Oct. 3, 1961 T. N. CARTER ET AL 3,002,326

CARTON FORMING AND HANDLING APPARATUS

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Fig. 1

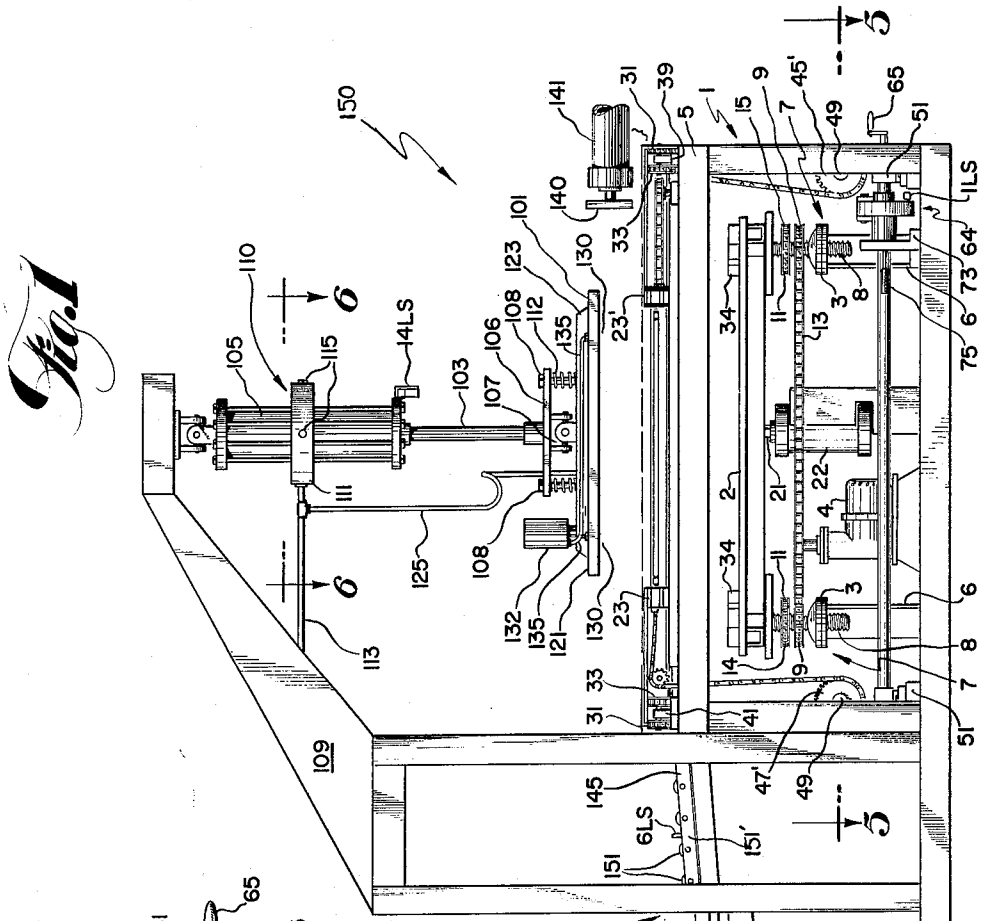
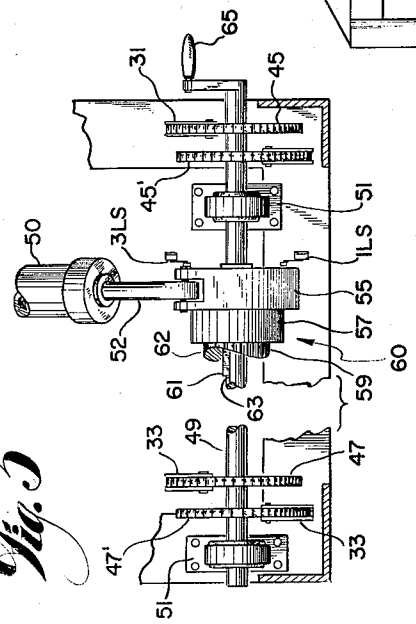


Fig. 3



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CARTON FORMING AND HANDLING APPARATUS

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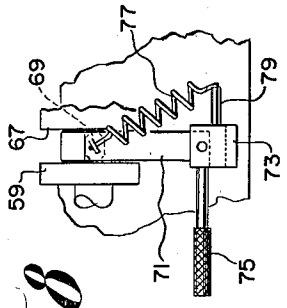


Fig. 8

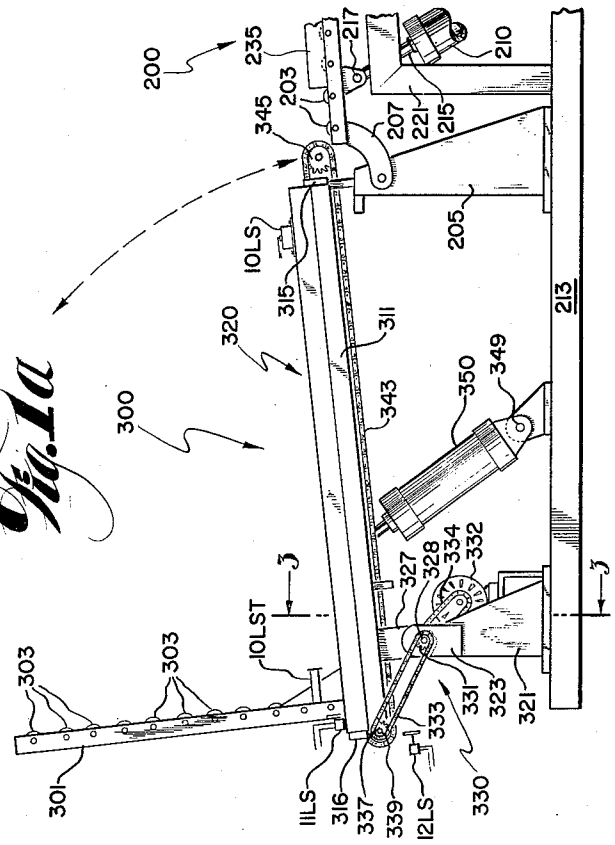
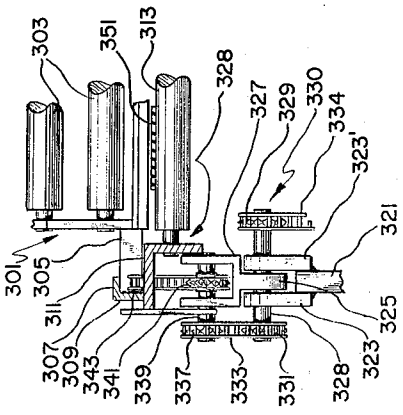


