

[54] PACKAGING APPARATUS

[75] Inventors: **Myron Scott Stringer**, Siler City;
Daniel W. Smith; Robert G. MacIvergan, both of Raleigh;
Robert W. Elderbaum, Cary, all of N.C.

[73] Assignee: **Kellwood Company**, St. Louis, Mo.

[22] Filed: **June 21, 1972**

[21] Appl. No.: **264,916**

[52] U.S. Cl. **53/188, 53/386, 53/63**

[51] Int. Cl. **B65b 5/04**

[58] Field of Search **53/63, 188, 186, 386, 187**

[56] **References Cited****UNITED STATES PATENTS**

2,964,892	12/1960	Grosjean.....	53/188
3,381,447	5/1968	Ash et al.....	53/188
3,427,780	2/1969	Bock.....	53/63
3,465,499	9/1969	Nelson et al.....	53/188 X

Primary Examiner—Donald R. Schran
Attorney, Agent, or Firm—Koenig, Senniger, Powers and Leavitt

[57] **ABSTRACT**

Apparatus for packaging merchandise, such as hosiery, panty hose, or other items of apparel, in envelopes, comprising a wheel having a plurality of envelope holders extending radially thereof and spaced at equal angular intervals therearound. The wheel is indexable from a first station at which one of the holders is in position to have an envelope dropped therein, to a second station at which the envelope held by the holder is opened for insertion of the merchandise, and thence to a third station at which a filled envelope is removed from the holder. The merchandise is delivered to a tray which is moved forward from a retracted position to insert the merchandise in the envelope at the second station. The tray then releases the merchandise and returns to its retracted position to permit rotation of the wheel.

22 Claims, 15 Drawing Figures

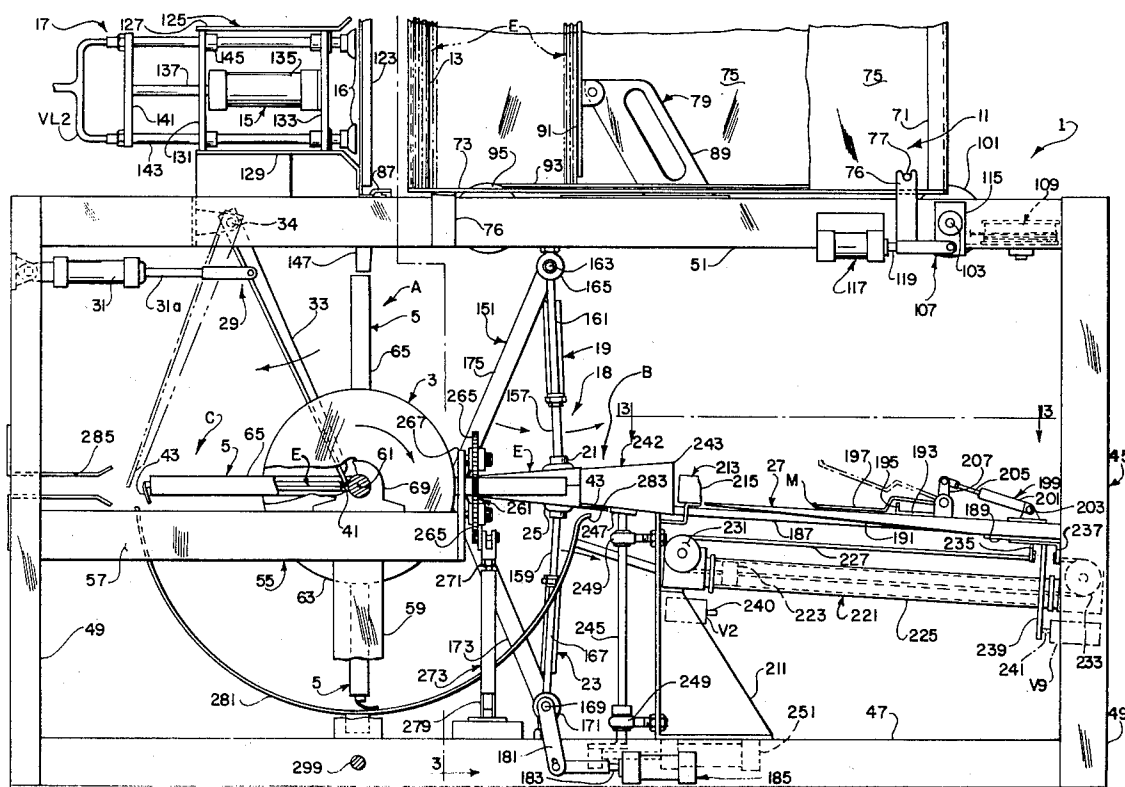
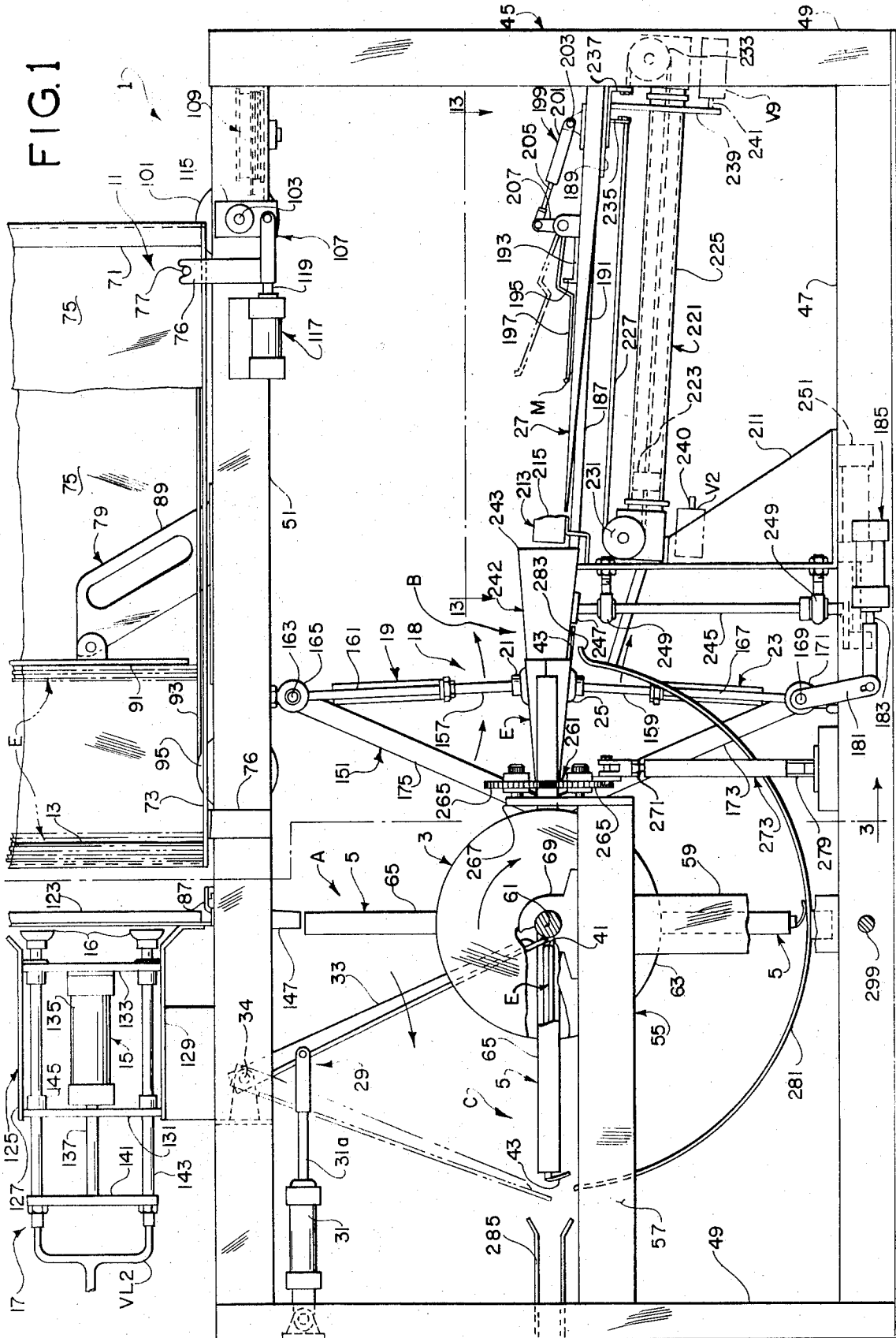


