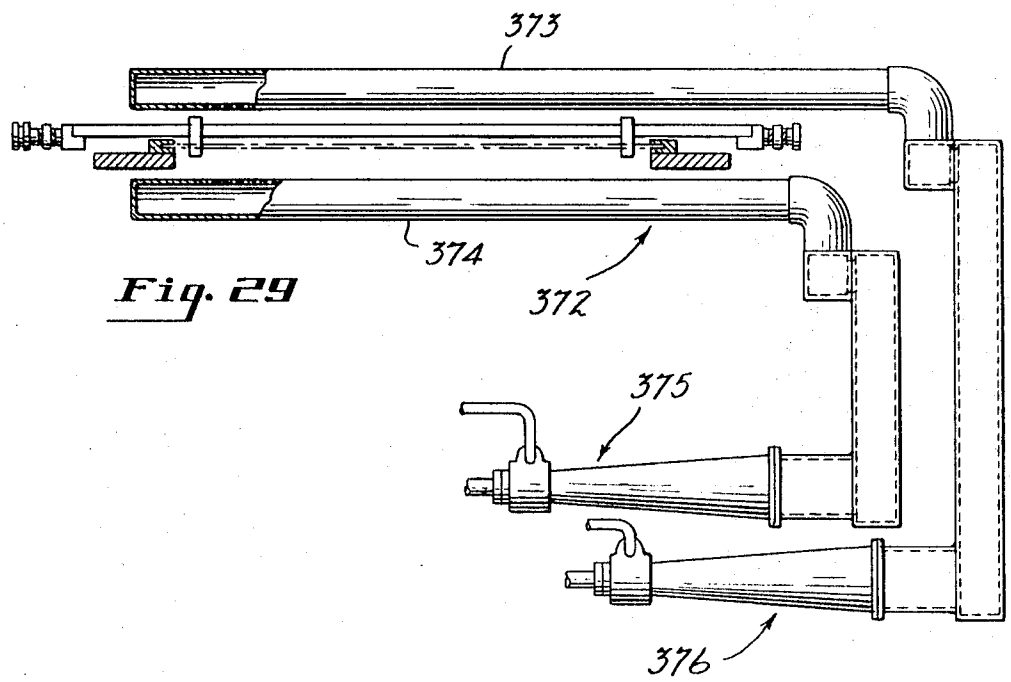


Fig. 29

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PACKAGE FORMING MACHINE

This invention relates to packaging machinery and more particularly to a machine for forming a plastic portion of a package to a predetermined contour.

In present-day merchandizing, many retail products are often packaged in separate units in order to show the products attractively against a display background which can contain artwork, illustrations of use, trademark, and price. These individual packages facilitate self-service sales, serve as protection in shipment, and deter pilferage.

One type of package which is ideally suited for retail display and other purposes, and methods of making packages of this type are described in greater detail in U.S. Pat. Nos. 3,053,023 and 3,217,465 issued respectively Sept. 11, 1962, and Nov. 16, 1965 to Ridley Watts, Jr. One of the problems met and solved by the disclosures in those patents is that of providing a technique for making an attractive and inexpensive container which can be manufactured by a packaging company and then economically shipped to a product manufacturer. The product manufacturer can economically load and seal these containers.

Both the packages described in these patents and other known packages fall into the general class in which the product is encased within the clear plastic enclosure and the plastic and enclosed products are secured to a support card.

With the package described in the Watts patents, a plastic film is secured to a card to cover and close one or more apertures in the card. The film is preformed to provide flexible, shape-retaining pockets contoured to a predetermined shape. The pockets are projectable through selected apertures and are collapsible. Once the pockets have been formed containers can be stacked tightly together for shipping and/or storage until they are subsequently loaded. On loading each product is inserted into a flexible pocket, and the container is then closed so that each product redistends its flexible pockets. Thereafter the card is sealed in a closed condition as by heat-sealing two halves of the card together.

One of the principal advantages of these containers is that a container manufacturer can economically form a wide variety of containers for a variety of different customers and products. The product manufacturer requires no equipment other than a mechanism for closing the packages and that mechanism can be a hand-stapling machine, a flat iron, or Demiautomatic or automatic sealing machinery, according to the volume needs of the customer.

In order to economically supply such containers to a variety of product manufacturers, it is important that the container manufacturer have equipment which is flexible, fast, efficient in its operation, and inexpensive to operate. The present invention is directed to a machine which meets these criteria and which is ideally suited for the formation of the containers described in the referenced patents and other containers as well.

The machine of this invention is readily adjustable to accept packages of a wide variety of both longitudinal and transverse dimensions. It is adapted to handle containers with a single pocket or any number of pairs of pockets adapted to be oriented together to encase a plurality of products in a single package. The machine is also quickly converted from one set of molds to another for quick conversion from one container to another. The machine is capable of accepting pockets of a wide variety of depths, films of a wide variety of thicknesses and consistencies, and even rigid plastic material for the formation of so-called blister packages. The machine is also readily adapted to the formation of other prior known packages.

With this machine, a feed magazine is provided in which a large number of unformed containers can be stacked. The containers are automatically fed to a feed station from which they are sequentially fed, one at a time, onto a horizontal conveyor.

As the containers are fed along the horizontal conveyor, they are heated to an appropriate temperature. The heated containers are then fed onto a forming drum by a novel feed system. crosspieces

The pockets of the containers are preformed to the desired contour on the forming drum, cooled sufficiently to set the pockets in their formed dimension, and then dropped from the drum onto a conveyor which feeds them away from the forming machine for storage, shipment, or loading.

Accordingly, the objects of this invention are to provide a novel and improved container forming machine.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims taken in conjunction with the accompanying drawings in which:

In the drawings:

FIG. 1 is a side elevational view of the forming machine of this invention;

FIG. 2 is a sectional view of a portion of the frame and drive mechanism as seen from the plane indicated by the line 2–2 of FIG. 1;

FIG. 3 is an enlarged end elevational view of the feed magazine as seen from the planes indicated by the lines 3–3 of FIG. 1;

FIG. 4 is a foreshortened top plan view of the feed mechanism on the scale of FIG. 3 and as seen from the plane indicated by the line 4–4;

FIG. 5 is a sectional view of the feed magazine as seen from the plane indicated by the lines 5–5 of FIG. 3;

FIG. 6 is an enlarged fragmentary end elevational view of a portion of the feed magazine as seen from the plane indicated by the line 6–6 of FIG. 3;

FIG. 7 is an enlarged fragmentary sectional view of a portion of the feed magazine as seen from the plane indicated by the line 7–7 of FIG. 3;

FIG. 8 is a further enlarged fragmentary view of a portion of the feed mechanism shown in FIG. 6 on substantially the same plane of FIG. 6 and with parts broken away and removed for clarity of illustration;

FIG. 9 is a fragmentary view of a portion of the container magazine feed mechanism as seen from the plane indicated by the line 9–9 of FIG. 6;