Fig. 1a

Fig. 3



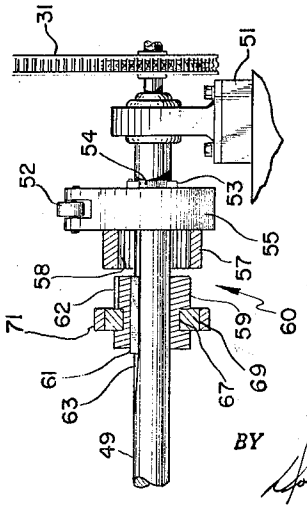


Fig. 4

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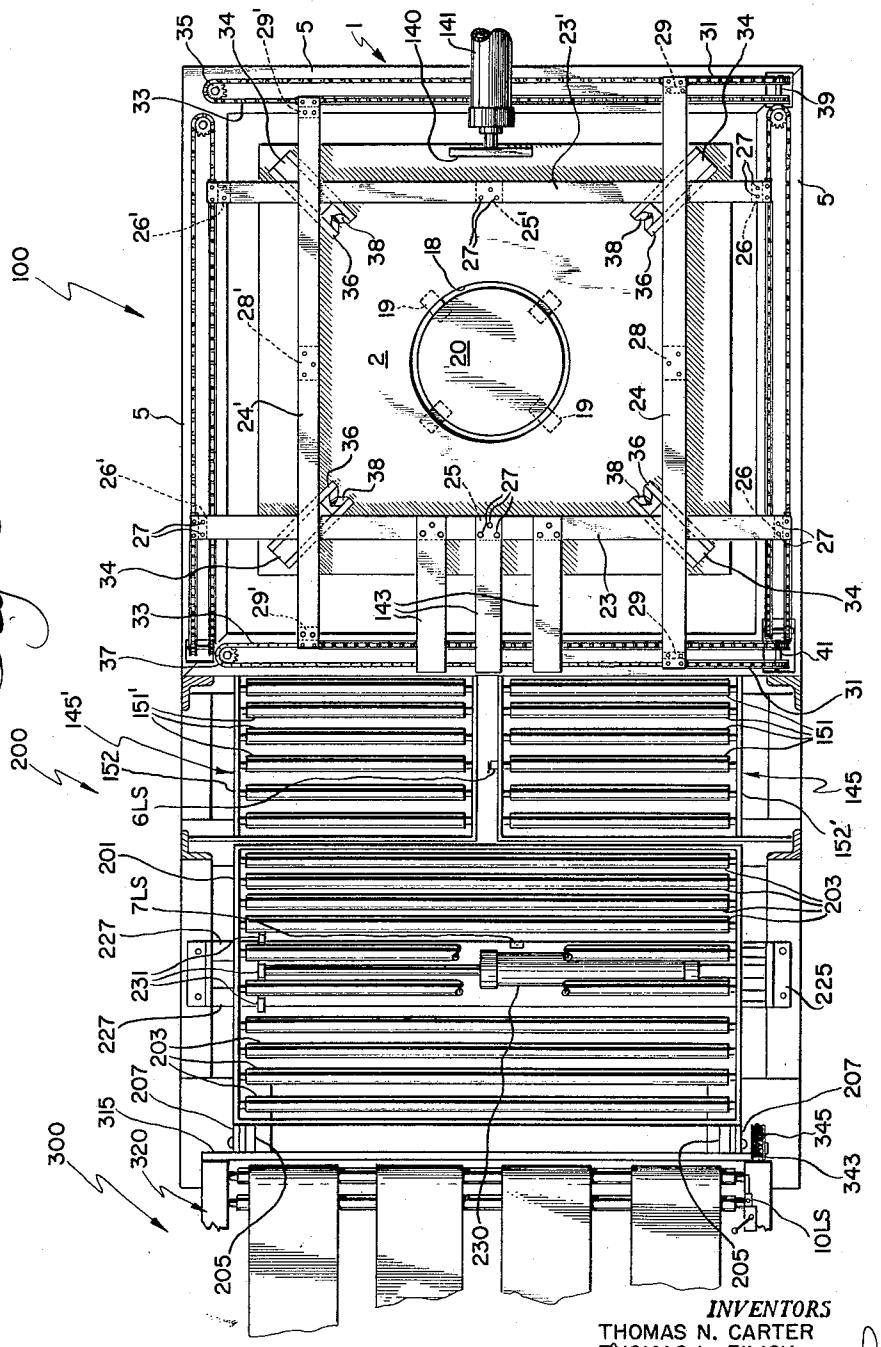
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CARTON FORMING AND HANDLING APPARATUS

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Fig. 2



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CARTON FORMING AND HANDLING APPARATUS

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Fig. 6

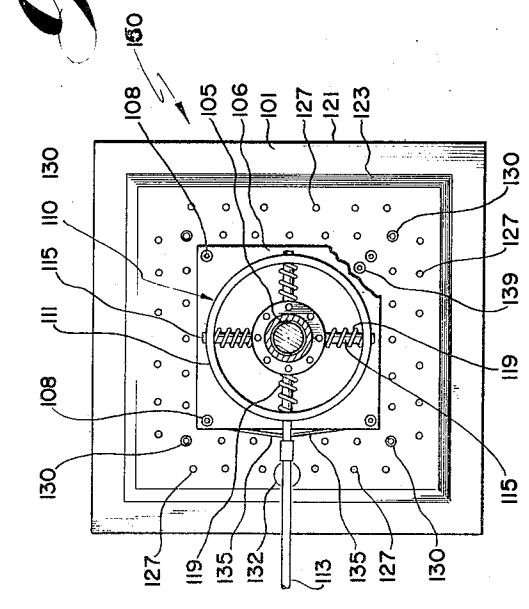


Fig. 7

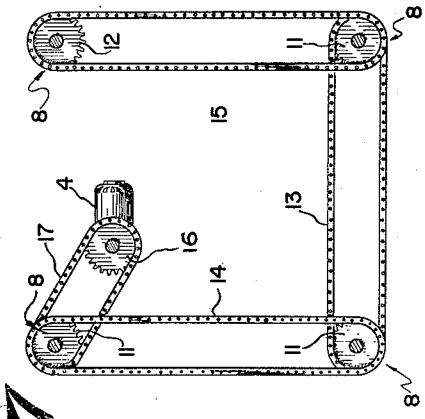
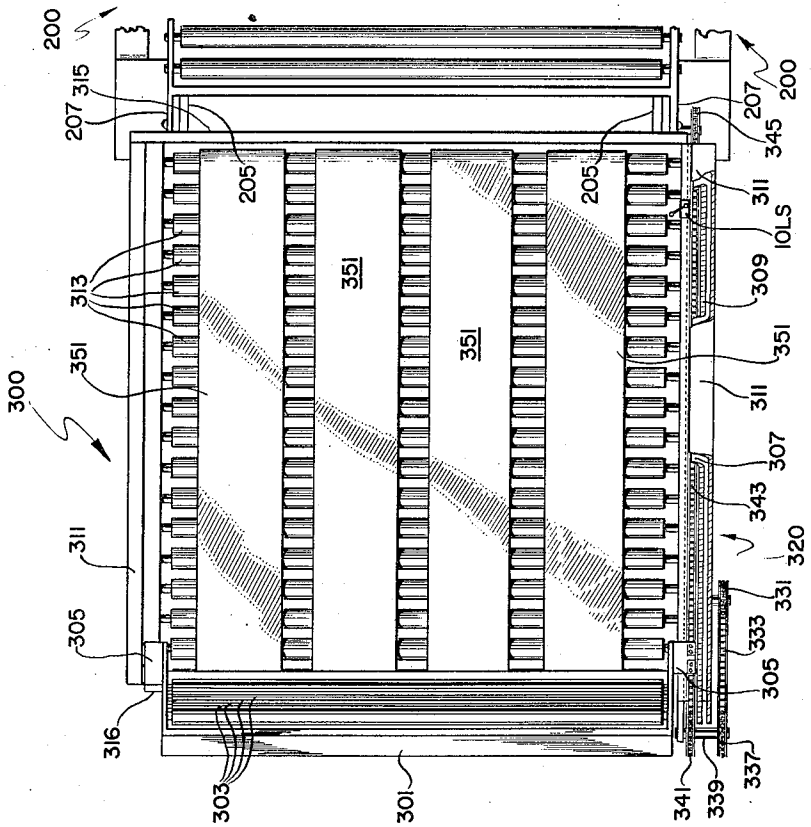


Fig. 1a



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CARTON FORMING AND HANDLING APPARATUS