FIG. 1



F/G.4

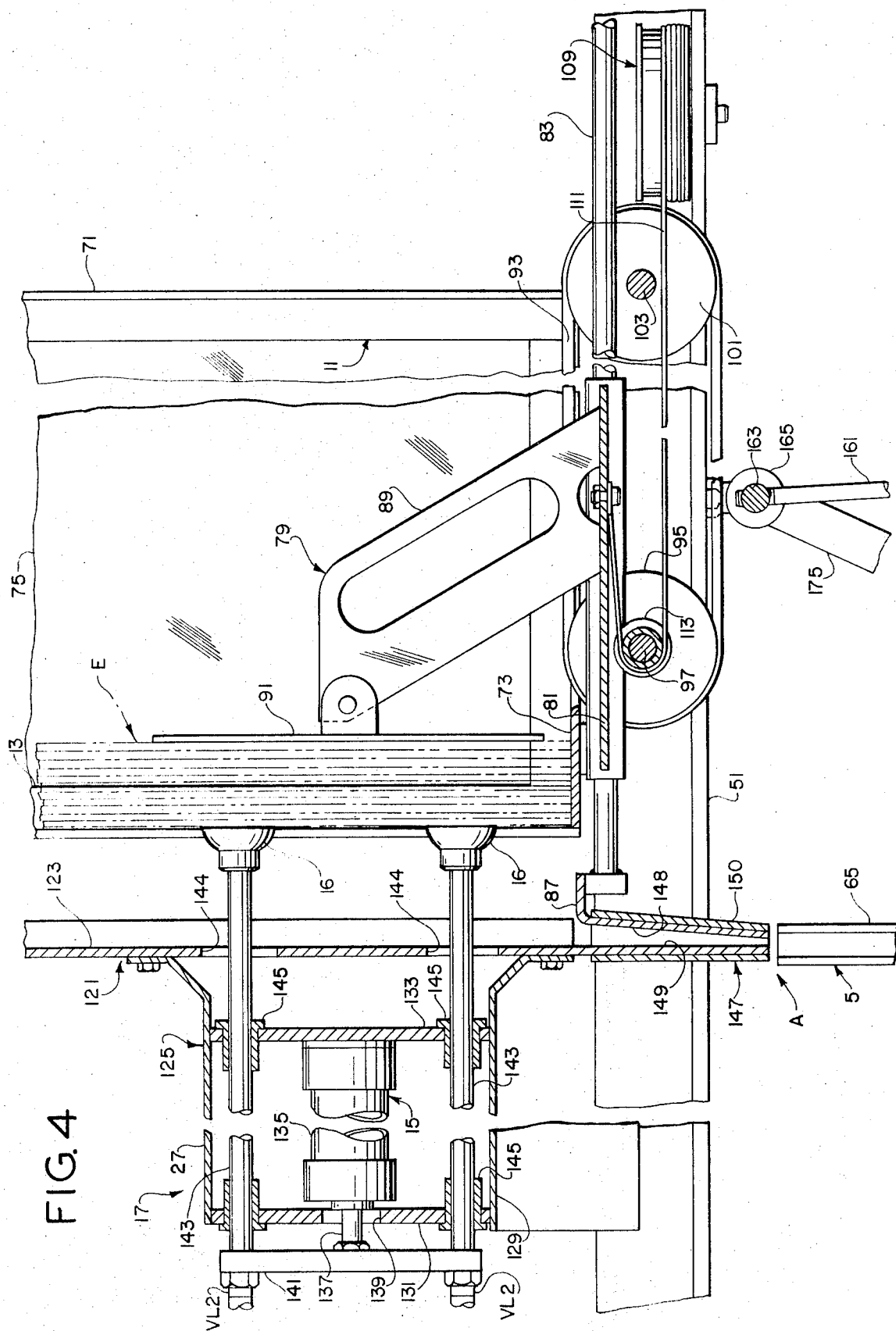


FIG. 5

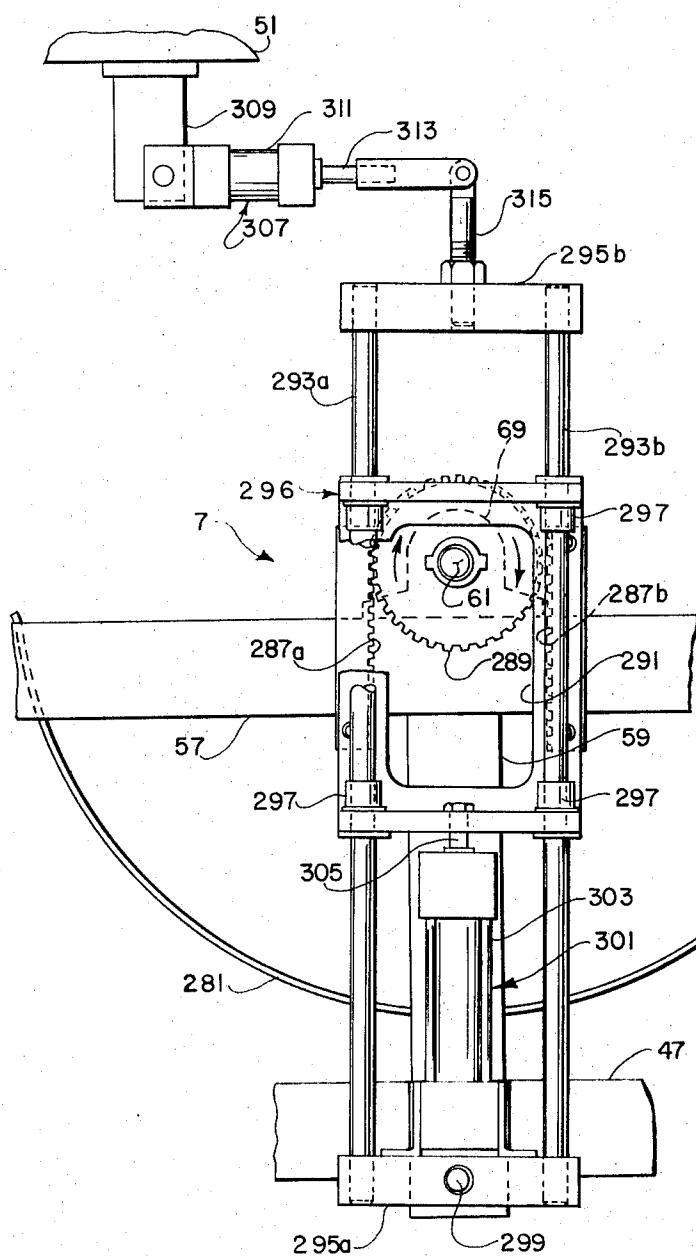


FIG. 6

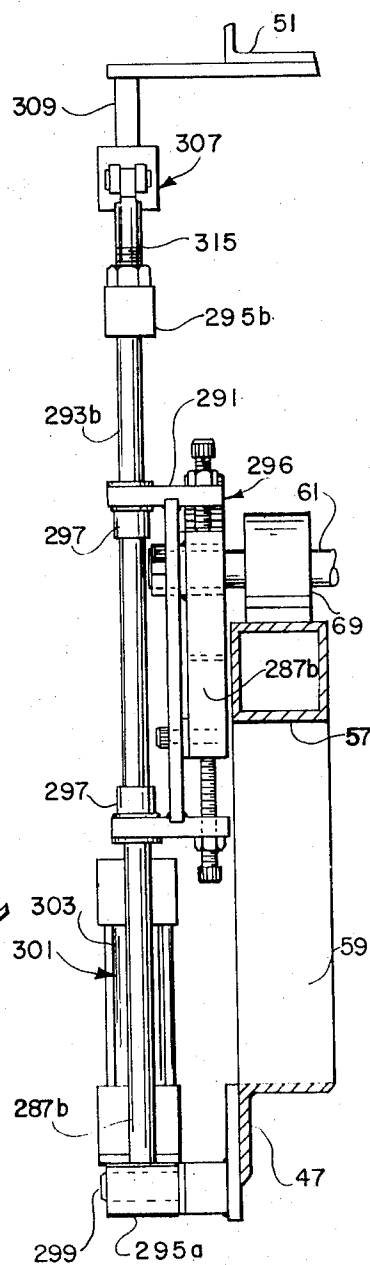


FIG.7

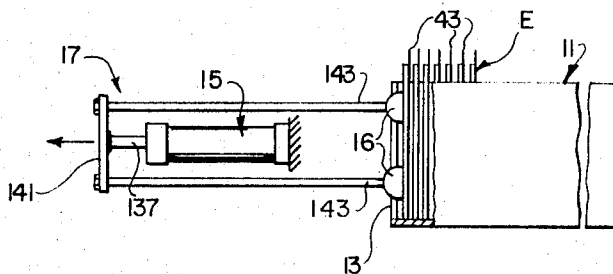


FIG.8

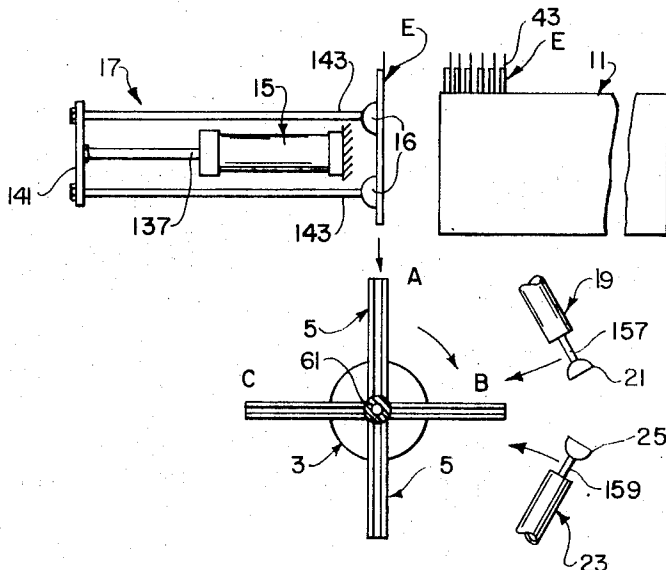


FIG.9

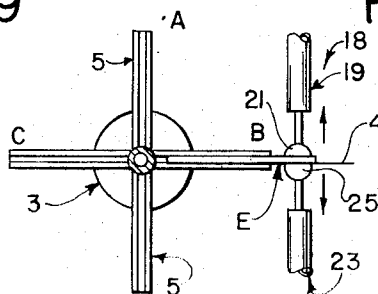


FIG.10

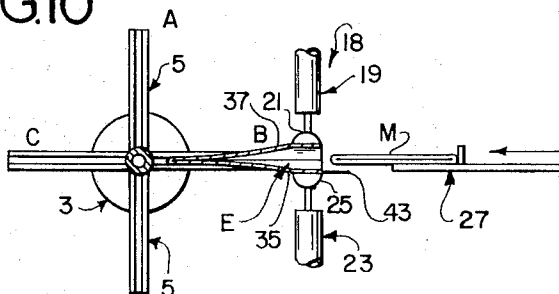


FIG.11

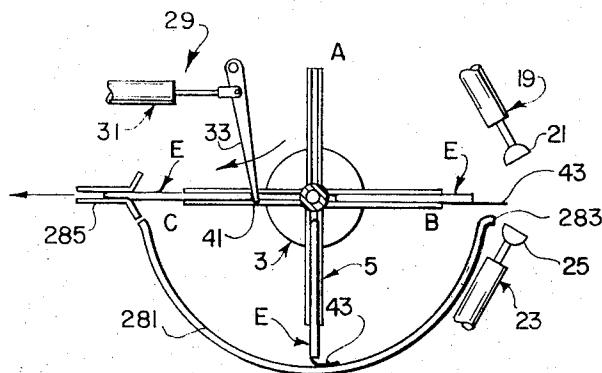
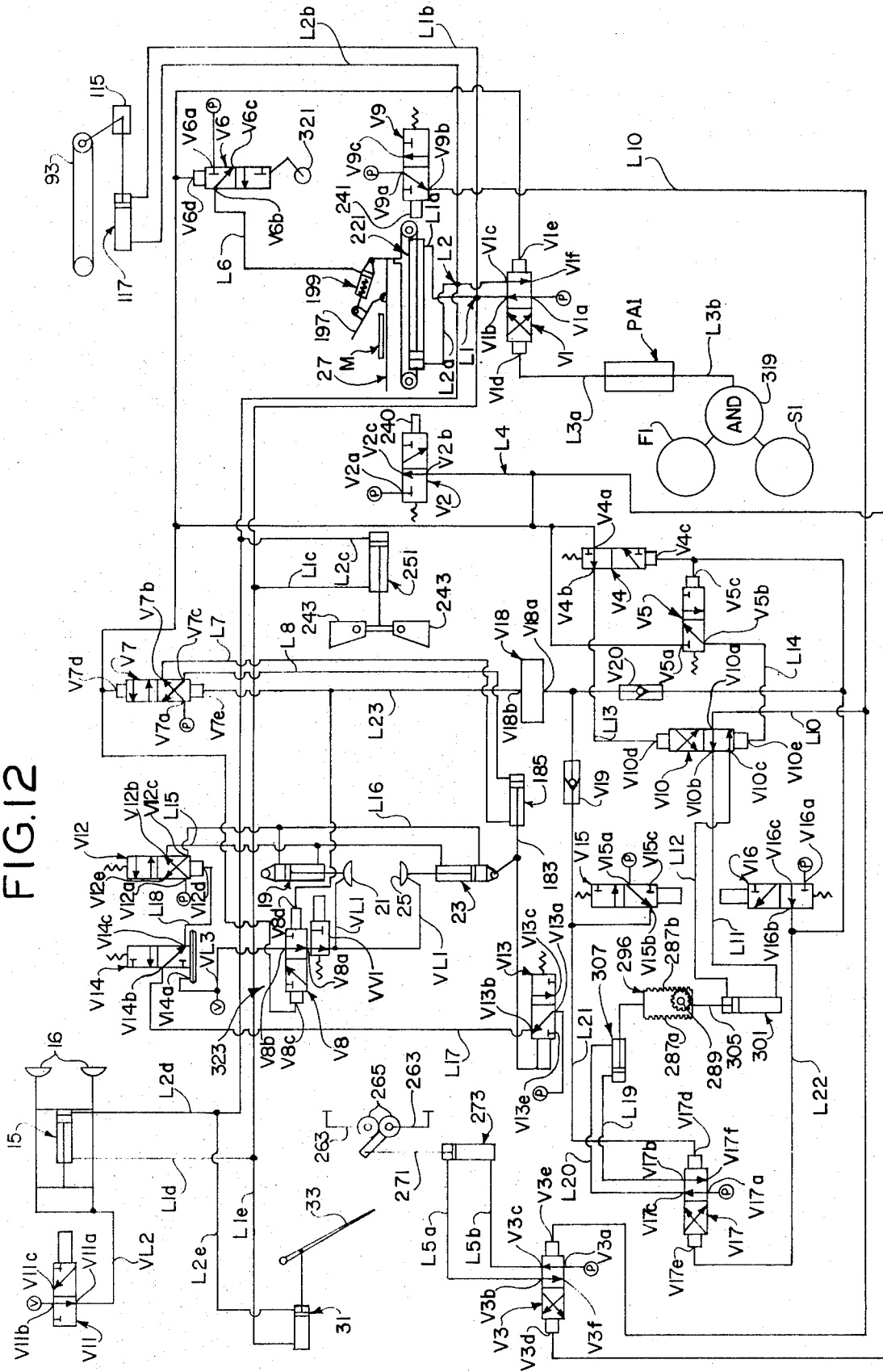


FIG. 12



PACKAGING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to packaging apparatus, and more particularly to apparatus for packaging merchandise in open-mouth receptacles of flexible packaging material (e.g., paper, plastic or the like).

The invention is especially concerned with apparatus for automatically packaging merchandise such as hosiery, panty hose and other items of apparel, in an envelope-type receptacle. The merchandise, being limp, is folded about a card for packaging in the envelope, as by means of the folding apparatus described and claimed in our coassigned copending U.S. Pat. application, Ser. No. 181,875, filed Sept. 20, 1971 now Pat. No. 3,750,916.

Generally, the invention is in the same field as U.S. Pat. No. 3,381,447.

SUMMARY OF THE INVENTION

Among the several objects of this invention may be noted the provision of improved apparatus such as above-described for packaging merchandise in open-mouth receptacles; the provision of such apparatus which may be used in conjunction with merchandise folding apparatus (such as disclosed in our copending U.S. Pat. application Ser. No. 181,875) automatically to package the merchandise folded by the latter without requiring a second operator for the packaging apparatus; the provision of such apparatus operable to package the merchandise without damage thereto; the provision of such apparatus adapted to close the receptacles after they have been loaded; and the provision of such apparatus which is reliable in operation.

In general, apparatus of this invention is especially adapted for packaging merchandise in receptacles made of flexible packaging material each having an open mouth. It comprises what is basically an endless conveyor having a plurality of receptacle holders spaced at equal intervals thereon, and means for indexing the conveyor to bring each holder from a first station at which a receptacle may be allowed to fall into the holder, to a second station at which the merchandise may be loaded in the receptacle via its mouth, thence to a third station at which the loaded receptacle may be removed from the holder, and back to the first station. Means is provided for holding a supply of the receptacles and for removing one receptacle at a time therefrom and for releasing it to fall into the envelope holder at the first station. Means is provided at the second station for opening the mouth of the receptacle carried by the holder at the second station for entry of merchandise therein, and means is also provided at the second station for inserting merchandise in the opened receptacle. At the third station, means is provided for removing the loaded receptacle from its holder.

Other objects and features will be in part apparent and in part pointed out hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of packaging apparatus of this invention with certain parts removed, showing an envelope held open for entry of merchandise therein;

FIG. 2 is a plan of the apparatus of FIG. 1 showing a magazine for holding a supply of envelopes and

means for feeding one envelope at a time into an envelope holder carried by a rotatable conveyor wheel of the apparatus;

FIG. 3 is a vertical section on line 3—3 of FIG. 1;

FIG. 4 is an enlarged longitudinal section on line 4—4 of FIG. 2;

FIG. 5 is an enlarged view on line 5—5 of FIG. 2 showing means for indexing the wheel;

FIG. 6 is an end elevation of FIG. 5;

FIGS. 7—11 are semi-diagrammatic views illustrating successive steps in the operation of the apparatus to package merchandise in an envelope;

FIG. 12 is a diagram of the pneumatic and vacuum circuits of the apparatus;

FIG. 13 (sheet 2) is an enlarged horizontal view on line 13—13 of FIG. 1;

FIG. 14 (sheet 2) is a side elevation of a receptacle into which merchandise may be inserted by apparatus of this invention; and

FIG. 15 (sheet 3) is an enlarged detail view on line 15—15 of FIG. 3.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, apparatus of this invention, indicated in its entirety at 1, for packaging merchandise M, such as hosiery, panty hose or other articles of apparel, in a receptacle (i.e., an envelope) E of flexible packaging material (e.g., paper card stock, plastic film or the like) is shown to comprise an endless conveyor (specifically a wheel) generally indicated at 3 having a plurality of receptacle or envelope holders 5 spaced at equal intervals therearound. As shown in FIGS. 1 and 8—11, this wheel is rotatable on a horizontal axis and has four holders 5 positioned radially thereof and spaced at equal angular intervals therearound (at 90° intervals). Means generally indicated at 7 (see FIGS. 5 and 6) is provided for indexing the wheel to bring each holder 5 from a first station A at which an envelope E is allowed to fall into the holder, to a second station B at which merchandise M is loaded in the envelope via its mouth. The wheel is further rotatable to a third station C at which the loaded envelope is ejected from the holder, and is then rotatable back to the first station for receiving another envelope.