FIG. 10 is a sectional view on the scale of FIG. 9 and as seen from the plane indicated by the line 10–10 of FIG. 6;

FIG. 11 is a fragmentary, side elevational view enlarged with respect to FIG. 1, of the card feed mechanism;

FIG. 12 is a top plan view of the card feed mechanism on the scale of FIG. 11;

FIG. 13 is a fragmentary end elevational view of a portion of the card feed mechanism as seen from the plane indicated by the line 13–13 of FIG. 12;

FIG. 14 is a sectional view of the portion of the mechanism shown in FIG. 13 as seen from the plane indicated by the line 14–14 of FIG. 13;

FIG. 15 is an enlarged fragmentary view of one of the suction cups used in the container feed mechanism and as seen from the plane indicated by the line 15–15 of FIG. 12;

FIG. 16 is an enlarged sectional view showing one end of the feed conveyor in plan and as seen from the plane indicated by the line 16–16 of FIG. 1;

FIG. 17 is a shortened plan view of the conveyor feed mechanism on a scale enlarged with respect to FIG. 1;

FIG. 18 is a sectional view of a portion of the conveyor feed mechanism as seen from the plane indicated by the line 18–18 of FIG. 17;

FIG. 19 is an enlarged fragmentary top plan view of a portion of the linkage which operates the card feed bars of the conveyor mechanism;

FIG. 20 is a side elevational view of the structure of FIG. 19;

FIG. 21 is an enlarged fragmentary view of the left-hand portion of FIG. 18 on the plane of FIG. 18;

FIG. 22 is an enlarged sectional view of a portion of the mechanism as seen from the plane indicated by the line 22–22 of FIG. 18;

FIG. 23 is an enlarged sectional view of the forming drum and associated mechanism as seen from the plane indicated by the line 23–23 of FIG. 1;

FIG. 24 is a top plan view of a forming die associated with the forming drum;

FIG. 25 is a fragmentary showing of an inlet and outlet pipe connection for providing a circulating flow of water to the forming drum;

FIG. 26 is a sectional view of the forming drum taken along the line 26–26 in FIG. 23;

FIG. 27 is a side elevation view as seen from the plane indicated by the line 27–27 of FIG. 23;

FIG. 28 is a sectional view taken along the line 28–28 of FIG. 27; and

FIG. 29 is an end elevation view with parts removed and with parts shown in section of an alternative arrangement of a heating mechanism for the heating section of the machine.

Referring now to FIG. 1, a frame is shown generally at 30. The frame 30 supports a supply magazine and mechanism shown generally at 100 and visible in the upper left-hand portion of FIG. 1. A feed mechanism is shown generally at 200 and is immediately to the right of the supply magazine 100.

When the machine is in operation, the feed mechanism 200 removes container cards one at a time from the supply magazine 100. The feed mechanism 200 supplies cards, one at a time, to the conveying and heating section of the machine shown generally at 300. Containers being formed are fed longitudinally from left to right by the conveyor and heating section 300 to a forming mechanism 400. Card pockets are preformed and set to a predetermined contour by the forming mechanism and the container cards are then deposited on a discharge conveyor 40.

In the balance of this specification, the supply magazine and mechanism 100, the feed mechanism 200, the conveying and heating section 300, and the forming mechanism 400 will be described in separately identified sections, followed by a section describing the complete operation of the machine and method of forming packages.

SUPPLY MAGAZINE AND MECHANISM

A supply magazine and mechanism 100 for holding and positioning cards to be fed by the feed mechanism 200 to the conveyor 300 are best shown in FIGS. 1 and 3 to 10. Two spaced vertical support plates 101, 102 are secured by foot portions 103, 104, respectively, to spaced upright members 32 of the frame 30, as shown at the left hand side of FIG. 1 of the drawings. A round cross bar 106 and a square cross bar 107 parallel to the round cross bar 106 extend between the two vertical plates 101, 102. The square rod is located at a lower level than the round rod and is spaced forward toward the feed mechanism so that the common plane of the two rods is tilted approximately 10° from the horizontal. This orients a stack of cards held in the magazine at a similar angle.

Two spaced vertical side plates 110, 112 form the sides of the supply magazine. The plates each include a foot portion 111, 113 to support portions of the lower edges of cards in the magazine. The plates are each carried by respective mounting plates 114, 115, which are adjustable to vary the distance between the plates 110, 112 to accommodate cards of different width. The mounting plates 114, 115 are carried by bushings 116, 117, which are freely rotatable and slidable on the round cross bar 106. Portions of the mounting plates 114, 115 extend forward from the bushings 116, 117 and rest upon the square cross bar 107. An adjustment rod 119 extends through the plates 114, 115 and a locking adjustment knob 120 carried by the vertical support plate 101 is secured to one end of the adjustment rod. Oppositely threaded portions 121, 122 of the adjustment rod 119 cooperate with oppositely threaded nuts 123, 124, respectively, on the mounting plates 114, 115 to provide an adjustment in the spacing between the two side plates 110, 112 relative to a center line of the supply magazine assembly when the rod 119 is rotated.

A pusher plate assembly 125 is carried by the cross bars 106, 107 centrally of the two spaced side plates 110, 112 to advance cards in the magazine toward the feed mechanism 200. The pusher plate assembly 125 includes two spaced rails 127, 128, which support the cards in the magazine, a pusher plate 129 and two spaced sprockets 130, 131 adjacent each end of the supply magazine. An endless chain 132 is carried by the two sprockets and the pusher plate 129 is secured to the upper reach of the chain 132 by a pin 134 in a mounting assembly 135 at the base of the pusher plate. Movement of the chain 132 advances the pusher plate 129 from the rear of the magazine assembly 100 to the front, adjacent the feed mechanism 200. This in turn advances a stack of cards C oriented in the manner shown in dotted line in FIG. 7 to the front of the magazine. When the pusher plate 129 approaches the front sprocket 131, the pin 134 can be removed, releasing the pusher plate and mounting assembly 135 from the chain 132. The pusher plate is then moved toward the back sprocket 130, again secured to the chain, and additional cards are loaded into the magazine in front of the pusher plate.

Movement of the chain 132 to provide a continuous supply of cards at the front end of the supply magazine 100 is provided by a cam driven ratchet and gear arrangement that provides a positive card advance in the magazine as cards are removed from the front of the magazine by the feed mechanism 200. To accomplish this, a shaft 138 is supported in the vertical support plate 102. See FIG. 4. A spaced parallel shaft 139 is also carried by the vertical support plate 102 and extends through the rail members 127, 128. The sprocket 131 is mounted on the shaft 139.

A pawl carrier 140 is keyed to the outer end of the shaft 138. A depending cam-operated arm 141 (FIGS. 5 and 10) is also keyed to the shaft 138 at the inside of support plate 102. A ratchet wheel 143 and a connected pinion 144 are supported and are freely rotatable on the shaft 138 between the pawl carrier 140 and the support plate 102. The pinion 144 meshes with a gear 145 that is keyed to the shaft 139. Thus, rotation of the ratchet wheel 143 and pinion 144 will drive the chain 132 via the sprocket 131, shaft 139 and gear 145.

