

Feb. 21, 1939.

F. E. BICKFORD

2,147,632

PACKAGING AND PACKAGE-MAKING MACHINE

Filed July 23, 1937

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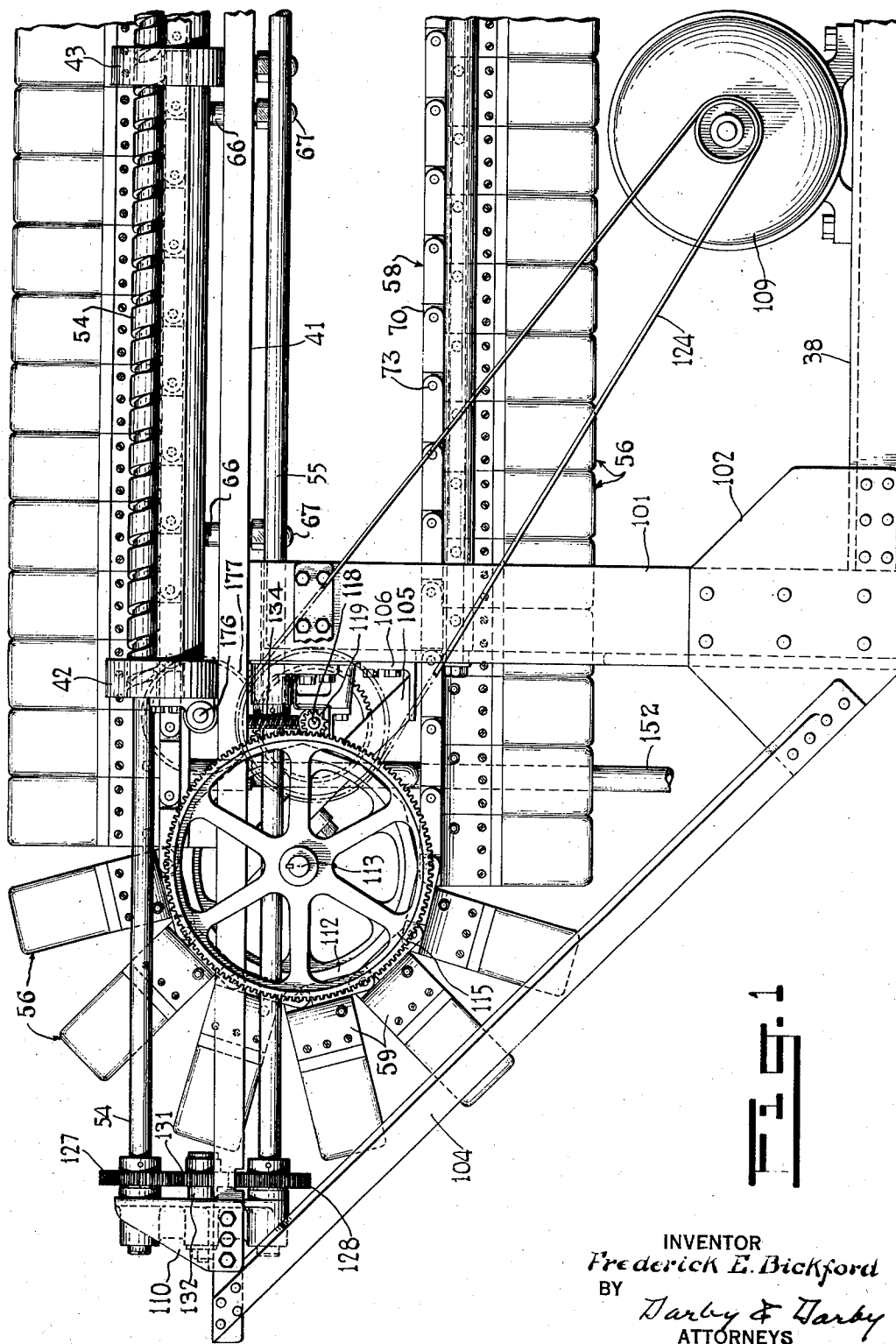


Fig. 1

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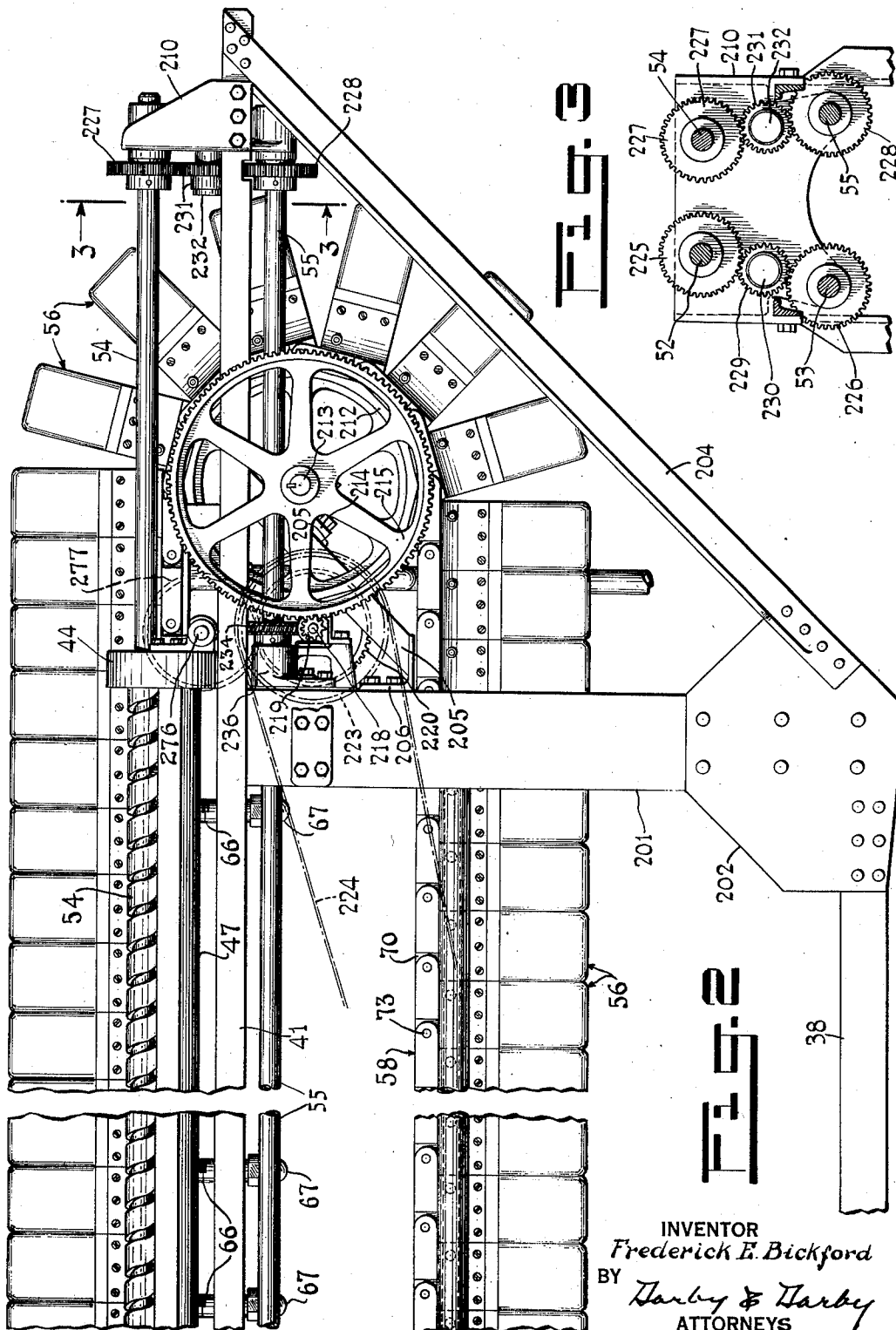
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PACKAGING AND PACKAGE-MAKING MACHINE

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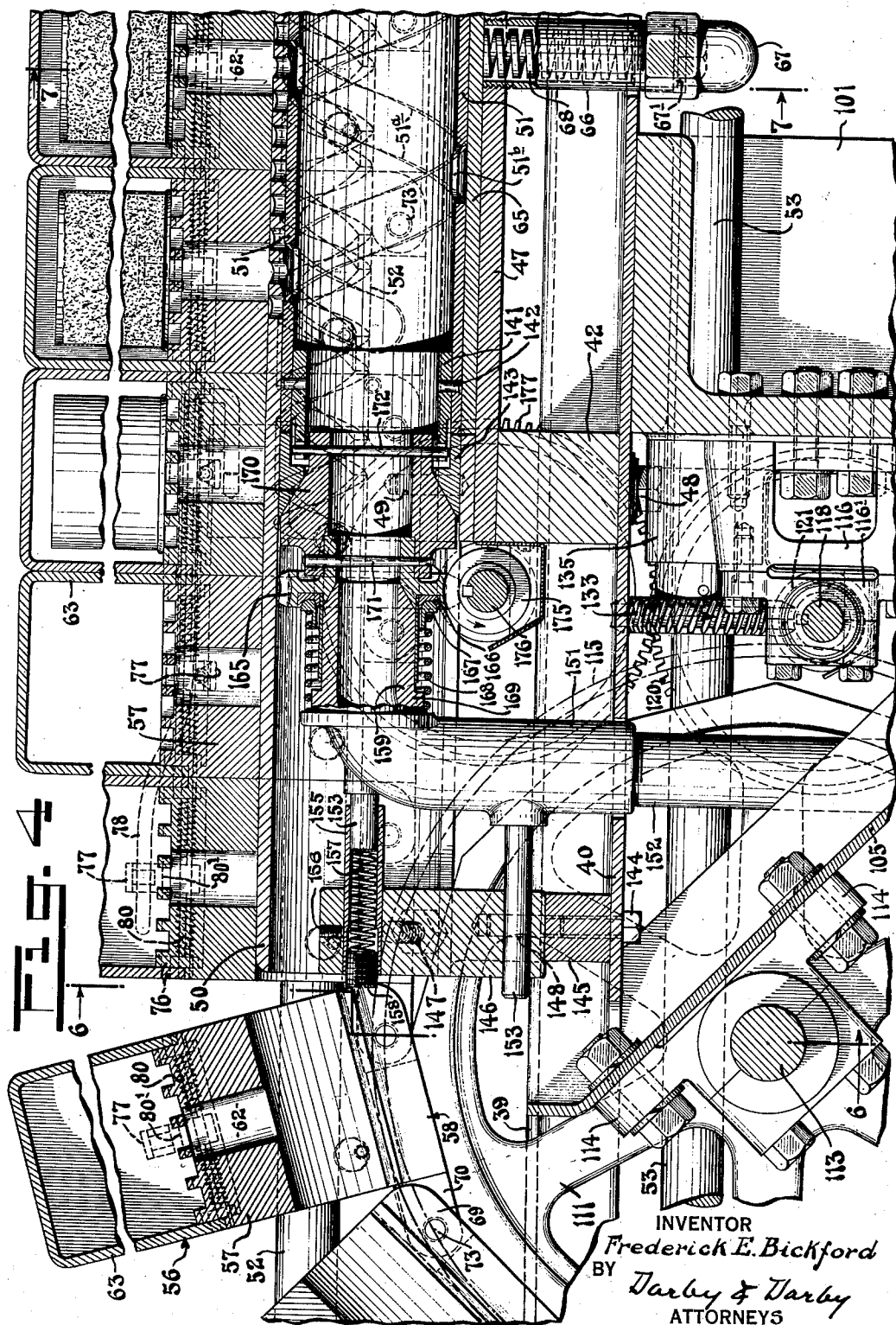
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PACKAGING AND PACKAGE-MAKING MACHINE

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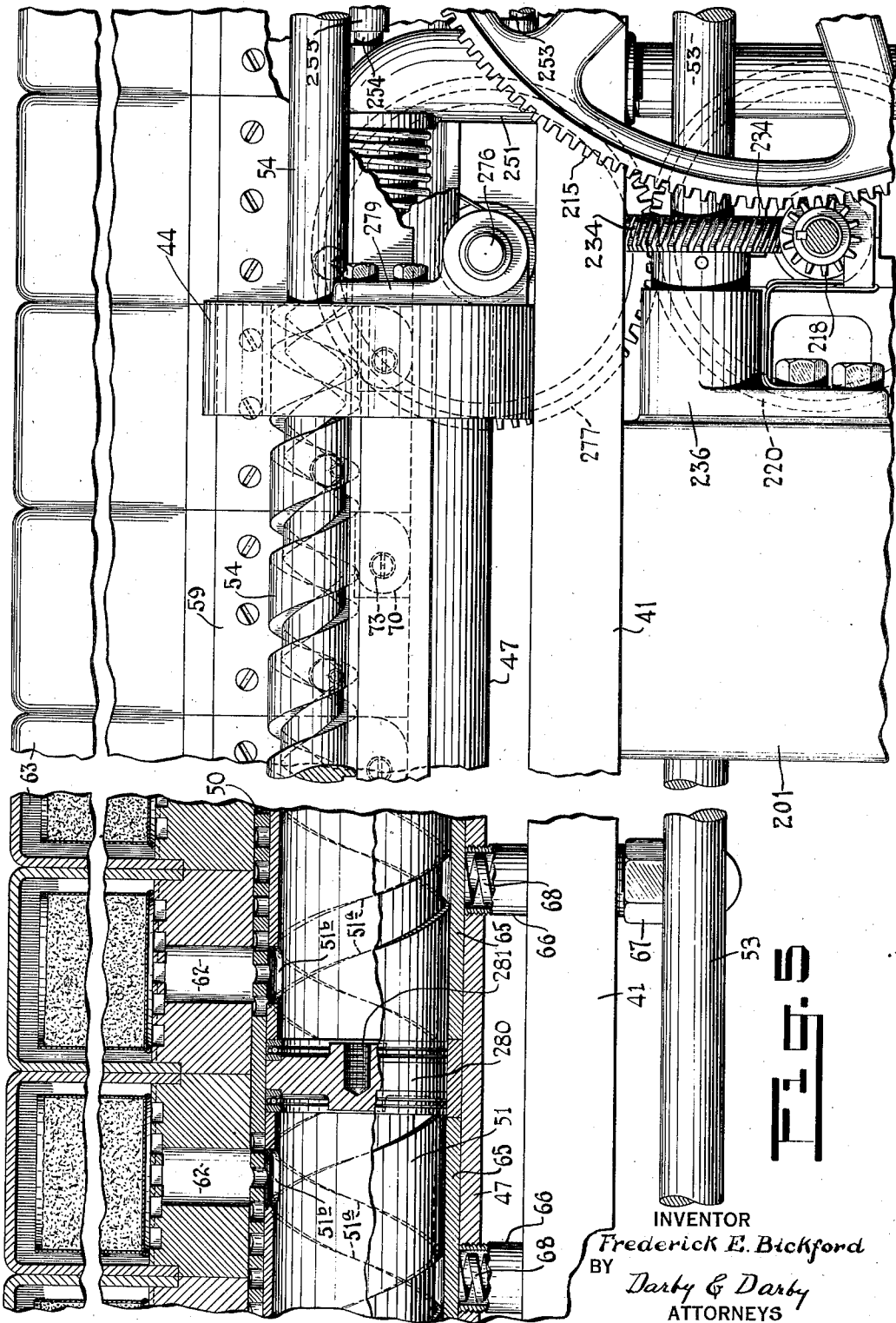
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PACKAGING AND PACKAGE-MAKING MACHINE

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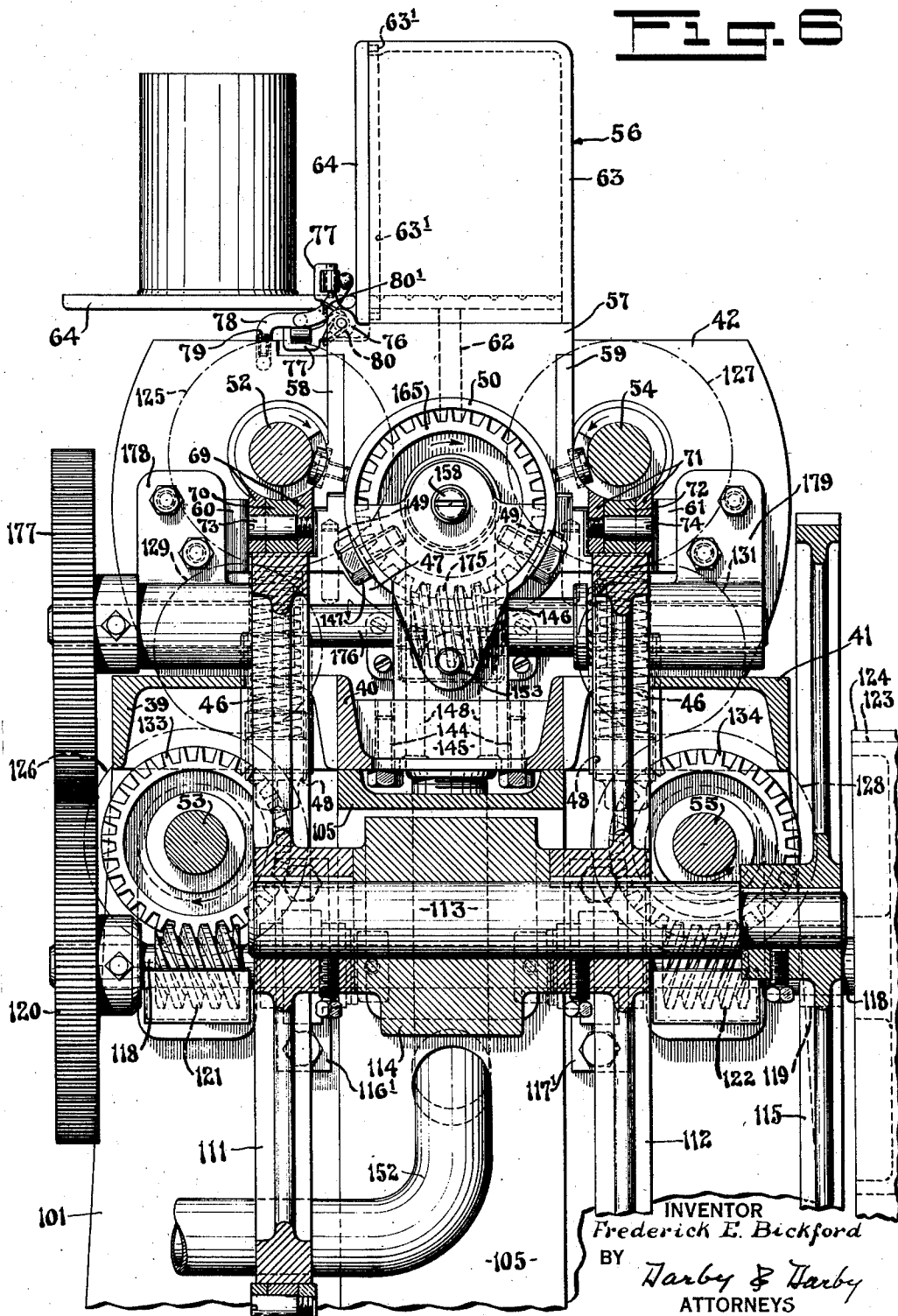
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PACKAGING AND PACKAGE-MAKING MACHINE

