

[54] APPARATUS FOR FILLING AND SEALING
CARTONS FOR HOLDING LIQUIDS

[75] Inventor: Charles Wright Jones, Los Angeles,
Calif.

[73] Assignee: Xepex Industries, Inc., Beverly Hills,
Calif.

[22] Filed: Apr. 29, 1971

[21] Appl. No.: 138,623

[52] U.S. Cl. 53/282, 53/297, 53/329

[51] Int. Cl. B65b 3/06

[58] Field of Search..... 53/282, 296, 297,
53/281, 298, 283, 186, 55, 266, 376, 377,
382, 383, 137, 313, 329, 388, 373, 36, 37,
41, 375; 141/44, 45, 237, 284; 93/53 R, 53 LF

[56] References Cited
UNITED STATES PATENTS

283,313	8/1883	Wiltse	141/237 X
731,526	6/1903	Troupe	141/284 X
1,416,345	5/1922	Gosselin.....	53/382 X
2,284,660	6/1942	Hothersall et al.	53/382
2,291,280	7/1942	Joplin	53/137
2,673,020	3/1954	Almgren et al.	53/382
2,727,648	12/1955	Grevich	53/137 X
2,852,900	9/1958	Egleston et al.	53/382
2,860,467	11/1958	Clemens et al.	53/381 R X
3,054,239	9/1962	Boyer et al.	53/266
3,254,469	6/1966	Dilot	53/266 X
3,328,937	7/1967	Newman et al.	53/282
3,448,560	6/1969	Shuttleworth.....	53/382
3,466,843	9/1969	Mumper	53/137
3,530,027	9/1970	Nuckols, Jr.	53/137 X
3,553,930	1/1971	Anderson et al.	53/373 X

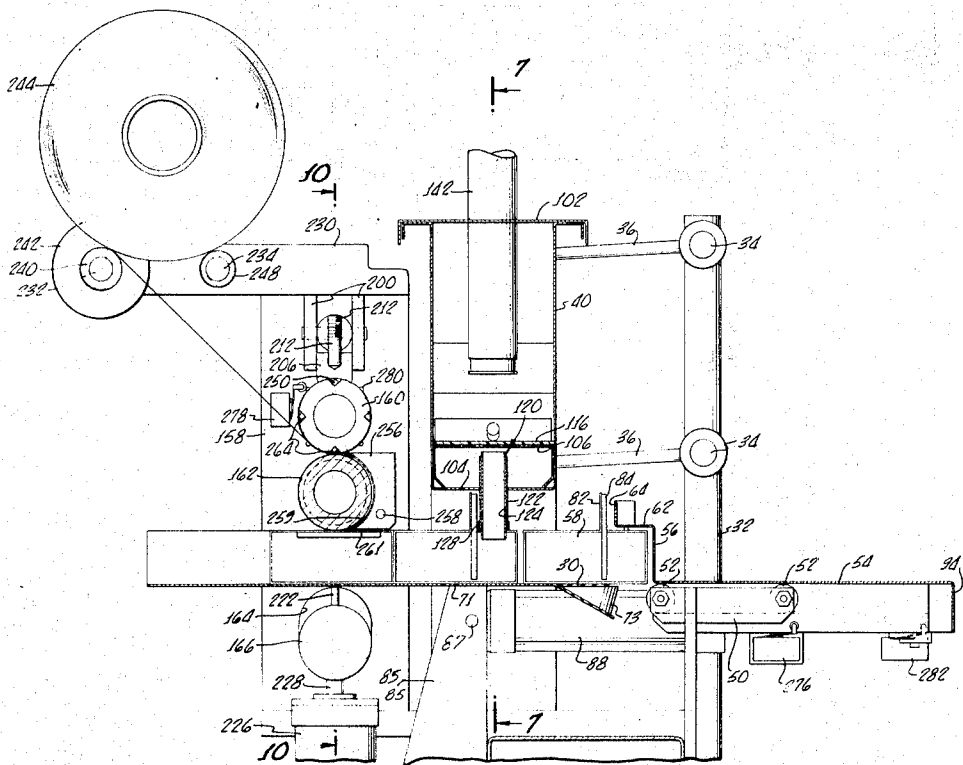
3,589,410	6/1971	Manas.....	141/45
3,204,752	9/1965	Conner	53/55 X

Primary Examiner—Travis S. McGehee
Assistant Examiner—Horace M. Culver
Attorney—Fowler, Knobbe & Martens

[57] ABSTRACT

The apparatus disclosed herein is arranged to fill with liquid and seal a carton which has as its single means of access an orifice closable by a simple, flat flap punched from one side of the carton but remaining integral with that side. The cartons are delivered one by one and accumulated on a platform of the carton filling and sealing apparatus. After a predetermined number of cartons have been accumulated, they are moved into position beneath a storage tank for the liquid with which they are to be filled. The tank is lowered to bring spout-like appendages on the tank into penetrative relation to the orifices of the cartons. After the cartons have been so positioned, valve mechanism associated with the tank meters a quantity of liquid into the cartons. Each of the spout-like members has associated with it a suction tube for drawing off and returning to the liquid storage tank any froth that may develop during the pouring of the liquid into the cartons. After the cartons have been filled, the storage tank is raised, and the next group of cartons is moved into position to be filled, the cartons which have been filled being moved out of position by the newly presented cartons. As the filled cartons are moved out of position, the closure flap is deflected back generally into carton closing position and a sealing tape is applied over the flap.