The racket wheel 143 is rotated by oscillating movement of the depending cam-actuated arm 141. As best shown in FIG. 5, the arm 141 has a cam follower 146 that rides on a single-lobed cam 147 driven at a constant speed of rotation by a cam shaft 148. The cam shaft 148 is driven from a drive and transmission which will be described subsequently. Oscillation of the arm 141 causes oscillation of the pawl carrier 140 about the common shaft 138 to which both are keyed. Clockwise rotation of the pawl carrier in the orientation of FIG. 6 causes a pawl 149 to engage the teeth of the ratchet wheel 143, causing the wheel to rotate. During the counterclockwise rotational movement of the pawl carrier 140, the pawl 149 slides over the teeth of the ratchet 143.

Although the cam 147 is continuously rotated and the arm 141 and pawl carrier 140 continuously oscillated, the pawl 149 is selectively moved out of contact with the ratchet wheel 143 when cards C are adjacent the front of the supply magazine 100. This eliminates the need for a complex supply drive arrangement coordinated between the supply magazine and the feed mechanism.

Control of the pawl 149 is accomplished with the following mechanism. A shaft 152 (FIGS. 4, 6, 7 and 8) extends through the support plate 102 and the rail 128, at the front of the supply magazine 100. At the outer end of the shaft 152, outside the support plate 102, an upstanding finger 153 is connected to the shaft 152. This finger pivots with the shaft 152 through a small distance, as indicated by the phantom position in FIG. 8 of the drawings. In the solid line position shown in FIG. 8, the finger element 153 engages a block 154 on the pawl 149, causing the pawl to pivot away from the ratchet wheel 143 on the downward or counterclockwise movement of the pawl carrier 140. As a result, the pawl 149 does not engage a lower tooth on the ratchet and does not cause the ratchet to rotate on the upward movement of the pawl carrier.

Thus, whenever the finger element 153 is pivoted from the phantom position in FIG. 8 to the solid line position, advancement of the pusher plate 129 and cards C in the magazine 100 stops.

As best shown in FIG. 7, the end of the shaft 152 associated with the pusher plate assembly 125 is pivoted in response to the presence or absence of cards C at the front end of the supply magazine. An upstanding stop member 158 engages the bottom edge of the leading card C in the stack of cards to retain the cards in the magazine. The stop member 158 is carried at one end of a bell crank lever 160. The lever 160 is in turn pivotally supported by a stud 161 at the upper end of a support plate 162. The plate 162 is supported by and keyed to the rotatable shaft 152. Two spaced stop members 164, 165 limit the pivotal movement of the support plate 162 and supporting shaft 152. A spring 166 tensions the support plate 162 against the stop member 165. A spring 167 is connected between a depending arm of the bell crank 160 and the support plate 162, biasing the stop member 158 into a position where it extends above the rails 127, 128. A stop 168 carried by the support plate 162 limits the upward movement of the stop member 158 in response to the tension of spring 167.

When an adequate supply of cards C are present at the front of the supply magazine 100 they press against the upstanding stop member 158 and pivot the support plate 162 against the stop member 164. This in turn pivots the shaft 152 in counterclockwise direction in the orientation of FIGS. 6, 7 and 8. As a result, the upstanding finger 153 is pivoted into a position to contact the block 154 carried by the pawl 149. The ratchet wheel 143 is therefore not driven by the pawl and no further advancement of the chain 132, pusher plate 129 or cards C occurs. As cards are removed from the front of the supply magazine by the feed mechanism 200, the stop member 158 and plate 162 are pivoted by the spring 166 in a clockwise direction as shown in FIG. 7. This rotates the shaft 152. After several cards have been removed, the plate 162 and shaft 152 are pivoted a sufficient distance to rotate the upstanding finger 153 out of contact with the block 154 of the pawl 149. The ratched 143 is then rotated, causing the chain 132 and pusher plate 129 to advance toward the front of the magazine. This moves the stack of cards to the front of the magazine until the stop member 158 is moved sufficiently forward to pivot the support plate 162 and shaft 152 a distance sufficient to cause the finger 153 to again engage the block 154 on the pawl 149. Adjustment of the relationship between the upstanding finger 153 and the pawl 149 is provided by an adjustment screw 169 carried by a plate 170 supported on the shaft 152. A compression spring 171 biases the finger element 153 against the adjustment screw 169.

FEED MECHANISM

The feed mechanism 200 takes cards one at a time from the supply magazine 100, carries the card and deposits it on the conveyor assembly 300. The construction of the feed mechanism is best shown in FIGS. 1 and 11 to 15. Basically, the feed mechanism includes an upright support 202 and a rotatable card carrier 204. The upright support 202 is pivotally mounted at its lower end about a shaft 205 carried by the frame 30. The rotatable card carrier is supported for rotation at the upper end of the upright support 202. The entire feed mechanism assembly is mounted in front of the supply magazine 100 and above the conveyor assembly 300. Card engaging vacuum cups 206 are carried by the rotatable card carrier and are moved through a desired path to engage a card from the supply magazine 100, remove the card from the magazine, carry the card to a position above the conveyor assembly 300 and deposit the card upon the conveyor.

The upright support 202 is comprised of two spaced, elongated, parallel arms 207, 208 pivotally supported at their lower ends about the horizontal shaft 205, which extends transversely across the conveyor 300. Each arm 207, 208 is on an opposite side of the conveyor. A double pulley wheel 210 (FIG. 11) is rotatably carried by the shaft 205 and is driven in rotation by a timing belt 211 from a drive mechanism yet to be described. A transverse shaft 214 extends between the support arms 207, 208 at the upper ends and supports the rotatable card carrier 204. A pulley wheel 215 is secured to an extending end of the shaft 214 and is driven by a timing belt 216 which is connected with and driven by the driven double pulley wheel 210.

The rotatable card carrier 204 includes two spaced plates 218, 219, which are constructed with three extending leglike portions equally spaced from each other about a central point through which the transverse shaft 214 passes. The plates are rotated by the shaft 214.

Three transverse supporting rods 220, 221, 222 extend between the two spaced plates 218, 219, one at the outer ends of each of the three leg portions. Three spaced, outwardly-extending, vacuum tubes 224 are carried by each of the supporting rods 220—222. The vacuum tubes are secured by clamping blocks 228 so that the vacuum tubes can be adjusted both about and along the supporting rods. As best shown in FIG. 12, the three vacuum tubes supported by each transverse rod are equally spaced and the middle tube is centered between the plates 218, 219. The precise location may vary, depending upon the shape and size of the cards being fed. Vacuum cups 206 are secured to the outer ends of the vacuum tubes 224 and are adapted to engage a portion of the card being removed from the supply magazine. The inner ends of the vacuum tubes 224 are connected by a flexible tube 227 to a vacuum supply tube 230, 231 or 232 carried by the associated legs of the plates 218, 219. Rotation of the transverse shaft 214 causes the plates 218, 219 and the associated vacuum supply tubes and vacuum cups to rotate about the axis of the shaft 214.