Means generally indicated at 11 is located above wheel 3 for holding a supply of envelopes E. This envelope supply means comprises a horizontal tray constituting a magazine holding a series of envelopes standing upright on the bottom thereof. The magazine is open at one end constituting its forward end except for a pair of relatively narrow abutment members or flanges 13 at opposite sides thereof engageable by the side margins of the forward envelope of the series of envelopes in the magazine. An air cylinder 15 (which may be generally referred to as the envelope feed cylinder unit) is located in front of and adjacent the forward end of the magazine. The piston rod of this envelope feed cylinder unit operates a pair of vacuum gripping cups, each indicated at 16, for movement between an advanced gripping position (see FIGS. 2 and 7) in which they are engageable with the front envelope of the series in the magazine, and a retracted position (see

FIG. 8) in which the envelope gripped thereby is in position for being released from the vacuum cups to fall into the holder 5 at station A. This cylinder unit in conjunction with its vacuum cups constitutes envelope feed means generally indicated at 17 for removing one envelope at a time from the magazine and releasing it to fall into a holder 5.

As shown in FIGS. 1, 9 and 10, means generally indicated at 18 is provided at station B for opening the mouth of the envelope E carried by the holder 5 at station B for the entry of merchandise M into the envelope. This envelope opening means includes an upper air cylinder unit 19 with its piston rod extending down and out through its lower end and carrying a vacuum gripping cup 21 engageable with the upper wall of the envelope and a lower air cylinder unit 23 with its piston rod extending up and out through its upper end and carrying a vacuum gripping cup 25 engageable with the bottom wall of the envelope. With the vacuum cups of these air cylinder units in vacuum gripping engagement with the walls of the envelope (see FIG. 9), the vacuum cups are movable apart from one another (as indicated by the arrows) to spread the walls of the envelope and thus open its mouth.

A merchandise pusher or tray generally indicated at 27 is provided at station B (see FIGS. 1 and 9) for inserting merchandise M in the envelope E at station B through the opened-up mouth of the envelope. This pusher is movable between a retracted receiving position (see FIGS. 1 and 13) in which merchandise may be deposited thereon and an advanced loading position in which the merchandise on the pusher is inserted in the envelope. After the merchandise has been inserted in the envelope, the pusher returns to its receiving position and vacuum cups 21 and 25 are vented to release the envelope walls, and air cylinder units 19 and 23 are swung clear of wheel 3 (see FIG. 11) to permit indexing of the wheel.

At station C, means generally indicated at 29 (see FIGS. 1 and 11) is provided in the vertical longitudinal center plane of the apparatus for ejecting or removing the loaded envelope E from its holder 5. This ejecting means comprises an air cylinder unit 31 (also referred to as an ejecting cylinder unit) pivotally carried by the apparatus having its piston rod 31a connected (as by a pin and slot connection) to an ejecting arm 33 pivotally carried by the apparatus, as indicated at 34, outside wheel 3 for swinging in a generally vertical plane. The arm extends inwardly of the wheel from its pivot 34 between the members constituting holders 5 with its free end adjacent the shaft mounting the wheel and swingable outwardly of the wheel from a retracted position in which the free end of the arm is interposed between the shaft mounting the wheel and the inner end of the envelope E held by the holder at station C (see FIG. 1) for pushing the loaded envelope radially outward out of the holder. The outermost movement of arm 33 may be referred to as its ejecting position (shown in phantom in FIG. 1) in which its free end is adjacent the outer ends of the holder at station C.

As shown in FIG. 14, envelope E has a first or front wall 35 and a second or back wall 37. These walls are joined together at their sides, as indicated at 39, and at the bottom end of the envelope, as indicated at 41. The walls are open at their other end constituting the mouth of the envelope and the front wall has a closure flap 43 extending beyond the mouth end of the back wall for

being folded over on the back wall to close the mouth of the envelope. By way of example, flap 43 and wall 37 may have self-sealing adhesive applied thereto, as indicated at 44, to adhere the flap to the back wall when the flap is pressed thereagainst.