6 Claims, 16 Drawing Figures



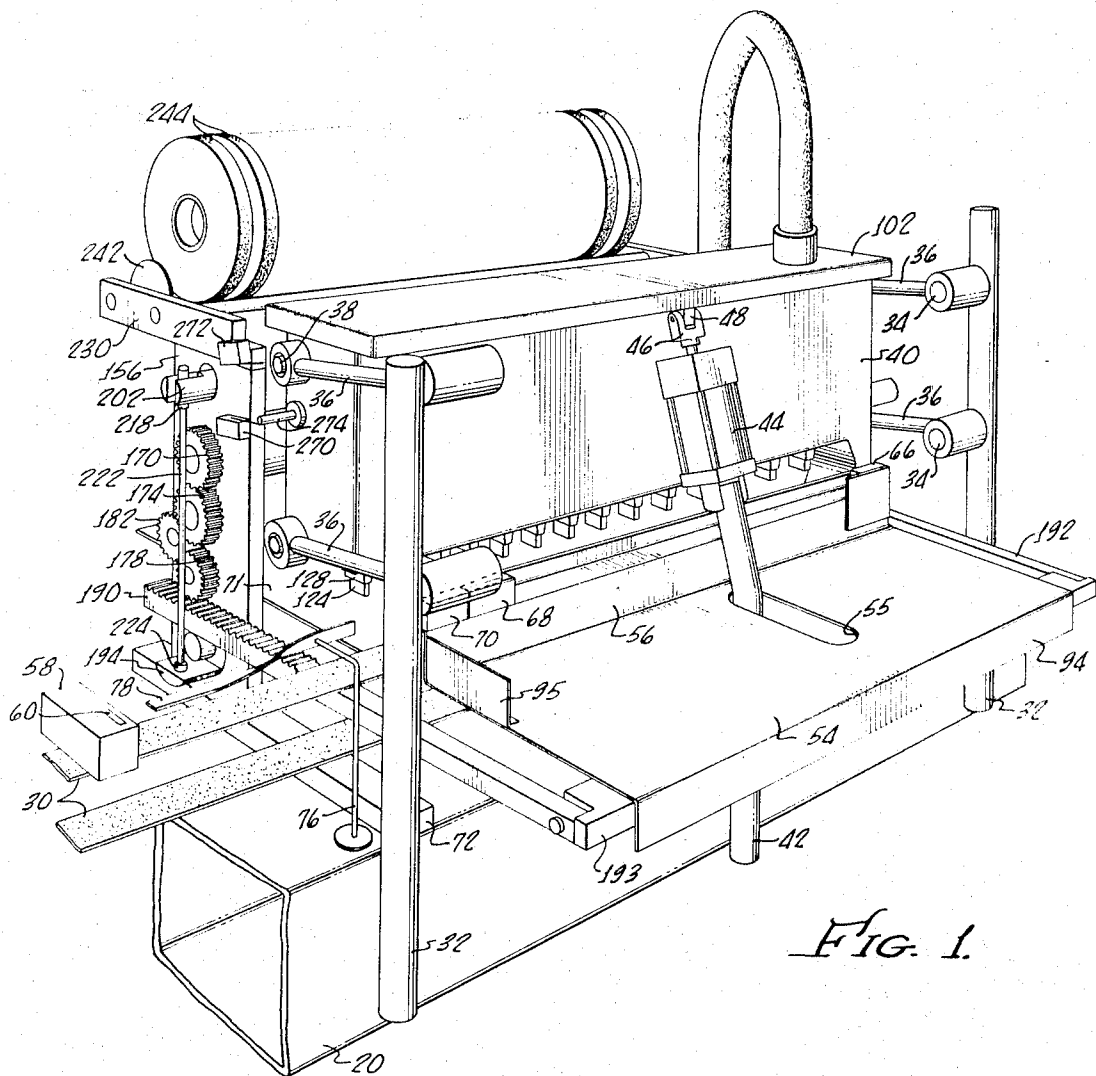


FIG. 1.

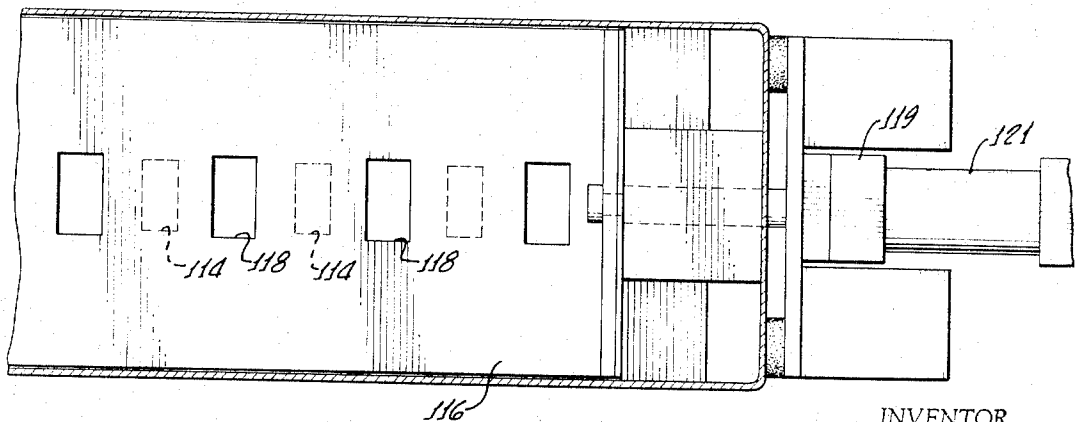


FIG. 9.

INVENTOR.
CHARLES WRIGHT JONES

BY
FOWLER, KNOBBE
& MARTENS

ATTORNEYS.