The vacuum supply tubes 230—232 are connected to a source of vacuum through a stationary control plate 235. See FIGS. 12, 13 and 14. The plate 235 is carried by the upright support arm 208 and is spring biased by three spaced compression springs 237 into face-to-face abutment with a seal plate 240 and carrier plate 241 that are rotatable with the side plate 218 of the rotatable card carrier 204. The ends of the tubes 230—232 open through the seal plate 240 adjacent the surface of the control plate 235. An arcuate groove 243 is formed in the inside surface of the control plate 235 and is connected at one end with a vacuum supply through a tube 244. The groove is located at a radial distance from the shaft 214 to coincide with the path of movement of the open ends of the tubes 230—232. The length and position of groove 243 are selected to provide communication with one of the vacuum supply tubes 230—232 during the time when one set of vacuum tubes and vacuum cups moves from a position adjacent the front of the supply magazine to a position directly above the conveyor. As best shown in FIG. 13, the arcuate groove 243 extends along slightly more than 90° of rotation of the card carrier 204. Thus, the vacuum source is connected to the vacuum cups when each set of cups arrives at the card carrying supply magazine and is cut off when the vacuum cups reach a lower vertical position directly above the conveyor.

The outer face of the control plate 235 has an extending stop member 245 positioned between a compression spring 246 and an adjustment screw 247 that are carried by the support arm 208. Adjustment of the screw 247 rotates the control plate about the axis of the transverse shaft 214. In this way, the exact location of the arcuate groove 243 can be varied to change the location at which the vacuum cups are connected and disconnected with the vacuum source.

The upright position and pivotal reciprocating movement of the upright support 202 and card carrier 204 is controlled by a rod 250 pivotally connected to the support arm 207 by a stud 251 intermediate the ends of the support arm. The opposite end of the rod 250 is connected to a shorter arm of a bell crank 252 pivotally connected to the frame by a stud 253. The longer arm of the bell crank 252 is connected to a vertical link 255, which is connected to one end of a horizontal lever 256

(see FIG. 1). The lever 256 is supported on a pivot shaft 257 and has a cam follower 258 on its opposite end. A cam 259 is rotated by a transmission 260, causing the upright support 202 to oscillate in a manner determined by the contour of the cam 259.

Each revolution of the cam 259 rocks the upright support 202 and the rotatable card carrier 204 back and forth about the horizontal support shaft 205, toward and away from the supply magazine 100. At the same time, the rotatable card carrier is rotated about the transverse shaft 214 carried at the upper ends of the upright support.

The path in which the vacuum cups 206 move and the operation of the feed mechanism can best be understood from FIGS. 1 and 11. The rotatable card carrier 204 rotates through one third of a revolution in each cycle of operation, that is, during each oscillation of the support 202 and the feeding of one card to the conveyor. The carrier 204 is rotated from a drive shaft 262 of the transmission 260. (See FIG. 1.) A timing belt 263, double pulley 264, timing belt 211, double pulley 205 and timing belt 216 transmit the rotation of shaft 262 to the rotatable card carrier 204. For each revolution of the shaft 262, the rotatable card carrier rotates through 120°. Due to the construction of the transmission 260, the rotation of shaft 262 is intermittent during each cycle.

Each cycle includes an acceleration, deceleration and dwell of the shaft 262 and card carrier 204. The movement is timed so that one set of vacuum cups of the rotatable card carrier is opposite the front end of the supply magazine 100 during the dwell period. As one set of vacuum cups rotates to a position opposite the front card in the supply magazine 100, the cam 259 rocks the lever 256, pivoting the upright support 202 toward the supply magazine 100 and places the vacuum cups directly in contact with the foremost card just as the rotatable card carrier dwells. The movement of the vacuum cups is shown by the dotted line in FIG. 11. The contour of the cam 259 then quickly reverses the movement of the lever 256 to rock the upright support 202 away from the supply magazine 100 while the rotatable card carrier is still in the dwell period. This pulls the bottom edge of the foremost card in the supply magazine 100 over the upstanding stop member 158. The stop member can be cammed downward by the card against spring 167 to release the lower edge of the card. Rotation of the card carrier 204 then begins again, carrying the vacuum cups through c120° of rotation to a lower position.

From the location at which the vacuum cups are positioned when the card carrier dwells to the lower position just in advance of the next dwell, the vacuum cups are communicated to the source of vacuum through the groove 243 in the control plate 235. Further rotation through a few degrees by the card carrier just as the card carrier begins to dwell carries the vacuum supply tube of the vacuum cups holding the card beyond the groove 243. This disconnects the vacuum, causing the card carried by the vacuum cups to drop onto the conveyor 300 directly beneath the feed mechanism 200. At the same time, the next row of vacuum cups has been placed in position at the supply magazine 100.

The gear box 260, as best shown in FIGS. 1 and 2, is mounted on a support plate 265 carried by the frame 30. An input shaft 266 is driven by a pulley 267 and belt 268 from a pulley 269 attached to an electric motor 270. A constant speed output shaft 272 (i.e., constant output for a constant input speed of input shaft 266) of the transmission is connected to the cam 259 and to a sprocket 273. The sprocket 273 drives a chain 274, in which in turn drives a sprocket 275, chain 276 and sprocket 277 fastened to the cam shaft 148. The intermediated sprocket 275 is mounted on a horizontal shaft 279 and provides a drive for the conveyor assembly 300.

A second constant speed output shaft 280 extends from the transmission gear box 260 and is connected by a universal 281 to a drive shaft 282. The drive shaft 282 is connected by a second universal 283 to a helical gear drive 284 for a discharge conveyor 40.

The third output shaft 262 of the transmission 270 rotates intermittently during each rotation of the constant speed output shaft. This shaft drives the card carrier 204 as already explained. The construction of a transmission suitable for driving one or more shafts at a constant output speed and an additional shaft in an intermittent manner is shown and described in the copending application of John F. Berry entitled Packaging Machine and Method, Ser. No. 445,386, filed Apr. 5, 1965.

CONVEYOR AND HEATING SECTION

Referring now to FIGS. 1 and 16 to 22, two longitudinally extending spaced side rails 302, 303 and a central rail 304 receive and support cards fed by the feeding mechanism 200 from the supply magazine 100. Movable bars or flights 306, which extend transversely across and above the rails, are moved along the rails to push cards from the feed mechanism over a heating unit and to the forming mechanism 400.