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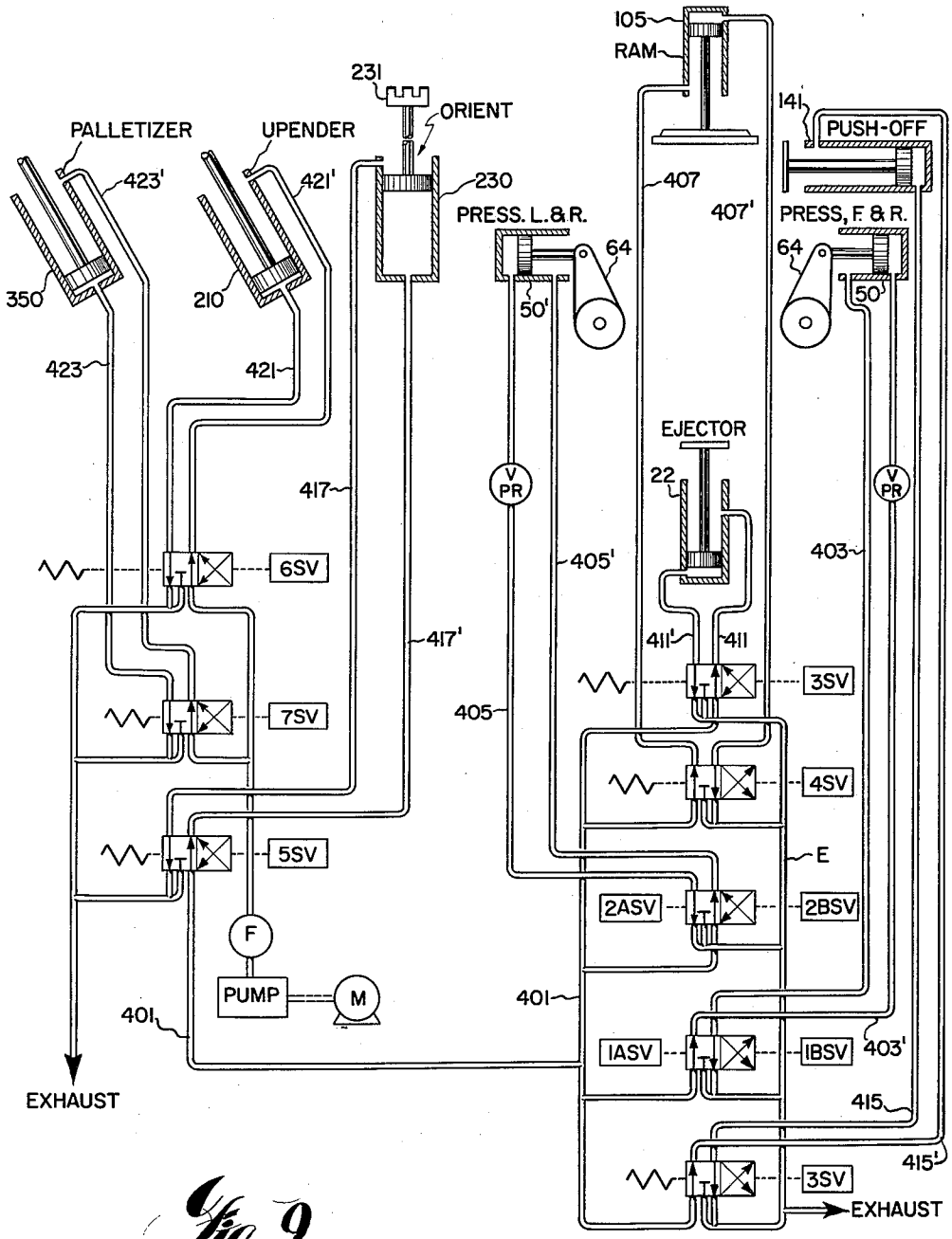


Fig. 9

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CARTON FORMING AND HANDLING APPARATUS

Filed Feb. 9, 1959 6 Sheets-Sheet 6

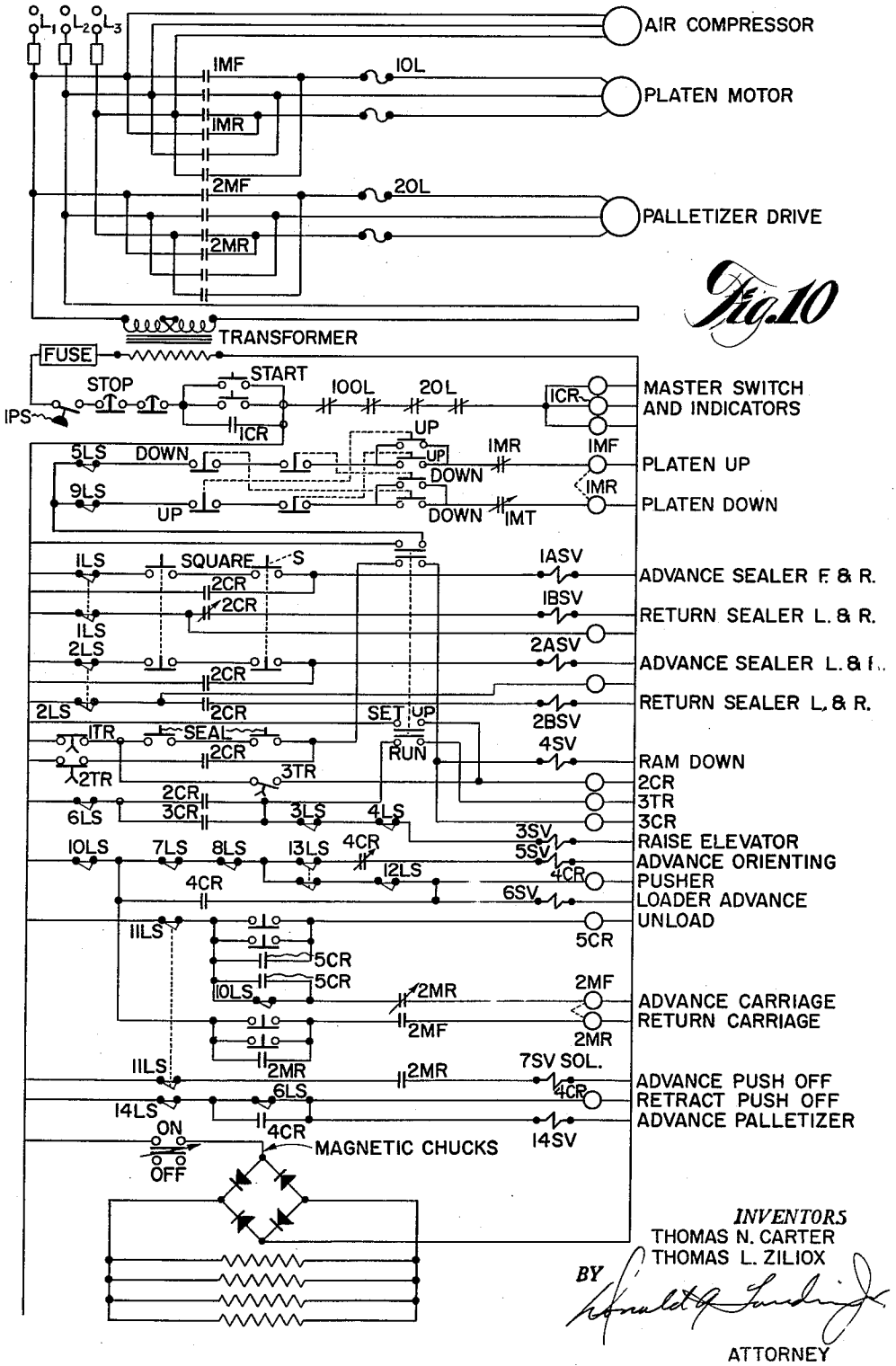


Fig. 10

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United States Patent Office 3,002,326 Patented Oct. 3, 1961

3,002,326
A CARTON FORMING AND HANDLING APPARATUS

Thomas N. Carter and Thomas L. Ziliox, Hamilton, Ohio, assignors to The Champion Paper and Fibre Company, Hamilton, Ohio, a corporation of Ohio

Filed Feb. 9, 1959, Ser. No. 792,178
14 Claims. (Cl. 53—185)

This invention is concerned with container forming and palletizing system and apparatus. More particularly, the invention is concerned with a system and apparatus for forming and palletizing containers of the type disclosed in copending application of Thomas L. Ziliox, S.N. 703,072 filed December 16, 1957, though the use of the system and apparatus to be herein described is not limited to such application and may readily be utilized with various types of container structures.

The container disclosed and claimed in the aforesaid application is one wherein sealing of a top and a bottom portion is obtained by means of an adhesive which bonds the side flaps of the container bottom and top to one another and wherein the container is ideally adapted for use in packaging paper in sheet form. The present system and apparatus, while having general utility, is none-the-less particularly useful in conjunction with the aforesaid container in finally forming, sealing, conveying and palletizing the filled, completed containers in a continuous operation.

While there are many ways containers of the type referred to may be formed and sealed, the present invention is unique in that it incorporates apparatus and defines a system for performing the desired result in a highly efficient, well organized manner, enabling economical, rapid and effective completion and palletizing of filled containers with a minimum of handling and of skilled personnel.

Accordingly, an object of the invention is to produce a continuous container forming, sealing and palletizing system.

A further object of the invention is to produce an apparatus which will completely seal and palletize filled containers.

An additional object of the invention is to produce a container forming apparatus wherein the container is literally formed about its contents.

Another object of the invention is to produce a system and apparatus for completing and palletizing containers of the type referred to above.

A still further object of the invention is to produce a novel container forming and sealing apparatus.

An additional object of the invention is to produce a unique palletizing system and apparatus for functioning in the system of exceptional efficiency.

These and other objects of the invention not specifically referred to above but none-the-less inherent in the invention, may be accomplished by providing a system which includes a means for finally forming and sealing the top and bottom elements of a container about the contents to be enclosed, thereafter providing means for ejecting the completely sealed container and its contents from the sealing apparatus in an inverted position and thereafter conveying, orienting and manipulating the filled container onto a pallet where a series of similar containers may also be placed ready for shipment except for a simple banding operation where required.