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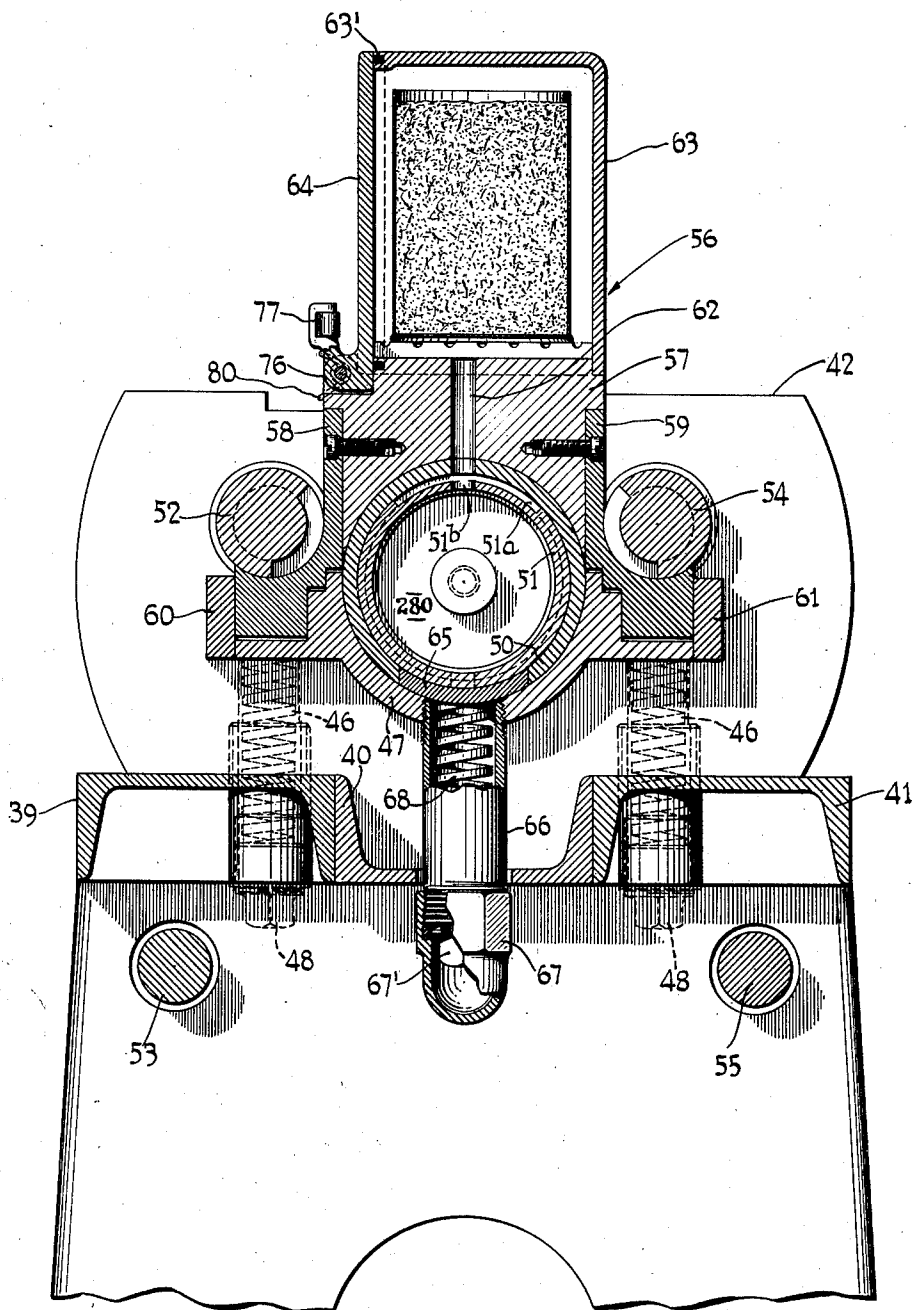
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PACKAGING AND PACKAGE-MAKING MACHINE

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Fig. 7



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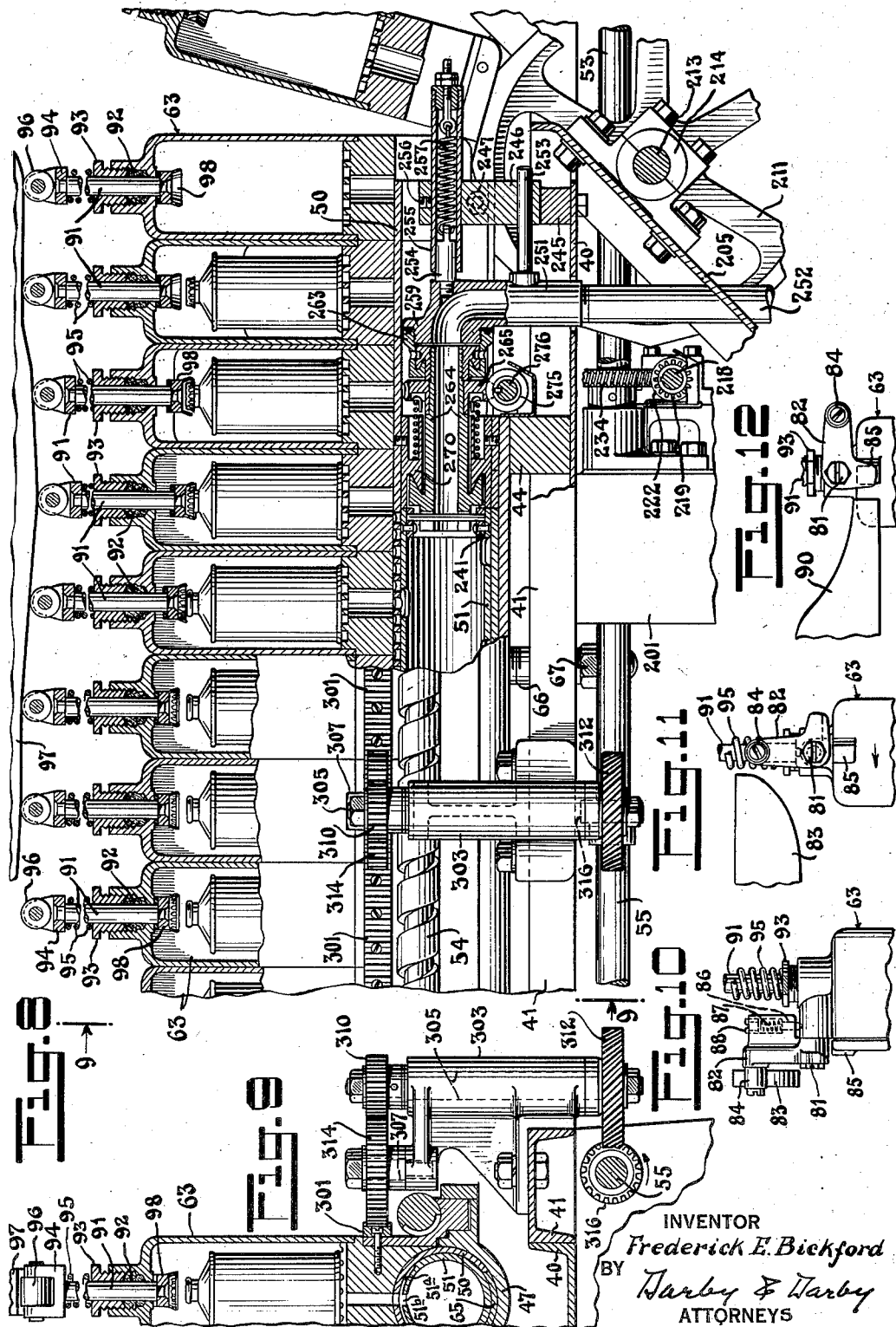
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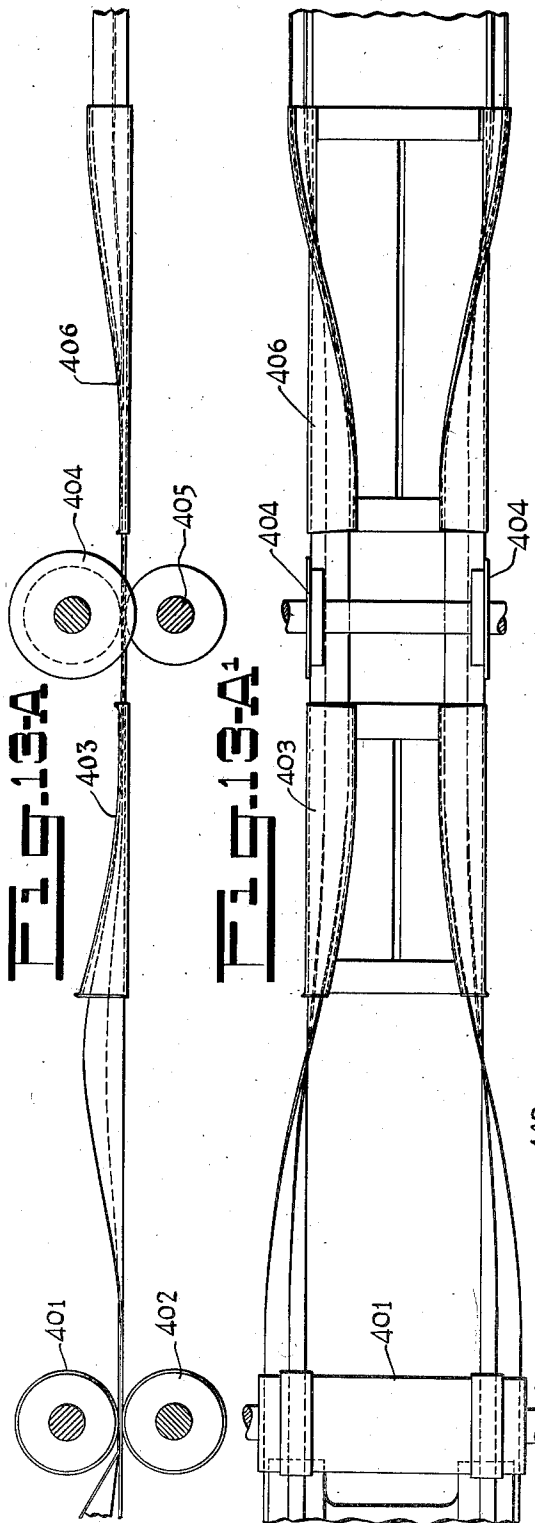
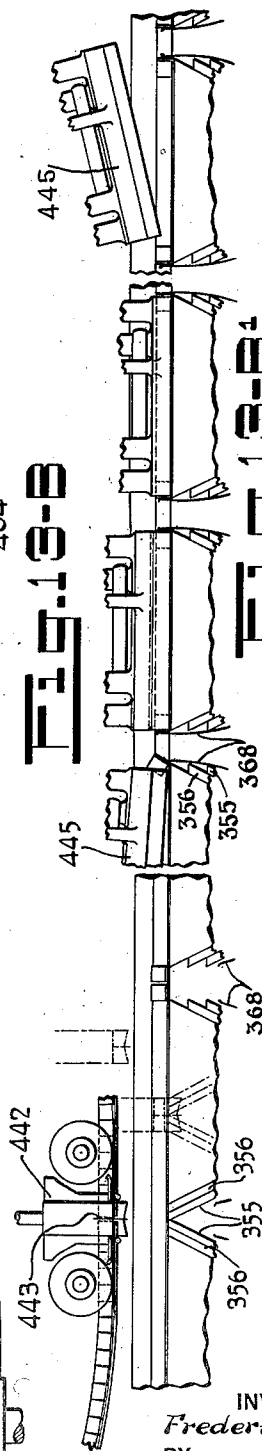
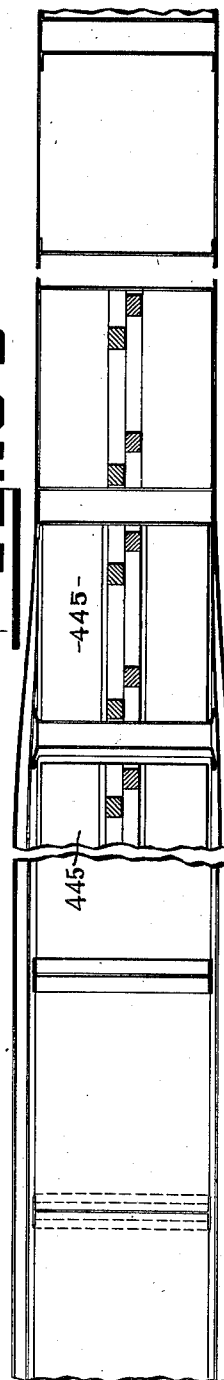


Fig. 13-B¹



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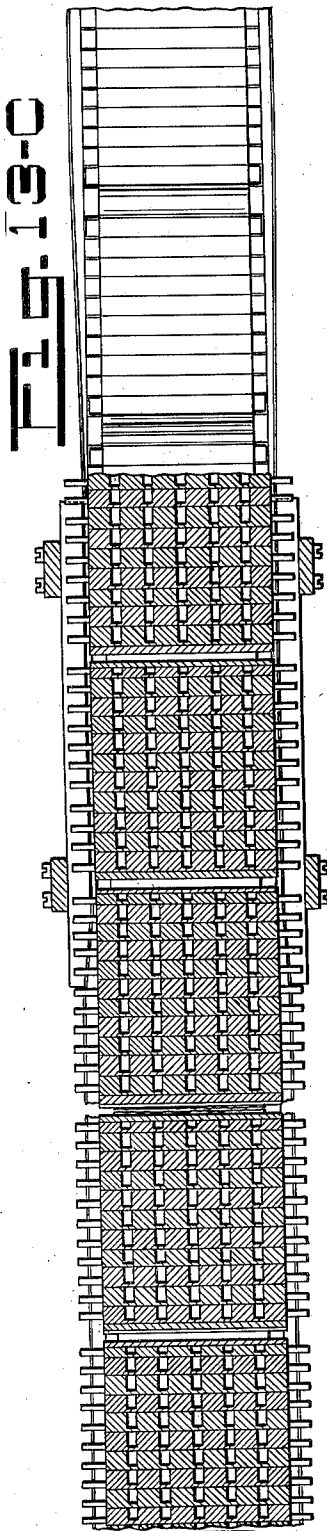
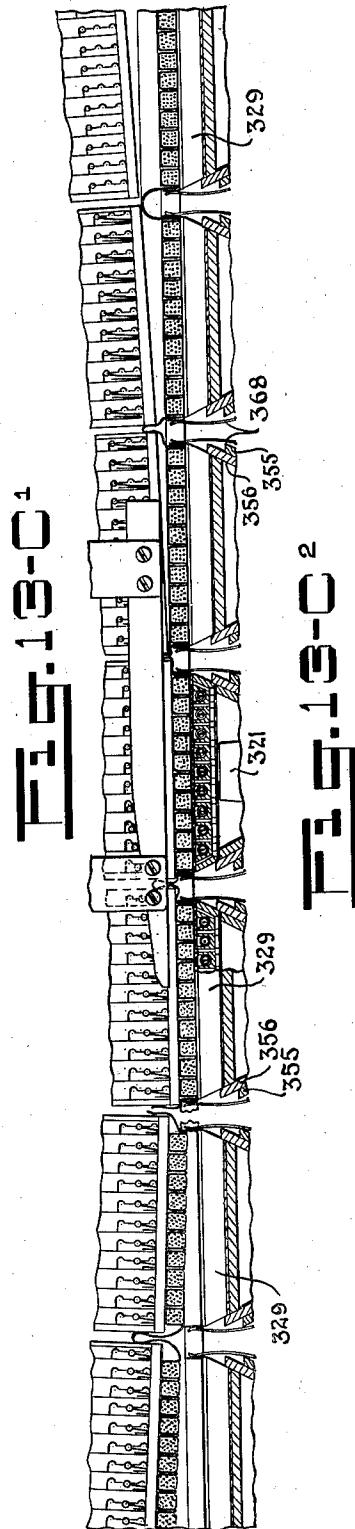
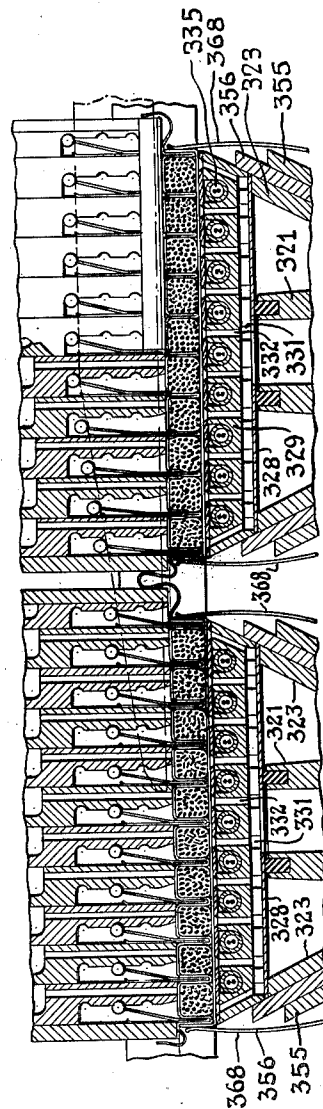
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PACKAGING AND PACKAGE-MAKING MACHINE