The three rails 302, 303, 304 are supported by transversely extending adjustment rods 308, 309, which are in turn carried by side plates 310, 311 secured to the frame 30. The adjustment rods 308, 309 are journaled for rotation in the side plates and each rod includes two oppositely threaded portions that cooperate with oppositely threaded nuts 312, 313 and 314, 315 associated with each rail 302, 303. The nuts 312—315 are secured to the lower sides of elongated supporting plates 316, 317 (see FIG. 18) to which the side rails 302, 303 respectively, are secured.

Each rail 302, 303 has an inwardly facing groove 319, 320, respectively, along the major portion of its length. The top portion of each track that forms the groove is removed along that portion of the track directly beneath the feed mechanism 200. This is best shown in FIG. 17 where an open portion of each groove is indicated at 319*a* and 320*a*, respectively. The open portions of the grooves receive cards from above from the feed mechanism 200. Each card is then moved forward by a card feed bar 306, positioning the longitudinally extending opposite edges of each card within the grooves 319, 320, as best shown in FIG. 18.

The spacing of the side rails 302, 303 is adjusted by a hand wheel 322 connected to the adjustment rod 308. Adjustment rod 309 is rotated from the hand wheel 322 by a sprocket 323 driven by a chain 324 from a similar sprocket 325 connected to the shaft of the hand wheel 322. Rotation of the adjustment rods moves the rails 302, 303 in a transverse direction to the conveyor, changing the spacing between the rails to accommodate cards of different widths.

Two endless chains 330, 331 are arranged with upper reaches extending parallel to, slightly above and to the outside of the tracks 302, 303. The chains are driven by respective sprockets 333, 334, which are keyed to the shaft 279 adjacent the front end of the machine, beneath the supply magazine 100. At the opposite end of the machine, the chains 330, 331 encircle large diameter sprockets 336, 337, which drive a rotatable forming die support of the forming mechanism, to be described subsequently. Two upper guide sprockets 338, one on each side of the rails, and two lower guide sprockets 339 are located adjacent the large diameter sprockets to maintain the upper and lower reaches of the endless chains 330, 331 parallel and in proper alignment along the conveyor and heating section 300.

The card feed bars 306 are secured at each end to the chains 330, 331 by link elements 340 (FIGS. 19 and 20), which permit the bars or flights to pivot about their central longitudinal axis. A roller 342 is journaled for rotation on an outwardly extending shaft 343 of each link element 340 on both chains 330, 331. In addition, the link elements 340 connected in chain 330 include an arm 344 secured to the end of the shaft 343. A second roller 345 is secured to the end of the arm 344. The inner end of the shaft 343 is fastened to the end of the feed bar 306 by a screw 346. Rotation of the arm 344 and shaft 343 extending through the link element 340 rotates

the bar 306 about the central longitudinal axis of the bar. The orientation of the bar is controlled during movement along the conveyor section 300 and forming mechanism 400 by a channel 348 in which rollers 342, 345 of chain 330 ride. A channel 349 on the opposite side of the conveyor guides rollers 342 of chain 331.

Each card feed bar 306 is provided with a plurality of closely spaced vertical grooves 351 in the front or leading surface of the bar. These grooves 351 serve to locate and position card engaging fingers 352 that extend in a plane generally perpendicular to the back edge of a card and transversely of the direction of chain movement. Portions of the fingers depend from the card feed bars to engage the back edge of a card supported by rails 302, 303.

Each finger 352 is secured to the front of a yoke 354 (see FIG. 22) with arms that extend above and below the feed bars 306. A key 356 extends from the back of each finger 352 within the arms of the yoke 354. The key 356 is receivable within the grooves 351 and serves to positively locate the card engaging fingers in one of the grooves. The yoke 354 has enough depth to permit the fingers to be moved forward a sufficient distance to remove the key 356 from the slot 351. A set screw 357 at the back of the yoke 354 maintains the key 356 within a selected groove 351 when the fingers are properly positioned on the bar for a given card size. Preferably, the fingers are located adjacent the rails 302, 303, where the greatest friction and resistance to sliding occurs.

With this arrangement, the cards deposited from the feed mechanism 200 onto the portion 319*a*, 320*a* of the rails 302, 303 and onto the central rail 304 are engaged along a trailing edge by fingers 352 of a card feed bar 306. The bar 306 is moved from behind the feed mechanism 200 by the chains 330, 331 to engage a card and move it along the conveyor 300, through a heating zone and then to the forming mechanism 400. The longitudinally extending side edges of the card extend into the grooves 319, 320 as soon as the card is pushed forward from the rail portions 319*a*, 320*a*.

A heating unit, indicated generally at 360, is located along the path of the conveyor, between the feed mechanism 200 and the forming mechanism 400. In the embodiment shown, the heating unit includes five transversely extending burner tubes 362 located beneath the rails 302, 303. An opening or openings 364 are provided along the upper surface of each burner tube 362 across a portion of the width of the conveying path of the cards to apply heat to a plastic window portion of the card, which is to be formed. An air conduit 366 and a gas conduit 367 supplying gas and air under pressure to a mixing chamber 368, from which the combustible mixture is supplied via a conduit 369 to a manifold 370 to which the tubes 362 are connected.

The number and arrangement of the burner tubes depends to a great extent upon the size and construction of the cards to be formed into packages and upon the speed at which the cards are conveyed. In addition, the thickness of the plastic material and the transparency of the plastic material to radiant heat may require a greater or lesser number of burners to supply sufficient heat to soften the plastic to the necessary extent for forming.

An alternative embodiment of a heating unit 372 is shown in FIG. 29 of the drawings. In this embodiment, upper burner tubes 373 as well as lower burner tubes 374 are provided above and below the conveying path. Separate air and gas inlet assemblies 375 and 376 are provided for the upper and lower burner tubes so that the heat may be independently adjusted. This arrangement may be particularly desirable where thick sheets of plastic are used, which require more heat to soften. With heat applied from both above and below, the time needed to soften the plastic to the extent necessary for forming is reduced.

FORMING MECHANISM

The forming mechanism is best shown in FIGS. 1 and 23 to 28.

Cards heated by the heating unit 360 are conveyed to the forming mechanism, where they are received upon forming dies 402 supported by a rotating die support 404. While the cards are supported and moved on the dies the heated plastic window portions are vacuum formed to a desired shape and cooled.

The rotating die support 404 is a boxlike affair having four rectangular sides 406, 407, 408, 409, two end walls 410, 411 and is square in transverse cross section. The die support 404 is supported for rotation about its longitudinal central axis on a transverse shaft 412 that passes through the end walls. The transverse shaft 412 is journaled at each end for free rotation in bearings 413, 414 attached to side plates 415, 416 supported by upright members of the frame 30.

A chamber 418 is provided within the die support member 404 by peripheral wall 419 and spaced end walls 420, 421. The end walls 420, 421 encircle the transverse shaft 412 and the peripheral wall 419 is spaced from the sides 406—409 of the die support 404. The end wall 420 of the chamber 418 has a plurality of openings 422 so that the chamber 418 communicates with the inside of the die support 404.