The operation of the system, the apparatus and the details of the invention will become more apparent when consideration is given to the following description thereof taken in conjunction with the drawings forming a part of the disclosure, and wherein

FIG. 1 is a partial side elevation of the apparatus,

FIG. 1*a* is a continuation of FIG. 1, and when viewed therewith is an elevation view of the entire apparatus,

FIG. 2 is a top plan view, with certain parts removed, of that portion of the apparatus shown in FIG. 1,

FIG. 2*a* is a top plan view, a continuation of FIG. 2 and which therewith forms a top plan view of the entire apparatus,

FIG. 3 is a partial sectional view of a portion of the apparatus taken along the line 3—3 of FIG. 2*a*,

FIG. 4 is an enlarged elevational view of a clutch device used in driving the sealing instrumentalities,

FIG. 5 is an enlarged top view of the sealing drive means, certain parts being removed for clarity and taken along the line 5—5 of FIG. 1,

FIG. 6 is a top view of the container compressing plunger, taken along the line 6—6 of FIG. 1,

FIG. 7 is a schematic top plan view of the drive means utilized to raise and lower the container supporting platen,

FIG. 8 is a top view of a simple manual operating means used with the clutch arrangement of FIG. 4,

FIG. 9 is a schematic diagram of the pneumatic operating system used to operate the various instrumentalities, and

FIG. 10 is a schematic ladder diagram of the electrical circuitry used in conjunction with the pneumatic system of FIG. 9 to effect proper operation of the system and apparatus.

Referring now to FIGS. 1, 1*a*, 2 and 2*a* it may be seen that the apparatus is comprised of a sealing station **100**, an up-ending station **200** and a palletizing station **300**. Each of these stations is interconnected in a control system such that a container may be filled, assembled and sealed at the sealing station **100**, ejected therefrom and thereafter it will be automatically oriented up-ended, and loaded on a suitable pallet at the palletizing station **300**.

Since the filling and sealing operation is the initial step in the overall sequence, consideration will first be given to this station **100**. As indicated in FIGS. 1 and 2, the sealing station includes apparatus comprising an open topped table-like frame **1**. Disposed within the frame **1** is a vertically moveable table **2**, hereinafter referred to as a platen, which is mounted on four screw jacks **3** suitably driven by a reversing motor **4** such that the platen may be moved toward and away from the table-like open top of the frame **1**.

Since the platen **2** must move in a vertical direction and be at all times horizontal and parallel to the plane defined by the top members **5** of the open topped frame **1**, a synchronously acting drive means is utilized to drive the screw jacks **3**. A schematic representation of that means is shown in FIG. 7, which when viewed with FIG. 1 is illustrative of the entire apparatus. In FIG. 1, the screw jacks **3** are shown as comprised of supports **6** to which is fastened a stationary mechanism **7**. The stationary mechanisms **7** essentially form a series of stationary nuts in which the threaded jack elements **8** can be caused to rotate and thus, as will be readily apparent, this rotation causes the elements **8** to raise and lower. These elements **8** are fixed to the platen **2** so that as they rotate the platen will be raised and lowered. Obviously, as it does so it is essential that all four of the jack elements **8** rotate simultaneously in the same direction to assure that in all vertical positions of adjustment, platen **2** remains horizontal at all times. This is accomplished (FIG. 7) by providing three of the four jack elements **8** with a pair of superposed sprockets **9** and **11**, and the remaining element **8** with a single sprocket **12**. The sprockets **9** lie in a common plane and are interconnected by a chain **13**. The sprockets **11** lie in a common plane spaced above that embracing

sprockets 9 and two are interconnected by a chain 13. The remaining sprocket 11 is connected by chain 15 to the sprocket 12 which lies in the latter mentioned common plane. Thus all of the jack elements 8 are interconnected through chains 13, 14 and 15 such that each rotates and automatically raises or lowers equally and simultaneously.

The driving source for the jack elements is effected through a reversible electric motor and right angle transmission combination 4 and sprocket 16 connected by a chain 17 to a sprocket (not shown) carried by one of the jack elements 8. Thus rotation of the sprocket 16 in either direction causes rotation of all of the jack elements 8 and platen 2 may be raised and lowered with respect to the top of frame 1.

Referring again to FIG. 1 it will be seen that the top surface of the platen 2 is provided with a central aperture 18 of annular configuration. Projecting inwardly toward the center of aperture 18 are a series of stops 19. These stops engage the bottom of an annular plate 20 defining an ejector; which plate is in turn connected by piston rod 21 to a piston and cylinder assembly 22.

The ejector 20 when in an at rest position rests against the stops 19 and forms with the platen 2 a substantially planar surface. Normally when at rest the platen will follow the vertical position of platen 2, since cylinder 22 is not energized. However, at a specific time in the operating cycle ejector 20 raises above the platen 2 to lift anything resting thereon above the platen 2 to a given position. The purpose and manner of operation of the ejector 20 will be described subsequently.

Returning once more to FIGS. 1 and 2 it will be seen that the top beam members 5 of the frame 2 serve as supports for two pairs of sealing bars 23, 23' and 24, 24'. For convenience, the bars 23, 23' will be referred to as left and right, while bars 24, 24' will hereinafter be referred to as front and rear, as viewed in FIGS. 1 and 2.

The scaling bars 23, 23' are movable toward and away from each other as are the bars 24, 24'. As will be seen in FIG. 2 each of the opposing pairs of bars are arranged so as to be symmetrically positioned with respect to the center of the platen 2. Since these bars are moved against the sides of a container to seal the same, it will be apparent that each pair of these bars must move in equal and opposite directions at all times and must be driven in such a manner and by such mechanisms as to be adjustable to accommodate different sized and shaped containers and further must exert equal pressure on all sides thereof and finally must move without interference between each other.

To accomplish the last mentioned end, the bars 23, 23' are formed of spaced leaves. These leaves comprised of flat strip members separated by spacer blocks 25, 25' and 26, 26' in the case of bars 24, 24'. These spacer blocks are interdigitated between the multiple superposed leaves at the center and ends thereof and hold the leaves in spaced relation and are fixed in place by fasteners 27. Preferably, bars 23, 23' comprise three such superposed leaves though a greater or lesser number may be advantageously used. The bars 24, 24' are formed in a similar manner with spacer blocks 28, 28', 29, 29'. The bars 24, 24' are interdigitated or interspersed between the spaced bars 23, 23' and thus both pairs of sealer bars may move laterally with respect to each other within the limits defined by the spacer blocks 25, 25', 26, 26' and 28, 28', 29, 29' as is apparent in FIG. 2.

The features of equal and opposite movement, adjustability etc., are effected by means of the unique drive trains which actuate the sealer bars 24, 24' and 25, 25'. Since the drive train for each pair of bars is identical a description of one will suffice as a description of both.

Referring to FIGS. 1, 2 and in particular FIGS, 4, 5 and 8, it will be seen that bars 24, 24' are connected at either end to a pair of chains 31 and 33 respectively. The ends of bar 24 are fixed to the outer flight of the chains 31 and 33 which are trained over idler sprocket assemblies 35 and 37 respectively while sealing bar 24' has its outer ends fixed to the inner flights of chains 31 and 33 respectively. The chains 31 and 33 respectively are further trained over sprocket assemblies 39 and 41 and pass vertically downwardly therefrom. The ends of each of the chains 31 and 33 are connected to a pair of drive sprockets 45, 45', 47 and 47' as may be clearly seen in FIG. 5. As also may be seen in FIG. 5 the chains 31 and 33 are connected to the sprockets 45, 45' and 47, 47' on opposite sides of each such that, for example, as sprockets 45 and 45' rotate in one direction the chain 31 is drawn around sprocket 45 and plays off sprocket 45', and visa versa. The same arrangement is made between chain 33 and sprockets 47, 47'. Thus remembering that the bars 24, 24' are fixed to opposite flights of chains 31 and 33 respectively, it will be seen that these bars will be moved in opposite directions, toward or away from each other depending on which way the drive sprockets 45, 45' and 47, 47' are rotated.