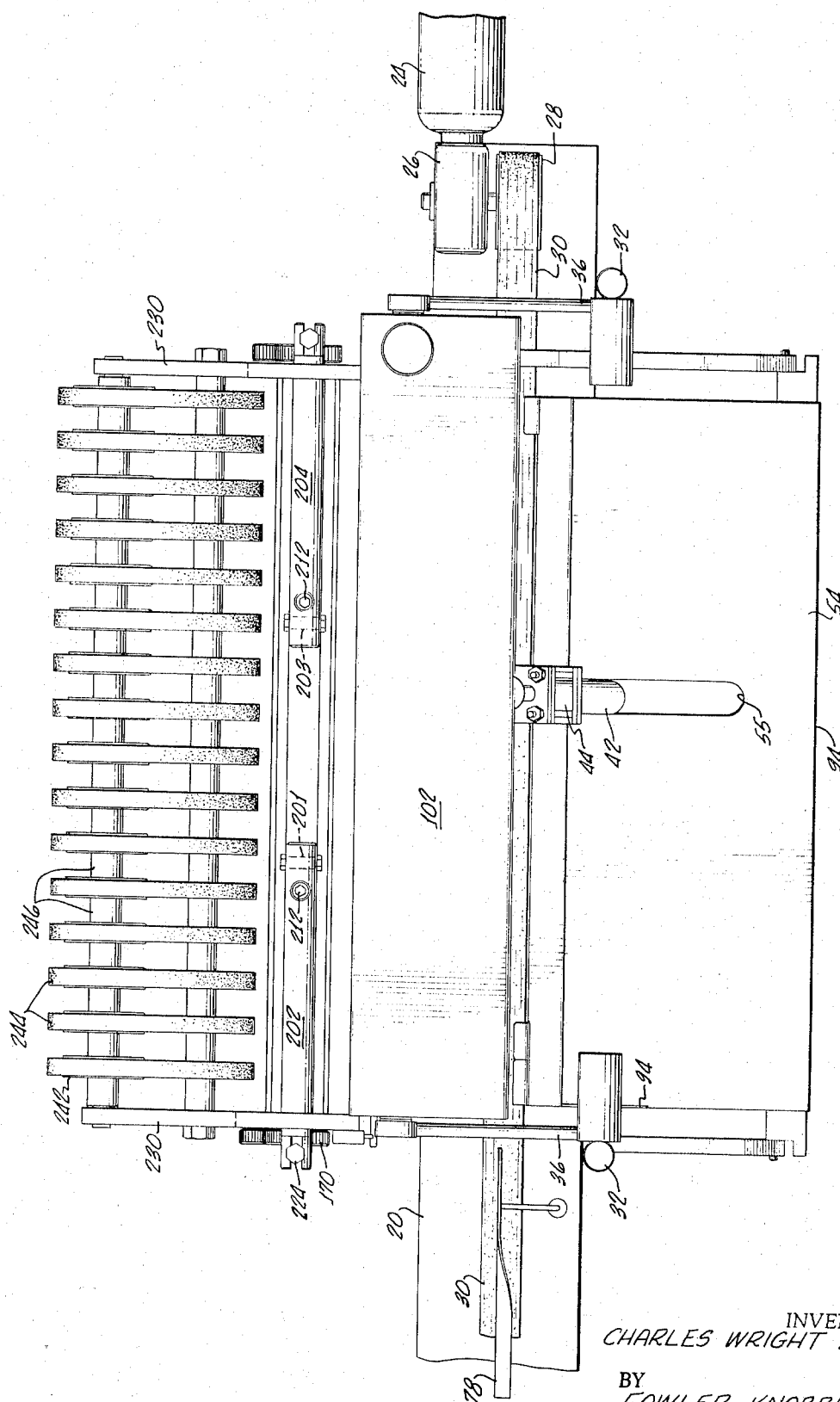


FIG. 2.

INVENTOR.
CHARLES WRIGHT JONES

BY
FOWLER, KNOBBE
& MARTENS

ATTORNEYS.

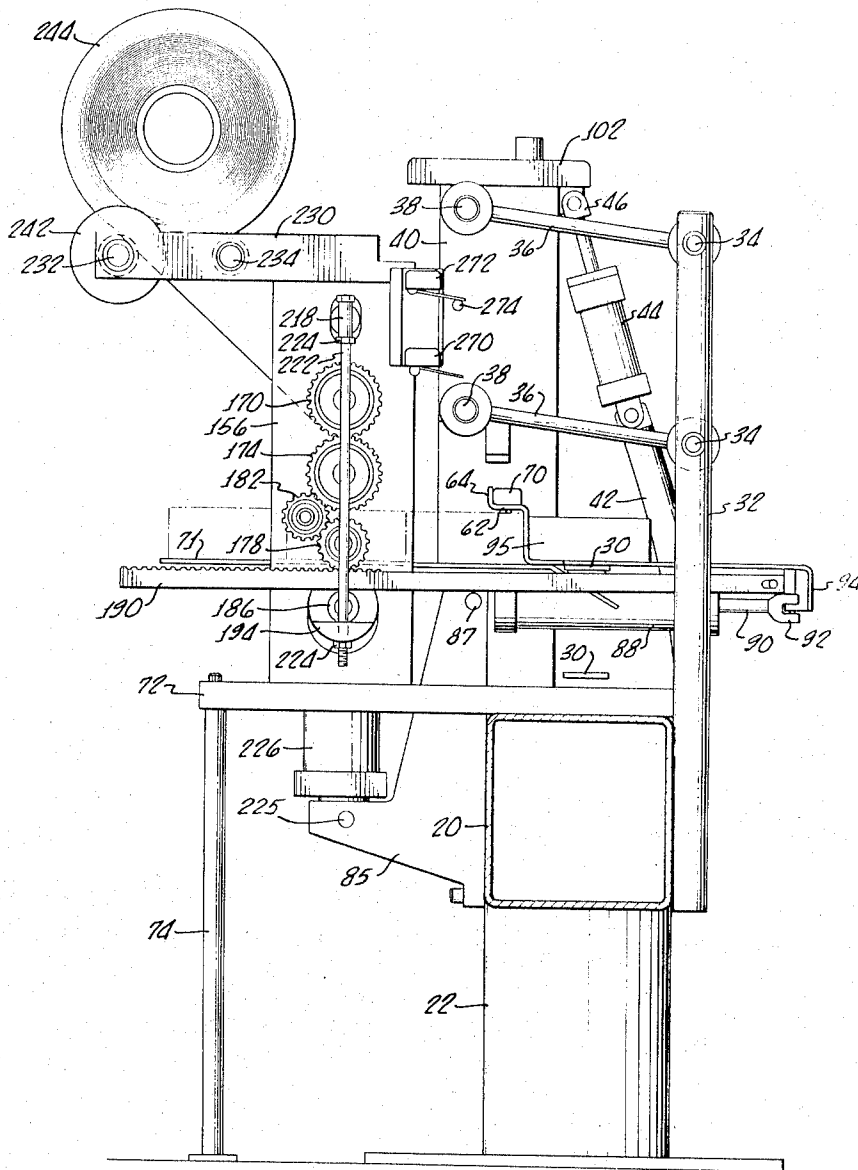


FIG. 3.

INVENTOR.
CHARLES WRIGHT JONES

BY
FOWLER, KNOBBE
& MARTENS

ATTORNEYS.