More particularly, apparatus 1 has a frame structure generally indicated at 45 (see FIG. 1) on which the above-described means and components are mounted. This frame structure is generally rectangular in plan and elevation and includes bottom side members 47, vertical corner members 49, and upper side members 51. Legs 52 (see FIG. 3) support the frame structure on the floor. As shown in FIGS. 2 and 3, the upper and bottom ends of corner members 49 are joined by cross members 53 extending transversely of the frame structure. A sub-frame generally indicated at 55 (see FIG. 1) is secured as by welding to the bottom side members 47 and to the left (as viewed in FIG. 1) corner members 49. This sub-frame is constituted by a pair of spaced apart horizontal members, each being indicated at 57, welded to the corner members and by vertical members 59 extending between and welded to the inner end of each horizontal member and the corresponding bottom side member 47 therebelow.

Wheel 3 is constituted by a center shaft 61 having a pair of spaced apart discs 63 welded thereon. As shown in FIG. 1, the wheel has four envelope holders 5 spaced at 90° angular intervals therearound with each holder extending radially outward beyond the periphery of discs 63. Each holder comprises a pair of coplanar spaced apart channel members, each generally designated 65, extending radially of the wheel with their open sides facing toward each other for receiving the side margins of an envelope. The web of each channel member is designated 65a, and its side flanges are designated 65b. The discs 63 and the two channel members of each holder 5 are spaced a distance such that the inner surfaces of the channel webs 65a are spaced a distance slightly greater than the width of an envelope E. As shown in FIG. 3, side flanges 65b of the channels thus straddle the side margins of the envelope, leaving envelope walls 35 and 37 and the envelope mouth free and accessible for being opened by envelope opening means 18. The length of the channel members is such that the mouth portion of the envelope and flap 43 extend beyond the outer ends of the channel members enabling the flap to be folded closed in a manner as will appear. Shaft 61 is journaled for rotation in bearing blocks 69 secured to the upper surfaces of horizontal members 57.

Referring to FIGS. 1-4, magazine 11 includes the vertical abutment members or flanges 13 at its front end, and rear vertical members 71 at its rear end. These members are secured to and extend upwardly from a U-shaped horizontal base 73 (see FIG. 2). The magazine has vertical side walls 75 extending between members 13 and 71, which form in conjunction with base member 73 a trough-like container or relatively deep tray for holding a supply of the envelopes E. The envelopes are placed in vertical position in the magazine with their bottom edges 41 down, their side edges 39 adjacent the inner faces of side walls 75, and with their back walls 37 facing forward. With the envelopes so placed in the magazine, an envelope removed from the magazine by vacuum cups 16 and released to fall into a holder 5 at station A has its end flap 43 facing in the

direction of rotation of wheel 3 for purposes as will appear.

As shown best in FIG. 2, abutment members or flanges 13 extend inwardly toward each other with their inner edges spaced a distance somewhat less than the width of an envelope, so that there is an opening therebetween of slightly less width than the envelope width. Thus, the side margins of the front wall 35 of the front envelope in the series are engageable with the abutment members thereby preventing the envelopes in the magazine from being pushed forward therefrom. As the vacuum gripping cups 16 are moved from their advanced gripping position to their retracted position, the center portion of the forward envelope of the series gripped thereby is bent outwardly (see FIG. 2) to permit its side margins to escape past abutment members 13. As shown in FIGS. 1-3, the magazine is narrower than frame structure 45 and is removably carried by mounting brackets 76 having notched upper ends for receiving pins 77 carried by the magazine thereby to permit an empty magazine to be lifted from the apparatus and replaced with a full one.

An envelope pusher generally indicated at 79 is movable longitudinally of magazine 11 to push the envelopes E in the magazine forward to maintain contact between the front envelope of the series and abutment members 13 as envelopes are removed from the magazine. This pusher includes a carriage 81 slidable on a pair of spaced apart guide rails 83 extending longitudinally of the magazine. The rear ends of these rails are welded, as indicated at 85, to the right (as viewed in FIG. 2) cross member 53 and their front ends are welded to a transverse member 87 (see FIG. 4) extending between the upper side members 51 adjacent station A. A support 89 extends upwardly from the carriage and pivotally carries a pusher plate 91 engageable with the back envelope of the series of envelopes in the magazine.

With envelope pusher 79 in position as illustrated in FIG. 1 urging a series of envelopes forward, the bottom edges 41 of the envelopes are supported on the upper reaches of a pair of horizontally disposed endless belts, each indicated at 93. Each of these belts is trained around a forward pulley 95 keyed to a forward shaft 97 rotatably supported in bearings 99 carried by the upper side members 51, and around a rear pulley 101 keyed to a rear shaft 103 journaled in bearings 105. As shown in FIG. 2, these belts are disposed on opposite sides of guide rails 83. Belts 93 are incrementally driven by a pneumatic magazine drive mechanism generally indicated at 107 to move their upper reaches forward toward abutment members 13 an incremental distance generally corresponding to the thickness of one envelope E (e.g., about one-eighth inch) after an envelope has been removed from magazine 11. Pusher 79 is connected to a constant tension spring reel 109 by a cable 111 trained around a pulley 113 journaled on shaft 97. This spring biases the pusher forward to aid belts 93 in moving the envelopes in the magazine forward and to maintain a forward-acting force on the envelopes to hold the frontmost envelope in engagement with abutment members 13 as shown in FIG. 2.

As shown in FIGS. 1 and 2, the pneumatic magazine drive mechanism 107 comprises a one-way clutch 115 at one end of the shaft 103 for effecting only counter-clockwise (as viewed in FIG. 1) rotation of shaft 103 for moving the upper reaches of belts 93 forward. This

one-way clutch is actuated by a magazine advance air cylinder unit 117 pivotally secured to upper side frame member 51. Piston rod 119 of this cylinder unit is connected to the one-way clutch in such manner that upon extension of the piston rod, the one-way clutch incrementally rotates shaft 103, without reversely rotating it on retraction of the piston rod.

Envelope feed means 17 comprises a mounting bracket generally indicated at 121 secured to and extending upwardly from the upper side members 51 of the frame structure 45 forward of abutment members 13 of magazine 11. This bracket has a vertical rear plate 123 extending up from the upper side members adjacent the forward end of the magazine. This rear plate carries a housing generally indicated at 125 having a top 127, a bottom 129, a front wall 131 and a rear wall 133.

Envelope feed cylinder unit 15 includes an air cylinder 135 and an extendable and retractable piston rod 137. The back end of the cylinder is secured to the inner face of rear wall 133 and the piston rod extends forwardly through an opening 139 in front wall 131. The free (forward) end of the piston rod carries a vertically disposed bar 141. This bar has a tubular vacuum rod 143 secured to each of its ends, these tubular rods extending rearwardly toward magazine 11 through openings in the front and rear walls 131 and 133 and through openings 144 in rear plate 123. The vacuum rods are slidably supported in bushings 145 carried by the vertical plates. Each vacuum rod carries a vacuum suction cup 16 at its rear end for engagement with the outside wall (i.e., back wall 37) of the front envelope E of the series in the magazine. The vacuum cups and the vacuum rods are connected to a vacuum source by a vacuum line VL2 (see FIG. 12). A mechanically actuated vacuum cutoff valve V11 is included in the vacuum line to break the vacuum circuit between the suction cups and the vacuum source when the suction cups are in their retracted position so as to release an envelope gripped thereby to fall into a holder 5 at station A. Valve V11 is mounted for actuation by bar 141 as the vacuum cups reach their retracted position. A generally vertically disposed chute 147 is located immediately below rear plate 123 to receive an envelope E released from vacuum cups 16 when they are in their retracted position. This chute guides the envelope into a holder 5 at station A, and has an inclined rear wall 148 and a generally vertical front wall 149. The inclined rear wall is constituted by an inclined portion of member 87 extending transversely of upper side members 51 and the vertical front wall is constituted by the bottom portion of rear wall 123. The ends of the chute are closed by U-shaped clips 150.

Envelope opening means 18 is shown to include a linkage assembly generally indicated at 151 for effecting movement of the upper and lower air cylinder units 19 and 23, respectively, between a retracted position (see FIGS. 8 and 11) in which the cylinder units and the vacuum cups 21 and 25 carried thereby are clear of wheel 3 for permitting indexing of the wheel and an operating position (see FIGS. 1, 3, 9 and 10) in which cylinder 19 is in position for its vacuum cup 21 to be moved into gripping engagement with the back (top) envelope wall 37 and in which cylinder 23 is in position for its vacuum gripping cup 25 to be moved into gripping engagement with the front (bottom) envelope wall 35. Each of units 19 and 23 has a respective cylinder

153 and 155 and a respective piston rod 157 and 159 movable in and out of its cylinder. Vacuum cups 21 and 25 are carried on the free ends of piston rods 157 and 159, respectively. By retracting the piston rods into their respective cylinders, vacuum cups 21 and 25 are spread apart (up and down) for spreading apart the walls of the envelope to open its mouth, and by extending the piston rods, the vacuum cups are moved toward one another (down and up) into gripping engagement with the respective envelope walls. Each vacuum cup is connected to a vacuum source by a branched vacuum line VL1 (see FIG. 12). Unit 19 carries a bracket 160 (see FIG. 3) for mounting a fluidic sensor F1 for sensing whether or not the envelope carried by the holder at station B has been opened.

Upper unit 19 is mounted above the holder 5 at station B on the lower ends of rods 161 extending down from a rotatable shaft 163. This shaft extends horizontally between upper side members 51 of frame structure 45 with its ends journaled in bearings 165 secured to the bottom of the side members. Lower unit 23 is mounted below the holder at station B on the upper ends of rods 167 extending up from a rotatable shaft 169 spanning the lower side members 47, the ends of this shaft 169 being journaled in bearings 171 on members 47. The upper and lower cylinder units are swingable in a vertical plane between their retracted and operative positions.

Shafts 163 and 169 are interconnected by linkage assembly 151 to effect conjoint rotation thereof to swing air cylinder units 19 and 23 between their operative and retracted positions. This linkage assembly 151 includes a lower lever 173 secured to one end of shaft 169 (its left end as viewed in FIG. 3) and an upper lever secured to the left end of shaft 163, these levers being swingable with their respective shafts. As shown in FIG. 15, the upper end of lower lever 173 has an elongate slot 177 therein receiving a pin 179 carried by the lower end of upper lever 175 to provide a pin and slot connection between the levers. As shown in FIG. 3, the right end of shaft 169 has a crank 181 affixed thereto. The lower end of this crank is pin-connected to a piston rod 183 of an air cylinder and piston unit 185 (see FIG. 1) whereby extension and retraction of the piston rod causes shaft 169 and lever 173 to rotate. Rotation of lower lever 173, in turn, rotates upon lever 175 and shaft 163. By extending piston rod 183, cylinder units 19 and 23 are conjointly moved from their operative positions to their retracted positions (as indicated by the arrows in FIG. 1) and by retracting the piston rod, these cylinder units are returned to their operative positions.