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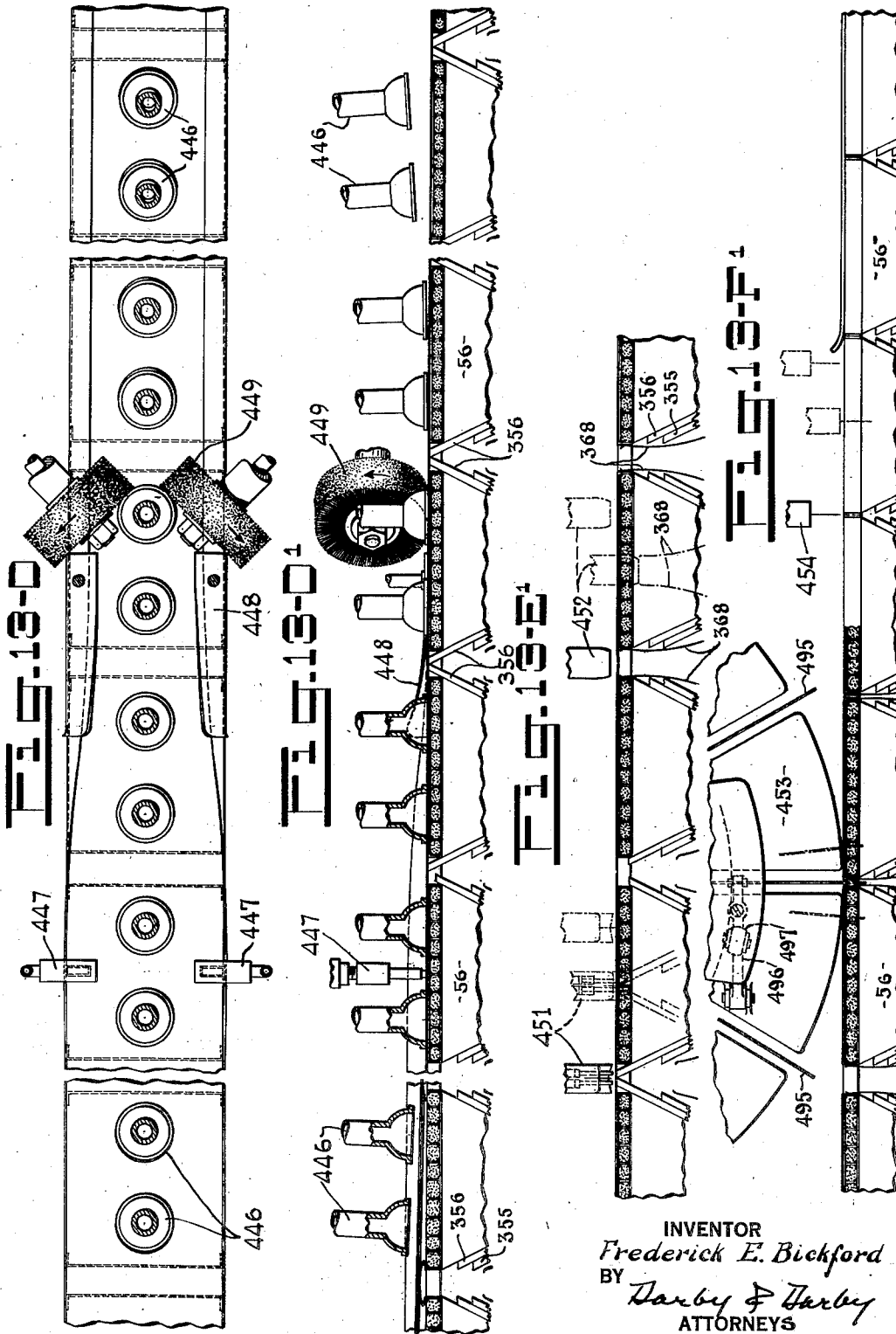
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PACKAGING AND PACKAGE-MAKING MACHINE

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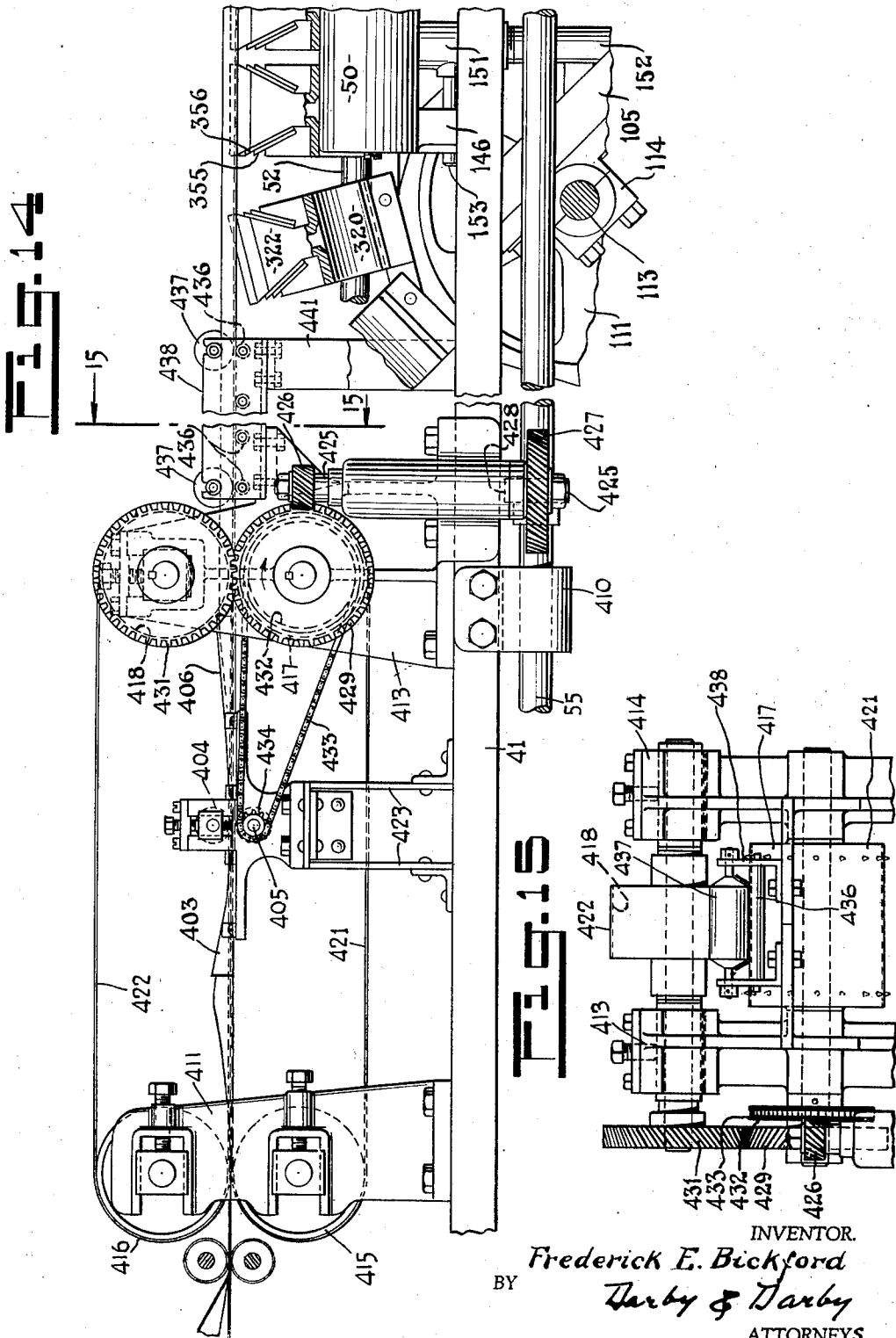
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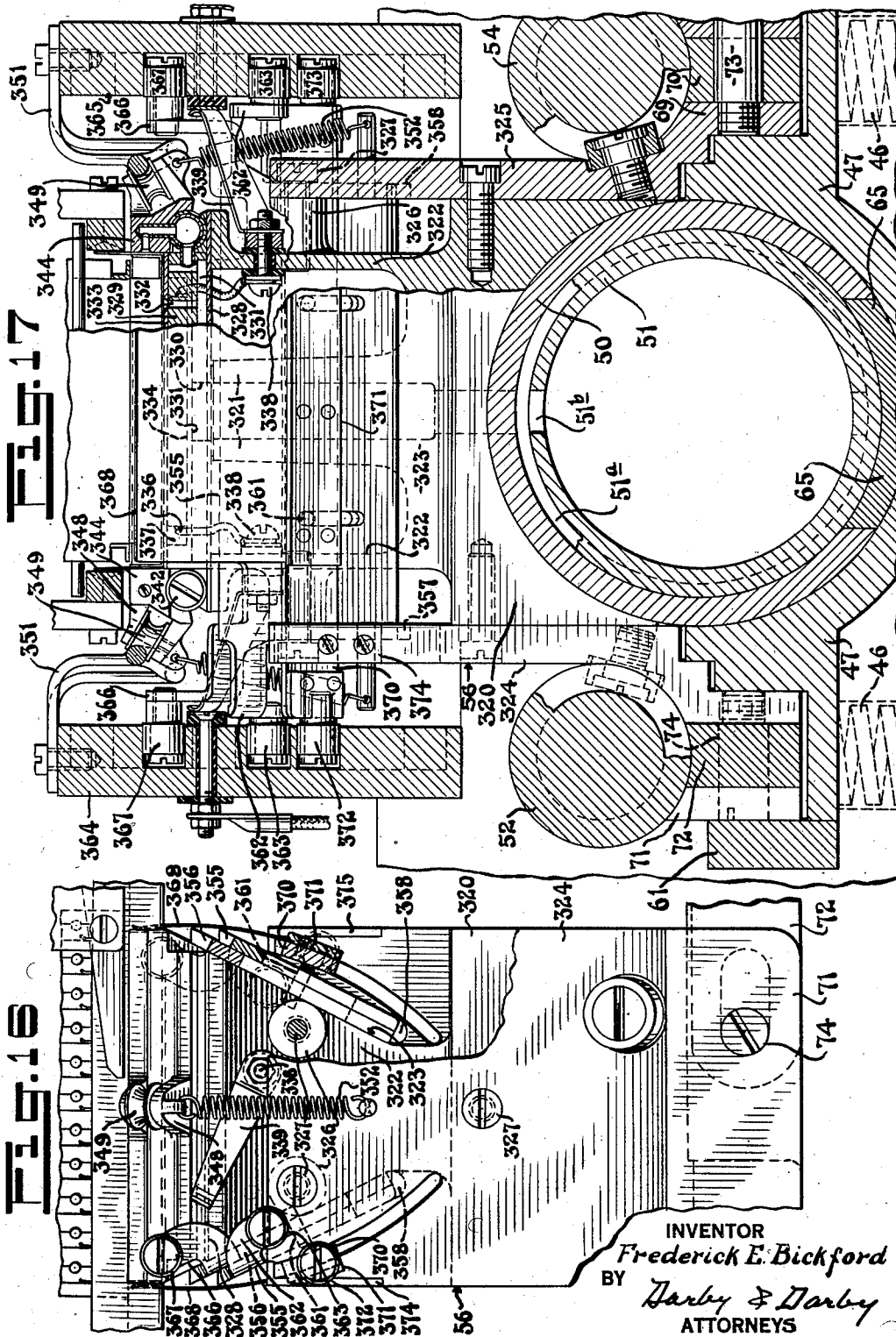
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PACKAGING AND PACKAGE-MAKING MACHINE

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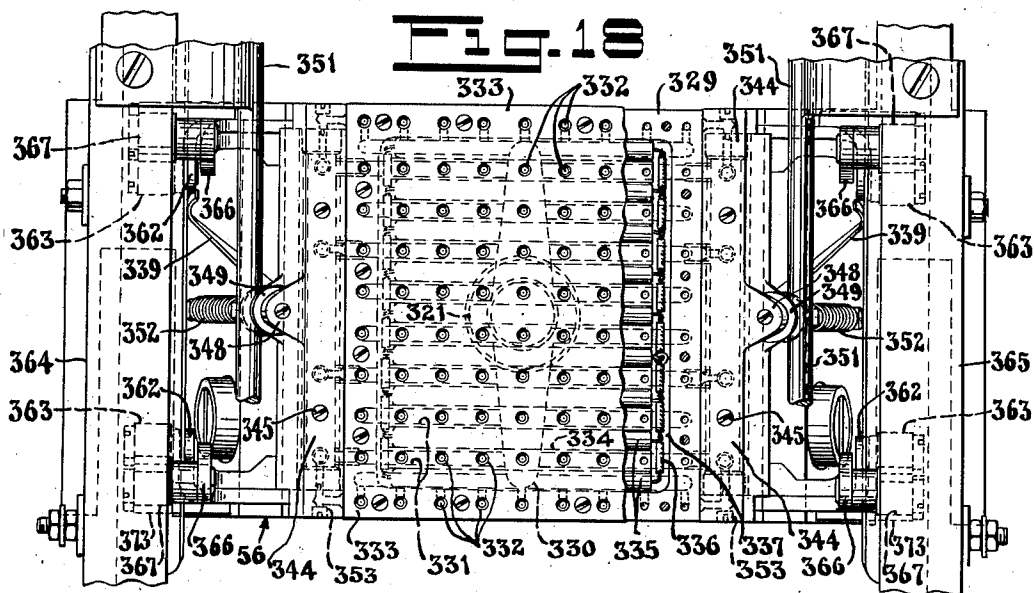
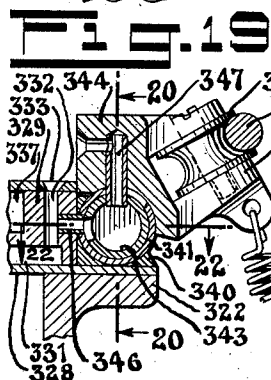
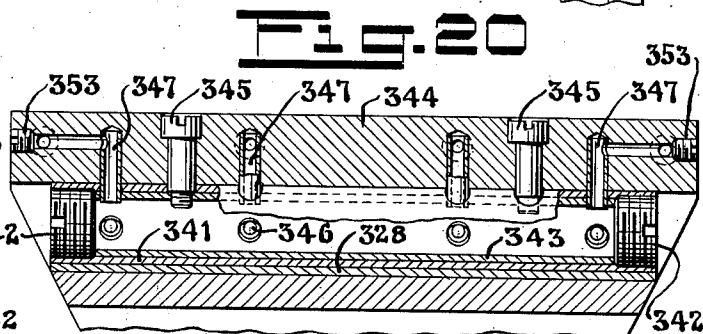
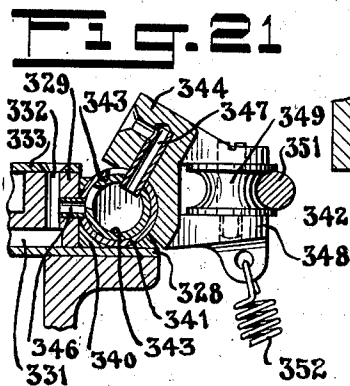
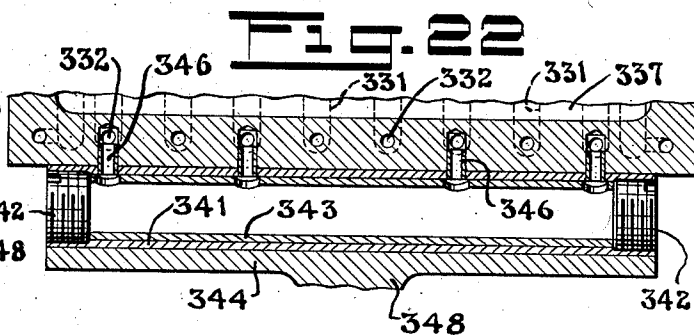
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PACKAGING AND PACKAGE-MAKING MACHINE

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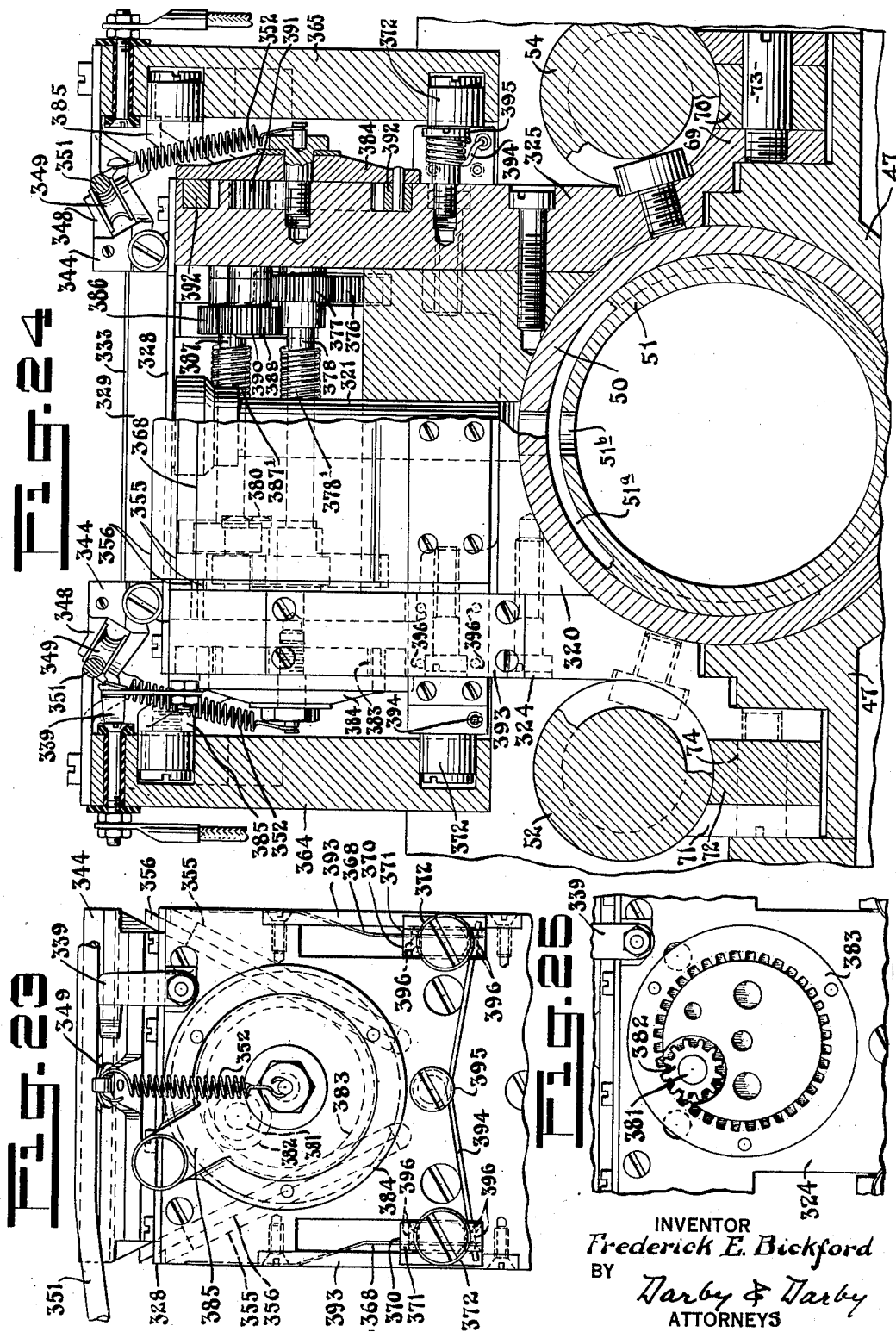
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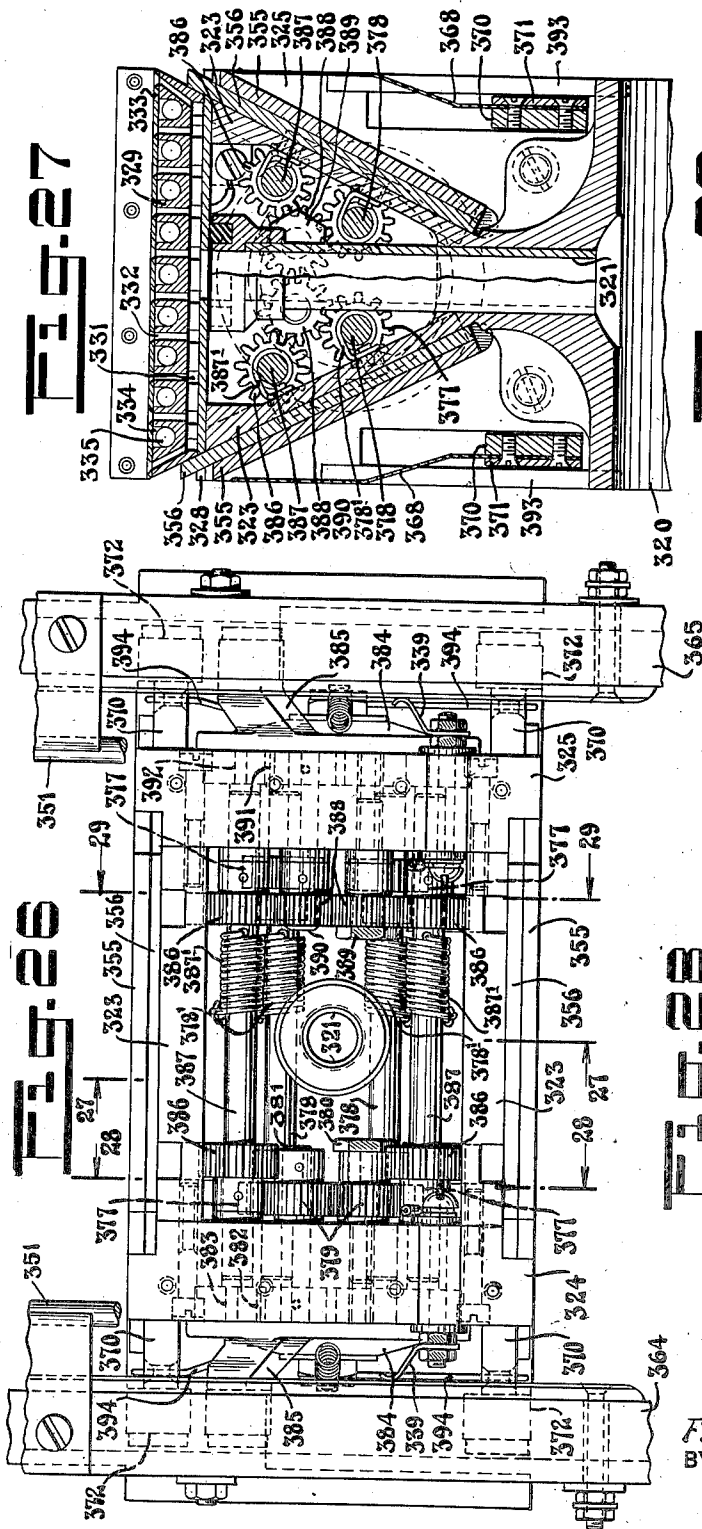
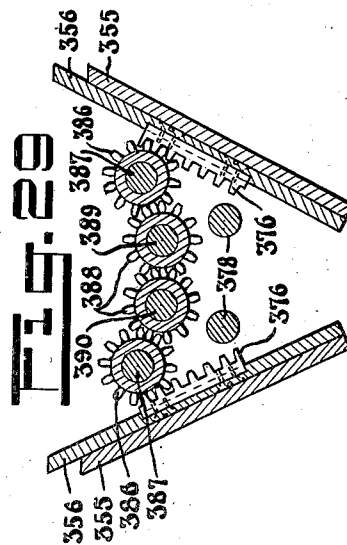
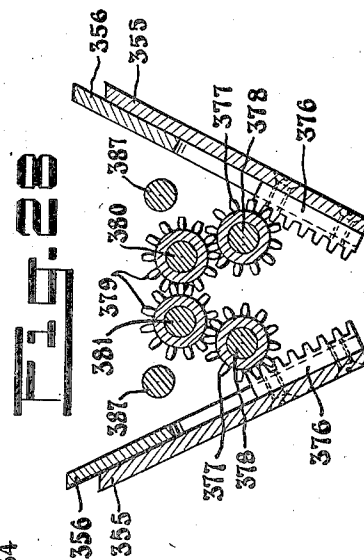
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PACKAGING AND PACKAGE-MAKING MACHINE