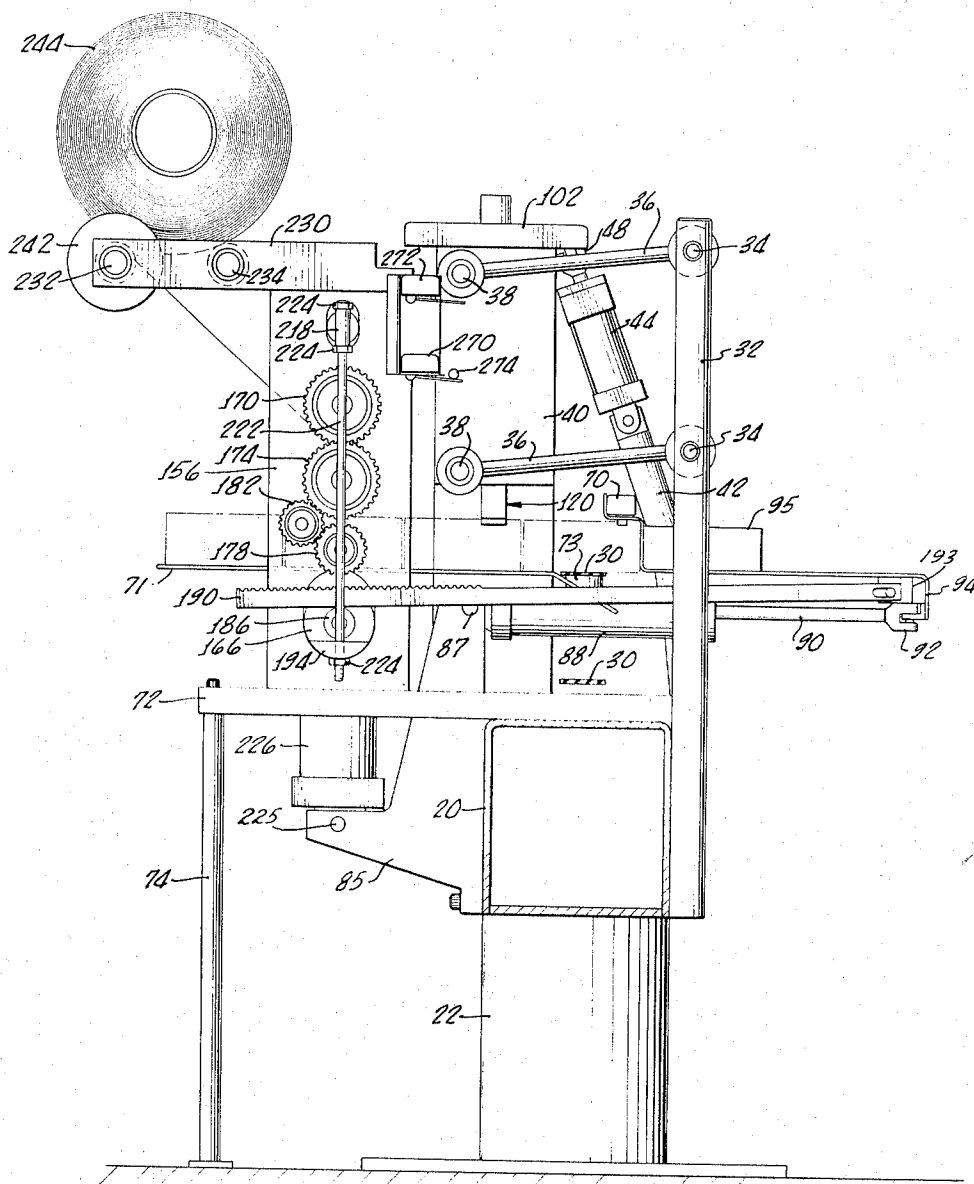


FIG. 4.

INVENTOR
CHARLES WRIGHT JONES

BY
FOWLER, KNOBBE
& MARTENS

ATTORNEYS.

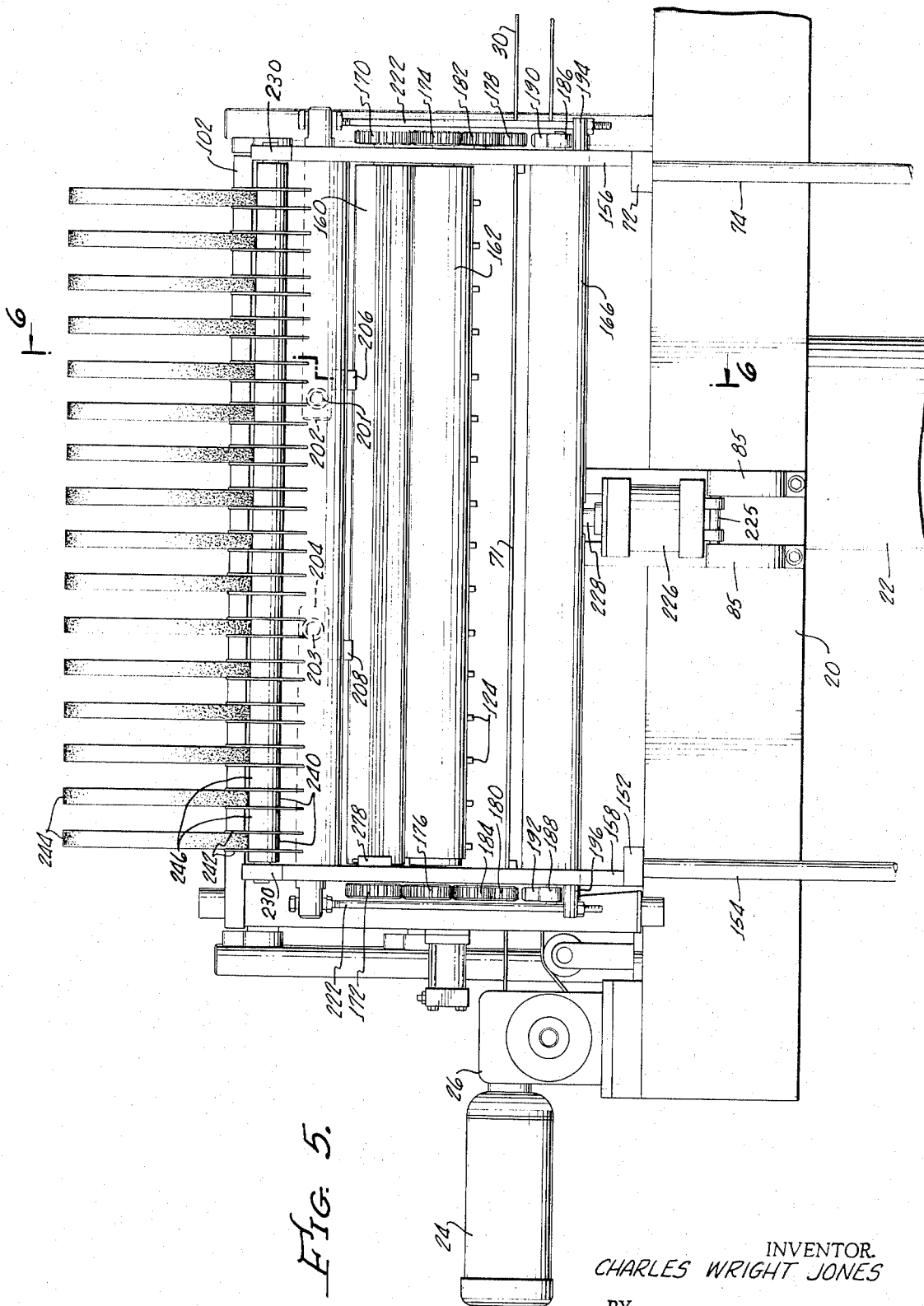
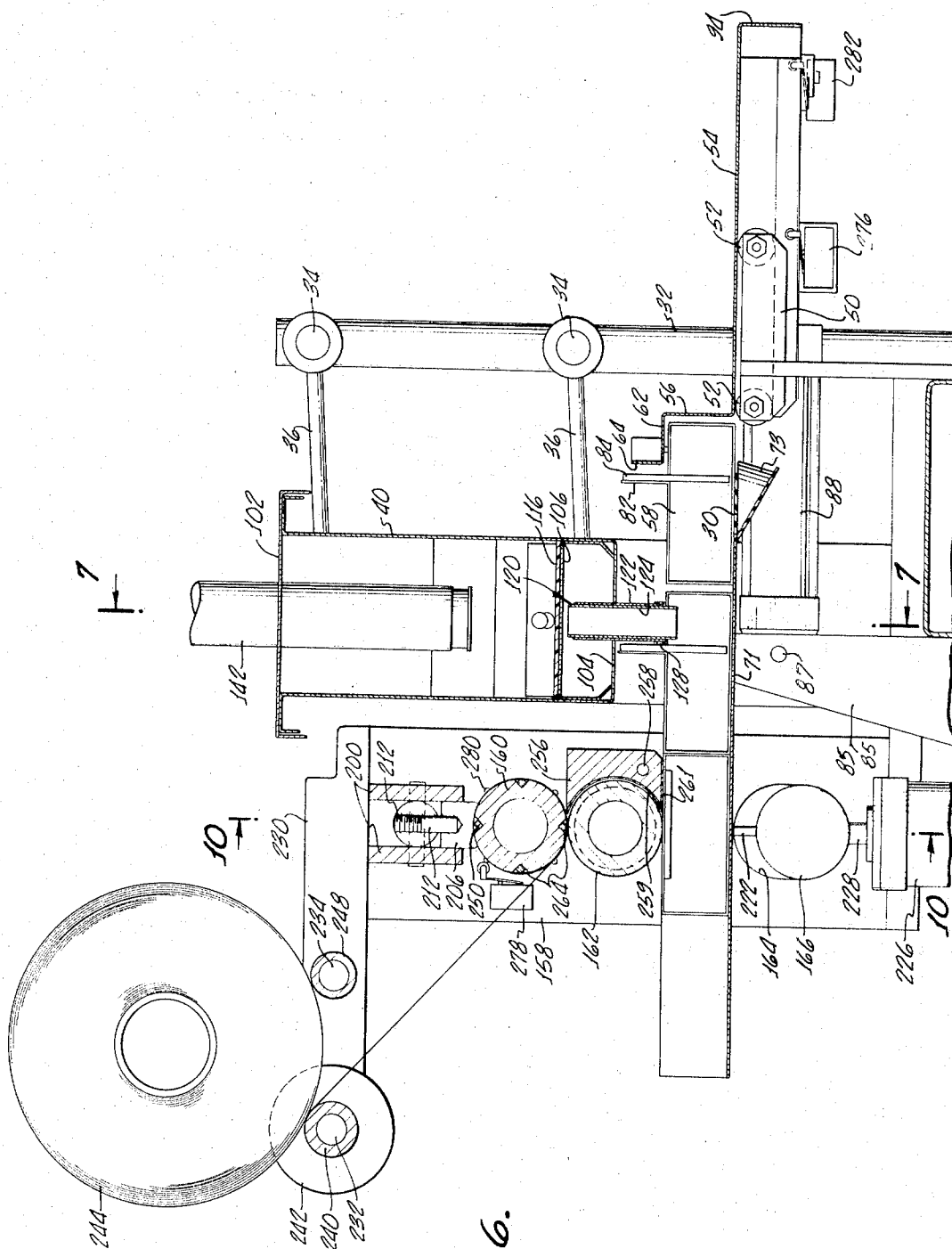