Referring now to FIGS. 1 and 13, merchandise pusher 27 is shown to be reciprocally mounted on a pair of spaced apart guide rails 187 for movement between a retracted receiving position in which merchandise M may be deposited thereon (in a manner as will appear) and an advanced loading position in which the merchandise is inserted in an open-up envelope E held by the holder 5 at station B. More particularly, pusher 27 includes a slide block 189 slidably mounted on rails 187. This block has an elongate tongue 191 secured thereto extending forwardly toward wheel 3. A bracket 193 is mounted on the upper surface of the tongue and is bolted to block 189. This bracket has a vertical flange 195 extending transversely of the tongue constituting an abutment for locating merchandise M on the

tongue. A merchandise holder 197 is pivotally carried by the bracket and is movable between a lowered holding position in which it is shown in solid lines in FIG. 1 for holding merchandise M down in position on tongue 191 for insertion in the envelope and a raised retracted position (shown in phantom in FIG. 1) permitting the merchandise to remain in the envelope as the tongue is returned to its retracted position. The holder is pivotally moved between its holding and retracted positions by an air cylinder and piston unit 199 having a cylinder 201 pivoted on slide block 189 as indicated at 203, and a piston rod 205 pin-connected to a crank arm 207 on the holder 197. By extending piston rod 205, the holder is swung down from its raised open position to its lowered holding position. Upon the release of the compressed air within cylinder 201, the piston rod is retracted by a return spring (not shown) within the cylinder 201.

As shown in FIG. 13, the rear ends of rails 187 are secured to a cross member 209 extending between and welded to vertical members 49 at the rear of frame structure 45 and their front ends are secured to a mounting bracket generally indicated at 211 secured to and extending up from bottom side members 47. A stationary tray generally indicated at 213 is secured to this mounting bracket and to an upright member 49. This stationary tray has a vertical side flange 215 extending along its length for locating merchandise M in proper position transversely of tongue 191. An endless conveyor 217 (shown in phantom in FIG. 13) delivers folded merchandise to merchandise pusher 27 for insertion in the opened envelope at station B. A second stationary tray 219 extends between tongue 191 and a position adjacent the conveyor to support the merchandise as it is moved forward by pusher 27 for insertion into the envelope. This last-mentioned tray is secured to the upper portion of bracket 211 and to cross member 209.

Pusher 27 is moved between its advanced and retracted positions by an air cylinder and piston unit 221 (generally referred to as the merchandise loading cylinder) carried by mounting bracket 211 and by cross member 209. As shown in FIG. 1, this unit 221 has a piston 223 reciprocable within a cylinder 225. The piston 223 is connected to the pusher via cables 227 and 229 trained around pulleys 231 and 233, respectively, rotatably carried by the cylinder at its ends. These cables are respectively secured to lugs 235 and 237 extending down from slide block 189 to reciprocate the slide block on guide rails 187 as piston 223 is reciprocated within cylinder 225. The use of such a cylinder unit in place of a conventional air cylinder unit having an extendable piston rod is preferred here because the overall length of the packaging apparatus may be significantly reduced. Slide member 189 also carries a downwardly extending valve-actuating finger 239 engageable with actuating buttons 240 and 241 of pneumatic valves V2 and V9, respectively. These valves V2 and V9 are positioned below the merchandise loading cylinder and are respectively engaged by finger 239 as the pusher 27 is fully moved to its advanced loading position and to its retracted receiving position to control the movement of the pusher as will appear.

At 242 is generally indicated a guide assembly for guiding merchandise M on pusher 27 into the mouth of an envelope E held by a holder 5 at station B. This guide assembly includes a pair of funnel-like members,

each indicated at 243, and each rotatably mounted on a vertical shaft 245. These funnels are rotatable between a guiding position shown in solid lines in FIG. 13 in which they are in register with the mouth of the envelope at station B, and a retracted position shown in phantom in FIG. 13 in which they are clear of the envelope and clear of wheel 3 to permit rotation of the wheel. Each funnel is generally channel-shaped with its open side facing inwardly toward the other funnel. Each funnel is mounted on a head 247 at the upper end of a respective shaft 245 with its enlarged end adjacent pusher 27 when it is in its guiding position. Shafts 245 are journaled in bearings 249 carried by bracket 211.

Funnels 243 are rotated between their guiding and retracted positions by an air cylinder and piston unit 251 (also referred to as the funnel cylinder unit) secured to the bottom of mounting bracket 211. This funnel cylinder unit has a bar 253 on the free end of its piston rod 254, the bar having elongate slots 255 adjacent its ends. The lower end of each shaft 245 has a crank 257 (see FIG. 3) secured thereto. Each of these cranks carries a pin 259 received in a respective slot 255 in bar 253, the arrangement being such that axial movement of the piston rod 254 causes rotation of shafts 245 via their cranks to effect rotation of the funnels between their guiding and retracted positions.

At 261 in FIG. 3 is generally indicated an envelope gripping mechanism for clamping the envelope E at station B to hold it and the merchandise M inserted therein in position relative to its holder as tongue 91 moves from its advanced loading position to its retracted receiving position. This gripping mechanism includes a pair of opposed gripping arms, each indicated at 263 and each being carried by one of a pair of gears 265. These gears are rotatably mounted on a plate 267 (see FIG. 1) secured to the rearward ends of horizontal members 57 of sub-frame 55. Each gripping arm is rotatable with its respective gear 265 through an arc of 90° between a gripping position (shown in FIG. 3) in which a gripping pad 269 carried thereby clamps the envelope and the merchandise therein, and a retracted position (shown in phantom in FIG. 3) in which the arms and their gripping pads are clear of the envelope, holder 5 and wheel 3 to permit the wheel to rotate. Gears 265 mesh with each other and the outer end of a piston rod 271 of an air cylinder and piston unit 273 (also referred to as a gripper cylinder) is pin-connected as indicated at 275 to a lug 277 carried by the lower gear. The gripper cylinder is pivotally mounted on the frame structure 45 as indicated at 279. As piston rod 271 is extended, the lower gear rotates counterclockwise (as viewed in FIG. 3) and the upper gear rotates clockwise thereby to effect movement of arms 263 from their gripping position to their retracted positions. Conversely, retraction of the piston rod causes the arms to rotate from their retracted positions to their gripping positions.

A curved shroud generally indicated at 281 (see FIG. 1) is secured to the frame structure 45 and has a radius of curvature somewhat larger than the distance from the axis of shaft 61 to the outer ends of holders 5. The arrangement is such that flap 43 of an envelope E held by a holder at station B is engageable with the rearward edge 283 of the shroud to effect folding of the envelope flap to close the mouth of the envelope as wheel 3 is indexed. In addition to folding the envelope flap, this

shroud holds each loaded and sealed envelope in its holder 5 as it is indexed from station B to station C. The shroud has an elongate notch (not shown) in its end adjacent its edge 283 for receiving lower cylinder unit 23 when it is in its operative position.

At station C, a guide 285 (see FIG. 1) is provided for receiving loaded envelopes as they are ejected from the holders 5 by the ejecting means 29. As the mouth of the envelope enters the guide 285, flap 43 is maintained in its folded position closing the envelope mouth. Rollers (not shown) may be provided to receive the loaded envelope from guide 285 and press the flap down against envelope back wall 37 to effect adhesion of the flap to the envelope wall and thus seal the envelope mouth.

Referring now to FIGS. 5 and 6, indexing means 7 is shown to comprise a pair of reciprocable racks 287a and 287b selectively engageable with a pinion 289 keyed on one end of shaft 61 for rotating wheel 3 through equal angular intervals (e.g., 90° intervals) to move holders 5 from station-to-station. The racks are held in fixed spaced relation relative to one another by a rack frame 291 spaced from one another a distance greater than the diameter of pinion 289 whereby only one rack at a time meshes with the pinion. The rack frame is slidably carried on a pair of spaced apart cylindrical guide rails 293a and 293b held in spaced relation by a lower end member 295a and an upper end member 295b. These guide rails together with the end bars constitute a rack assembly generally indicated at 296.

Rack frame 291 is slidably carried on the guide rails by bushings 297. End bar 295a is pivotally mounted on a horizontal pin 299 secured to and extending from the lower side bar 47 of frame structure 45 for permitting pivotal movement of the rack assembly and thus enabling racks 287a and 287b to be selectively engaged with pinion 289. End bar 295a carries an air cylinder and piston unit generally indicated at 301 (referred to as an index cylinder) having a cylinder 303 secured to the end bar and an extendable and retractable piston rod 305 which has its free end secured to rack frame 291. As this piston rod is moved in and out of its cylinder, the racks carried by the rack frame are reciprocated relative to the pinion so that the rack meshing with the pinion causes the latter to rotate. Rack 287a only meshes with the pinion as the rack frame moves upwardly on guide rails 293a, 293b and rack 287b only meshes with the pinion as the rack frame moves downwardly. Thus, the pinion is always rotated clockwise (as viewed in FIG. 5) by the racks. The distance the rack frame is reciprocated on the guide rails controls the interval through which wheel 3 is indexed. In this case, the rack frame is moved through a distance sufficient to rotate the pinion 90°, this distance being fixed by the length of the stroke of cylinder unit 301.

At 307 is generally indicated an air cylinder and piston unit (referred to as a shift cylinder) for pivotally moving rack assembly 296 on pin 299 to effect selective engagement of racks 287a and 287b with pinion 289. This shift cylinder is pivotally carried by a bracket 309 secured to upper side rail 51 of frame structure 45 and has a cylinder 311 and a retractable and extendable piston rod 313. The piston rod is pin-connected to a rigid rod 315 secured to and extending up from end bar 295b.

The various pneumatic and vacuum components of the apparatus are diagrammatically depicted in FIG.

12. For the sake of clarity and convenience, the symbol $\textcircled{P}$ represents that a component is connected to a compressed air source and the symbol $\textcircled{V}$ represents that a component is connected to a vacuum source. More particularly, the merchandise loading cylinder unit 221 is shown to be supplied with compressed air via a valve V1 having outlet ports V1b and V1c respectively connected to the rearward end of the cylinder by a branch L1a of line L1 and to the forward end of the cylinder by a branch L2a of line L2. This valve also has an inlet port V1a connected to the compressed air source, a first pilot port V1d, a second pilot port V1e, and a vent port V1f. When merchandise pusher 27 is in its retracted position (as shown in FIG. 12), inlet port V1a is connected to outlet port V1b to supply compressed air to the rearward end of the loading cylinder 221 by a branch L1a of line L1, to the forward end of magazine advance cylinder 117 by a branch L1b, to the forward end of the funnel cylinder unit 251 by a branch L1c, to the forward end of the envelope feed cylinder unit 15 by a branch L1d, and to the rearward end of the envelope eject cylinder 31 by a branch L1e.