Filed July 23, 1937

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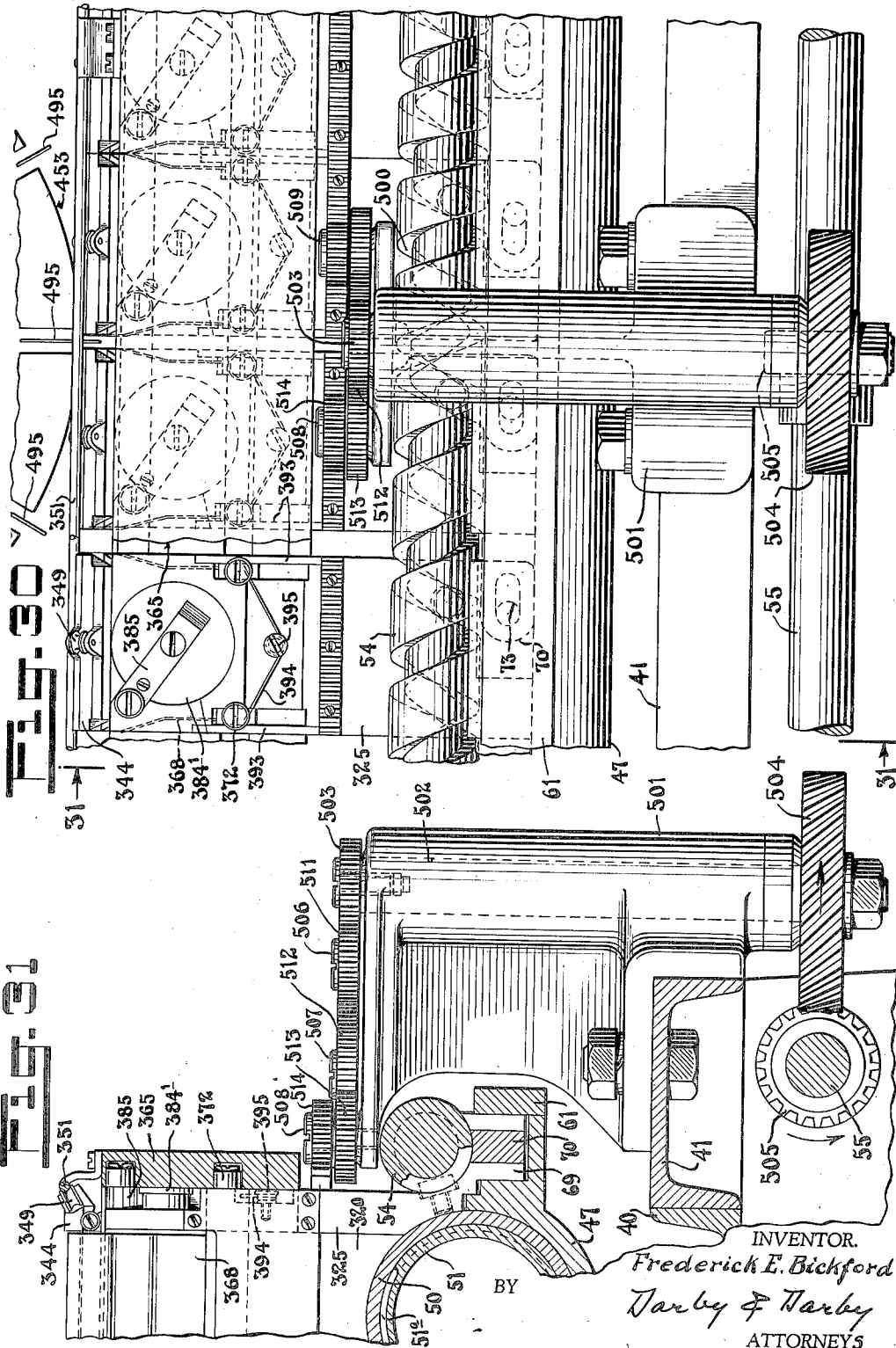
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PACKAGING AND PACKAGE-MAKING MACHINE

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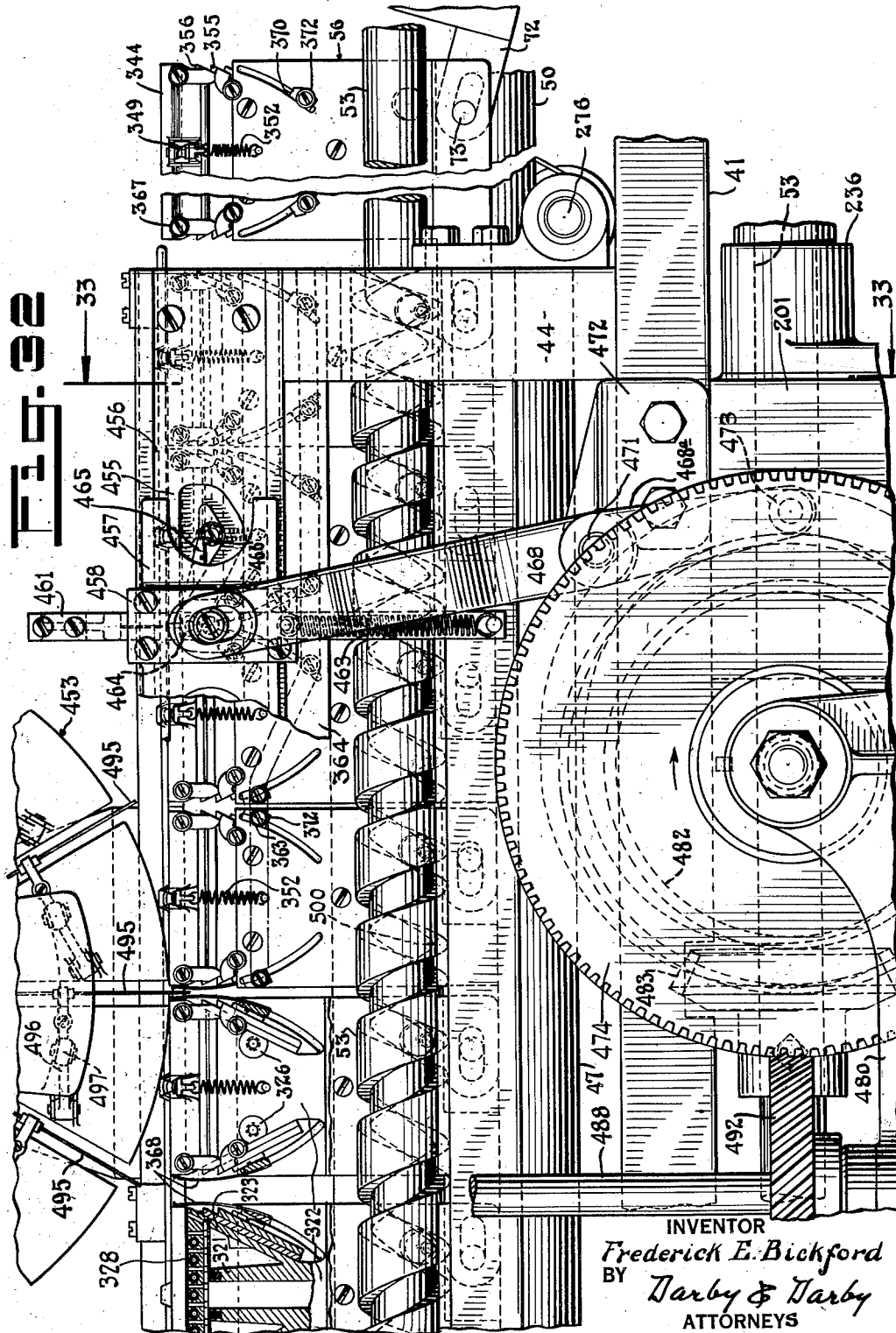
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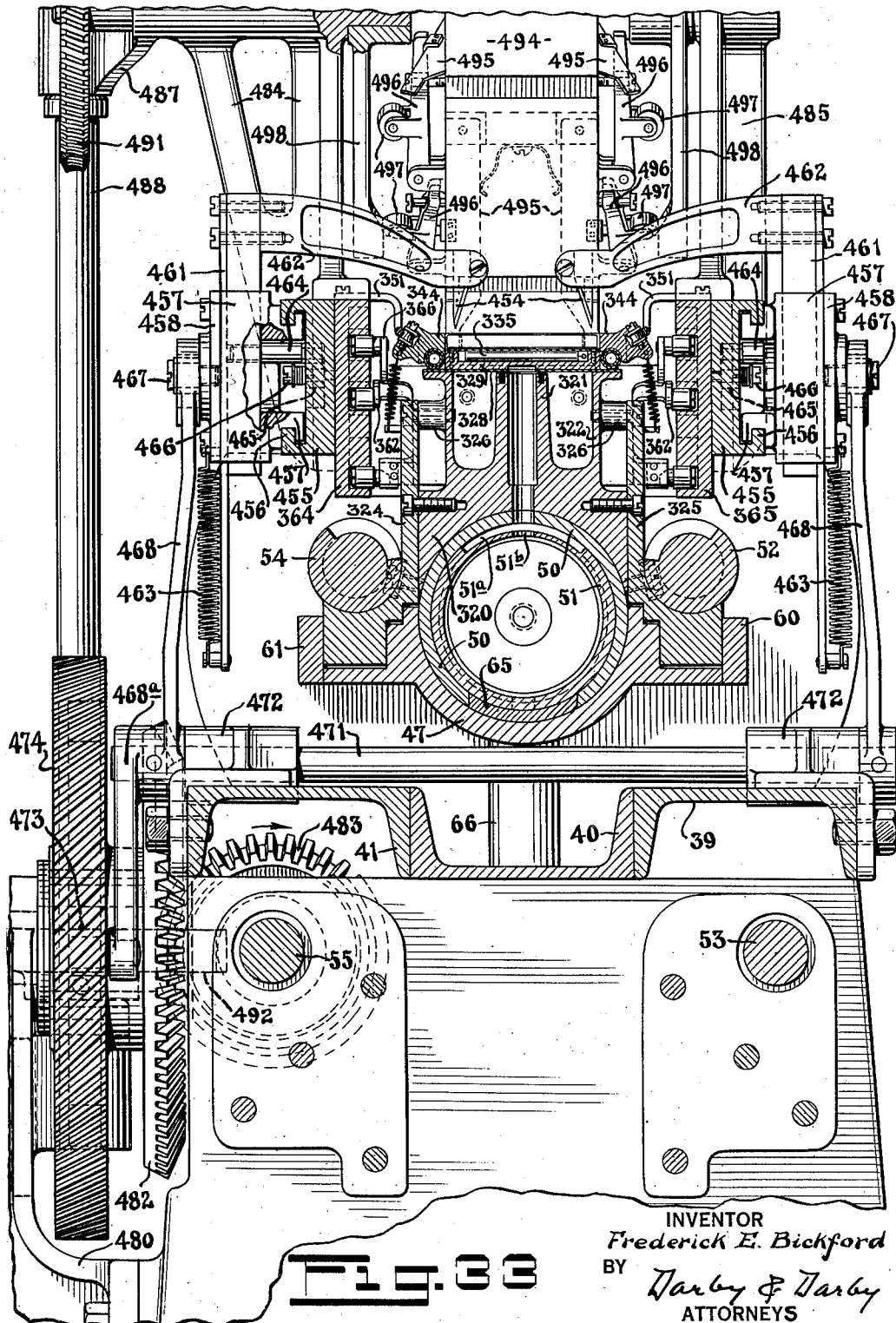
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PACKAGING AND PACKAGE-MAKING MACHINE

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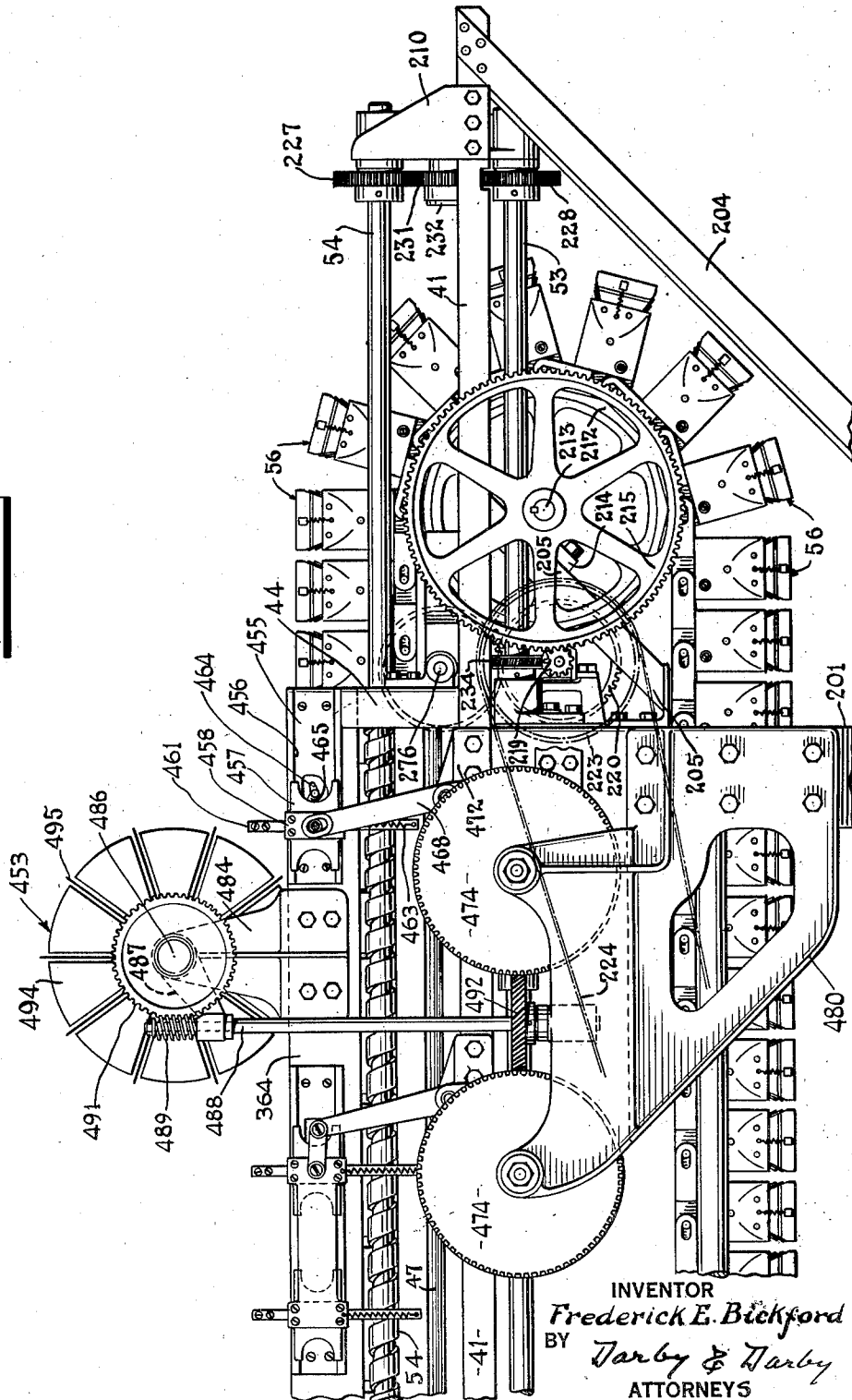
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Fig. 34



UNITED STATES PATENT OFFICE

2,147,632

PACKAGING AND PACKAGE-MAKING
MACHINE

Frederick E. Bickford, Rye, N. Y.