FIG. 5.

INVENTOR.
CHARLES WRIGHT JONES
BY
FOWLER, KNOBBE
& MARTENS
ATTORNEYS.



INVENTOR.
CHARLES WRIGHT JONES

BY
FOWLER, KNOBBE
& MARTENS

ATTORNEYS.

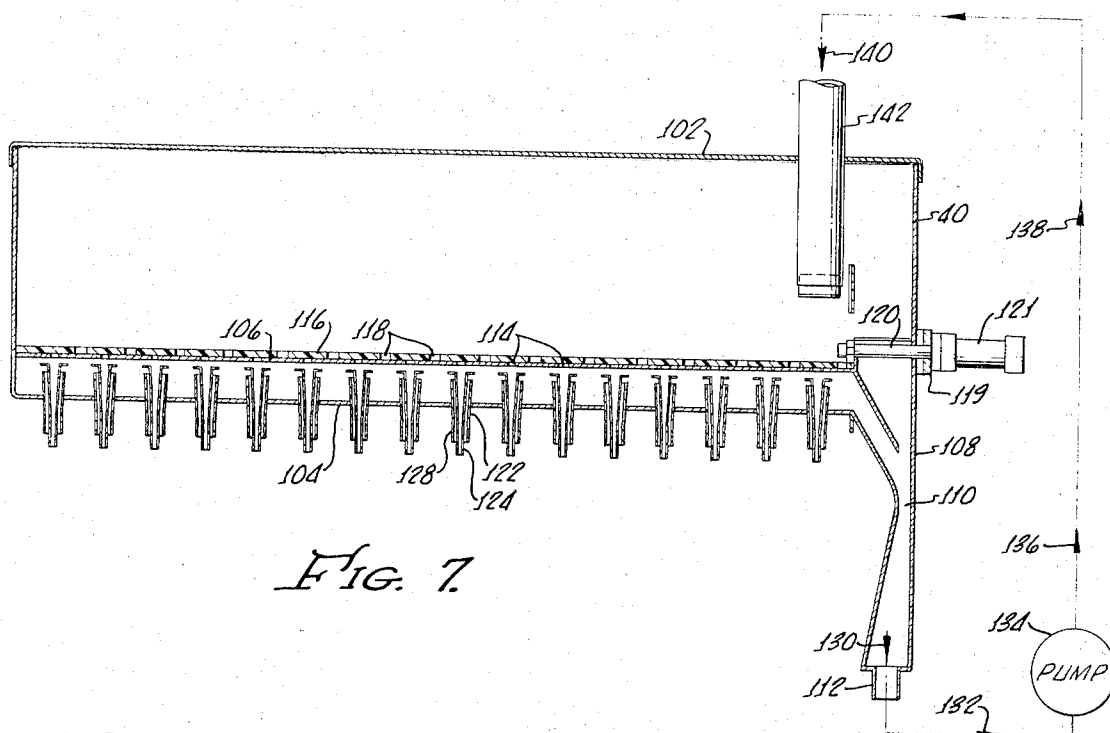


FIG. 7

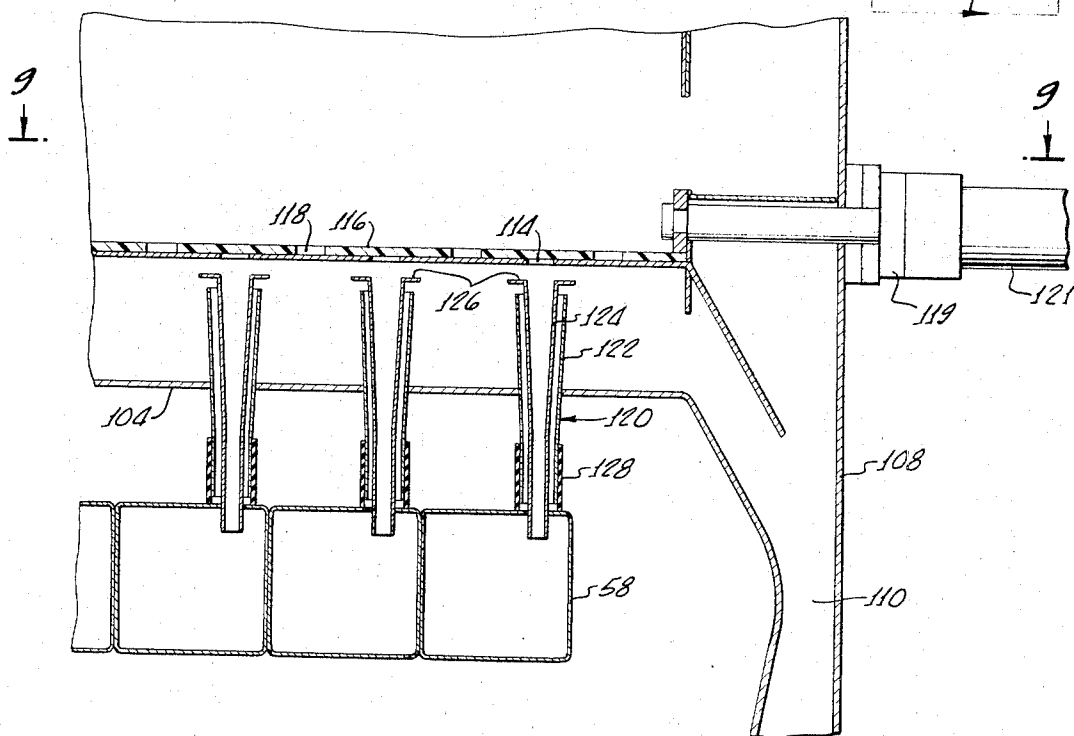


FIG. 8.

INVENTOR