Returning again to FIG. 5 it will be seen that the drive sprockets 45, 45', 47, 47' are mounted on a shaft 49 journaled in bearings 51. The shaft 49 is in turn connected by a clutch and crank assembly 60 to a double acting pneumatic piston and cylinder assembly 50. Thus reciprocating movement of piston rod 52 is converted into rotary motion of shaft 49 to actuate the sealing bars 24, 24' as has been described.

As has been indicated, the sealing bars must be adjustable to all the apparatus to accommodate and operate upon various sizes and shapes of containers. Referring to FIG. 4, the clutch and crank assembly which enables such adjustment will be described.

The clutch assembly 60 consists primarily of a crank 55 rotatably mounted on shaft 49 and held against axial movement on the shaft by a split collar 53 which rides in an annular groove 54 and is bolted to the crank. Thus the crank 55 may idle on the shaft. The opposite side of the crank 55, the left side as viewed in FIG. 4, is provided with a cylindrical extension 57. This cylindrical extension 57 is provided with inwardly directed spline-like teeth 58.

Also slidably mounted on shaft 49 is an axially movable clutch member 59 which is keyed to shaft 49 by a key 61 slidable in slot 63 provided in the shaft 49. This clutch member 59 is provided with circumferential teeth 62 which are engageable with the spline-like teeth 58 provided on the crank extension 57. Thus with the clutch member 59 in the position shown in FIG. 4 will be disengaged and shaft 49 may be rotated irrespective of the position of the driving piston rod 52. Since movement of shaft 49 effects movement of sprockets 45, 45' and chains 31, 33 it will be seen that the sealing bars 24, 24' may be adjusted toward and away from one another, dependent upon which way the shaft 49 is moved. To facilitate manual movement of the shaft 49 independently of the piston and cylinder assembly 50 one end of shaft 49 may be provided with a hand crank 65 as clearly shown in FIG. 5.

It will be appreciated that the stroke of the cylinder assembly 50 is constant regardless of the position at which shaft 49 may be at any given time. Thus the sealing bars 24, 24' will exert the same pressure during a sealing cycle regardless of the size of container upon which the apparatus may be operating and further, since the sealing bars are always set to have a ¾ inch overtravel at their minimum position, the regulation of the pressure which actuates cylinder assembly 50 enables control of the pressure with which the sealing bars act on a container.

The clutch member 59 may be actuated by an suitable means. For illustration purposes FIG. 8 discloses a simple device for performing this function. As shown, the clutch member 59 may be provided with an annular

groove 67. A pair of opposed pins 69 carried by a yoke 71 ride in the groove 67. The yoke 71 is pivotally connected to a support 73 and provided with a hand lever 75 by which it may be moved. A spring 77 connected to yoke 71 and an extension 79 tends to bias the yoke 71 and hence clutch member 59 to an engaged position with crank extension 57. Actuation of the hand lever 75 disengages the clutch member from the crank extension as is apparent.

As has been indicated, a similar drive mechanism actuates the sealer bars 23, 23' and portions of shafts 49' and sprockets 45' and 47' which drive the latter sealing bars may be seen in FIG. 1. Thus it will be apparent that the apparatus may be adjusted to accommodate various sizes and shapes of container having planar sides than can be engaged, at least in part, by the bars 23, 23' and 24, 24'.

Returning now to FIG. 1 and in conjunction therewith, FIG. 6, it will be seen that disposed directly above the previously described sealing bars etc., is a plunger assembly 150. This assembly includes a vertically movable compressing plate 101 carried on the end piston rod 103 which forms a part of a piston and cylinder assembly 105 suspended by a universal connector 107 from an overhead boom 109.

The cylinder assembly 105 may be pneumatically operated and in addition is stabilized by a spring biasing centering assembly 110 which maintains the piston rod 103 in vertical alignment with the center of the container supporting platen 2. As seen in FIG. 6 this assembly is shown as being comprised of an annular ring 111 surrounding the cylinder 105 and is supported from a strut 113 connected to boom 109. The cylinder assembly 105 is provided with four radially extending projections 115 which project through the ring 111. Surrounding these projections 115, which are coterminous and at 90° with respect to each other, are coil springs 119 which act against the ring 111 and the cylinder assembly 105 to keep the latter centered in the ring and thus the piston rod 103 and the pusher plate 101 centered with respect to the lower assembly, i.e., the platen 2.

The pusher plate 101 is connected to the piston rod 103 and is comprised of a comparatively smooth, planar plate 121 provided with suitable apertures and having welded to its upper surface a hood-like member 123 which defines therewith a plenum chamber. This chamber is pressurized from a suitable source by means of air-line 125 and the plate 121 is provided with a plurality of contact actuated valves 127, as shown in FIG. 6. These valves are of a standard construction, such as those manufactured by the Lamb-Greys-Harbor Co., and when the plate contacts a container, these valves open and an air cushion is developed between the container body and the plate such that the container body may move relative to the plate 121. The purpose of this arrangement will be apparent.

It will be seen that the plate and hood assembly is connected to the piston rod 103, through the medium of a swivel connector 104 and a spring biasing means which tends to maintain the plate 101 and its associated parts in a horizontal position, yet will yield in the event that, for some reason, the plate 101 in its downward stroke encounters an unexpected resistance. This means is comprised of a rectangular plate 106 having apertures in each corner through which headed bolts 108 may readily slide. Disposed around bolts 108 and bearing against the underside of plate 106 and the top surface of hood 123 are coil spring 112 which exert a pressure biasing the two apart but which may readily yield in the event plate 101 encounters a resistance which tends to cock it with respect to the horizontal.

Additionally, the plate is provided with a plurality, preferably four, adhesive pumps 130 supplied from a reservoir 132 and lines 135 which are also disposed so as to contact the container body and, upon such contact, to express a suitable adhesive thereon. The pumps 130 are movable to one of two positions as defined by the apertures 137 and 139 as shown in FIG. 6. Thus the pumps may be moved to accommodate various sized containers and their purpose will also be described in detail hereinafter.

Having described details of the mechanism for sealing and forming containers, consideration will now be given to the palletizing operation.

As seen in FIGS. 1 and 2, a pivotally mounted push-off means is disposed at one edge of the sealing apparatus. Preferably this is comprised of a plate member 139 actuated by an air cylinder assembly 141, which causes the plate 139 to traverse the surface of the sealing and forming assembly to push off a sealed container which rests on the ejector 20 after completion of the sealing cycle. The container is thus caused to pass over the bar members 143 provided on sealing bar 23' for this purpose, and from there onto roller conveyor assemblies 145, 145'. The cylinder 141 is preferably mounted on a pivot which permits the assembly to pivot out of the way during loading operations.

The latter assemblies are conventional roller conveyor assemblies including simple supporting frames 152, 152' and frictionless bearing mounted rollers 151, 151' which act to feed the container beneath the boom 109 and onto the up-ender 200. It will be noted that a switch 6LS is provided between assemblies 145, 145' and projects upwardly above the surface of the rollers 151, 151'. Its function will be described subsequently.

As shown particularly in FIGS. 1 and 2, the up-ender assembly 200 is comprised of a pivotally mounted, horizontal roller conveyor frame 201 provided with the usual conveying rollers 203. The frame 201 is pivoted on supports 205 by suitable hinge elements 207 such that it may pivot about a horizontal axis which is transverse to the normal direction of travel of a container as ejected from the forming and sealing assembly 100 as indicated by the arrow in FIG. 1. The entire assembly is caused to swing about this axis by a conventional pneumatically operated piston and cylinder assembly 210 having the cylinder pivotally fixed at 211 to the base frame member 213 and the piston rod 215 connected by a suitable bracket 217 to the frame 201. It will be seen that the entire assembly 200 is thus swingable from its at rest position as shown in FIG. 1 to a discharge position (not shown) and that any container disposed thereon will be up-ended and deposited on the palletizer assembly 300.

Before, however, the filled and sealed containers are transferred to the palletizer, it is necessary that an orientation thereof be effected. To this end it will be seen that there is provided a suitable frame 221 which is positioned beneath the up-ending frame 201. Mounted on frame 221 is a bracket assembly 225 which includes two parallel guide members 227 extending across the entire width of the frame beneath the pivoted frame 201. The guide members 227 guide a plate 229 having upwardly projecting fingers 231 laterally of the frame 201. As will be apparent the fingers 231 project upwardly between certain of the rolls 203 a sufficient distance to be able to engage an object which may be disposed on the rolls 203. It will also be apparent that the plate 229 is movable laterally of the up-ender frame by means of a pneumatic cylinder and piston assembly 230 having one end fixed to the bracket assembly 225 and the other, the rod end, connected to the plate 229. As shown in FIG. 2 the plate 229 and fingers 231 are in an "at rest" position. When actuated however, it will be seen that the plate 229 will be pulled to the opposite side of the frame 201 by the fingers 231 such that any object resting on rollers 203 will be pushed against a suitable stop means 235 and oriented on the rolls 203 prior to the time the frame 201 and associated parts are up-ended. The manner and sequence of operating this device as well as the up-ender will be described hereinafter.