Application July 23, 1937, Serial No. 155,215

13 Claims. (Cl. 93—3)

This invention relates to means for applying vacuum or suction to the links of the moving chain of a conveyor mechanism. Particularly, it relates to the application of vacuum or suction to the moving carrier links of a packaging machine in which the suction causes a sheet of material, such as cellulose acetate, at all times to be in registration with the conveyor and thus in synchronism with the mechanism which operates upon the material to form packages.

An object of the invention is to provide a machine in which suction is continuously applied to the moving links of a chain with a minimum of leakage at any point.

Another object of the invention is to provide positive driving means for the chain links, synchronized with valve means for admitting suction to the links.

A further object of the invention is to apply a gas at or above atmospheric pressure to the evacuated material container, or to the package, as the case may be, subsequent to the application of the vacuum.

Further objects and features of the invention will appear when the following specification is considered in connection with the annexed drawings, in which,

Figures 1 and 2, taken together, form a side view of a machine embodying the evacuating and pressure applying mechanism. This mechanism is here utilized to evacuate containers during continuous movement of the links of a chain in airtight compartments of which the containers are carried; and to also fill the containers with gas under pressure;

Fig. 3 is a transverse cross-sectional view taken along the line 3—3 of Figure 2, showing a portion of the driving mechanism;

Fig. 4 is a longitudinal cross-sectional view of the left hand portion of the machine of Figures 1 and 2;

Fig. 5 is in part a broken, longitudinal section of the machine of Figures 1 and 2, the section being taken off center, and is in part a side elevation of a portion of the machine on a larger scale than that of Figures 1 and 2;

Fig. 6 is a transverse cross-sectional view taken on the line 6—6 of Figure 4;

Fig. 7 is a transverse cross-sectional view taken on the line 7—7 of Figure 4;

Fig. 8 is a fragmentary elevation of the right hand portion of the machine showing the connection of the pressure source to the machine, and showing likewise a modification and addition to the means for synchronizing the move-

ment of the chain links with the controlling valve structure and the means for automatically opening and closing the evacuating chambers. This figure also shows a mode of capping a container which has been evacuated and then filled with gas under pressure.

Fig. 9 is a fragmentary, transverse, cross-sectional view of the mechanism of Figure 8, taken along the line 9—9 of that figure;

Fig. 10 is a fragmentary end view of the upper portion of the evacuating chamber of Figure 8 showing the means for latching the door in closed position;

Fig. 11 is a side view of the mechanism of Figure 10;

Fig. 12 is a view similar to that of Figure 11 showing the latching means in operated position;

Figs. 13A through 13F are schematic diagrams of a complete packaging machine in both plan and elevation. In these figures the simple letters designate plan views, and the prime letters elevational views;

Fig. 14 is a side view of the left end of a packaging machine showing mechanism for folding a sheet of material prior to registration of the sheet on the packaging machine links;

Fig. 15 is a fragmentary sectional view of the mechanism of Figure 14. The section is on the plane indicated by line 15—15 of Figure 14;

Fig. 16 is a side view of one form of link for a packaging machine;

Fig. 17 is a cross-sectional view of the upper portion of a packaging machine, this view showing especially the construction of one form of link;

Fig. 18 is a plan view of the link of Figures 16 and 17;

Fig. 19 is a fragmentary cross-sectional view of the link of Figures 16—18 showing the construction of the vacuum or suction communicating hinge;

Fig. 20 is a cross-sectional view of the hinge of Figure 19 taken along the line 20—20 of Figure 19;

Fig. 21 is a view similar to Figure 19 but showing the hinge in unoperated position;

Fig. 22 is a cross-sectional view taken along the line 22—22 of Figure 19;

Fig. 23 is a side view of a second form of link structure;

Fig. 24 is a cross-sectional view of the upper portion of the packaging machine showing particularly the link of Figure 23;

Fig. 25 is a side view, with parts broken away, of the link of Figure 23;

Fig. 26 is a top plan view, with portions removed, of the link of Figure 23;

Fig. 27 is a cross-sectional view of the link of Figures 23-26, the section being taken along the lines 27-27 of Figure 26;

Fig. 28 is a fragmentary, sectional view of the link of Figures 23-27, this section being along line 28-28 of Figure 26;

Fig. 29 is a fragmentary, sectional view of the link of Figures 23-26, this view being taken along the line 29-29 of Figure 26;

Fig. 30 is a side view of a portion of a packaging machine showing a third form of link structure and showing also mechanism for causing a link to approach a preceding link during a portion of the machine operation;

Fig. 31 is a fragmentary transverse section of the mechanism of Figure 30, the section being taken along the line 31-31 of that figure;

Fig. 32 is a side view of a portion of the packaging machine showing mechanism for operating knives for severing the material strips connecting completed unit packages;

Fig. 33 is a transverse, cross-sectional view of the packaging machine on the plane indicated by the line 33-33 of Figure 32. This view shows the construction of the first form of link, the severing mechanism of Figure 32, and in addition mechanism for folding the lateral connecting strips prior to severing those strips;

Fig. 34 is a side view of the packaging machine showing the organization of the various parts, of which details are illustrated in Figures 16 to 33;

Fig. 35 is a top plan view of the mechanism of Figures 30 and 31; and

Fig. 36 is a schematic diagram illustrating the dimensions utilized in computing the speed of the links at different portions of their traverse of the vacuum or suction applying mechanism.

This application is a continuation in part of my copending application Serial No. 744,928, filed September 21, 1934, for Packaging machine.

Supporting structure

The various moving parts of this machine are supported upon a frame structure which comprises two castings 101 and 201 (Figs. 1 and 2) joined together at their bases by the angle members 38, and at their tops by the channel members 39, 40 and 41, the two outer ones of which (Fig. 6) rest on their flanges, and the middle one of which rests on its base. The two outer channels 39 and 41 extend considerably beyond the castings 101 and 201, and are supported at their extreme ends by the inclined angle members 103, 104, and 203, 204, which are fastened to the castings by means of plates as 102 and 202. The center channel 40 extends but slightly beyond the supporting castings; it is supported at each end by one of the short channel members 105 and 205, extending to a bracket 106 or 206 bolted to the casting.

Spaced along the channel members at any desired intervals are castings as 42, 43 and 44 which rest on the upturned bases of the outer channels 39 and 41, and are so shaped as to protrude within the channel member 40. Supported by the castings 42, 43 and 44, through the medium of compression springs 46, which are within vertical bores in the castings (Fig. 7) 42, 43 and 44, is the valve mechanism support 47. The compression springs 46 are adjustable by means of plungers 48 (Figs. 5, 6 and 7) screwed into the castings.

The support 47 is guided in its vertical movement by means of guide pins 49 (Fig. 6), which

pins are driven into castings 42, 43 and 44 and extend into corresponding holes in support 47. These pins 49 prevent movement of support 47 either longitudinally, transversely, or rotationally, while permitting vertical movement thereof.

The support 47 is generally semi-cylindrical and has fitted into its semi-cylindrical upper surface a tube 50 which forms the guide or track for the links of a moving chain as will be described hereinafter. Rotatable within the tube 50 is a second tube 51 which has, in its outer surface, a helical groove cooperating with holes in the exterior tube to form means for controlling the application of vacuum or pressure to the moving links as will be described hereinafter.

Supported near the ends of the outer channel members 39 and 41 are two castings 110 and 210 (Figs. 1 and 2), each of which is supplied with a plurality of bearing blocks which rotatably support the four shafts 52, 53, 54 and 55, which shafts extend longitudinally of the machine. Shafts 52 and 54 pass through the castings 42, 43 and 44, being freely rotatable in semi-cylindrical bushings inserted in holes in the castings and thus supported by the bushings against upward pressure. Shafts 53 and 55 are supported in bearing blocks 135, 136, 235, 236, fastened to the castings 101, 201. The upper shafts 52 and 54 are helically grooved throughout the distance between castings 42 and 44 in order to control the movement of the chain links, as will appear hereinafter. Shafts 52 and 54 are arranged to be driven respectively from shafts 53 and 55 in a manner which will be discussed under the heading "Chain driving mechanism".

Chain driving mechanism

At each end of the machine (Figs. 1, 2 and 6), there are two sprockets 111, 112 and 211, 212, the periphery of each of which is polygonal in shape. These sprockets drive a continuous chain which is formed of the link 56, which links are shaped to form a vacuum seat with the tube 50.

The sprockets 111, 112 are supported on the shaft 113 which is in turn rotatably supported in a bushing 114, (Figs. 4 and 6), which is fastened to the inclined channel member 105. On the outer end of the shaft 113, a gear wheel 115 is fastened. It will appear, therefore, that as the gear wheel 115 is driven, it in turn turns the shaft 113, causing the sprockets 111, 112, fixed thereto, to rotate and to move the links of the chain continuously.

The corresponding movement of sprockets 211 and 212 is transmitted to the gear wheel 215 and shaft 213, which shaft is similarly supported by bearing block 214 fastened to the channel member 205.

Adjacent the casting 101 and supported therefrom through the medium of the auxiliary castings 116, 117, and bearing blocks 116', 117' (one on either side of the machine) is a shaft 118 which carries a pulley wheel 123 and small pinion 119 at one end, a gear wheel 120 at the other end, and two worms 121 and 122 (one adjacent either end). The pinion 119 meshes with the gear wheel 115 in order to supply power for driving the sprocket wheels as described. Power is applied to the shaft 118, through the medium of the pulley wheel 123, belt 124, and motor 109, which motor is fastened to the angle members 38 of the frame structure.

At the right hand end of the machine, looking at Figs. 1 and 2, a similar shaft arrange-

ment is provided, comprising a shaft 218 carrying the worms 221 and 222, the gear 220, the pinion 219, and a pulley 223, power being supplied to this end of the machine through a belt 224 (Figs. 1 and 2) as well as through the shafts mentioned above, and considered in detail hereinafter.

As is best shown in Fig. 3, shaft 52 has fixed thereon a gear 225; shaft 53, gear 226; shaft 54, gear 227; and shaft 55, gear 228. Gear 226 drives gear 225 through the medium of idler gear 229 which rotates on the stub shaft 230, fixed to the casting 210. Similarly, gear 228 drives gear 227 through the medium of idler gear 231, mounted on the stub shaft 232, likewise fixed in the casting 210.

At the left hand of the machine, similar idler gears 129 and 131 mounted on stub shafts 130 and 132 are provided to drive gears 125 and 127, the idlers being themselves driven by gears 126 and 128.

Lower longitudinal shafts 53 and 55 have mounted thereon near their left ends worm wheels 133 and 134 and at their right ends worm wheels 233 and 234 which mesh with the worms 121, 122, 221 and 222 previously described, thus providing means for driving the various longitudinal shafts of the machine.

Chain links

In the form of the invention first considered, namely that for evacuating packages, the chain links include air-tight chambers in which the containers to be evacuated are placed during the evacuating and gas admitting portions of the chain travel.

Each chain link 56 comprises a body portion 57 having a longitudinal semi-cylindrical groove in the base thereof (Figs. 6 and 7), which groove is adapted to form a vacuum or pressure-tight seal with the outer valve tube 50. Each base portion 57 has fastened thereto two side members 58 and 59 which extend downwardly and outwardly, and are stepped along their lower edges to cooperate with similarly stepped surfaces of the valve support 47. The lower, outer surfaces of the members 58 and 59 are guided for vertical movement by the guide rails 60 and 61, which guide rails extend longitudinally of the machine and are fixed in the castings 42, 43 and 44. The upper faces of the downward extremities of the side members 58 and 59 are curved to fit the outer surfaces of the helically cut shafts 52 and 54.

Extending through the base portion 57 of each chain link is a passage-way 62 which communicates with the chamber formed above the base by the housing 63 and the air-tight door 64. As will be hereinafter described, means are provided for holding the door 64 in closed position during evacuating and pressure applying operations and for opening the door in order to permit placement of a container in the compartment, and removal of the container therefrom at the completion of operation.

It will be seen from the description previously given that springs 46 push the valve or tube support 47 upward against the bottom of the outer valve tube 50, said tube 50 pushing upward against the bottom of the base portion 57 of the link 56 which in turn holds the curved upper faces of the extensions 58 and 59 up against the under side of the helically cut shafts 52 and 54, thus assuring a vacuum-tight joint between the links 56 and the outer valve tube 50.

Means are likewise provided to assure a tight joint between the outer tube 50 and inner tube 51, this means comprising an arcuate plate 65 (Fig. 7) which extends for substantially the entire length of the support 47 along the bottom thereof, the outer tube 50 being cut away to accommodate this plate. Screwed into the support 47 at spaced intervals along the bottom thereof are cylindrical spring holders 66 which are closed at their ends by cap nuts 67 screwed on the outside of the holder. The plug 67¹ screwed inside the lower end of the holder regulates the pressure of the springs 68, within the tubes, against the member 65. The screw joints between the support 47 and the spring holders 66, as well as the screw joints between holders 66 and nuts 67, are hermetically sealed to prevent any loss of vacuum or pressure through these members. Due to the construction just mentioned, the inner tube 51 is kept in vacuum-tight register with the outer tube 50, thus assuring that there shall be no leakage of vacuum or pressure from the outside atmosphere into the evacuated or pressure chambers. As wear takes place the springs compensate therefor and maintain the vacuum-tight register.

Side members 58 and 59 of each link are slotted at their forward ends (Figs. 4 and 6) to fit over rearward extensions of adjacent link side members so that the rearward end of each link side piece may extend into the slot of the link following, thus forming the continuous chain which is a feature of the machine. After the rearward extensions of the link pieces are positioned in the slotted forward portions, screws are passed through holes in the forward slotted portions and the extensions to pivotally connect the links together. This link construction is best shown in Fig. 6 wherein the slotted forward portions and narrow rearward extensions of the side members are clearly shown in section at 69 and 70, 71 and 72, respectively, the shouldered pivot screws being shown at 73 and 74.

Extending outwardly from each side piece 58, 59, on a line through the center of shaft 52 or 54, is a stud carrying a roller adapted to fit the helical groove of the corresponding shaft.

The rollers cooperate with the respective shafts 52, 54 to assure the correct rate of movement of the links 56 with respect to the rotation of the helically grooved inner tube 51 and in addition are mounted on the side members 58 and 59 in such manner that the rotation of the shafts tends to seat the body portion 57 of the links squarely and solidly on the outer valve tube 50.

Vacuum control mechanism

As has been stated, the moving links 56 are adapted to the application of either vacuum or pressure to the chambers forming part of these links, the vacuum or pressure being continuously applied during the movement of the links through portions of their cycle.

The two tubes 50 and 51 already mentioned co-operate to control the application of vacuum or pressure to the moving links, the pitch of the helical groove in the inner tube relative to the spacing of holes in the outer tube assuring the continuous application of a vacuum or pressure to the links as they are moving in the path described. The mode of supporting these tubes has already been described; the mode of applying vacuum or pressure thereto, and the means for rotating the inner tube remain to be described.

Referring now to Fig. 4, it will be seen that the inner tube 51 is provided with a helical groove 51a, the pitch of the helix on which the said groove is cut being such that one complete turn of the helix occurs in a distance equal to that between the centers of two successive chain links 56 and the width of the groove being such that it covers two adjacent holes in the outer tube 50. Also the passage 62 covers two adjacent holes in tube 50. In other words, the center of the surface between successive turns of the helix always lies midway between the centers of two successive chain links. Therefore, any link is constantly in communication with the inner valve tube, and the flat surfaces between turns of the helix always bear against the surfaces between the openings, thus shutting off the spaces between successive chambers.

At intervals along the helical groove there are holes 51b connecting the groove with the interior of the tube so that vacuum drawn through the center of the tube will cause evacuation of the groove and through it and the holes in the stationary tube 50 cause evacuation of the chambers of the links 56.

If the material in the containers is finely powdered or of like nature and likely to be removed from the container by sudden application of the suction, then the holes in outer valve tube 50 may be smaller at the left end of the machine, thus causing gradual application of the suction.

Inserted in the left end of the inner tube 51 is a short section of slightly smaller tubing 141 which is fastened to tube 51 by rivets or pins 142 and which has a reduced portion at the left end thereof. The inner tube 51 terminates slightly to the right (Fig. 4) of the left end of tube section 141.

In the outer tube 50 and abutting the end of inner tube 51 is a tube 143 having an integral flange at its left hand end. This flange is ground to form a conical seat for a conically flanged, rotatable member hereinafter described.

Fastened to the channel 40 near its left end (Figs. 4 and 6) by means of screws 144, is a block 145 which supports a casting 146. The casting 146 has an upward portion which is flared out to form a semi-circular block adapted to fit within and support the extreme left end of the outer valve tube 50, which tube has a wide cut at its base at the end. The tube 50 is fastened to casting 146 by means of screws 147.

Casting 146 is held in place on block 145 by pins 148 which permit vertical movement only. As wear takes place shims may be inserted between the block and casting in order to compensate therefor.

The casting 146 also serves to support a pipe elbow 151, one end of which is connected to pipe 152, which in turn is flexibly connected to a vacuum pump or other source of negative pressure (not shown). The other end of pipe elbow 151 communicates with the interior of valve tube 51 in the manner about to be described.

Projecting from the side of a vertical portion of pipe elbow 151 is a pin 153 which slidably fits within a hole in the casting 146 to guide the elbow for limited horizontal movement.

Projecting from the pipe elbow 151 along its horizontal center line is a second pin 154 which extends within a cylinder 155 fitted into a bore in the upper portion of casting 146 and which is held in position by set screw 156. Within the cylinder 155 is a compression spring 157 which is compressed against the end of pin 153 by means

of screw 158 which threads into the cylinder at its left end and bears against the spring.

The horizontal portion 159 of the pipe elbow 151 extends to the right and is beveled at its end to form a seat for the correspondingly beveled hub of a worm wheel 165. In the left hand face of this worm wheel is a circular grooved bearing member 166 in which runs a spring thrust and centralizing member 167. This member 167 is held in the grooved bearing 166 by means of a spring 168, the other end of which bears against a flange 169 on the pipe elbow 151.

Worm wheel 165 has a tubular portion projecting to the right and fitting into the internal bore of a tube 170, which has a conical outer surface which fits the conical seat mentioned above. The tube 170 is caused to rotate with the worm wheel 165 by means of a pin 171 extending through the two members. To the right of the conical flare on the member 170 is a short cylindrical hub portion which extends within the tube section 141 and which is connected to tube 141 for rotation thereof by means of pin 172 extending through holes in member 170 and into arcuate slots in tube 151.

It will be seen from the description given that the conical member 170 is caused by the spring 68 to bear against the conical seat formed on tube 143 and the spring 157 holds beveled end of the portion 159 against the conical seat of the beveled hub of the worm wheel 165 to maintain vacuum tight joints through which air can be evacuated from the interior of tube 51 by means of the vacuum pump or other source of suction. It will likewise be seen that rotation of worm wheel 165 causes rotation of tube or tube sections 170, 141 and 51. As has been described, tube 51 is spring-pressed upwardly to bear against the upper, inner surface of tube 50. It is because of this that tube section 141, and the hub portion of member 170, are joined for rotation by pin 172 which permits slight movement of inner tube 51 to care for wear.