One end of the transverse shaft 412 includes a large diameter bore 423 and a smaller diameter bore 424 that extends from the inner end of the bore 423 farther along the axis of the shaft 412. The larger bore 423 terminates within the die support 404 and outside of the end wall 421 of the chamber 418. Ports 426 extend through the wall of the shaft 412 in communication with the large bore 423 to provide passageways between the larger bore and the inside of the die support 404. The small bore 424 terminates within the chamber 418 and has ports 428 that communicate between the interior of the chamber 418 and the smaller bore 424. A tube 429, which fits tightly within the smaller bore 424 extends from the smaller bore through the larger bore 423 and out the end of the shaft 412. A coupling 430 is attached at the outer end of the shaft 412 and connects the larger bore 423 with a water inlet pipe 431 and connects the tube 429 with a water outlet tube 432. With this arrangement, cooling water is introduced through the larger bore 423 and ports 426 and flows in contact with the inner walls of the die support 404. The water flows into the chamber 418 through the opening 422 in the end wall 420, into the ports 428 to the tube 429 and thence out through the coupling 430 and water outlet tube 432. The coupling 430 permits the transverse shaft 412 and the die support 404 to rotate.

It will be apparent that the die support 404 is of considerable volume. Because of this volume the die support can, in the absence of cooling, absorb and dissipate substantial quantities of heat. This heat dissipation is enhanced if the die box is made from a material which is a good heat conductor such as aluminum.

It has been discovered that in many pocket forming operations it is desirable to warm rather than cool the die support. Accordingly the water chamber 418 may properly be termed a temperature control chamber into which fluid is introduced. The fluid controls the temperature of the dies so that the heated plastic remains plastic long enough to be properly formed but is thereafter cooled sufficiently quickly to "freeze" the plastic in its newly molded shape before the container is dropped onto the discharge conveyor 40.

A conduit 435 extends longitudinally partway along the length of each side 406—409 of the die support 404. Each conduit 435 communicates through an opening 436 in the end wall 410 of the die support 404 and also through two openings 437, 438 in the respective side wall 406—409, centrally of the wall. The openings 436 of the conduits 435 communicate through the sprocket 337 and a seal plate 440 to a nonrotary control disc 442. The control disc 442 has an inner surface that abuts the seal plate 440 and slides with respect thereto. The control disc 442 is spring biased by compression springs 443 against the seal plate 440.

Two arcuate grooves 444 and 445 are formed on the inner face of the control disc 442, and are positioned as shown in FIG. 27. The groove 444 extends through approximately 130°

of rotation of the die support 404 and communicates via a flexible tube 446 to a vacuum source. The groove 445 is positioned subsequent to the groove 444 in the direction of rotation of the die support and extends through approximately 70° of rotation of the die support. The groove 445 communicates to a source of air pressure through a flexible tube 447. Both grooves 444 and 445 are located radially from the central axis of the transverse shaft 412 a distance equal to the radial distance of the openings 436 of the conduits 435. In this way, the openings 436 communicate with the grooves 444 and 445 during rotation of the die support 404.

A die support plate 450 (FIG. 23) is fastened to each side 406—409 of the die support. The support plates 450 each have conduits 451, 452 that communicate with the openings 437, 438 of the conduits 435 in the sidewalls of the die support. A forming die 402 is fastened to each support platen 450. The precise design of the forming die depends upon the package to be formed. In the embodiment shown, a package is being formed to hold four objects that will extend beyond the plane of the folded card on each side of the card after the card is folded in half about a center line. See FIG. 24.

Eight spaced cavities 453 are provided in the upper surface of the forming die 402. Four openings 454 are provided in the bottom of the cavities 453. These openings communicate through small bores 455 to a larger U-shaped manifold bore 456. A manifold bore 456 is provided for each four of the cavities and communicates directly with one of the conduits 451, 452 through the support platens 450. With this arrangement, each cavity 453 communicates with an associated conduit 435 in the die support and is connected through an opening 436 with each of the arcuate grooves 444, 445 during rotation of the die support 404. From FIGS. 26 and 27 it can be seen that during rotation of the die support 404 in a counterclockwise direction starting at the top, the cavities 453 will first be subjected to a vacuum and then to a positive gas pressure. The vacuum draws the heated plastic window into contact with the cavities to form pockets. The positive gas pressure then ejects the formed card from the die.

As best shown in FIG. 26, the endless chains 330, 331 encircle the large sprockets 336, 337 on opposite sides of the conveyor. The chains are held in close proximity to the rails 302, 303 by the pairs of guide sprockets 338, 339. The coordinated relationship of the rotating die support 404 with the movement of the card feed bars 306 is shown in FIG. 26. As the card, shown in phantom and indicated at C, is pushed from the grooves in the tracks 302, 303 the front edge is received on a forming die 402, which rotates into a generally horizontal position as it receives the card. The card engaging fingers 352 position the back edge of the card into alignment with the back edge of the die. At this point, the forming die is connected with the vacuum source through the arcuate groove 444, holding the card firmly in place and forming the heated plastic portion of the card into pockets.

Endless belts 458 are positioned above and spaced across the width of the die support member 404. Each of the belts are trained around three supporting rollers 460, 461, 462 to form the belts 458 into generally triangular-shaped contours, as shown in FIG. 26. The length of belt 458 passing between rollers 460 and 462 intersects the path of rotation of the forming dies 402 on the die support 404. The wheels 460 for each belt 458 are pivotally mounted and resiliently biased to tension the belts. With this arrangement, the belts press down upon the cards C after the cards have been properly located upon the forming dies 402 and as the cards are rotated by the support 404. This assures that the cards remain properly seated during the forming operation. The lowermost pulleys 460 are positioned at approximately the horizontal midplane of the die support 404. Contact between the belts 458 and the cards on the forming dies ends before the dies reach an upside down position as shown in FIG. 26, at which time the positive air pressure is applied to the die cavities to remove the formed and cooled card from the forming die.

As shown in FIGS. 26 and 27, the card engaging fingers 352 are maintained substantially perpendicular to the plane of the card C and in contact with the trailing edge of the card and forming die 402 as the card is positioned on the forming die and rotated about a circular path with the rotating die support. This is accomplished by the shape of the groove 348, which receives the two rollers 342 and 345 carried by chain 330. As shown in FIG. 27, the channel 348 divides into two channels 348*a* and 348*b* of different radius and depth. Roller 345 attached to the end of arm 344 follows channel 348*b* while roller 342, which is axially aligned with the card feed bars 306 follows shallower groove 348*a*. The arrangement of the grooves pivots the arm 344 and also the card feed bars 306 relative to the link elements 340 so that the orientation of the fingers 352 is changed relative to the chain but maintained essentially fixed relative to the plane of the card being pushed. In this way, the card is moved by the chain and the card engaging fingers 352 in a fixed relationship with the moving forming dies 402. The fingers 352 guide the card C to proper position on the forming die 402 and thereafter provide a rear abutment in contact with the trailing edge of the forming die during the rotation of the die support 404. The belts 458 in no way interfere with the upper extending portions of the fingers 352, because the fingers are positioned between or to the sides of the spaced belts.