Considering now FIGS. 1*a*, 2*a*, and also FIG. 3, the palletizing structure 300 will be described in detail. Basically this apparatus comprises a second up-ender in

sequence with up-ender **200**, but modified to include a drive means associated with a movable back stop formed of a generally rectangular frame **301** having anti-friction conveyor rolls **303** journaled therein. The frame **301** has fixed thereto at its lowermost ends a pair of ear-like guides **305**. These guides (see FIG. 3) project laterally outwardly from the frame **301** and are slidable in guideways **307** formed of an inverted L-shaped member **309** and a pair of side frame members **311** which serve as the basic frame members supporting driven rolls **313**. These frame members are connected laterally by a pair of cross-members **315** and **316** which along therewith define a generally rectangular frame assembly **320**. The frame assembly **320** is mounted for vertical pivotal movement on a pair of hinge assemblies **330**. Each of the hinges is identical and comprises a support **321** provided with yoke-like trunnions **323**, **323'** which receive the tongue **325** of a further yoke-like hinge element **327** which has its arms welded or otherwise fixed to the frame members **311**. The left side hinge assembly (as viewed in FIG. 2*a*) is simply pin connected by a pin passing through trunnions **323**, **323'** and tongue **325**. The right side connection, however, is effected through a driven shaft **328**. This shaft carries sprockets **329**, **331**. Sprocket **329** is a driven sprocket connected to a reversible electric motor **330** by a chain **331**. Sprocket **331** is a driving sprocket and is connected by a chain **333** to sprocket **337** mounted on the rear of right hand frame member **311**. Since this sprocket moves with frame **311** in a constant arc at a fixed distance from sprocket **331** it is obvious that the sprocket **337** will be driven regardless of what position frame **320** may assume.

The sprocket **337** is connected to and carried by a stub shaft **339** having thereon sprocket **341** which is connected to and drives a chain **343**. Chain **343** extends the length of the frame **320** and passes around a reversing sprocket **345** disposed at the opposite end of frame member **311** and thence beneath this frame member back to the sprocket **341**. The ends of the chain **343** are connected to the frame **301** at **347**, shown in FIG. 2*a*. Thus the back stop **300** may be moved longitudinally along the frame **320**.

For reasons that will be apparent subsequently, the rolls **313** must be driven. To this end a plurality of wide belts **351** are trained over rollers **313** and the ends of the belts are connected to the bottom of the movable backstop **301**. Thus as the backstop moves on the base frame **320** the belts **351** and rollers **313** are moved accordingly.

The frame **320** is as has been described, pivotally mounted on the hinge assemblies **330**. Thus the entire frame may swing from its at rest position, as shown in FIGS. 2 and 2*a* to an unload position. As is apparent in the "at rest" position the frame **320** is disposed in a generally horizontal position, though preferably at a slight angle thereto while the backstop frame **301** is disposed generally vertically. If the frame **320** is tilted to an unload position it will be seen that it will assume a generally vertical position while backstop **301** becomes a generally horizontal conveyor. Thus an article or articles resting against the backstop will be down-ended and discharged from the palletizer in this position. To effect this unloading operation the frame **320** is connected to a double acting pneumatic piston and cylinder assembly **350** pivotally connected to frame **213** at **351**. Extension of this assembly tilts the palletizer to an unload position, retraction of the assembly **350** returns the palletizer to its "at rest" position.

Before considering the operation of the apparatus and the further illustrations of FIGS. 9 and 10, a brief reference back to FIG. 2 will indicate that the platen **2** is provided with a plurality of magnetic plate members **34**. These are four in number and are in diametrically opposed relation at the corners of the platen. Each of these plates is preferably flat and the source of the lines of force developed therein may be a coil disposed below their surface such that they are contiguous with the planar surface of the platen **2** and ejector **20**. Disposed on each of plates **34** are one each of a group of corner stops **36**. These stops are simply blocks of paramagnetic material such that when placed in the magnetic field they remain anchored to the plates **34**. Their use is that of orientation stops as will be apparent and to this end they are provided with sloping V-shaped faces **38** adapted to engage and guide the lower corners of a container blank into proper oriented position on platen **2**, i.e., centered thereon.

Having thus far disclosed the structural components which form the apparatus defining the container forming, sealing and palletizing system, consideration will now be given to the manner in which the entire system operates and the control system, both electric and pneumatic, wherein the proper sequence of phases in an operating cycle may be accomplished. To this end FIGS. 9 and 10 respectively are schematic diagrams of the pneumatic and electrical circuits which control the operation of the apparatus.

Considering initially the driving instrumentalities for the various operating components it will be seen in FIG. 9 that all elements except the palletizer backstop and the platen raising and lowering are pneumatically operated. Thus there are eight air cylinders used in the apparatus. Each of these cylinders **22**, **50**, **50'**, **105**, **141**, **210**, **230** and **35** is a double acting cylinder, i.e., delivers power from either rod or head end. To control these cylinders there are provided a series of solenoid operated two-way valves, **3SV**, **4SV**, **5SV**, **6SV**, **7SV** and **8SV**, of the spring biased, solenoid energized type which are biased to a given condition when at rest; others, **1SV**, **2SV**, are of the solenoid operated type wherein energization of one of two solenoids is required to change the valve to either of two different positions. All of these valves are operated by the electrical system as shown in FIG. 10.

Initially, on "start up" the master switch is closed, closing contacts **10L** and **20L** which sets the brake on the palletizer drive motor and starts air compressor motor to build up pressure in the pneumatic system. The control system however is inoperative until pressure switch **1PS** (FIG. 10) closes as sufficient air pressure builds up in the system. The operator will then set the selector switch to "set up" position. The sealer bars **23**, **23'**, **24** and **24'** move to their innermost positions and are adjusted for the proper dimensioned container by disengaging the clutches in the drive train through hand levers **75** and rotating shafts **49** with cranks **65**. Also the platen **2** is adjusted by depressing the Up or Down button to energize relays **1MF** or **1MR** in turn closing the contacts **1MF** or **1MR** to move the platen in the desired direction. Preferably the platen **2** is adjusted such that the sealer bars **23**, **23'** and **24**, **24'** will engage the sides of the container about their vertical midpoints. The next step in "setting up" is to position the corner guides **36** on the surfaces **34** carried by the platen **2**. The apparatus is then ready to begin operation.

The operator will then change the selector switch to the "Run" position. This energizes relay **2CR**, closing the normally open contacts **2CR** (FIG. 10) which energizes solenoids **1ASV** and **2ASV** to move the valves **1SV** and **2SV** to the opposite position from that in which they are shown in FIG. 9. Thus pressure will pass from the pump through conduit **401** to valve **1AS** through the valve to conduit **405**, to the rod end of cylinder **50**, and through valve **2BS** to conduit **405'** to the rod end of cylinder **50'** to retract the sealing bars **23**, **23'** and **24**, **24'**. The conduits **403**, **403'** and, of course, connected simultaneously by valves **1SV** and **2SV** through conduits **403**, **403'** to exhaust.

The apparatus is then at rest and the operator will place a container top of the type described in the aforesaid copending application of Thomas L. Ziliox, in in-

verted position on the platen 2. This container top is provided with side flaps which form, along with similar flaps provided on the container bottom, the vertical walls of the completed container. The top panel will rest on the platen 2 while the side walls will be at an angle to the vertical and rest against the sealing bars 23, 23' and 24, 24' which are in retracted position. Meanwhile the lower corners of the inverted top will engage the sloping surfaces 38 of the corner blocks 36 and will be aligned equidistantly from the center of the platen 2. Then the contents appropriate for the particular container will be placed in the inverted top, after which the operator then pushes a button marked "Square." Solenoids 1BSV and 1ASV of valves 1BV and 2SV are energized and the valves are moved to the position shown in FIG. 10 placing conduits 403, 403' in communication with pressure conduit 401 and conduits 405, 405' in communication with the exhaust line E. The head ends of cylinders 50, 50' are thus pressurized and sealer bars 23, 23', 24, 24' move inwardly, pressing the wall flaps of the container body inwardly toward one another. This inward motion continues until limit switch 1LS for the front and rear sealers (shown in FIG. 1) is tripped by rotation of the crank assembly 60, and limit switch LS2 (not shown) is tripped by the drive for the left and right sealing bar drive. When these switches trip the circuit to solenoids 1BSV and 2BSV are broken and since the relay 2CR is energized and all of its contacts 2CR shown in FIG. 10 are either opened or closed as the case may be, the opposite solenoids of valves 1SV and 2SV, i.e., 1ASV and 2BSV are energized to return the sealing bars to retracted position.