When pilot port V1d of valve V1 receives a pressure signal from a diaphragm pressure amplifier PA1 via line L3a, the spool in valve V1 is caused to shift from the position shown in FIG. 12 to connect its vent port V1f to its outlet port V1b and to connect its outlet port V1c to its inlet port V1a. This diaphragm pressure amplifier is connected to an AND pressure switch 319 by a line L3b, and this AND switch is connected to fluidic sensor F1 and to a pneumatic switch S1. Switch S1 is carried by stationary tray 213 adjacent flange 215 (see FIG. 13) and it senses whether merchandise M has been deposited on pusher 27 in proper position for insertion in an envelope at station B. The AND switch sends a pressure signal to pressure amplifier PA1 only if it receives a signal from both the sensor F1 and the switch S1 respectively indicating that the envelope opening cylinder units 19 and 23 have opened an envelope E held by holder 5 at station B and merchandise M is in position on pusher 27 for insertion in the opened envelope. With the spool in valve V1 shifted, compressed air enters the branched line L2 and flows to the forward end of loading cylinder 221 via branch L2a, to the rearward end of magazine advance cylinder 117 via branch L2b, to the rearward end of funnel cylinder 251 via branch L2c, to the rearward end of envelope feed cylinder 15 via branch L2d, and to the forward end of eject cylinder 31 via branch L2e.

A mechanically operated valve V2 (see FIGS. 1 and 12) having an inlet port V2a connected to the compressed air source, an outlet port V2b, and a vent port V2c is actuated by finger 239 movable with pusher 27 as the pusher moves to its fully advanced position thereby to connect inlet port V2a to outlet port V2b. Port V2b is connected by a branched line L4 to valves V3, V4, V5, V6, V7 and V8.

Valve V3 has an inlet port V3a connected to the compressed air source, a first outlet port V3b, a second outlet port V3c, a first pilot port V3d, a second pilot port V3e and a vent port V3f. Port V3d is connected to port V2b of valve V2 by a branch of line L4 and pressure from valve V2 shifts the spool in valve V3 so that its outlet port V3b is connected to its inlet port V3a and to the compressed air source. Port V3b is connected to the forward end of envelope gripping cylinder 273 by a line L5a to retract piston rod 271 and

thereby move gripping arms 263 from their retracted to their gripping positions and port V3c is connected to the rear end of the gripping cylinder by a line L5b to extend its piston rod and effect the release of the envelope from arms 263.

Valve V4 has an inlet port V4a, an outlet port V4b, and a pilot port V4c. Port V4a is connected to port V2b of valve V2 by a branch of line L4.

Valve V5 is similar to valve V4 and it has an inlet port V5a, an outlet port V5b, and a pressure pilot port V5c. Port V5a is also connected to port V2b of valve V2 by a branch of line L4. Valves V4 and V5 control the direction of piston rod 305 of index cylinder 301.

Valve V6 has an inlet port V6a connected to the compressed air source, an outlet port V6b, and a vent port V6c, and a pressure pilot port V6d. This pressure pilot port is connected to a branch of line L4 and receives a pressure signal from port V2b of valve V2. The spool of valve V6 is shifted by a mechanical operating finger 321 engageable by pusher 27 as the pusher moves from its retracted position to its advanced position to connect its outlet port V6b to its inlet port V6a. Port V6b is connected to the rear end of cylinder unit 199 by a line L6, whereby piston rod 205 of the cylinder unit is extended to effect movement of merchandise holder 197 from its raised clear position to its lowered holding position. A pressure signal at port V6d causes its spool to shift thereby connecting its port V6b to its vent port V6c and thus relieving pressure from cylinder unit 199 to permit the return spring therein to raise the holder to its raised position.

Valve V7 has an inlet port V7a connected to the compressed air supply, a first outlet port V7b, a second outlet port V7c, a first pilot port V7d, and a second pilot port V7e. Pilot port V7d is connected to port V2b of valve V2 by a branch of line L4. Outlet ports V7b and V7c are respectively connected by lines L7 and L8 to the front and rear ends of cylinder unit 185 to effect movement of the envelope opening cylinder units 19 and 23 between their operative and retracted positions.

Valve V8 includes a vacuum port V8a connected to the vacuum gripping cups 21 and 25 of cylinder units 19 and 23, respectively, by a branched vacuum line VL1, a vacuum inlet port V8b connected to the vacuum source, a pressure pilot port V8c connected to port V2b of valve V2 by a branch of line L4, and a pilot port V8d. A manually actuated vacuum cutoff valve VV1 is included in line VL1 to block the flow of air from the vacuum cups to the vacuum source for purposes as will appear.

A mechanically operated valve V9 (see FIGS. 1 and 12) is actuated by finger 239 as pusher 27 fully returns to its retracted receiving position. This valve has an inlet port V9a connected to the compressed air supply, an outlet port V9b, and a vent port V9c. Outlet port V9b is connected to pilot port V3e of valve V3 and to an inlet port V10a of a valve V10 by a branched line L10.

In addition to inlet port V10a, valve V10 has a first outlet port V10b connected to the rear end of index cylinder unit 301 by a line L11, a second outlet port V10c connected to the forward end of the index cylinder by line L12, a first pilot port V10d connected to outlet port V4b of valve V4 by line L13 and a second

pilot port V10e connected to port V5b of valve V5 by a line L14.

A mechanically actuated vacuum valve V11 is mounted on housing 125 (see FIGS. 1 and 12) in position to be actuated as the envelope feed cylinder 15 moves to its retracted position (see FIG. 1) in which an envelope gripped by vacuum cups 16 is in position to fall into chute 147. This valve interrupts the vacuum supplied to the vacuum cups and permits the envelope to be released therefrom. Valve V11 has a vacuum inlet port V11a connected to vacuum rods 143 via a vacuum line VL2, a vacuum outlet port V11b connected to the vacuum source and a vent port V11c.

Sensing means generally indicated at 323 (see FIG. 12) is provided in the vacuum circuit for supplying suction to vacuum gripping cups 21 and 25 of the envelope opening cylinder units 19 and 23 and for sensing whether or not these vacuum gripping cups are in gripping engagement with walls 35 and 37 of the envelope E held by the holder at station B, and if not, repeating movement of the cylinder units into engagement with the envelope walls for gripping and opening them. This sensing means also prevents operation of pusher 27 from its retracted position to its advanced position until the envelope has been opened. More particularly, means 323 includes a valve V12 for supplying compressed air to cylinder units 19 and 23, an inter-pilot valve V13 actuated by movement of cylinder unit 185 as cylinder units 19 and 23 are moved from their retracted to their operative positions, a diaphragm vacuum-pressure valve V14 which senses whether vacuum cups 21 and 25 are in gripping engagement with the envelope, vacuum cutoff valve VV1 and valve V8.

Valve V12 has an inlet port V12a connected to the compressed air source, a first outlet port V12b connected to the front ends of cylinder units 19 and 23 by a branched line L15, a second outlet port V12c connected to the rear ends of the cylinders by a branched line L16, a pilot port V12d, and a vent port V12e.

Valve V13 has an inlet port V13a connected to the compressed air supply, an outlet port V13b, and a vent port V13c. The spool of this inter-pilot valve V13 shifts in response to retraction of piston rod 183 of cylinder unit 185 (i.e., when the envelope opening cylinder units 19 and 23 are moved from their retracted to their operative positions) to connect its port V13a to its port V13b, and it reversely shifts in response to extension of the piston rod to effect movement of the cylinder units from their operative positions to their retracted positions to connect its port V13b to its vent port V13c for purposes as will appear.

Valve V14 has a vacuum port V14a connected to the vacuum source and to port V8b of valve V8 by a vacuum line VL3, a pressure inlet port V14b connected to port V13b of valve V13 by a line L17, and a pressure outlet port V14c connected to pilot port V12d of valve V12 by a line L18.

Valve V8, diaphragm-pressure valve V14, and valve V12 together further constitute vacuum feedback means for determining if vacuum cups 21 and 25 are in gripping engagement with envelope walls 35 and 37 when the vacuum cups are moved apart from one another for opening the envelope. If not, the lack of sufficient vacuum pressure at port V14a of valve V14 causes its spool to shift from the position shown in FIG. 12 thereby to disconnect its inlet port V14b from its port V14c. This causes the spool in valve V12 to shift

from the position shown in FIG. 12 thus directing compressed air via line L16 to the rear ends of cylinder units 19 and 23 to extend their respective piston rods 157 and 159. Upon reaching their extended positions, the vacuum cups are again brought into gripping engagement with the walls of the envelope at station B. This enables sufficient vacuum pressure to be present at port V14a of valve V14 to shift its spool and again connect its inlet port V14b to its outlet port V14c and thus shift the spool in valve V12 which in turn effects retraction of piston rods 157 and 159 of cylinder units 19 and 23 to open the envelope. Valve VV1 in line VL1 may be manually actuated to block line VL1 thereby to simulate gripping of an envelope by the vacuum cups. This prevents repeated cycling of cylinders 19 and 23 in the event there is no envelope in the holder at station B.

Referring now to the portion of the pneumatic circuit which effects operation of index means 7, mechanically actuated valves V15 and V16 are shown to be operable in response to movement of the index cylinder unit 301 to shift the spool in a valve V17 which controls the movement of shift cylinder unit 307.

Valve V15 has an inlet port V15a connected to the compressed air source, an outlet port V15b and a vent port V15c. Valve V16 is similar to valve V15 and it has an inlet port V16a connected to the compressed air source, an outlet port V16b, and a vent port V16c. Valve V17 has an inlet port V17a connected to the compressed air source, a first outlet port V17b connected to the rear end of shift cylinder 307 by a line L19, a second outlet port V17c connected to the forward end of the shift cylinder by a line L20, a first pilot port V17d connected to port V15b of valve V15 by branched line L21, a second pilot port V17e connected to port V16b of valve V16 and to port V4c of valve V4 by a branched line 22, and a vent port V17f.

An impulse valve V18 is provided having an inlet port V18a connected to port V15b of valve V15 by a branch of line L21 which includes a check valve V19 and is also connected to port V16b of valve V16 by a branch of line L22 which includes a check valve V20, and an outlet port V18b connected to pilot port V7e of valve V7 and to pilot port V8d of valve V8 by a branched line L23.