As best shown in FIGS. 1 and 23, a discharge conveyor 40 is located beneath the forming mechanism 400. Spaced, longitudinally extending fixed support strips 470 provide a surface to receive cards from the forming mechanism. The strips 470 are supported at each end by crosspieces 472, 473, which are secured to the frame 30. As shown in FIG. 1, the strips 470 are essentially horizontal through the major portion of the their length beneath the forming mechanism 400, and curve downward at the far end of the apparatus.

An endless chain conveyor 475 is formed by two spaced endless chains 476, 477 supported at one end by two drive sprockets 478, 479 and at the other end by idler sprockets, one of which is shown at 480 in FIG. 1. Four conveyor bars 482 extend between the two chains 476, 477 and are equally spaced along the length of the chains. Fingers 484 extend from the conveyor bars 482 outwardly, away from the chain, so as to project upwardly between the support strips 470 as the bars pass beneath the supports strips. As previously explained, the sprockets 478, 479 are driven from the transmission 260 by the drive shaft 282 and suitable gearing 284. The gearing 284 drives a shaft 485 to which the drive sprockets 478, 479 are fastened.

Cards deposited on the longitudinally extending support strips 470 from the forming mechanism 400 are engaged by the upstanding fingers 484 of the bars 482 and moved along the support strips 470 to the right hand end of the apparatus as shown in FIG. 1, where they are received by a hopper or other handling mechanism (not shown).

SUMMARY OF OPERATION

An incline stack of cards is provided in the supply magazine 100. The electric motor 270 is started, causing the pusher plate assembly 125 to advance cards C to the forward end of the magazine, in abutment with the upstanding stop member 158. The chains 330, 331 of the conveyor are driven by the chain 274 and sprockets 333, 334. These chains 330, 331 move the card feed bars and rotate the die support apparatus 404.

The rotatable card carrier 204 is rotated intermittently from the output shaft 262 of the transmission 260 and is oscillated about the support shaft 205 by the link 250 in response to rotation of the cam 259 of the transmission 260. The rotatable card carrier 204 rotates one-third of a revolution for each oscillation of the support 202. During this rotation, the card carrier dwells as one set of vacuum cups is directly opposite the lower edge of cards held in magazine 100. At this time, the oscillation of the upright support 202 has brought the vacuum

cups into contact with a card. Suction is applied to the vacuum cups in contact with the card when the card carrier has rotated to this position. The upright support then osciliates the support away from the magazine 100 to remove the card held by the vacuum cups. The rotatable card carrier 204 then resumes rotation to swing an engaged card by the vacuum cups to a position directly over the tracks 302, 303, 304 of the conveyor. The vacuum to the vacuum cups engaging the card is cut off as the vacuum cups reach a lower position of rotation. At the same time, another set of vacuum cups carried by card carrier 204 has approached the next card in the magazine 100 and the rotatable card carrier is slowing down to dwell. The first engaged card is released and the card carrier is further rotated to a position where the next set of vacuum cups is connected by the associated vacuum supply tube 230—232 to the vacuum.

The card that is released upon the tracks 302, 303, 304 rests on the lower portions 319*a*, 320*a* of the grooves 319, 320. Movement of the chains 330, 331 brings a card feed bar 306 into position behind the card supported on the tracks 302, 303. The card engaging fingers 352 on the feed bar 306 engage the trailing transversely extending edge of the card and advance it along the rails 302, 303, 304. The longitudinally extending edges of the card are engaged in the slots 319, 320 of the rails. As the card is advanced over the heating unit 360, which is positioned just in advance of the forming mechanism 400, the plastic window portions of the card are heated and softened. Continual feeding of cards by the feed mechanism 200 and continuous movement of the chains 330, 331 causes successive, spaced feed bars to engage successive cards deposited on the conveyor and move them in spaced relationship to the forming mechanism.

The card is next moved by the card feed bars into position to be received by a rotating forming die 402 that is rotated in timed relationship by the chains 330, 331 with the movement of the card feed bars 306. Thus, as the card feed bars continue to advance the card beyond the termination point of the rails 302, 303, as shown in FIG. 26, the card is picked up by the top surface of a moving forming die 402. The card engaging fingers 352 are maintained in proper relationship with respect to the trailing edge of the card C by the roller 345 and arm 344 following the track 348*b*. When the forming die 402 that has received the card C reaches a horizontal position as shown in phantom in FIG. 27, the vacuum source from tube 446 and arcuate groove 444 is connected with the cavities 453 of the forming die. This creates a differential pressure on opposite sides of the heated window and draws the hot, softened plastic of the window area of the card into the cavities 453 to form the windows in a desired predetermined shape. The dies are cooled to below the softening temperature of the plastic by the water circulated within the die support 404. The cooler dies lower the temperature of the formed pocket in the window area of the card so that the plastic retains its distended dimensions.

Further rotation of the die support brings the forming die around to an upside down position above the conveyor 40. At this time, the conduits to the die cavities are connected to a source of air under pressure through the arcuate groove 445, assuring a positive ejectment of the finished card from the forming die. The card is received on the support strips 470 of the conveyor 40 and the rear edge of the card is engaged by fingers 484 moving longitudinally between the support strips 470, moved to the end of the apparatus and collected by a suitable hopper or other mechanism.

With the present construction a nd arrangement cards can be automatically fed from a magazine, deposited upon an endless conveyor and continuously moved through a heating zone in preparation for forming. The heated cards are received by a moving forming dies, formed and cooled while moving, and are thereafter automatically ejected. As a result, it is not necessary to start and stop the conveyor while the plastic window is formed into a pocket or bubble and cooled. Nor are special adapters shaped to the particular package needed to permit the pocket to be formed while the card is supported on the conveyor. In addition, the cycling time is not dependent upon the time needed to form the pocket, as is the case with intermittent single station forming machines. Rather, by the use of a plurality of continuously moving forming dies, adequate time is allowed for the forming and cooling cycle while yet rapidly and continuously moving successive cards along the conveying path.

While in the foregoing disclosure a preferred embodiment of this invention has been described in detail, it will be apparent that numerous modifications or alterations may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

We claim:

1. Apparatus for forming pockets in plastic window portions of card-type packages, comprising:
   a. a magazine for holding a stack of cards having window portions to be formed to a predetermined contour,
   b. means to move cards in the magazine toward one end of the magazine,
   c. feed means adjacent said one end of the magazine to engage and remove cards singly from the magazine and transport them to a conveyor,
   d. conveying means adjacent the feed means for receiving cards removed from the magazine and for transporting cards along a processing path,
   e. forming means movable in a path partially along said processing path and in part coincident with the path along which the cards are moved by the conveyor,
   f. means to operate said conveyor means and to move said forming means in timed relationship to position a card moved by said conveyor on the moving forming means,
   g. means to operate said forming means while said conveyor and forming means are moving to form the plastic window portion of a positioned card to a predetermined shape, and
   h. means to heat the plastic window portion along the processing path in advance of a location at which the cards are positioned on the moving forming means.