CHARLES WRIGHT JONES
BY
FOWLER, KNOBBE
& MARTENS
ATTORNEYS.

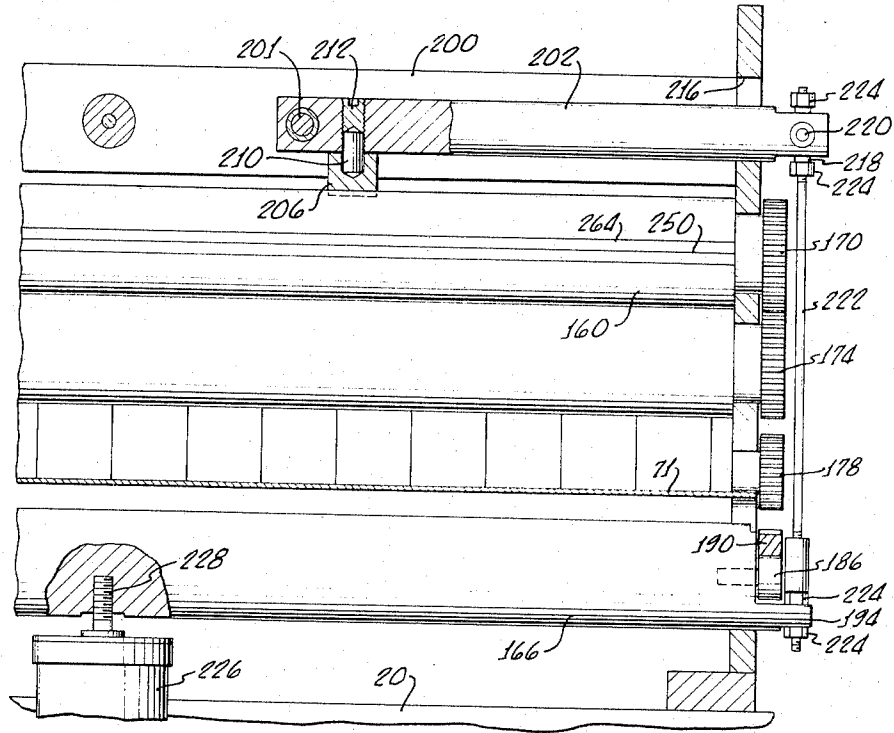


FIG. 10.

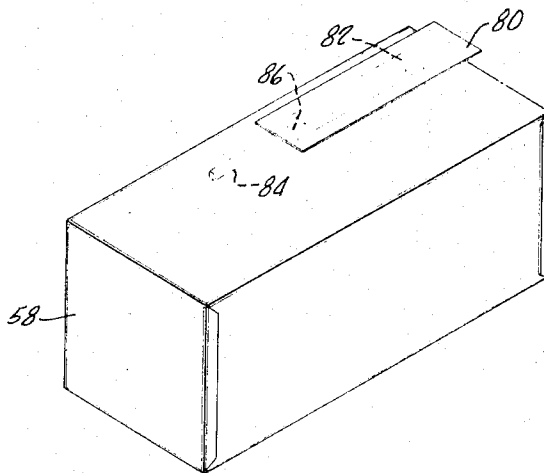
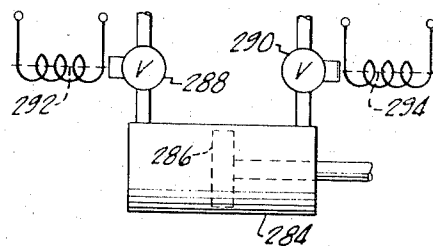
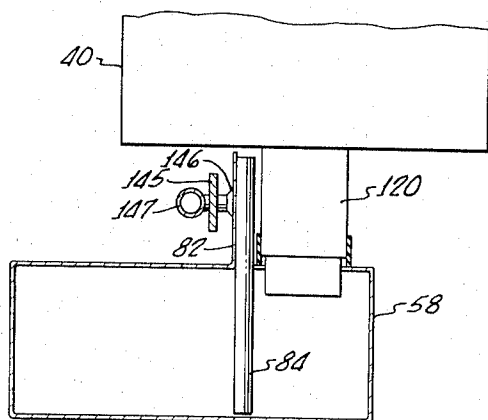
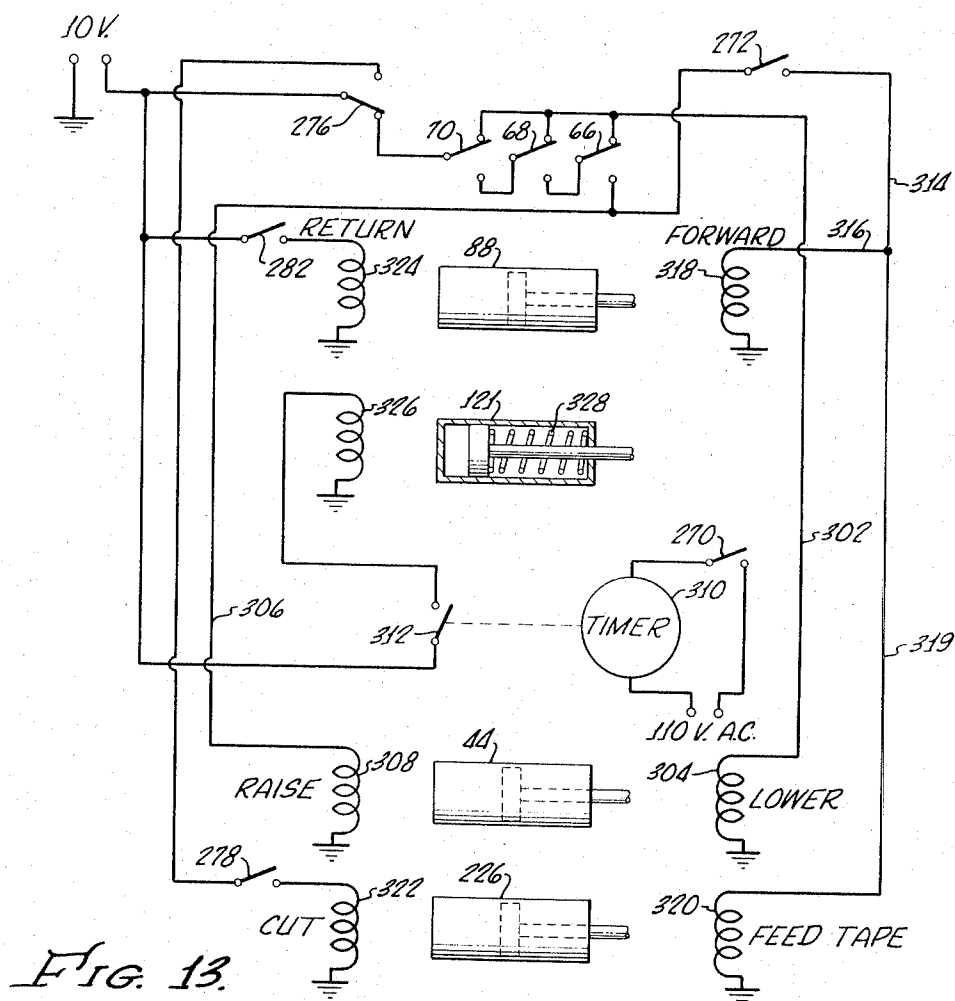