Driving means for the valve tube

As has been indicated, the valve tube 51 must be driven synchronously with the chain sprockets 111, 112, 211, 212, and with the helically grooved shafts 52, 54. For this purpose a worm 175 is provided, which worm is mounted on a shaft 176 (Figs. 4 and 6) for rotation therewith. Shaft 176 is supported for rotation by bearing blocks 178 and 179 screwed to the casting 42. Fixed to shaft 176 at its left hand end is a gear 177 which meshes with the gear 120 fixed to the shaft 118. Shaft 118 is rotated in the manner previously described.

At the right hand end of the machine shown in Figs. 2, 5 and 8, a substantial duplicate of this arrangement is provided, the only difference being that the construction of the conical seat and valve member is altered to provide for pressure rather than vacuum. The driving equipment is, however, exactly similar. Referring now to Fig. 8, worm wheel 265 drives the right hand portion of the inner tube 51 in a manner similar to that in which worm wheel 165 drives the left hand portion of the tube. Worm wheel 265 is driven by worm 275 mounted on shaft 276 supported in bearings 278 and 279. Shaft 276 is driven by gear 277 meshing with gear 220 on shaft 218.

It is, of course, possible to evacuate containers without thereafter admitting gas under pressure to those containers. If this is to be done, the tube 51 is continuous from one end of the ma-

chine to the other, and the valve arrangements at the two ends are exactly similar, or the tube is blocked at one end, as is preferable. Under these circumstances, the two worm wheels 165 and 265 simply drive the one tube 51 and prevent any twisting of that tube by their synchronous operation, one on either end.

Pressure control mechanism

When the containers are to be evacuated and then filled with gas, the tube 51 is made in two pieces, a plug being inserted substantially in the middle of the outer tube 50. This plug is shown in Fig. 5 and is designated 280. It is inserted in the tube 50 by heating tube 50 and cooling the plug, threading a long rod into the screw thread 281 of the plug, and pushing the plug to the desired point in tube 50. As the plug 280 and tube 50 reach the same temperature, the plug will have expanded, and the tube contracted, to form a vacuum and pressure tight joint so that there will be no leakage from one portion of tube 51 to the other. The rod used for inserting the plug is then removed. When this plug is inserted there are two separate inner tubes 51; also a central portion of outer tube 50 is left solid so that for an instant there is no application of either vacuum or pressure to the link chambers (Fig. 5).

Coming now to the valve structure utilized when this pressure application is to take place, reference is made to Fig. 8 in which a structure similar to that of Fig. 4 is shown, modified, however, as indicated.

Fastened to the channel 40 is a block 245 which supports a casting 246. The casting 246 has an upward portion which is flared out to form a semi-circular block adapted to fit within and support the extreme right end of the outer valve tube 50. The lower portion of the tube 50 is cut away in order to provide space for the various parts about to be described. Tube 50 is fastened to the casting 246 by means of screws 247.

Casting 246 is held in place on block 245 by pins (not shown) which permit vertical movement only. As wear takes place shims may be inserted between the block and casting to compensate therefor.

Casting 246 supports a pipe elbow 251, one end of which is connected by means of a pipe 252 to a source of supply for whatever gas may be suitable for preserving the articles being processed. This may be under pressure or not, depending on the vacuum existing in the chambers. The other, or horizontal, end of the pipe elbow 251 communicates with the interior of the valve tube 51.

A pin 253, extending from the pressure pipe elbow 251, is guided in a hole in casting 246. At the horizontal center line of the pipe elbow there is a threaded thick walled portion into which a small pin 254 is inserted. This pin fits within a spring containing cylinder 255 which is fastened in a bore of the casting 246 by means of the set screw 256. The pin 253 has a hook at its right hand end in which the end of a coil spring 257 is inserted. The other end of the spring is inserted in a screw eye which extends through the end of the spring cylinder, and is held by a nut on the screw portion of the eye. This construction makes it possible to adjust the spring tension with which the pipe elbow is urged toward the right.

Threaded on the horizontal portion 259 of the pipe elbow 251 is a collar 263 having an inturned

beveled flange thereon which fits into a recess of a similar collar which is in turn screwed to a tube 264. Tube 264 has a flange at its left hand end, which flange is beveled to cooperate with a similar bevel on a tube 270 fixed within the outer valve tube 50. Tube 264 also has a reduced diameter portion near its right hand end on which the hub of worm wheel 265 is mounted. At the far left end of tube 264 there is a pin which extends through the tube, and into a short tube section 241, which tubular section is in turn riveted to the right hand end of tube 51. Worm wheel 265 meshes with a worm 275 on the shaft 276 which is driven in the manner indicated above. It will be seen that the spring tension exerted on the pipe elbow 251 tends to draw the beveled edges of tubes 264 and 270 together to form a pressure tight joint between the pipe elbow and tube 51 while providing for rotation of the tube 51 under drive of the worm wheel 265.

Door operating mechanism

It will be obvious from the above description that it is intended to place containers to be evacuated and gassed in chambers 63 at the left of the machine, and to remove these containers, after they have been operated upon in the manner indicated, at the right hand end of the machine. During the interval when the chain links 56, and consequently the chambers 63, are passing over the rotating valve mechanism described, these chambers must be closed and air tight.

Mechanism for causing closing of the doors 64 of the chambers 63, latching them closed, and unlatching and reopening them, is described below.

Supported on the body portion 57 of each chain link 56 is a hinge 76 (Fig. 7) on which is rotatably mounted the door or gate 64, which door comprises substantially one entire side of the evacuating chamber 63. Door 64 is normally held in its closed position by means of the combination right and left hand coil spring 80 (Figs. 4 and 6) located on the hinge pin with its ends bearing against the link body portion 57. Formed in the middle of the spring, between the right and left hand coils, is the inverted U-shaped portion which engages the arm 77 integral with the bottom of the door 64. This arm 77 carries a roller which bears against a rod 78 (Figs. 4 and 6) extending longitudinally of the machine and fastened to the casting 42. The rod 78 is bent in J-shape, the short end of the J being inserted in a hole in the upper portion of casting 42, and fixed therein by means of a set screw 79 (Fig. 6). The long arm of the J of rod 78, as it extends toward the left (Fig. 4) is bent upwardly and inwardly as shown in Figs. 4 and 6.

As link 56 is moved to the right, the roller of arm 77 will make contact with the outer (Fig. 6) surface of rod 78, and as the link continues to advance the rod will force the lever downwardly until the gate or door 64 is fully open which will occur at approximately the time that the link 56 is opposite the casting 42 (Fig. 4). Shortly thereafter, the roller on the end of arm 77 will pass from beneath the rod 78, and the hinge spring 80 will cause the door to shut. The door will be retained in its closed position during the evacuating of the container by virtue of the atmospheric pressures on the outside of the door and the pressure of the spring 80 and the vacuum pull on the inside of the door. A tight seal is created by the soft rubber gasket 63' located in the edge of the chamber 63. When the link has

passed from the suction or evacuating portion of the apparatus to the pressure applying portion, the door must be held shut against pressure. For this purpose the mechanism shown in Figs. 10, 11 and 12 is provided.

Door latching mechanism

The mechanism for latching the doors is shown in connection with the particular form of chamber 63 of Fig. 8; it is obvious that this mechanism is equally applicable to any form of chamber as, for example, that shown in Figs. 6 and 7.

Mounted in a hole in the thick walled top of chamber 63, Figs. 10, 11 and 12, is a shaft or stud 81 on which a bell crank 82 is rotatably mounted. The vertical arm of the bell crank 82 is provided with a cam following roller 84 for cooperation with a cam 83 suitably mounted on the frame of the machine in position to operate the bell crank just prior to the passage of the link-borne chamber 63 into the pressure applying zone. The horizontal arm of the bell crank 82 has a beveled end which is adapted to cooperate with a latch plate 85 integral with the door 64. Integral with the vertical arm of the bell crank 82 is an extension in which a pin 86 is inserted and pressed downwardly by a spring 87 extending between the shoulder on the pin and a screw 88 inserted in the hole. This pin cooperates with a depression in the wall 63 of the chamber to act as a detent and hold the bell crank in the position shown in Figs. 10 and 11. When the cam follower roller 84 strikes the cam 83 the bell crank 82 is caused to rotate through a 90° angle taking the position shown in Fig. 12 and latching the door closed, the edges of the door seating against a gasket such as that shown at 63¹ in Fig. 7.

The bell crank remains in the position of Fig. 12 until the container has been filled with gas and sealed, at which time the link 56 will have moved to the right and will be adjacent to the end of tube 50. Suitably mounted on the machine frame at this point is another cam 90 which, as the link continues to move, is contacted by the cam follower 84 and causes the arm of the bell crank to rise and return to its normal position, unlatching the door 64, said door then being opened as already described in connection with Fig. 7 so that the operator may remove the gas filled and sealed container.

Container sealing mechanism

It is obvious that after the containers have been evacuated and gassed, they must be sealed before removal from the chamber 63. There are many common ways of sealing containers, as, for example, capping them with crown caps, spinning tops thereon, etc. For purposes of simplicity, the containers shown in Figs. 8 and 9 are bottles or cans which are sealed by the application of crown caps. The chambers 63 of Figs. 8 and 9 are shown with mechanism for performing this sealing operation.

Each chamber 63 has a cylindrical, projecting portion integral with the top thereof. Through a hole in this projection a plunger 91 is inserted, this plunger being surrounded by the packing 92 inserted in the hole and held in place by the packing nut 93. At the top of the plunger a head 94 is riveted. Between the packing nut and the head 94 a coil spring 95 is compressed. Mounted on the head 94 is a cam follower 96 which cooperates with a cam rail 97 which is supported in any suitable manner from the frame of the machine.

Fastened to the bottom of the plunger 91 is a cap holding member 98 adapted to resiliently retain a single crown cap.

Just prior to the passage of the link into the evacuating zone, or, in other words, during the interval while the door 64 is open, the operator places the container to be evacuated within the chamber, and likewise places a crown cap in the member 98. When a link reaches the cam rail 97, the cam follower moving along that rail causes depression of the plunger 91 and downward movement of the crown cap on to the container top. As the follower continues to move along the rail, pressure is exerted to force the cap on to the container top, sealing the container. Additional movement of the link 56 causes the cam follower 92 to move upward under pressure of the spring 95, removing the cap member from the applied cap. At about this time the door latching mechanism described above permits the door to open, and the operator can then remove the evacuated, gassed, and sealed container.

Additional synchronizing means

An alternative or additional means for assuring synchronization of the movement of the chain link 56 with the rotation of the inner valve tube 51 is provided, this mechanism comprising rack segments on each of the chain links cooperating with gears driven from the main power source. This alternative synchronizing method is shown in detail in Figs. 8 and 9. It is to be understood that the mechanism is provided in duplicate, one on either side of the machine, although this is not shown in Figs. 8 and 9 since Fig. 9 is a broken, transverse section showing but one side of the machine.

The body 57 of each link 56 has fastened thereto on either side, a rack segment 301. The rack segments of the successive links form in effect a continuous rack. Fixed at any suitable point along the machine, and fastened to the outer channels 39 and 41, are castings 303 which serve to support shafts 305 and stub shafts 307. Mounted on the upper end of shaft 305 is a spur gear 310. At the lower end of shaft 305 is a spiral gear 312. Mounted on the stub shaft 307 is an idler gear 314 which engages both the rack segment 301 and the gear 310. Fixed for rotation with shaft 55 and in position to mesh with the spiral gear 312 is a spiral gear 316.

As shaft 55 rotates it causes rotation of shaft 305, gears 310 and 314, and movement of the rack segment to assure movement of the links 56 along the tube 50 at a definite rate.

The worm wheels, gears, and rack segments are so proportioned that the chain links are moved at exactly the same rate as that at which a roller, if placed in the helical groove of tube 51, would advance longitudinally of that tube.

The above has described a machine for evacuating and gassing containers as a continuous process, the containers being mounted in air tight chambers adapted for continuous movement along a vacuum and pressure applying tubular valve guide-way. This identical method of applying vacuum is of value in registering thin, pliable packaging material for operations thereon to form complete packages or to form containers. A machine of the type mentioned is disclosed in my co-pending application Serial No. 744,928, filed September 21, 1934. The machine hereinafter described is in some respects a modification of the machine of that application, for which reason the co-pending application will

be frequently referred to in the following description.

Since the frame structure, the driving mechanism, and the tubular valve arrangement for controlling the application of vacuum to the moving links of the conveyor chain are substantially identical with those already described, this description will not be repeated. It should be noted, however, that like parts in Figs. 13 to 36 are given the identical reference characters as in Figs. 1 through 12. Where minor differences do occur they are pointed out in the following material.

Referring now to Figs. 13A to 13F' the cellulose acetate or other material from which packages are to be made is supplied from any convenient source such as the reel shown in my prior application Serial No. 744,928, and is then drawn, together with reinforcing strips, between rollers 401, 402, Figs. 13A and 13A', and thereafter passed through the forming member 403 to turn its edges downward toward each other after which the turned edges are passed between the rolls 404 and 405 to crease the folds into the material. Subsequently the sheet is passed through the oppositely positioned forming member 406 to raise the turned over edges to a position at an angle of approximately 120° to the base of the sheet. The sheet with its turned up and reinforced lateral edges is then fed to the link structure and caused to register with the links by the suction applied there-through.

In order to assure that the creases in the material be properly placed, and sufficiently sharp, additional mechanism such as that shown in Figs. 14 and 15 may be provided. This mechanism includes forming edges over which the material is folded as well as tapered rollers to assure that the material, once shaped, retains its shape until it is in place on the chain links.

The supplemental folding mechanism is mounted on extensions of the channel members 39 and 41 and is driven from an extension of shaft 55, this extension being supported in any suitable manner, as by bearing block 410, from the channel 41.

Mounted on channels 39 and 41 are brackets 411, 412, (not shown), 413 and 414 (Figs. 14 and 15). Brackets 411 and 412 (not shown) adjustably support rollers 415 and 416 while brackets 413 and 414 support sprocket roller 417 and roller 418. Rollers 415 and 417 support an endless belt 421 which is considerably wider than the sheet of material and is provided with perforations along its edges to engage pins inserted in the periphery of roller 417 to prevent slipping of the belt (Fig. 15), while rollers 416 and 418 carry a similar endless belt 422 which is approximately the width of the completed package as will be seen. These belts are endless steel belting which are common in use for this kind of machine.

Supported intermediate the pairs of brackets is a third pair of brackets 422 and 423 (only 423 being shown in the drawings) on which are mounted the forming members 403 and 406 as well as a pair of forming rollers 404 and 405, the upper forming roller 404 in this form having no flanges since it rests upon the upper belt 422, the lower belt being supported by roller 405.

Bracket 413 has a portion formed as a bearing to rotatably support a vertical shaft 425 which carries the spiral gears 426 and 427 one on either end. The gear 427 on the lower end

of the shaft meshes with and is driven by a spiral gear 428 on shaft 55.

Upper gear 426 meshes with a spiral gear 429 on the shaft of roller 417, gear 429 in turn meshing with a spiral gear 431 on the shaft of roller 418. Also, on the shaft of roller 417 is a sprocket wheel 432 which drives chain 433 passing over sprocket wheel 434 on the shaft of roller 405, the ratio of the sprocket wheels being such that the roller 405 moves with the same peripheral speed as that of the belt 421.

It will be seen from the above that when the mechanism described is used the sheet material together with its reinforcing strips passes between the two belts and is carried with them to the forming piece 403. Here the lower belt 421 passes beneath the forming member while the material sheet and the upper belt 422 pass through the forming piece which causes the edges of the sheet to be bent over the upper belt. Thereupon the two belts with the sheet (with its edges turned over on top of the belt 422), pass between rollers 405 and 404. Rollers 405 cause the creases in the sheet to be pressed in. Thereafter, the sheet and upper belt pass through the forming member 406, the sheet being threaded through the piece in such manner that as it advances therethrough the sides are raised until they are at an angle of approximately 120° to the base.

In order to guide the folded sheet into position on the chain links the guide rollers 436 and 437 are provided. These rollers are supported in bars 438 supported on brackets 413 and 414 at one end and on the other end on separate brackets 441. The upper rollers 437 have tapered sides which conform to the taper put into the material and thus maintain that taper until the sheet is delivered to the chain links.

Then as shown in Figures 13B and 13B' reinforcing cross strips are moved into position above the sheet of material and between successive links of the moving chain. The end reinforcing strip applying mechanism which is shown at 442 moves in an elliptical path causing the reinforced strips with bent up ends to be pressed down against anvils 355 and 356 which will be described hereinafter, and which are mounted on the links 56 for movement therewith. Prior to application of these reinforcing strips by the member 442, a knife 443 carried by that member moves downwardly and severs the sheet. Thus a reinforcing strip is placed on each of the two adjacent portions of the sheet. As the strip continues to move the reinforced portions of the sheet are turned upwardly by means hereinafter described. At the same time templates or shaping members 445 similar to those shown in Figs. 87, 88 and 89 of the above mentioned co-pending application Serial No. 744,928, are caused to seat against the top of the link 56 and the lateral edges of the sheet are folded up against the sides of the templates and reinforcing corners applied thus forming a series of joined tray shaped containers with reinforced corners.

After the formation of the containers in the manner described above, articles to be packaged are inserted within these containers in the manner diagrammatically shown in Figs. 13C, 13C' and 13C''. The details of the mechanism for performing this operation are either disclosed in the above mentioned co-pending application or discussed hereinafter.

The next step in the process is the application of cover sheets to the containers. This is accom-

plished by means of the vacuum registration members 446 (Figs. 13D and 13D') which carry a strip of cover sheet material to position over the containers. After this cover sheet has been applied, passage of the chain link between adhesive applicators 447 causes the insides of the lateral turned up edges of the package forming sheet to be coated with adhesive at their inner surfaces. As the chain continues to move, the folding members 448 fold these lateral edges down upon the cover, and cause adhesion thereto, the mounted brushes 449 smoothing down and wiping off any excess adhesive. These brushes due to the angle they are set at pull the turned down sides in tightly against the outer edges of the cover strip. It is to be noted that during the above mentioned operations the anvil members 356 assume positions to aid in holding the package forming sheet material in position for the application of the pressure from the brushes 449. It is also to be noted that the cover sheet causes the loop of partition material formed between packets (Figs. 13C' and 13C'') to be flattened and to lie flat beneath the cover sheet as shown at left hand side of Fig. 13D'.