It will be noted that these sealing bars can be caused to "jog," i.e., advance and retract rapidly through a very short distance of travel, as long as the operator holds the "Square" button. This is caused by the fact that as the limit switches 1LS and 2LS break their respective circuits the sealer bars begin to return to a retracted position until these switches are cleared. Since the circuit to the solenoids 2BSV and 2ASV are again completed as soon as the switches 1LS and 2LS are cleared the bars again close and this rapid return will be repeated each time the contacts made by switches 1LS and 2LS are broken and closed by movement of the crank assemblies 60.

When the bars 23, 23' and 24, 24' are finally allowed to retract to their rest position the inverted carton top has been partially prefolded and is "square" on the platen 2. In addition the contents are also properly squared up in the container top. The container bottom is then superposed thereover, in inverted position. This container bottom also is provided with side flaps and they also are provided with an adhesive band, but on their outside surfaces. Since the flaps of the inverted carton top are disposed at an angle, i.e. they flare outwardly, resting against the retracted sealing bars 23, 23', it will be apparent that the flaps of the inverted bottom may be placed between the outwardly flared top flaps and the container contents without difficulty. The closing and sealing operation may begin.

To this end the operator presses a "Seal" button, FIG. 10, and the sealing phase begins. The relay 2CR is again closed. Since the operation of the sealing bars has been described it need not be repeated except as it may vary slightly during the "Sealing" phase. Depression of the "Seal" button first energizes solenoid 4SV. This solenoid actuates valve 4SV to the left from the position shown in FIG. 10 and places conduit 401 in communication with conduit 407 and the head end of the cylinder 105 and conduit 407 in communication with exhaust line E. Thus the compression plate 101 moves downward to contact the bottom of the inverted container forcing the bottom into the inverted top resting on the platen 2. Meanwhile timer switch 3TR is tripped as the package is engaged and closes energizing the relay 2CR. Again solenoids 1ASV and 2ASV are energized while the two contacts CR in the circuits to solenoids 1BSV and 2BSV are opened and the valves 1SV and 2SV shift to admit pressure to the head ends of cylinders 50, 50' and the sealing bars 23, 23' and 24, 24' move toward the package. As they approach the package, the limit switches 1LS and 2LS are tripped and bringing into the circuit timer switches 1TR and 2TR which hold the existing conditions in the system as the sealing bars stall against the top and side flaps and the pressure in the cylinders 50, 50' builds up to that defined by regulator valves V—PR in conduits 403, 403'. Thus the top and bottom flaps of the container are folded inwardly against the contents within the inverted container and the pressure sensitive adhesive strips are brought into contact and bonded to one another.

Before continuing, a word about the compressing plate assembly 101 is in order. It will be remembered that the plate is provided with adhesive pumps 130 and air valves 127. Both the air valves 127 and pumps 130 are actuated by contact of the compressing plate 101 with the container bottom. The air valves 127 open to emit air under pressure to form a thin layer between the bottom of the plate and the container bottom. The air layer acts as a friction free surface to allow the container bottom to shift laterally in all directions to orient and seal itself properly with respect to the contents and its inverted top resting on the platen 2, while the adhesive pumps 130 deposit four spots of adhesive on the container bottom.

Returning now to the sealing bar, etc., operation, it will be seen that after the given lapse of time the timer switches 1TR and 2TR open dropping out contact 2CR in their respective circuits and closing contacts 2CR in the circuits of solenoid 1ASV, 2ASV, solenoid 4SV and relay 3CR which closes contacts 3CR energizing solenoid 3SV. All of the valves 1SV, 2SV, 3SV and 4SV are thus energized. Valves 1SV, 2SV and 4SV return to the positions shown in FIG. 9, while valve 3SV is moved to the left from the position shown. The rod ends of cylinders 50, 50' and 105 are thus pressurized through conduits 401, 405, 405' and 407 while the head end of the ejector cylinder 22 is pressurized through conduit 401, valve 3SV and conduit 411, its rod end exhausting through conduit 411' to exhaust conduit E.

Simultaneously the sealing bars 23, 23' and 24, 24' begin to retract, the compressing plate 101 moves upwardly and the ejector 20 which is provided in platen 2 raises following the plate 101 to lift the sealed and filled container from the platen 2.

The sealer bars meanwhile have retracted to trip limit switches 3 and 4SL and are at rest, the compression plate 101 is held in its raised position by the pressure on the rod end of the cylinder 105 and the container rests on the ejector 20 which is held in the raised position.

As the ram 105 and thus plate 101 is raised it trips limit switch LS-14. This energizes relay 4CR (FIG. 10) which in turn closes contacts 4CR in the circuit to solenoid valve SV (FIG. 9). This valve moves to the left from the position shown in FIG. 9 and thus the head end of the push-off cylinder 141 is pressurized via conduit 415 while its rod end is at exhaust through the conduit 415'. The push-off plate 140 engages the container and pushes it from ejector 20 over the bars 143 attached to the sealing bar 23' and onto the conveyor rolls 151. Due to the slight inclination of the surface defined by the rollers 151 the container will move by gravity toward up-ender 200. As it does so it trips 6LS, which opens the circuit to both solenoids 3SV and 7SV causing the valves to return to the position shown in FIG. 9 and obviously reversing the pressure flow to cylinders 141 and 22 whereby the ejector 20 drops back into contact with stops 19 on platen 2 and the push-off plate 139 is retracted back to its initial position. The sealing phase of the operating cycle is now complete.

It will be apparent that the completed package may

move down the conveyor somewhat off center, and since it is to be palletized it is essential that it and its succeeding packages be aligned before they are up-ended. To this end the up-ender **200** is provided with three limit switches 7LS, 8LS and 13LS. These switches are arranged at the center, the end and the side of up-ender **200** such that a package must contact each one simultaneously before the up-ender will operate. If the packages are large only one package will trip all three. If small, two or more packages may have to be placed on the up-ending apparatus before it will be actuated. The position of the switches **6**, **7** and 13LS are shown in FIG. 2.

Returning to the diagrammatic showings of FIGS. 9 and 10 it will be seen that as switches 7LS and 8LS are tripped it will energize solenoid 5SV, this solenoid actuates valve 5SV (FIG. 9) placing pressure conduit **401** in communication with the conduit **417** leading to the rod end of the cylinder **230**. Conduit **417'** is placed in communication with exhaust line E. The fingered plate **229** will then move transversely of the up-ender, the fingers **231** acting to engage the container and pull it against stop **235** where it will engage the 13LS. As switch 13LS is tripped solenoid 5SV is de-energized while at the same time relay 4CR is energized. This closes contacts 4CR energizing solenoid 6SV causing valve 6SV to move to the left, placing conduit **401** in communication with conduit **421** and conduit **421'** in communication with exhaust line E wherein the head end of cylinder **210** is energized and the up-ender **200** pivots about its hinge points to discharge the filled, sealed and oriented container on the palletizing station **300**. It suffices to say presently that as the container is placed on the palletizer **300** the contact with the switches **7** and 8LS is broken, the valve 6SV is de-energized, returns to the position shown in FIG. 9 and thus since the connections to cylinder **210** are reversed the up-ender **200** returns to its "at rest" position as shown in FIGS. 1 and 2.

As has been indicated, the palletizer **300** is provided with a movable back stop driven by a suitable motor indicated in FIG. 10 as the Palletizer Drive. This motor is reversible and moves the back stop **301** in either direction along the palletizer frame **311**. The operation of this motor is determined by either of two controls, push buttons 2MR and 2MF or limit switches 10LS and 11LS. Switch 10LS is closed by contact to move the back stop away from the up-ending apparatus **200** while switch 11LS is tripped when the carriage reaches the end of its travel along the frame. It opens relay 5CR and its associated contacts while energizing solenoid valve 7SV to cause valve 7SV to move to the left from the position shown in FIG. 9 and thus cylinder **350** is pressurized at its head end through conduit **423** and exhausts from its rod end through conduit **423'**. The palletizer **300** thus up-ends to discharge any containers onto the floor over the backstop.