FIG. 11.

INVENTOR.
CHARLES WRIGHT JONES
BY
FOWLER, KNOBBE
& MARTENS
ATTORNEYS.



INVENTOR.
CHARLES WRIGHT JONES
BY
FOWLER, KNOBBE
& MARTENS
ATTORNEYS.

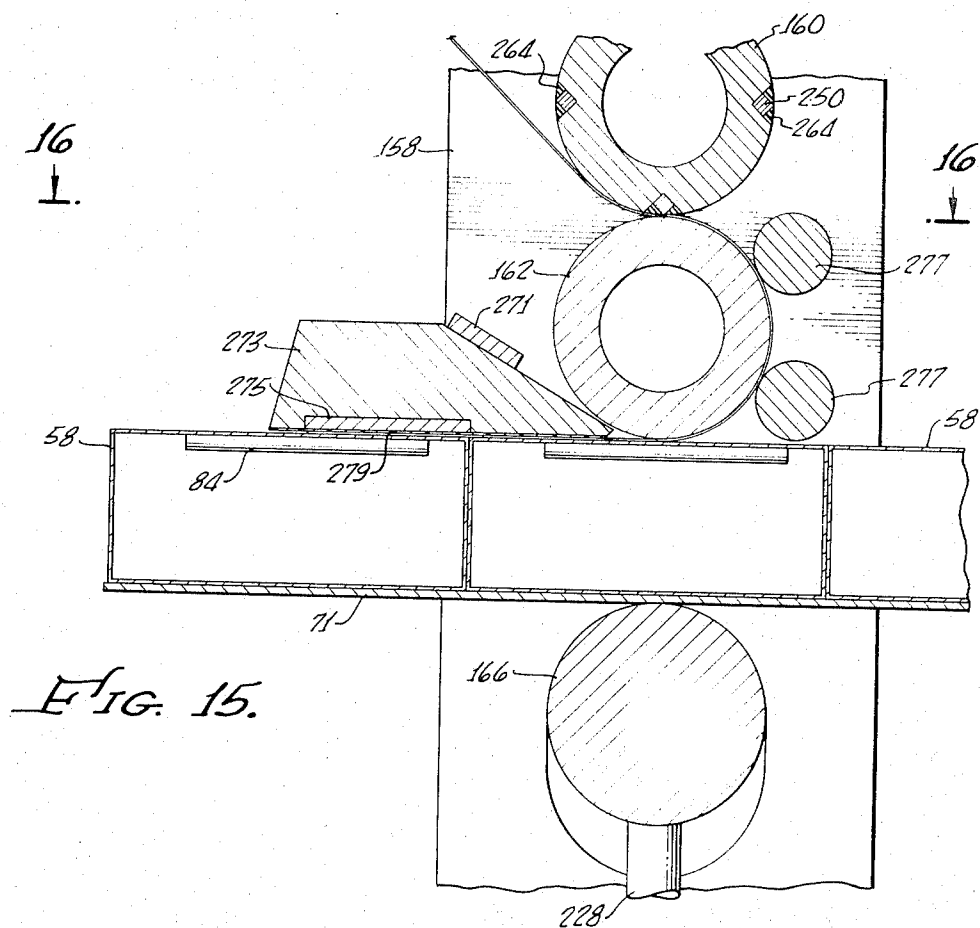


FIG. 15.

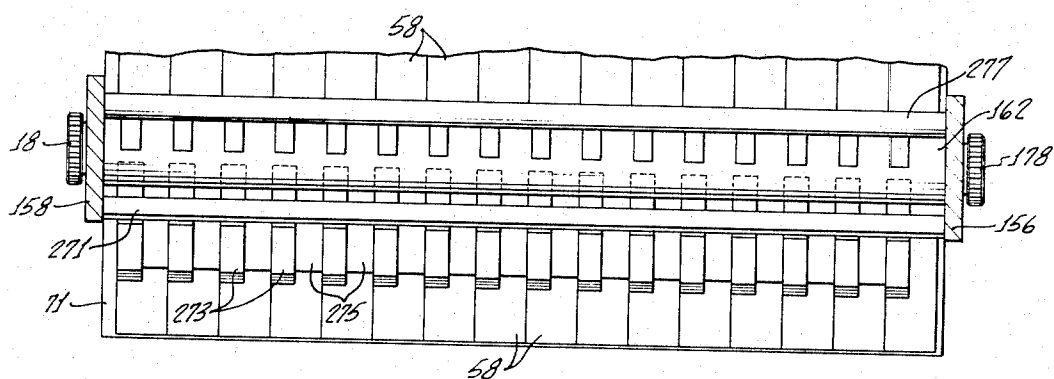


FIG. 16.

INVENTOR
CHARLES WRIGHT JONES
BY
FOWLER, KNOBBE
& MARTENS
ATTORNEYS.