2. The apparatus of claim 1 wherein the means to move cards in the magazine includes a pusher plate carried by an endless chain, a ratchet and pawl drive connected with the chain to advance the endless chain and pusher plate toward the said one end of the magazine, rotating cam and lever to actuate the pawl, and means to selectively disengage the pawl from the ratched to stop advancement of the endless chain while the cam continues to rotate.

3. The apparatus of claim 2 including means to sense cards at the said one end of the magazine and to cause the pawl to be disengaged in response to the presence of the cards at a predetermined location at the said one end of the magazine.

4. The apparatus of claim 1 wherein the feed means includes a vacuum cup adapted to engage a card in the magazine, said cup being supported for rotation about a first axis and for arcuate movement about a second axis parallel to the first axis, means to rotate the vacuum cup about the first axis and means to oscillate the vacuum cup and first axis about the second axis.

5. The apparatus of claim 4 wherein the means to rotate the vacuum cup about the first axis rotates the vacuum cup intermittently.

6. The apparatus of claim 5 wherein the means to oscillate the vacuum cup and first axis includes cam means for oscillating the vacuum cup and first axis while the vacuum cup is stationary relative to the first axis.

7. The apparatus of claim 4 including means to connect and disconnect the vacuum cup to a vacuum source in response to rotation of the vacuum cup about the first axis.

8. The apparatus of claim 1 wherein the conveyor includes fixed support and guide means for receiving, supporting and guiding a card deposited by the feed means, and driven movable means to engage and move a card along the support and guide means.

9. The apparatus of claim 8 wherein the support and guide means includes two spaced rails having inwardly directed grooves extending in a common plane along a predetermined path and adapted to receive opposite edges of a card.

10. The apparatus of claim 9 wherein the driven movable means includes an endless loop having an upper reach adjacent the plane of the tracks, a card-engaging element moved by the upper reach of the endless loop and extending through the plane of the tracks adapted to engage a trailing edge of a card supported by the rails, and means to move the upper reach of the endless loop relative to the tracks.

11. The apparatus of claim 10 including means associated with the card engaging element to maintain the element in a predetermined relationship with the plane of the card.

12. The apparatus of claim 1 wherein the means to heat the plastic windows includes a heating unit extending beneath the conveyor in advance of the forming means relative to the movement of the cards.

13. The apparatus of claim 12 wherein the heating unit includes gas burner tubes.

14. The apparatus of claim 1 wherein the forming means includes a plurality of forming dies, a rotatable support for the forming dies, and means mounting the support for rotation.

15. The apparatus of claim 14 wherein the forming means includes means for exhausting gas from a cavity in a forming die to vacuum form a plastic window to the shape of the cavity, means for cooling the forming die and means for introducing gas under pressure to the cavity in the forming die.

16. The apparatus of claim 15 including means to connect the cavity to a vacuum source and to a source of gas under pressure in response to rotation of the rotatable support for the forming die.

17. The apparatus of claim 15 wherein the means for cooling the forming die includes an enclosure formed by the rotatable support for the forming dies and means to circulate cooling water to and from the enclosure.

18. In apparatus for conveying, heating and forming card-type packages having window areas of thermoplastic material: a conveyor, including longitudinally extending card support rails; an endless loop extending along the conveyor and drivingly connected with a rotatable forming means in line with the conveyor, said forming means having a plurality of forming dies; card engaging means carried by the loop for engaging and moving cards along the conveyor; and means to drive the loop and thereby move a card and rotate the forming means in synchronism therewith, said forming means being constructed and arranged to intersect the path of movement of cards moved by the endless loop as the forming means is rotated and to receive on a forming die a card moved from the rails by the card engaging means.

19. The apparatus of claim 18 including means along the conveyor to heat the window areas of cards, means associated with the forming means and forming dies to vacuum form the heated window areas to a predetermined shape, and means to cool the formed window areas.

20. The apparatus of claim 18 including a plurality of endless belts mounted on a stationary support and constructed and arranged to cooperate with the rotating forming means to press a card being formed into close contact with a forming die.

21. Apparatus for forming pockets in plastic window portions of card type packages, comprising:

a. conveying means to move individual, spaced, cards along a predetermined path,

b. means adjacent said conveying means for enlarging the plastic window portions of moving cards to provide a pocket, said means including pocket forming means movable along a path in part coincident with the path of said conveying means to receive cards moved by said conveying means and to carry said cards along a portion of said processing path while enlarging said window portions, and

c. means to move the forming means in timed relationship with cards moved by said conveying means so that cards are received by said forming means where the paths of said forming means and conveying means are coincident.

22. The apparatus of claim 21 including means adjacent the conveying means to heat the plastic windows as the cards are moved to the forming means.

23. The apparatus of claim 1 wherein said magazine for holding a stack of cards comprises spaced side guides and a bottom support adapted to hold a plurality of cards, means mounting the bottom support at an angle from the horizontal so that the cards form an inclined stack and the bottom support and the stack have a lower end and an upper end, a stop adjacent the lower end of the bottom support positioned to engage a lower portion of a card at the lower end of the stack to retain the cards in a magazine, and means to move cards on the bottom support toward the lower end of the bottom support; and wherein said feed means includes card engaging means adjacent said magazine, means supporting the card engaging means for movement in an arcuate path about a first axis of rotation, means supporting the card engaging means for movement about a second axis of rotation parallel to the said first axis of rotation, means to intermittently rotate the card engaging means about the first axis of rotation, and means to oscillate the card-engaging means about the second axis of rotation toward and away from said magazine.

24. The apparatus of claim 21 wherein said forming means includes dies, a support for said dies rotatable about an axis transverse to the direction in which said conveying means moves cards, said dies being secured to said support and spaced peripherally, with outer surfaces adapted to receive cards moved by said conveying means, means interconnecting said conveying means and said support for concurrent interrelated movement, and means adjacent said support for retaining cards on the outer surface of each forming die during a part of the rotation of said support.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,590,434 Dated July 6, 1971

Inventor(s) Ridley Watts Jr. and John F. Berry

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 47, "Demiautomatic" should be -- semiautomatic --
Column 2, line 4, "crosspieces" should be omitted.
Column 4, line 41, "racket" should be -- ratchet --.
Column 5, line 41, "ratched" should be -- ratchet --.
Column 7, line 46, before "120°" delete "c".
Column 7, line 67, after "274," delete "in".

Column 13, line 71, "dies" should be -- die --.
Claim 2, line 7, "ratched" should be -- ratchet --.

Signed and sealed this 8th day of February 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

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