Operation of packaging apparatus 1 of this invention is as follows:

The packaging apparatus of this invention having vacuum and pneumatic circuitry as shown in FIG. 12 is primarily intended to be used in conjunction with the merchandise folding apparatus such as described in the aforesaid copending U.S. Pat. application, Ser. No. 181,875, filed Sept. 20, 1971. By means of suitable pneumatic components (not shown), the packaging apparatus 1 may be interconnected with the folding apparatus in such manner that the packaging apparatus is prevented from cycling until the folding apparatus has delivered folding merchandise M onto pusher 27. This merchandise is delivered from the folding apparatus to the packaging apparatus by means of conveyor 217 (see FIG. 3). Initially, the packaging apparatus has a supply of envelopes E in its magazine 11. Furthermore, its suction cups 16 carried by envelope feed cylinder 15 are in gripping engagement with the front envelope of the supply held in the magazine; holder 5 at station A is empty; holder 5 at station B has an envelope therein, this envelope being held open by the envelope opening

cylinder units 19 and 23 (see FIG. 3); merchandise pusher 27 is in its retracted position for receiving the merchandise; and eject arm 33 is in its starting position for ejecting a loaded envelope held by a holder at station C.

With an envelope E at station B held open and with merchandise M deposited on pusher 27 in position to be inserted in the open envelope, fluidic sensor F1 and pressure switch S1 send pressure signals to the AND pressure switch 319 which in turn sends a pressure signal to the pressure amplifier PA1. This pressure amplifier sends a signal via line L3a to pilot port V1d of valve V1 to shift the spool therein thereby to connect its inlet port V1a to its outlet port V1c and thus supply compressed air to line L2. This line then directs compressed air to the forward end of loading cylinder 221 via branch line L2a, to the rearward end of magazine advance cylinder 117 via line L2b, to the rearward end of funnel cylinder 251 via branch L2c, to the rearward end of envelope feed cylinder 15 via branch L2d, and to the forward end of eject cylinder 31 via branch L2e. This flow of air in branch line L2 causes the following events to occur: The loading cylinder moves pusher 27 from its retracted receiving position to its advanced loading position for inserting merchandise M on the pusher into the opened envelope at station B; the magazine advance cylinder is actuated to operate one-way clutch 115 to effect incremental movement of belts 93 and thus advance the supply of envelopes in the magazine toward abutment members 13; the funnel cylinder is actuated to effect rotation of funnels 243 from their retracted to their guiding positions; the envelope feed cylinder is actuated to move vacuum cups 16 forward from their extended position to their retracted position, and vacuum valve V11 is thereby deactuated to cut off the vacuum in the cups, releasing the envelope to fall into chute 147; and the eject cylinder 31 is actuated to swing eject arm 33 from its starting position to its ejecting position for pushing a loaded envelope from its holder at station C. The eject arm extends down between the discs 63 behind the envelope at station C, and engages the bottom edge 41 of the envelope between the channels 65 to push the envelope radially outward and slide it out of the channels.

As pusher 27 moves from its retracted position, it engages operating finger 321 of valve V6 and thereby connects the inlet port V6a of valve V6 to its outlet port V6b to supply compressed air via line L6 to cylinder 199, this cylinder effecting movement of holder 197 from its raised retracted position to its lowered holding position for holding merchandise M in position on tongue 191 as pusher 27 moves forward to insert the merchandise in the opened envelope at station B.

When pusher 27 reaches its advanced loading position, finger 239 carried by slide block 189 actuates the mechanically operated valve V2 to shift the spool therein and connect its inlet port V2a to its outlet port V2b and thus permit compressed air to flow into the branched line L4. Air flowing in this line is directed by pilot port V3d of valve V3, to pilot port V6d of valve V6, to port V1e of valve V1, to pilot port V7d of valve V7, to pilot port V8c of valve V8 for interrupting the vacuum to vacuum cups 21 and 25 to effect release of the envelope, to inlet port V5a of valve V5, and to pilot port V10d of valve V10 via ports V4a, V4b of valve V4 and line L13 for shifting the spool in valve V10.

Air entering port V3d of valve V3 causes its spool to shift thereby connecting its inlet port V3a to its outlet port V3b to supply compressed air via line L5 to the forward end of the envelope gripping cylinder 273 for rotating gripping arms 263 from their retracted to their gripping positions (see FIG. 3) for holding the envelope E and the merchandise M therein in the holder at station B as pusher 27 returns toward its retracted receiving position. Air entering port V7d of valve V7 causes its spool to shift thus connecting its inlet port V7a to its outlet port V7c to direct compressed air via line L8 to the rear end of cylinder unit 185. This causes piston rod 183 to be extended and thus effect movement of linkage 151 as shown by the arrows in FIG. 1 to move the envelope opening cylinder units 19 and 23 from their operative positions to their retracted positions clearing the way for indexing of wheel 3.

Air entering port V6d of valve V6 causes its spool to shift so that its outlet port V6b is connected to its vent port V6c thus permitting air to be vented from cylinder unit 199 so that the return spring included therein may lift holder 197 from its holding position and thus release merchandise M from the pusher as the latter begins to move toward its retracted position.

Air entering port V1e of valve V1 causes its spool to shift thus connecting its outlet port V1c to its vent port V1f and connecting its other outlet port V1b to its inlet port V1a. Compressed air may then enter the rear end of loading cylinder 221 via branch L1a to effect movement of pusher 27 from its forward advanced position to its retracted receiving position. Air flowing in branched line L1 is also directed to the forward end of magazine advance cylinder 117 to reset one-way clutch 115; to the forward end of funnel cylinder 251 to effect rotation of funnels 243 from their guiding to their retracted positions; to the forward end of envelope feed cylinder 15 to effect movement of vacuum cups 16 from their retracted position to their gripping position to be in gripping engagement with the front envelope E of the series of envelopes held by magazine 11; and to the rear end of eject cylinder 31 for returning eject arm 33 to its starting position.

Upon reaching its retracted receiving position, operating finger 239 trips valve V9 and thereby connects its outlet port V9b to its inlet port V9a to supply compressed air to line L10. Air entering line L10 is directed to pilot port V3e of valve V3 to shift the spool therein so that its outlet port V3b is connected to vent port V3f and its other outlet port V3c is connected to its inlet port V3a to supply compressed air via line L5b to the rear end of gripping cylinder 273 for effecting movement of gripping arms 263 from their gripping positions to their retracted positions and thus permitting indexing of wheel 3.

Wheel 3 is rotated clockwise (as viewed in FIG. 1) through 90° steps by index means 7 (shown in FIGS. 5 and 6) to move holders 5 from one station to another. The index means operates in response to compressed air flowing in line L10 from valve V9 and entering port V10a of valve V10. With piston rod 305 of index cylinder 301 in its extended position and with rack 287b meshing with pinion 289 as depicted in FIG. 12, outlet port V10c of valve V10, now shifted from the position shown, is connected to its inlet port V10a so that compressed air from valve V9 is directed into line L12 for retracting piston rod 305 and thus moving rack 287b down relative to the pinion to effect clockwise (as

viewed in FIG. 5) rotation of wheel 3. The distance the racks are moved as the index cylinder is stroked is a predetermined distance for rotating the pinion and the wheel through 90°. Upon reaching its lowered position, rack frame 291 trips valve V16 to connect its inlet port V16a to its outlet port V16b for directing compressed air into branched line L22 thereby sending a pressure signal to pilot port V17e of valve V17, to pilot port V5c of valve V5, and to pilot port V4c of valve V4, and to inlet port V18a of impulse valve V18.

The pressure signal at port V17e of valve V17 causes its spool to shift and to connect its outlet port V17c to its vent port V17f and to connect its other outlet port V17b to its inlet port V17a. This permits compressed air to enter line L19 and to be directed to the rear end of shift cylinder 307 so that rack assembly 296 may be rotated on pin 299 to engage rack 287a with pinion 289. The pressure signal from valve V16 also causes the spools of valve V4 and V5 to shift from their positions shown in FIG. 12 so that as pusher 27 is next cycled, compressed air from valve V2 will enter port V5a of valve V5 and be directed to its outlet port V5b into line L14 to pilot port V10e of valve V10. This shifts the spool of valve V10 to connect its outlet port V10b to its inlet port V10a and thus extend piston rod 305 of index cylinder 301 during the next cycle.

The pressure signal received at inlet port V18a of valve V18 causes valve V18 to send an impulse pressure signal to pilot port V7e of valve V7 which causes its spool to shift to connect its outlet port V7b to its inlet port V7a and thus direct compressed air via line L7 to the forward end of cylinder 185 and retract its piston rod 183. This in turn effects movement of linkage 151 to swing envelope opening cylinders 19 and 23 from their retracted to their operative positions. As piston rod 183 is retracted, valve V13 is actuated and its inlet port V13a is connected to its outlet port V13b whereby compressed air is directed via line L17 to port V14b of valve V14. Valve V18 also sends a pressure signal to pilot port V8d of valve V8 via line L23 to shift the spool in valve V8 to the position shown in FIG. 12 thereby to vent line VL3 to the atmosphere via vacuum cups 21 and 25. Venting of line VL3 causes the spool in valve V14 to shift from the position shown for blocking communication between its ports V14b and V14c thus blocking the pressure signal from reaching port V12d of valve V12. The absence of a pressure signal at port V12d causes the spool of valve V12 to shift to connect its inlet port V12a to its outlet port V12c thus effecting movement of the vacuum cups into engagement with the envelope E held at station B. Since the vacuum cups are connected to the vacuum source by valve V8, the cups will grip the walls of the envelope. This sends a vacuum signal to port V14a of valve V14 and causes its spool to shift to the position shown in FIG. 12 connecting its inlet port V14b to its outlet port V14c and sending pressure to port V12d of valve V12. Pressure at port V12d causes the spool of valve V12 to shift to the position shown in FIG. 12 for connecting its inlet port V12a to its outlet port V12b to direct compressed air to the front ends of cylinder units 19 and 23 via line L16 to retract piston rods 157 and 159. Thus, vacuum cups 21 and 23 are moved apart from one another for opening the envelope walls 35 and 37 of the envelope at station B. It will be understood that the timing of the operation of cylinder 185 is such that the envelope

opening cylinder units are rotated to their operative positions after the wheel has been indexed.

Thus, with the vacuum cups 21 and 23 gripping the walls of the envelope, the packaging apparatus of this invention is again ready to insert folded merchandise into the envelope in accordance with the stated steps when the merchandise is placed on pusher 27.

Tracing the operation of the apparatus of this invention as shown in FIGS. 7-11, starting with the dispensing of an envelope E from magazine 11 and the ensuing opening and loading of the envelope at station B, the folding over of its flap 43 and its ultimate ejection from the apparatus at station C, the sequence is as follows:

15 An envelope E is removed from magazine 11 and dropped into a holder 5 at station A by admitting compressed air into the rear end of envelope feed cylinder 15 to extend its piston rod 137 to move vacuum cups 16 from their advanced gripping position in which they grip wall 37 of the front envelope of the series of envelopes in the magazine to their retracted position above chute 147. As the vacuum cups reach their retracted position, they are vented to release the envelope gripped thereby to drop into the holder therebelow.