After the application of the cover sheet this sheet and the loop of partition material mentioned above are cut apart between packages by means of the knives 451 which operate through a triangular path under control of a mechanism hereinafter described. Subsequent to the cutting operation the severed portions are folded down over the ends of the packages by means of a plunger 452 likewise moving in a triangular path and controlled by mechanism similar to that mentioned in connection with knives 451. When the plunger 452 moves downward the end folding blades 368 (Fig. 13E') move down with it as shown in dotted lines and then they move upward with the plunger to pass over the outside of the folded down portions of the cover to hold them in position. At this time the packages are complete except for the fact that they are joined by the reinforced lateral edges or sides of the original sheet of material, and are spaced apart a short distance. In order to fold these lateral edges and permit the packages to approach each other, the mechanism shown at 453 of Figs. 32, 33, 34 and 13F' is provided. This mechanism will not be described in detail since it is identical with the folding mechanism shown in the co-pending application mentioned. After the folding operation, knives 454, which operate in a triangular path, cut the packages apart, this being the final operation. As in the co-pending application these knives may be caused to cut apart all packages, or may be controlled to cut between only each second or third package, leaving one or more unit packages close coupled as the completed package.

As has been stated hereinabove the tubular valve mechanism comprising the tubes 50 and 51, is substantially identical, when utilized to supply vacuum for registering the sheet of pliable material, to the mechanism when used for evacuating and gassing containers.

One of the differences which exist is the fact that the plug 280 is not provided since the tube 51 is evacuated throughout its length, and both pipes 157 and 257 supply vacuum. Another slight difference between the mechanisms, when used for the two purposes, is caused by the fact that the conveyor links 56 in the packaging machine are separated a slight distance during the major portion of their traverse of the valve structure, and are moved together near the ends of

that traverse at the time when the lateral edges of the cellulose, or other sheet, are folded inwardly by the mechanism. In order to provide for this the rearward extensions of the link side pieces 58 and 59 are provided with slots instead of holes so that successive links may move toward and away from each other. In order to positively move the successive links towards each other, as the lateral edges of the sheet are folded inwardly, the pitch of the helical grooves of shafts 52 and 54 is lessened, thus causing a slower rate of advance during the latter portion of the traverse of the link over the valve structure. The links are again separated to initial spacing by the terminal sprocket. Additional mechanism for assuring that the links move together, may be supplied. One form of such mechanism is discussed hereafter.

Since the vacuum must be continuously applied to the moving links, the pitch of the helical groove cut out in the inner tube 51 is likewise lessened so that a portion of that groove always lies directly beneath the passage-way to the conveyor or chain link, and the center of the flat surface between helical grooves remains at the center of the space between links.

Link structure

The links 56 when utilized in a packaging machine are provided with means for folding up the sides and ends of incised portions of the sheet material to form tray shaped containers. In my co-pending application above mentioned hinged suction sides and ends are provided for the link platform or top, and these sides and ends are caused to rotate about their hinges, at proper times in the machine cycle, to cause folding up of the sides and ends of the material. In the present machine this structure is slightly modified, the hinged vacuum forming sides being rotatable but movable to a lesser degree than formerly, and the hinged vacuum ends being replaced by mechanically operated anvil and folding members as is best shown in Figs. 16, 17, and 23-26.

Moreover in the present machine heating elements are provided to cause partitioning strips (similar to those of the above mentioned co-pending application Serial No. 744,928), shown in Figs. 13C' and 13C'' as used in cigarette packaging, to adhere to the bottoms of the tray shaped sheet portions. These heating elements are shown in Figs. 17 and 22.

The links which are provided when the machine is adapted for packaging differ from those used when the machine is utilized for package evacuating in the respects mentioned above and in other minor details as will appear in the following description.

There are shown a number of forms of packaging machine link and cooperating parts. Since these forms are generally similar one form only will be described in detail and the differences between it and other forms pointed out.

In the first form each link 56 (Figs. 16-18 and 32) comprises a base portion 320 having a semi-cylindrical under surface adapted to fit over the outer valve tube 50 to form an air tight seal therewith; an integral hub portion 321 extending upwardly and having a central bore communicating with a passageway through the base; substantially V shaped side walls 322 integral with the base and hub, these side walls having outwardly extending flanges on their upper edges; and upwardly divergent end walls 323 joining the

enclosed edges of opposite side walls and made integral with the side walls and hub (see Figs. 16, 17 and 32).

Side pieces 324 and 325, generally similar to the pieces 58 and 59 of the links heretofore described, are fastened to the base 320. The pieces 324 and 325 are spaced from the side walls and fastened thereto by means of bosses 326 and screws 327. In addition to performing the functions of side pieces 58 and 59 the side pieces 324 and 325 serve as guides for the anvil and end-folding members.

A plate 328 is mounted on the flanges of the side members 322 and on end members 323, this plate having a central hole which registers with the bore of hub 321, the plate being pressed against a gasket fitted in the upper edge of hub 321 to insure an air tight joint (Fig. 32).

Mounted on the plate 328 is a rectangular suction block 329. Block 329 has in its lower surface an oval shaped longitudinal central groove 330 (Fig. 18) which communicates with the bore of hub 321. Extending transversely of the under surface of block 329 at spaced intervals are small grooves 331 which at their inner ends merge into groove 330 and thus form suction passageways. Spaced transversely of the link along each groove 331 are holes 332 which register with countersunk holes in a top plate 333. By this construction suction ports are formed whereby the negative pressure existing in the valve tube 51 is applied to a sheet of material fed to the top plate on link platform 333.

Lying intermediate the grooves 331 and in the upper surface of block 329 are grooves 334 in which electrical resistance heating elements 335 are placed. These heating elements are electrically connected by means of short lengths of insulated wire 336 lying in longitudinal grooves 337 at each side of the link (Figs. 17, 18, 19, 22).

Near the center of each of these longitudinal grooves there is a hole in block 329 and a corresponding hole beneath it in plate 328. Through these holes lead in wires pass and are connected to binding posts 338 (Fig. 17) insulatedly mounted in side walls 322 of the link. The binding posts 338 also serve to support upwardly and outwardly extending brushes 339 which make sliding contact with trolley rails and convey electrical current from the rails to the heating elements during that portion of the machine cycle during which partitioning strips, together with the articles to be packaged, are placed in the pre-formed trays, i. e. during that portion of the movement of a link represented in Figs. 13C' and 13C''.

The links are provided with hinged side portions which contain suction ports and which serve to fold the sides of the sheet of material to vertical position and retain them in such position until the package has been completed. The construction of the hinged side members is best shown in Figs. 18-22 and will be described in connection therewith, reference being made also to Fig. 17.

Fastened in the angles between the sides of block 329 and the extended edges of plate 328 (Figs. 19 and 21) are supports 340 which are shaped to accommodate outer hinge tubes 341, the latter being closed at their ends by screw plugs 342 and forming the stationary portion of vacuum or suction-communicating hinges. The movable portions of these hinges comprise the inner tubes 343 and the side-folding members 344, the members 344 being shaped to fit the outer tubes and each mechanically joined to its respective inner tube 343. The folding members 344 are fastened to the inner tubes 343 by shoulder screws 345 which pass through arcuate slits in outer tubes 341 and thread into inner tubes 343.

At spaced intervals small tubes 346 (Figs. 19 and 22) extend horizontally through the supports 340 and the edges of suction block 329 and connect the outer tube with the suction holes 332 at the sides of suction block 329; at similarly spaced intervals and in position to register with the tubes 346 there are slotted holes in the inner tubes 342. Ordinarily, when the members are in the position of Fig. 21 the holes in the tubes are in partial register only and thus a very slight suction is caused to be applied to the side-folding members. When the folding member 344 is in the position of Fig. 19 the holes are in exact register and full suction is applied.

At regular intervals along each tube 343 there are arcuate slots through which pass small tubes 347 fixed in holes in the inner tube and extending into holes in the folding members. Holes are drilled in the face of folding members 344 these holes connecting with the interior of tubes 347. Means are provided for rotating the folding members about their hinges to cause the edges of a sheet of material to be folded up at right angles to the sides. The mechanism for causing this rotation is seen in Figs. 18, 19 and 21; it comprises a central bifurcated extension 348 of the member 344 in which a roller 349 is rotatably mounted, cooperating with a cam rod 351 fastened to a fixed part of the machine. Cam rods 351 are bent downwardly and outwardly near their left ends which lie adjacent the point at which template 445 seats squarely upon the link platform, (Figs. 13B and 13B'). Springs 352, stretched from the folding members 344 to pins in the link side pieces 324 or 325 serve to hold the roller against the cam rods 351.

Due to the shape of the link, i. e. due to the upward divergence of the end walls 323, the hinge tubes are not carried out to the extreme ends of the side-folding members 344. Since it is desirable to apply suction to the lateral edges of the packaging material, particularly at the link ends, means are provided for so doing.

Holes are drilled inward from the ends of members 344 each of these holes communicating with one of the tubes 347 and a second hole is then drilled from the face of the member to meet the first hole, the end of the first hole being then sealed by means of screw plugs 353 (Fig. 20).

Anvil members are provided to form surfaces on which pressure, as for applying the reinforcing strips (Fig. 13B element 442), may be exerted and between sets of which (Fig. 13B element 443) a knife may descend to make an incision in the sheet material.

Each of the anvil plates 355 and 356 of the first form of link structure is a plate which is generally rectangular (Fig. 17) in shape and the sides of which extend into inclined grooves 357 and 358 in the side pieces 324 and 325. In addition to being guided by the grooves mentioned the anvil plates 355 and 356 have slots therein through which extend pins 361 fastened to the end pieces 323, the pins and slots limiting the movement of the plates.

Each anvil plate has a pair of lugs extending outwardly therefrom, one on either side. Thus anvil plate 355 is provided with lugs 362 which extend to the sides and are then bent downwardly (Fig. 17) and carry on their ends rollers 363 which rollers lie in a groove in a cam rail 364 or 365.

Each anvil plate has a pair of lugs extending outwardly therefrom, one on either side. Thus anvil plate 355 is provided with lugs 362 which extend to the sides and are then bent downwardly (Fig. 17) and carry on their ends rollers 363 which rollers lie in a groove in a cam rail 364 or 365.

Each anvil plate has a pair of lugs extending outwardly therefrom, one on either side. Thus anvil plate 355 is provided with lugs 362 which extend to the sides and are then bent downwardly (Fig. 17) and carry on their ends rollers 363 which rollers lie in a groove in a cam rail 364 or 365.

Similarly each anvil plate 356 is provided with lugs 366 which lugs extend outwardly and upwardly and carry at their ends cam rollers 367 which lie in another groove in the cam rails 364 or 365.

The cam rails 364 and 365 extend longitudinally of the machine for substantially its entire length, being supported by the castings 42, 43, 44. The cam grooves for rollers 363 and 367 are cut in such manner as to cause the anvil plates to rise at proper times to form a support for the end portions of the material during operations thereon, as is indicated in Figs. 13B, 13D, 13E', 13F, 13F'. Cam rails 364 and 365 support the cam rods 351 and the trolley rails previously mentioned (Fig. 17).

Means are provided to fold the ends of the sheet portion upwardly to form tray shaped containers. In the present machine this folding is done by thin flexible plates 368 (Figs. 16, 17) which rise and fall under control of a third groove in the cam rails 364 and 365. In the embodiment of Figs. 16 and 17 each plate 368 (one at each end of each link) is fastened between two bars 370 and 371, the latter of which extends through slots in the side pieces 324 and 325 and carries at its outer ends cam rollers 372 and 373 which lie in the third grooves of cam rails 364 and 365 respectively. The bars 370 are retained in the slots of pieces 324 and 325 by angles 374 and 375 fastened to the pieces with the horizontal portions overlying the slots.

It will be obvious that the end-folding members or plates 368 are moved upwardly and downwardly along an inclined path as the links move along the machine; the cam rails being so grooved that these movements occur as indicated in Figs. 13A—13F'.

Because of a possible tendency for the action of the cam rollers in their groove to cause upward movement of the entire link structure and consequent leakage of suction, the alternative form of anvil plate mechanism and link structure of Figs. 23—29 has been devised.

In this form the link structure, other than the mechanism for operating the anvil plates, is similar to that above described. It comprises the base portion 320 adapted to fit over and cooperate with the valve tube 50, the hub portion 321 communicating, through a passage in the base portion 320, with the valve tube 50 and the upwardly divergent end walls 323, Figs. 26 and 27. It will be noted that no integral side walls are provided and that the end walls 323 are made thicker at the top to cooperate with plate 328 on which a suction block 329 and top plate 333, or link platform, and side-folding members are mounted as before.

Side pieces 324 and 325 are made much thicker than in the first form and in effect combine the side pieces 322 and 324 or 325 in one member. Cam rails 364 and 365, with trolley rails mounted thereon, cooperating with brushes 339 on the link structure, are provided. While the elements just mentioned differ slightly from those previously described and illustrated in Figs. 16, 17 and 18 the drawings illustrate the differences sufficiently so that no further description is believed necessary.

Anvil plates 355 and 356, generally rectangular in shape, but having their upper corners cut away (see Fig. 24), have their outer edges in inclined grooves in the inner surfaces of side pieces 324 and 325. Each anvil plate has attached thereto a pair of rack segments 376, those

of plate 355 being adjacent the sides of the plate and at the bottom thereof and passing through slots in the inner plate 356; the rack segments 376 of plate 356 are slightly toward the link center from those on plates 355 and are approximately midway up the plate (Figs. 28 and 29).

Meshing with each of the rack segments is a gear which serves to move the anvil plates up and down as the link traverses the valve tube.

Meshing with each rack of any plate 355 is a gear 377, there being four such gears to operate the two anvil plates 355 of a link (Figs. 26, 27 and 28). These gears are mounted in pairs on shafts 378, each gear of a pair lying adjacent one end of its shaft. Shafts 378 are mounted in holes in side pieces 324 and 325.

The gears 377 on the left of the link (Fig. 26) are driven by gears 379, one of which is rotatably mounted on stub shaft 380 and is an idler gear, and the second of which is fixed to shaft 381, which shaft is rotatably mounted in side piece 324 and extends to the surface of this piece. Mounted on shaft 381 in a depression in piece 324 is a gear 382 (Figs. 23 and 25) which is adapted to be driven by an internal gear 383 in an annular groove in piece 324. Fixed to internal gear 383 is a disc 384, integral with which is an arm 385 which carries a roller lying in a groove of the cam rail 364 (Figs. 23, 25 and 26).

It will be obvious from the above that as the roller follows the cam groove of the cam rail, the disc 384 and consequently the gear 383 is oscillated about its center, thus driving gear 382 and shaft 381. Gear 379 on shaft 381 drives one shaft 378 through gear 377 and the other shaft 378 through idler gear 379 on the stub shaft 380 and the gear 377. Consequently, since gears 377 mesh with the rack segments, anvil plates 355 move up and down as the cam roller moves along its groove. (It is to be noted that in this form of mechanism the two anvil plates, one at either end of a link, move together whereas in the first form the anvil plates on the two ends of the link move successively.)

Inner anvil plates 356 are driven by a system of gearing similar to that described in connection with plates 355. Each rack segment 376 of plates 355 has meshing with it a gear 386. Two gears 386 are mounted on the opposite ends of each of two shafts 387 (Fig. 26), these shafts being journaled in the side pieces 324 and 325. Meshing with each of the two gears 386 at the right of the link (Fig. 26) is a gear 388, one of which (the lower in Fig. 26) is an idler gear mounted on stub shaft 389 and the other of which is a drive gear is fixed on a shaft 390. Shaft 390 is journaled in the side piece 325. Fixed on the other end of shaft 390 (right end, Figs. 24 and 26) is a gear 391, which lies in a depression in the outer surface in side piece 325 and is in mesh with an internally toothed gear 392 which lies in an annular depression of piece 325. Internal gear 392 has a disc 384 pinned to it which disc carries an arm 385, a cam roller on which extends into a groove in the cam rail 365.

Thus as the link moves along the valve tube 50 the inner anvil plates 356 are caused to move up and down under control of the cam groove in the rail 365 and are retained in their normal positions by the coil springs 378' and 387' which are anchored to end walls 323 by screws and hooked into holes in the shafts 378 and 387 respectively (Figs. 26 and 27).

In this form of link, as in the one previously

described, end-folding members or plates 368 (Figs. 23, 24 and 27) are provided. While before these members were guided by grooves in side pieces 324 and 325, for movement along curved paths, they are now guided by straight grooves in the pieces. The construction is generally similar to that employed in the first form, the flexible folding member or plate being held between two rigid bars 370 and 371, the bar 370 extending through a groove in each side piece and being held in place by a plate 393. The two end-folding members at the ends of a link are held in their lower positions by two springs 394 (one on either side of the link) coiled about a central screw 395 (Figs. 23 and 24) and extending into the bar 370 or a block fixed thereto. The bars 370 have small holes therein in which balls 396 (Fig. 23, and lefthand side of Fig. 24) are placed, these balls cooperating with the bases of the grooves and with the plates 393 to reduce the friction necessary to be overcome in operating the end-folding members.

As in the first form the bar 370 carries rollers 372 which lie in grooves in cam rails 364 and 365 and thus the end-folding members are raised and lowered at proper times to cooperate with the various mechanism of Figs. 13A-13F.

A third form of link structure is shown schematically in Figs. 30 and 31. In this instance the second form is modified by fastening the cam roller arm 385 and a cover disc 384' to the internally toothed gears 383 or 392. The arms 385 and discs 384' are located in depressions of the side pieces 324 and 325, said depressions being of such shape to allow the arms 385 to oscillate. By also placing springs 394, screws 395 and the ends of bars 370 below the surface of side pieces 324 and 325, the cam rails 364 and 365 have been moved inwardly to bear against pieces 324 and 325, and thus serve to provide bearing surfaces and prevent any possible rotary or tipping movement of the links during their traverse of the valve tube.

Auxiliary mechanism

In discussing the schematic diagrams of Figs. 13A-13F, mention was made of a mechanism for causing certain of the knives and folding members to travel in a generally elliptical path. This mechanism is shown in connection with the final cutting knives 454 in Figs. 32 and 33 and in connection with the folding plunger 452 and cover sheet knife 451 as well as the final cutting knives 454 in Fig. 34.

Fixed to the cam rails 364 and 365 described above are rails 455 having guide-ways 456 therein in which blocks 457 are adapted to reciprocate (Fig. 33). Mounted in a vertical slot in each block 457 and held in place by plate 458 is a slide 461 which carries an arm 462 on which the cutting blade 454 is carried. The slide 461 is urged upwardly by a spring 463 tensioned between a pin on the end of the slide and a pin on the plate 458. A pin 464 projects inwardly from the slide and into a groove in the surface of the rail 455. The groove is generally triangular in shape, the base of the triangle lying toward the top of the rail; the right hand leg of the triangle being shorter than the left.

The left hand portion of the inner margin of the groove is formed as a switch arm 465 which is urged upwardly by a spring coiled about the pivot screw 466.

Extending forwardly from the plates 458 are pins 467 which project into slots in the levers 468

(Figs. 32 and 33), which lever is fixed on shaft 471, which shaft is supported in bearings 472 fastened to channel members 39 and 41. The lever arm 468a of lever 468 carries a roller 473 which rides in a box cam or groove cut in the inner side of a gear 474.