In the ordinary operations the backstop **301** is run up toward the up-ender **200** until switch 10LS is tripped. It will move back the necessary amount to clear this switch and remain in this position until switch 10LS is again tripped. This occurs when a container from up-ender **200** is deposited on the palletizer. It causes switch to be tripped and the container and backstop move away from limit switch 10LS until the container carried by belts **351** moves enough to clear the switch. Remembering that the container bottoms have been provided with glue spots and that they are in oriented alignment, it will be seen that the containers will be stacked neatly on the palletizer in a generally horizontal column which when the palletizer is up-ended will place the containers in vertically stacked relation. Ordinarily a conventional skid is placed against the backstop rolls **303** such that the containers are aligned on the skid which along with the containers is up-ended, with the result that the containers are ready for shipping.

The two control buttons MF and MR are to take care of any contingencies which might require adjustment of the backstop **301** along frame **311**. Thus it will be apparent that the control system provides for substantially any contingency which may be encountered during the palletizing operation.

In the foregoing description of the operation of the apparatus, and in particular with reference to FIG. 10, only the essentials of the control system have been described in order to adequately disclose the sequence of operations of the apparatus. The system may include other features such as safety interlocks and the like which are not necessarily essential to the operation of the apparatus, though important as safety factors and the like, and which therefore are not considered part of the present invention, and are not described in detail.

It will be apparent to those skilled in the art that the invention comprises the unique container-forming and palletizing system and embodies equipment for use in such a system which is capable of accomplishing the objects set forth herein above. It will be also obvious that various changes and modifications may occur to those skilled in the art, all of which fall within the scope of the inventive concept, which is limited only to the extent as defined in the following claims, wherein

What is claimed is:

1. A container forming, closing and palletizing system comprising a sealing station, said sealing station including means for forming and sealing a container about the contents thereof while in an inverted position, a conveying and positioning means for conveying a filled, sealed container from said sealing station while in inverted position, means associated with said sealing station and said conveying and positioning means for transferring the container from said sealing station onto said conveying and positioning means, said last mentioned means including means for orienting the container in predetermined manner and means for bodily moving the container from its inverted position to an upended position, a palletizing station positioned at the terminal end of said conveying and positioning means, said means for bodily moving the container acting to stack a plurality of containers received from said moving means one upon the other on a pallet and thereafter ejecting the palletized and stacked containers from the system.

2. A container forming, closing and palletizing system as defined in claim 1 including a common control means for operating said closing and sealing means, said ejector means, said orienting and upending means and said palletizing means sequentially.

3. A container forming, closing and palletizing system as defined in claim 1 wherein said forming and closing station includes a table-like frame, a vertically adjustable platen disposed beneath the top of said frame, a plurality of press bars disposed above said frame and carried thereby, said press bars being arranged in two opposing pairs, each pair being movable toward and away from one another to compress the sidewalls of a container disposed on said platen into sealed interengagement; drive means for said bars and compressing means disposed above said platen and movable vertically to engage the top of a container immediately prior to engagement of said sealer bars with the sides thereof.

4. A container forming, closing and palletizing system as defined in claim 3 wherein said drive means for each of said bars comprises a reciprocating power source, a shaft, a crank assembly on said shaft assembly and connected to said power source; said crank assembly including clutch means acting between said shaft and said assembly to release said shaft from said power source, chain means driven by said shaft, said last mentioned means being connected to said sealer bars such that rotation of said shaft moves said pair of sealer bars an equal distance toward and away from each other.

5. A container forming, closing and palletizing system as defined in claim 1 wherein said conveying means com-

prises a pivoted frame swingable about a horizontal axis, rollers carried by said frame in spaced, coplanar relation, a fixed frame disposed beneath said swingable frame and means on said fixed frame projecting between and above selected rolls on said swingable frame for directing containers resting on said rolls against one side of said swingable frame.

6. A container forming, closing and palletizing system as defined in claim 1 wherein said palletizing station includes a support, a vertically swingable frame mounted on said support, a movable surface carried by said frame, a backstop assembly mounted on said frame and movable in conjunction with said surface, drive means for said backstop and said surface, said backstop assembly comprising a further frame disposed generally perpendicular to said swingable frame and guided thereby so as to traverse the movable surface from end to end in the direction of movement of a container carried by said surface and roller means defining a conveyor surface mounted on said further frame.

7. A sealing apparatus for closing and sealing a container around the contents to be enclosed therein comprising an open topped, table-like frame, a platen disposed beneath the frame and adjustable vertically toward and away from a horizontal plane passing through the frame adjacent the top thereof, a compressing means mounted above said platen and movable vertically toward and away from said plane, press means disposed in said plane and movable toward and away from the center of the frame and drive means for said press means; said compressing means comprising a flat plate and a hood associated therewith to define a plenum chamber, a source of pneumatic pressure in communication with said chamber, valve means in said plate, said valve means being opened by contact of said plate with a container to exhaust a pneumatic flow between the plate and the container.

8. A sealing apparatus for closing and sealing a container around the contents to be enclosed therein comprising an open topped, table-like frame, a platen disposed beneath the frame and adjustable toward and away from a horizontal plane disposed adjacent the top of said frame, a compressing means mounted above said platen and movable vertically toward and away from said plane, press means disposed in said plane and movable toward and away from the center of said frame between said platen and said compressing means; said press means comprising opposed pairs of bar members movable horizontally toward and away from one another toward a common center, each bar member being comprised of a plurality of plates fixed together in vertically spaced, superposed relation, the plates defining one pair of opposed bars being interleaved between the plates defining the other pair of opposed bars, a common drive means for moving each pair of bars toward and away from each other in simultaneous and equal increments of movement and the plurality of pairs simultaneously toward and away from said common center.

9. A container palletizing apparatus comprising a support structure, a normally horizontal frame pivotally mounted on said support structure and swingable in a vertical arc to a generally vertical position, a prime mover for swinging said frame from one position to the other, a driven conveying surface carried by said frame, a guide means carried by said frame, a further vertical frame mounted in said guide means for traversing movement across said frame, drive means for actuating said driven conveying surface and for simultaneously moving said further frame across said first mentioned frame, control means for actuating said last mentioned drive means in response to an article deposited on said normally horizontal frame, further control means for actuating said prime mover to swing said swingable frame from its normally horizontal position to a vertical position when said further frame has traversed at least a part of said conveying surface, said further frame defining a conveying surface, when said first mentioned frame is swung to a vertical position.

10. A sealing apparatus as defined in claim 8 wherein said drive means including clutch means permitting simultaneous movement of each pair of said bar members independently of each other and independently of said common drive means.

11. A container palletizing apparatus as defined in claim 9 wherein a plurality of rollers are carried by said further frame, said rollers defining a further conveying surface.

12. A palletizing apparatus as defined in claim 9, including further a conveying means for receiving articles in one position disposed adjacent to said palletizing means and delivering said articles in a second position to said movable conveying surface.

13. A palletizing apparatus as defined in claim 12 wherein said conveying means comprises a support, a generally horizontal frame pivotally mounted on said support for swinging movable about a horizontal axis toward said movable conveying surface and means for moving said frame from a generally horizontal to a generally vertical position.

14. A palletizing apparatus as defined in claim 13 wherein said pivotally mounted frame is provided with a series of space rollers to define a conveying surface.

References Cited in the file of this patent

UNITED STATES PATENTS

1,293,182	Parker	Feb. 4, 1919
1,535,784	Koerner	Apr. 28, 1925
2,394,219	Vachon	Feb. 5, 1946
2,508,698	Von Beren	May 23, 1950
2,605,598	MacKenzie	Aug. 5, 1952
2,608,811	Stern	Sept. 2, 1952
2,650,459	McGinley	Sept. 1, 1953
2,656,659	Buechek	Oct. 27, 1953
2,671,998	Demler	Mar. 16, 1954
2,737,002	Demler	Mar. 6, 1956
2,833,099	Rejsa	May 6, 1958
2,941,339	Salwasser	June 21, 1960
2,947,125	Wilson et al.	Aug. 2, 1960

FOREIGN PATENTS

279,170	Great Britain	Oct. 24, 1927