20 The wheel 3 is then indexed 90° to move the envelope in its holder 5 from station A to station B. The envelope opening cylinder units 19 and 23 are then swung from their retracted (FIG. 8) to their operative (FIG. 9) positions. Piston rods 157 and 159 are extended (FIG. 9) for respectively moving the vacuum gripping cups 21 and 25 carried thereby into gripping engagement with walls 35 and 37 of the envelope held horizontally at station B. Cylinders 19 and 21 are then actuated to retract their piston rods to move vacuum cups 21 and 25 apart from one another to spread the walls of the envelope and open its mouth (see FIG. 10).

30 Loading cylinder 221 is then actuated to move pusher 27 from its retracted receiving position to its advanced loading position to insert merchandise M on the pusher in the opened envelope (see FIG. 10). Gripper cylinder 273 is actuated to move gripping arms 263 from their retracted positions to their gripping positions to hold the envelope and the merchandise stationary relative to the holder at station B. The pusher is then returned to its retracted position. Vacuum cups 21 and 25 are vented to release the envelope walls gripped thereby, the cylinder units 19 and 23 are swung to their retracted positions (FIG. 11), and the gripping arms 263 are rotated to their retracted positions clear of wheel 3 to permit rotation of the wheel.

35 Wheel 3 is then indexed through a 90° angular interval to move holder 5 from station B to an intermediate position between stations B and C. As the holder is rotated from station B, the flap 43 of the envelope engages the rearward edge 283 of shroud 281 to fold the flap and close the mouth of the envelope (see FIG. 11). Wheel 3 is again indexed 90° to move the envelope from the intermediate position to station C for removal from the apparatus. Upon reaching station C, compressed air is admitted into the forward end of eject cylinder unit 31 to retract its piston rod 31a and thus swing eject arm 33 on its pivot 34. The free end of the eject arm engages the bottom edge 41 of the envelope at station C and pushes the envelope to the left as shown in FIG. 11 out of its holder 5 into guide 285. The wheel is again indexed 90° to move the now empty

holder back to station A for repetition of the sequence.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Apparatus for packaging merchandise in receptacles made of flexible packaging material each having an open mouth, comprising:

a frame;

an endless conveyor carried by the frame;

a plurality of receptacle holders spaced at equal intervals on the conveyor;

means for indexing the conveyor to bring each holder from a first station at which a receptacle may be allowed to fall into the holder to a second station at which the merchandise may be loaded in the receptacle via its mouth, thence to a third station at which the loaded receptacle may be removed from the holder, and back to the first station;

means for holding a supply of receptacles;

means for removing one receptacle at a time from said supply means and for releasing it to fall into a holder at said first station;

means at the second station carried by said frame for opening the mouth of the receptacle carried by the holder at the second station for entry of said merchandise therein, said opening means being movable between a retracted position clear of said conveyor for permitting indexing of the conveyor and an operating position in which said opening means is engageable with the receptacle held by the holder at the second station for opening the receptacle;

means at the second station for inserting the merchandise in the opened receptacle; and

means at the third station for removing the loaded receptacle from its holder.

2. Apparatus as set forth in claim 1 wherein said endless conveyor is a wheel rotatable on a horizontal axis, said holders being positioned radially of the wheel at equal angular intervals therearound.

3. Apparatus as set forth in claim 2 for utilization of envelopes as the receptacles wherein the holders are formed and arranged to hold the envelopes in radial position relative to the wheel with the bottoms of the envelopes toward the axis of the wheel, and with the mouth end of each envelope positioned for being opened by said opening means at the second station.

4. Apparatus as set forth in claim 3 wherein each holder comprises a pair of channels extending radially of the wheel with their open sides toward one another for receiving the side margins of an envelope.

5. Apparatus as set forth in claim 3 wherein said supply means comprises a generally horizontal magazine having a pair of spaced-apart abutments at one end thereof constituting its forward end engageable by the said margins of the forward envelope of a series of envelopes held within the magazine, and means for maintaining said series with the forward envelope in engage-

ment with the abutments as envelopes are removed therefrom.

6. Apparatus as set forth in claim 5 wherein said removing means comprises vacuum grip means movable between a first position in engagement with the outside of the forward envelope of said series between said abutments and a second position in which the vacuum grip means and an envelope gripped thereby is in position for dropping the envelope into the holder at said first station, said forward envelope being bent outwardly between said abutments as said vacuum grip means moves from its first position to its second position to permit the side margins of the envelope to escape past said abutments.

7. Apparatus as set forth in claim 6 wherein said removing means further includes a chute for guiding the envelope into the holder at the first station as it drops from said vacuum grip means.

8. Apparatus as set forth in claim 6 wherein said vacuum grip means comprises at least one vacuum suction cup engageable with said forward envelope, an air cylinder and piston means for moving said vacuum suction cup between the said first and second positions, and means for effecting the release of said envelope from said vacuum suction cup when the latter is in the second position to permit the envelope to drop into the holder at the first station.

9. Apparatus as set forth in claim 3 wherein said opening means comprises first and second vacuum grip means movable between a retracted position in which both said vacuum grip means are clear of the wheel for permitting rotation thereof, and an operating position in which the first vacuum grip means is engageable with one wall of the envelope held by the holder at said second station and the second vacuum grip means is engageable with the other wall of said envelope, said first and second vacuum grip means, when in their operating position, being movable toward one another into gripping engagement with said walls and then away from one another for spreading apart said walls thereby to open the mouth of the envelope.

10. Apparatus as set forth in claim 9 comprising means for sensing whether or not said vacuum grip means are in gripping engagement with said envelope and, if not, repeating the movement of said vacuum grip means into engagement with said envelope walls for gripping and opening them, and preventing operation of said merchandise inserting means until the mouth of the envelope has been opened.

11. Apparatus as set forth in claim 10 wherein said sensing means comprises vacuum feedback means for determining if said vacuum grip means are in gripping engagement with the envelope walls.

12. Apparatus as set forth in claim 3 wherein said merchandise inserting means comprises a pusher movable between a retracted receiving position in which said merchandise may be deposited thereon and an advanced loading position in which the merchandise on the pusher is inserted in the envelope held by a holder at said second station, said pusher having merchandise holding means thereon movable between a lowered holding position in which the merchandise is held in position on the pusher and a raised retracted position for releasing the merchandise from the pusher, said merchandise holding means being in its holding position as the pusher moves from its receiving position to its advanced position and in a raised retracted position dur-

ing return movement of the pusher from its advanced position to its receiving position for releasing the merchandise from the pusher.

13. Apparatus as set forth in claim 12 further including means at said second station for guiding said merchandise on said pusher into the open mouth of the envelope held by the holder at said second station, said guiding means being movable from a guiding position in which it is in register with the mouth of the envelope and a retracted position in which it is clear of the envelope and the wheel to permit rotation thereof.

14. Apparatus as set forth in claim 3 wherein the envelope has a closure flap on one wall thereof and said apparatus further comprises means for folding the flap to close off the mouth of the envelope after the merchandise has been inserted therein.

15. Apparatus as set forth in claim 14 wherein said envelope is placed in a holder at said first station with the wall having said closure flap extending therefrom facing in the direction of rotation of said wheel, and wherein said flap closure means comprises a curved shroud adjacent the outer ends of said holders engageable by said flap as the envelope in its holder is indexed from said second station to said third station to fold the flap over the mouth of the envelope and to hold the envelope in its holder.

16. Apparatus as set forth in claim 3 wherein said ejecting means comprises a member movable between a starting position in which it is engageable with the bottom end of a filled envelope held by its holder at said third station and an ejecting position in which the member is adjacent the outer end of the holder for pushing the filled envelope endwise of its holder for removal therefrom.

17. Apparatus as set forth in claim 1 wherein said conveyor has a drive shaft, and said indexing means comprises a pinion on said shaft, a rack assembly comprising a first rack and a second rack on opposite sides of the pinion, means mounting the rack assembly for movement between a first position wherein the first rack is in mesh with the pinion on one side thereof and the second rack is clear of the pinion, and a second position wherein the second rack is in mesh with the pinion on the other side thereof and the first rack is clear of the pinion, means for reciprocating the rack assembly through a predetermined stroke, and means for shifting the rack assembly from its first to its second position at one end of its stroke and from its second to its first position at the other end of its stroke.

18. Apparatus as set forth in claim 17 wherein the means mounting the rack assembly comprises a pivot on which the rack assembly is swingable between its first and second positions.

19. Apparatus as set forth in claim 1 wherein said endless conveyor is a wheel comprising a pair of spaced

side members on a shaft rotatable on a horizontal axis, each holder comprising a pair of channels extending radially on the inside of said side members with their open sides toward one another for receiving the side margins of an envelope, said means at the third station for removing the loaded receptacle from the holder at the third station comprising an arm pivoted on a fixed axis outside the wheel and extending inwardly from its said axis between said side members and swingable outwardly from a retracted position wherein it is interposed between the shaft and the inner end of the envelope in the holder at the third station for pushing the envelope radially outward out of the holder.

20. Apparatus as set forth in claim 3 wherein said envelope opening means comprises first and second cylinder and piston units each having vacuum grip means on the free end of its piston rod and each being pivoted for swinging movement on a fixed axis between a retracted position in which both cylinder and piston units and their vacuum grip means are clear of the wheel and the envelope held by a holder at the second station for permitting rotation of the wheel, and an operative position in which the vacuum grip means carried by the first cylinder and piston unit is engageable with one wall of the envelope held by the holder at the second station and the vacuum grip means carried by the second cylinder and piston unit is engageable with the other wall of the envelope, said first and second cylinder and piston units, when in their operative positions, being operable to effect movement of their respective vacuum grip means toward one another into gripping engagement with said walls and then away from one another for spreading apart the walls of the envelope gripped thereby to open the mouth of the envelope.

21. Apparatus as set forth in claim 20 further comprising means for moving the cylinder and piston units between their retracted and operative positions including linkage means interconnecting the cylinder units for conjointly swinging them on their respective fixed axes.

22. Apparatus as set forth in claim 21 wherein the envelope held by a holder at the second station is generally horizontal, and wherein said first cylinder and piston unit is pivoted on a horizontal axis above the holder at the second station for swinging in a generally vertical plane and said second cylinder and piston unit is pivoted on a horizontal axis below the holder at the second station for swinging in a generally vertical plane, whereby the vacuum grip means carried by the first cylinder and piston unit is engageable with the upwardly facing wall of the envelope and the vacuum grip means of the second cylinder and piston unit is engageable with the downwardly facing wall of the envelope.

* * * * *