As the gear rotates, therefore, the lever 468 will oscillate about, causing reciprocation of the pair of blocks 457 along the rails 455. Upon movement of the blocks to the right, the pins on the slides 461 will move downwardly following the groove beneath the switch arm 465 and causing the knives to likewise move downwardly so that their inclined edges may sever the folded transverse portion between successive packages. During this movement the pin will ride against the lower edge of the switch arm 465 to the lowest point of the groove, after which it will be urged upwardly following the rise of the groove due to tension. As the block moves to the left the pin will force the switch arm down and the knives will move horizontally back to their starting point. If the knives are to sever the material between each second package or each third package, it is only necessary to alter the speed of gear 482 and the cam groove in gear 474 to accomplish this.

Folding mechanism

The mechanism for folding and close coupling adjacent unit packages to form final packages of a number of units is generally similar to that shown and described in my co-pending application. However, there is this difference, in the co-pending application the unit packages have left the links and are traveling in guide channels when the folding of the lateral edges inwardly occurs, whereas in the instant invention the folding inwardly of the lateral edges occurs while the unit packages are maintained in registration with the links by suction.

Supported on the rails 364 and 365 are upwardly extending castings 484 and 485 integral with which are bosses for rotatably supporting a shaft 486 (Fig. 34). Integral with casting 484 is an arm 487 which forms a support for a vertical shaft 488. The shaft 488 has fixed thereto at its upper end a worm 489 which meshes with a worm wheel 491 on the shaft 486. Shaft 488 is supported at its lower end in a bushing in casting 480 and carries near its lower end a spirally cut gear 492 which meshes with spiral gear 474.

Fixed for rotation with shaft 486 is a wheel 453 (Figs. 32 and 34) comprising a disc 494 having a plurality of radial slots therein. Pivoted to the disc at the base of each slot is a pair of folding arms 495, each pair of arms being spring pressed outwardly by a leaf spring fastened at the base of the slot and bearing against the inner edge of each arm. The arms 495 thus extend radially and are adapted to move toward each other, about pivots at their inner ends, until they lie entirely within the slots.

Cooperating with each folding arm is an operating lever 496 (Fig. 32) which is pivoted to the outside of the disc at one end and at the other end carries a bracket which is fastened to the folding arm. On each operating lever there is a cam roller 497 adapted to cooperate with one of the cam plates 498, which plates are fastened to the hub portions of castings 484 and 485 and extend downwardly therefrom.

The peripheral speed of the wheel 453 is such that the folding arms, when vertical, lie midway between the ends of two successive packages.

Link speed variation

As has been indicated, the speed of the links must be varied in order that adjacent links may move together as the strips of material joining the unit packages at their ends are folded inward.

In order that the links move together the pitch of the helices cut in shafts 52 and 54 is changed so that links whose rollers lie on one side of the point of change move the length of a package plus the distance between successive packages in a given unit of time, while links whose rollers lie on the other side of the point of change move the length of a package during the same unit of time. The point designated 500 (Figs. 31 and 32) represents the point of pitch change.

The cam plates 498 (Figs. 32 and 33) have their cam surfaces so cut that the folding arms 495 start to move inwardly immediately after their ends lie beneath the upper edge of the package joining strips and continue to move inwardly until the arms are vertical. At this time the distance between adjacent packages (and links) has been diminished, but not eliminated. The arms 495 are narrowed at their ends so that they fold inwardly only as much material as has been made available by the movement of the links (Fig. 35) and do not exert any force tending to unseat the unit packages from the links or to cut the strips. Immediately after the folding arms have been moved inward to the greatest possible extent the cam rollers 497 ride off the cam surface of plate 498 and the folding arms move outwardly under action of the leaf springs mentioned. The folding in of the strip of material which is thus started is readily completed due to the movement of the links to close up the remaining space between packages as described.

In order to assure that the links move together at the proper time, and to supplement the drive of the helical grooves in shafts 52 and 54, a compound gear arrangement is provided, this arrangement being illustrated in Figs. 30, 31, 35 and 36.

Mounted on channels 39 and 41, and substantially under the shaft of folding wheel 453 are castings 501 which rotatably support vertical shafts 502 which shafts carry gears 503 and 504. The spiral gears 504 mesh with gears 505 fixed for rotation with shafts 53 and 55. Each casting 501 has mounted therein the stud shafts 506, 507, 508 and 509. Shafts 506 and 507 carry the idler gears 511 and 512, while shafts 508 carry compound gears 513, 514 and shafts 509 carry compound gears 515, 516.

Gears 514 and 516 mesh with rack segments on the links, these segments being identical with segments 301 (Fig. 9) already described.

The gear ratio is dependent upon the height and length of the package. Referring now to Fig. 36 it will be seen that the distance between two successive packages must be equal to twice the height of the package (since the base and cover sheets are folded down and up respectively to form and cover the ends of adjacent packages). The height of the package is represented in Fig. 36 by dimension C.

It will be obvious that during the time in which one link travels the length of a package or A, the succeeding link must travel the distance B or $A+2C$. The speed ratio of two successive links is then the ratio of A to $A+2C$.

With the package illustrated the height is $\frac{1}{4}$ " and the length $3\frac{1}{8}$ ". When this package is considered the speed ratio between succeeding links is 25 to 29.

In order to procure this ratio, using standard gears, the compound gears 513—514 and 515—516 are utilized. Gear 513 has 30 teeth; gear 514, 24 teeth; gear 515, 29 teeth; and gear 516, 20 teeth. Thus the ratio of compound gear 515—516 to compound gear 513—514 is as 25 to 29, giving the correct speed ratio for successive links.

Miscellaneous mechanisms

In the general description of the packaging machine various mechanisms were mentioned most of which have been described above. Certain mechanisms, which are identical with those of the copending application above mentioned have not been described in detail.

The template shaping members 445 are identical with those shown in Figs. 87, 88 and 89 of the prior application and need not be described herein.

Likewise, the mechanism for forming packets of cigarettes (Figs. 13C—13C'') is identical to that shown in Figs. 2 and 35F—38F of the copending application and described in connection with those figures.

The cover sheet applying mechanism 446, while generally similar to that of Fig. 3 of the copending application is simpler than that described therein since mechanism 446 applies a continuous sheet of material rather than the small sheet portions of Fig. 3 of the earlier application and therefore requires no mechanism for cutting the sheet at intervals. Mechanism 446 comprises simply suction cups arranged to travel in an oval path, as in Fig. 3 of my copending application, and to place the cover material on the unit packages during the traverse of the lower portion of that path, suction being applied to the cups during that period alone.

Operation

The foregoing has described generally the sequence of operations of the packaging machine utilizing the new vacuum applying mechanism and has set forth the structure of various of the mechanisms in detail. In order to show the mode of cooperation of these mechanisms in performing the sequence of operations indicated, a brief summary of the operation of the packaging machine follows.

Material of a width sufficient to form a base, side walls and top flaps for the desired package is led from a reel (not shown) to feed rollers 401 and 402 driven in any suitable manner, as by gears on an extension of shaft 55. Reinforcing strips are fed from another reel to the rollers 401 and 402, these strips being coated with adhesive on their under sides so that they adhere to the sheet material. The lateral reinforcing strips are spaced apart the width of the package base and thus are adapted to become side wall reinforcements.

The material with the reinforcing strips thereon is next fed to the mechanism 403, 404, 405 and 406 of Figs. 13A and 13A' or, in the alternative, to the mechanism of Fig. 14. Either of these mechanisms serve to crease the material along the inner edge of the reinforcing strip and to unfold the edges of the sheet until there is an angle of approximately 120° between the base and side wall.

The material is then fed to the suction platform of one of the links 56 of a chain and when the link passage 321 communicates with the first of the series of holes in outer valve tube 50 suction is applied to the material to hold it to the

link. The links 56 are spaced apart a distance equal to twice the height of the desired package. The sides of the material lie against the side folding members 344 (Fig. 19) and are held in position by the slight suction exerted by these members when in their lower position as explained.

Shortly after the link has moved into position on the valve tube the rollers on the forward anvil plates 355 and 356 carried by that link (which rollers pass into respective grooves in the cam rails 364 and 365 as the link moves onto the tube) move upwardly due to the shape of the cam grooves, and, with the rear anvil plates on the preceding link (which have also moved upwardly), form a platform or anvil, this platform having a narrow slit in the middle thereof as shown at the left of Fig. 13B. The mechanism 442-443 is caused to move downwardly, while advancing at the same rate as the link chain (under control of mechanism such as that of Figs. 32 and 33), thus causing knife 443 to make an H-shaped incision in the material and also causing mechanism 442 to press transverse reinforcing strips against the edges of the incision. The transverse reinforcing strips are prepared in advance in any suitable manner and are provided with turned-up tabs at the ends, these tabs as well as the body of the strip being coated with adhesive.

As the links continue to advance, the anvil plates are moved downwardly to their lowest positions. Then the templates or shaping members 445 move into position against the base of the sheet and as this is occurring the end folding members of the links start to rise. Thus, when the template is finally seated the end folding members will have reached their uppermost positions so that the reinforced transverse portions of the sheet are folded upwardly and lie against the end of the template with the tabs of the reinforcing strip against the side of the template. Grooves in cam rails 364 and 365 control the end folding member as described hereinabove.

While the template or shaping member 445 is seated on the material, and while the end-folding members are still in their uppermost positions the side folding members 344 are caused, due to cam rod 351, to rotate about their hinges and thus fold the sides of the sheet material upward.

Due to the light suction applied at first and due also to the stiffness given the sides by the material reinforcing strips the side forming members slide over the material and cause a right angle to be formed between base and side walls. Of course, the suction becomes progressively stronger as the hinged side-folding members reach their extreme position so that at that position the side walls are held in register with the folding members and against the template or shaping member.

As the folding members move into place the side walls move against the adhesive coated tabs on the transverse reinforcing strips and thus the sides and ends of the tray-shaped containers are held together.

While the side and end folding members remain in their operated positions the template moves out of the tray (as it continues its traverse) and the mechanism of Figs. 13C-13C'' comes into action to place a packet of articles into the tray. Each packet is comprised of a plurality of articles (cigarettes in the illustrations) and these articles are retained in the packet by partitioning strips which lie between the successive articles and are retained in position by fins which extend between adjacent articles and help support them,

as described in connection with Figs. 2 and 35F to 37F of my copending application. As the packet-depositing mechanism operates, the fins come successively into contact with cam members so that they are withdrawn from their positions between successive articles. Prior to the positioning of a packet in a tray on a link, the brushes 339 of the link will have come into contact with the trolley rail so that at the time the packets are deposited the plate 328 of the link will be heated and consequently the partitioning strip of the packet will be caused to adhere to the bottom of the tray by the heat and the pressure of the fins, which causes the two surfaces to fuse.

The partitioning strip is continuous and extends between adjacent packets, and, therefore, between adjacent links in a loop.

After the packet has been deposited in the tray shape on a link, a cover sheet, guided by the vacuum cups 446 carried on an endless chain as indicated, is placed over the packet and held in place while the appliers 447 deliver adhesive to the top flaps of the side walls and suitable mechanism applies adhesive to the under side of the cover sheet where it will contact the loop of partitioning material. Then the folding member 448 folds the flaps over the cover sheet, and the brushes 449 remove any excess adhesive. The pressure of the cover sheet against the loop of partitioning material causes that loop to flatten out as shown in Fig. 13D'.

When the top flaps are being folded down by member 448 the anvil plates are in extreme raised position so that a pressure resisting platform is provided to assure that the flaps will be secured to the cover sheet between links, and that the loop of material will also be fastened to the cover sheet.

After the top flaps have been folded down a knife member 451, operated by mechanism such as that of Figs. 32 and 33, make an H-shaped incision in the cover sheet making cuts likewise through the top flaps where they overlie the cover sheet and through the partition sheet. The knife member 451 cooperates with the raised anvil plates 356 in making this incision.

After the anvil plates have served the purpose mentioned above, they descend under control of the groove in the cam rail and shortly thereafter the end folding members ascend and present edges over which the plunger 452 bends down the flaps formed by action of the cutting member 451. Any suitable means of applying adhesive to the under surface of the flaps may be utilized to assure that the flaps adhere to the ends of the unit packages.

The end folding members continue in their raised position while the folding wheel 453 folds the lateral edges inwardly (these edges being coated with adhesive by a suitable mechanism) to cause close coupling of the unit packages. After the packages have been close coupled by the folding wheel and the mechanism for closing up the interlink spaces the knives 454 are operated, by mechanism such as that described, to cut apart the packages. This mechanism may be adjusted to cut between each two packages or between alternate packages or in any other desirable manner, leaving any desired number of unit packages connected together to form the final package.

Shortly after the final cutting the links pass out of the vacuumizing zone and the packages are released and taken from the machine.

While a preferred embodiment of the invention

has been described and while this embodiment has been described as utilized in preferred forms of apparatus, it is to be understood that other forms are contemplated and that the invention is capable of application to other uses. Therefore, the scope of the invention is not to be limited by the foregoing description but only by the appended claims.

I claim:

1. In a machine of the class described a link structure comprising a body portion adapted to communicate with a vacuum or suction source, a platform for applying suction to packaging material, anvil members at the ends of said platform, said anvil members being movable to supply pressure platforms and shearing edges for cooperation with mechanism operating upon the packaging materials.

2. In a machine of the class described, in combination, a tubular valve mechanism, a continuous chain of links arranged to be moved along said valve mechanism while in communication therewith to cause packaging material to be registered with said links, means carried by each said link to cause said packaging material to be folded upward to form tray shaped containers, said means comprising plates having rollers thereon which cooperate with grooves in rails extending along said valve mechanism at either side thereof.

3. A vacuum or suction applying mechanism comprising a valve tube having longitudinally spaced openings therein, a second valve tube rotatable within said first tube, said second tube having a continuous groove in the outer surface thereof, a portion of said groove being a helix of a pitch such that a group of said longitudinal openings lies between corresponding points of successive turns of said helix, a second portion of said groove being a helix of a pitch such that a smaller group of openings lies between corresponding points of successive turns thereof, said groove having a width such that a plurality of openings, less than the number in the smaller group, is covered thereby; passage-ways from the interior of said second tube to said groove, means for applying suction to the interior of said second tube and means for rotating said second tube to communicate suction progressively to similar pluralities of openings of the several groups, the rate of progression being less for the second portion of the groove than for the first.

4. In a machine of the class described, in combination, a link structure including a platform adapted to communicate with a vacuum or suction source and to apply suction to packaging material, anvil plates slidably mounted on said links at the ends thereof and means for moving said plates, said means comprising cam followers mounted on said plates.

5. In a machine of the class described, a link structure comprising a platform adapted to communicate with a vacuum or suction source and to communicate the suction to packaging material, anvil plates on the ends of said link structure adapted to move into position to form pressure platforms and shearing edges for cooperation with mechanism operating upon the packaging material, means for moving said plates in and out of position, said means including rack segments on said plates and gear elements meshing therewith, and means for operating said plate moving means under control of cams and cam followers associated therewith.

6. In combination, means for making packages

of thin pliable material comprising a succession of perforated plate bearing links, a valve mechanism, means for moving said links along said valve mechanism at varying rates, and means for applying suction through said valve mechanism to register the material therewith during operations on said material, said valve mechanism being adapted to maintain registration of the material whatever the rate of movement of the links.

7. In combination, a valve mechanism of substantial length comprising longitudinally spaced openings, means for applying suction to said valve mechanism, means for operating said valve mechanism to transmit suction progressively to said spaced openings, the rate of progression being greater during transmission to the openings of one turn than to those of a second portion, a succession of links adapted to move along said valve mechanism, and means for driving said links at rates in synchronism with the progression of transmittal of suction, said means comprising rotating shafts extending along said valve mechanism, said shafts having continuous helical grooves of varying pitch cut therein, said grooves cooperating with rollers carried by each link of said succession of links.

8. In combination, a valve mechanism of substantial length comprising longitudinally spaced openings, means for applying suction to said valve mechanism, means for operating said valve mechanism to transmit suction progressively to said spaced openings the rate of progression being different to the openings of one portion of the mechanism than to those of another portion, a succession of links adapted to move along said valve mechanism and to communicate with said openings, means to drive said links at rates corresponding to the rates of progression of suction transmission, and auxiliary means for driving said links, said means comprising rack segments on said links and gears meshing therewith at either side of the point of rate change, the gears on one side operating at a speed synchronous with one rate of progression and those on the other side at a speed synchronous with the second rate of progression.

9. In a machine for making a package of thin pliable material, in combination, a valve mechanism of substantial length comprising longitudinally spaced openings, means for operating said valve mechanism to transmit suction progressively to said spaced openings the rate of progression being different for transmission to the openings of a portion of the mechanism than for transmission to those of another portion thereof, a succession of perforated platform bearing links adapted to move along said valve mechanism in communication with said openings to register the material with the perforated platforms during operations on the material to produce a package of definite dimensions, means to drive said links at rates corresponding to the rates of progression of suction transmission, and auxiliary means for driving said links, said means comprising rack segments on said links and gears meshing therewith at either side of the point of rate change, the gears at one side operating at a speed synchronous with rate of progression and those at the other side bearing the ratio to the first set that the length of the package bears to the length plus twice the height.

10. In combination means for making packages of thin pliable material comprising a succession of perforated plate bearing links, a valve mechanism,

nism, means for moving said links along said valve mechanism at varying rates, means for pre-forming and supplying material continuously to said links, and means for applying suction through said valve mechanism to register the material therewith during operations on said material, said valve mechanism being adapted to maintain a registration of material whatever the rate of movement of the links.

11. In combination means for making packages of thin pliable material comprising a succession of perforated plate bearing links, a valve mechanism, means for moving said links along said valve mechanism to cause packaging material to be registered with said links, means to supply a continuous strip of material with edges folded upwardly at an obtuse angle to the base thereof to said links, means carried by each said link to cause folding of the said edges in right angle position, means to incise the base portion of the material between the links, and means to fold the portions adjacent the incisions to form with the folded edges tray shaped containers, one of which is registered with each said link.

12. In combination means for making packages of thin pliable material comprising a succession of perforated plate bearing links, a valve mechanism, means for moving said links along said valve mechanism to cause packaging material to be registered with said links, means to supply a continuous strip of material with edges folded upwardly at an obtuse angle to the base thereof

to said links, means carried by each said link to cause folding of the said edges in right angle position, means to incise the base portion of the material between the links, and means to fold the portions adjacent the incisions to form with the folded edges tray shaped containers, one of which is registered with each said link, said last mentioned means comprising plates having rollers thereon which cooperate with grooves in rails extending along said valve mechanism on either side thereof.

13. In combination means for making packages of thin pliable material comprising a succession of perforated plate bearing links, a valve mechanism, means for moving said links along said valve mechanism to cause packaging material to be registered with said links, means to supply a continuous strip of material with edges folded upwardly at an obtuse angle to the base thereof to said links, means carried by each said link to cause folding of the said edges in right angle position, means to incise the base portion of the material between the links, and means to fold the portions adjacent the incisions to form with the folded edges tray shaped containers, one of which is registered with each said link, said last mentioned means comprising anvil plates operable by rack elements mounted on said plates and gear elements meshing therewith, said gear elements being operable under control of cams and cam followers associated therewith.

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