APPARATUS FOR FILLING AND SEALING CARTONS FOR HOLDING LIQUIDS

BACKGROUND OF THE INVENTION

Kalajian U.S. Pat. No. 3,259,297 granted July 5, 1966, discloses a container for milk, fruit juice, or other potable liquids, which is provided with a self-contained sipping tube or straw. The carton itself will be recognized, apart from the provision of the straw, as being of a type in wide use by dairies and suppliers of fruit juices, and having as a characteristic feature, a crimped sealing construction at the ends and a liftable corner flap with a circular depressed portion that closes the orifice through which the container is filled and from which the contents are poured in the case of containers of a size customarily used in the household.

Another type of container that is in wide use by suppliers of potable liquids is characterized by a flat bottom, and a top comprised of oppositely sloping closure members brought together and sealed along a center line, forming a ridge. The ridge is arranged to be torn apart along a portion of its length to reveal a folded-in pouring spout. For situations in which the liquid is to be taken directly from the container into the mouth, rather than the normal household usage involving pouring of the liquid from the self-contained spout into another vessel, the top of the container is sometimes provided with a knock-out disc which may easily be punched through to reveal an orifice into which a sipping straw may be inserted. In this case as well as in the case of the flat topped carton with the liftable flap, and lacking the self-contained straw according to the teachings of the Kalajian patent, it is necessary that a supply of straws be available to accommodate those persons, particularly at places of amusement, or in the school lunch room facilities, who desire to drink directly from the container.

BRIEF DESCRIPTION OF THE INVENTION

The present invention relates to apparatus for filling and sealing a carton more appropriate to embodying the invention of the Kalajian patent and more easily handled in processing than either of the cartons described above. Specifically, the carton is completely sealed at both ends and the only point of access for filling the carton or for removing the contents is an orifice closed by a flap punched from a side wall of the carton and liftable to reveal the access orifice, and to bring into usable position the straw that has been attached to the inner surface of the flap.

In the disclosed apparatus for filling and sealing cartons of this type, the completed cartons are delivered by the conveyer from apparatus which forms them from blanks and seals them into liquid tight condition except for the access orifice, to a receiving platform of the apparatus for filling and sealing them. When a predetermined number of cartons has been accumulated side by side with their recess flaps and attached straws facing upwardly, they are moved into registry with depending spout-like members of a liquid storage tank. Following the positioning of the cartons, the tank is lowered to insert the tips of the spout-like members into the access orifices of the cartons. Valving mechanism associated with the storage tank then permits the liquid contained in the tank to flow through the spouts into the cartons until a predetermined quantity of liq-

uid has been transferred to the cartons, whereupon the flow of liquid is cut off.

The spout-like members are provided with suction tubes, the lower ends of which terminate near the tips of the spout-like members, and the upper ends of which are in communication with a chamber or compartment beneath the storage tank. The purpose of these tubes is to draw off froth that may develop during the passage of liquid into the cartons, and the suction is produced by connecting the chamber or compartment to a throat-like constriction in an external recirculation path for the liquid storage tank. A motor driven pump in the recirculation path produces a continuous withdrawal of liquid from the tank and return of the liquid to the tank, and the throat-like constriction in the recirculation path, by venturi action, produces a suction in the compartment or chamber with which the suction tubes are in communication, to cause froth to be drawn off and returned to the liquid storage tank.

When the desired amount of liquid has been metered into the cartons the storage tank is lifted to withdraw the tips of the spout-like members from the cartons, and while the filling of the one group of cartons has been taking place another group has been accumulated on the table. These cartons are then moved into the liquid receiving position, and they engage and move outwardly and away from registry with the liquid storage tank the cartons that had been filled.

As the filled cartons are moved away from the filling position, they pass beneath a roll, around a portion of the periphery of which a severed length of sealing tape, supplied from a separate supply roll of tape for each of the cartons, is wrapped. The roll is rotated in timed relation to the movement of the carton and as the carton passes beneath the roll the severed segment of tape is pressed against the surface of the carton to cover and seal the orifice and its closure flap.

The sealing tape may have its surface that faces the carton coated with a pressure sensitive adhesive which will adhere to the surface of the carton.

In the preferred embodiment of the carton, it is made of paper in sheet form and coated, at least on the exterior surface, with polyethylene. This substance is thermoplastic, and softens and becomes sticky in the presence of heat, and may be employed as an adhesive. Accordingly, the sealing tape preferably is also of paper coated on at least one surface with polyethylene, and at the tape applying position a heater unit is provided to heat the polyethylene coated surface of the severed length of tape that is to be applied to the carton and also the external surface of the carton in the area where the tape is to be supplied is also heated. When the roll presses the tape against the surface of the carton and the carton is moved away from the sealing position the tape will adhere to the surface of the carton and prevent leakage of the liquid from the orifice through which the liquid was poured into the carton.

For a complete understanding of the invention, reference may be had to the following detailed description to be interpreted in the light of the accompanying drawings in which:

FIG. 1 is a perspective view showing the preferred embodiment of the carton filling and sealing apparatus; FIG. 2 is a top plan view looking downwardly on the carton filling and sealing apparatus shown in FIG. 1;

FIGS. 3 and 4 are elevational views of the same end of the apparatus that is seen at the left of FIG. 1 in two

different operative conditions of the apparatus, namely with the liquid storage tank in its raised position in FIG. 3 and in its lowered position in FIG. 4, with other components in their corresponding operational conditions;

FIG. 5 is an elevational view taken at the rear of the apparatus, this being the opposite side from that shown in the perspective of FIG. 1, which will be considered as the front of the apparatus;

FIG. 6 is an enlarged sectional view taken generally on the section line 6—6 in FIG. 5;

FIG. 7 is a vertical sectional view taken generally on the line 7—7 in FIG. 6;

FIG. 8 is an enlarged view of the right hand portion of FIG. 7;

FIG. 9 is a horizontal sectional view taken generally on the line 9—9 of FIG. 8;

FIG. 10 is a vertical sectional view taken generally on the line 10—10 in FIG. 6;

FIG. 11 is a perspective view of a carton for holding liquids after being filled and sealed by the apparatus shown in the foregoing figures of the drawings;

FIG. 12 is a schematic representation of an air cylinder type of actuator employed in the apparatus embodying the invention;

FIG. 13 is a schematic wiring and operating diagram;

FIG. 14 is a vertical sectional view similar to the central portion of FIG. 6 showing an arrangement for positively engaging the closure flaps of the cartons preparatory to the filling of the cartons;

FIG. 15 is a vertical sectional view similar to the left-hand portion of FIG. 6 showing an alternative arrangement for sealing tapes on the cartons; and

FIG. 16 is a horizontal sectional view taken on the line 16—16 of FIG. 15.

DETAILED DESCRIPTION

Referring now to the drawings and particularly to FIGS. 1, 2, 3 and 4 the reference numerals 20 and 22 designate respectively a main longitudinal supporting member and pedestals for supporting it. As shown in FIGS. 1, 3 and 4, the supporting member 20 is a hollow beam in tubular form of rectangular cross-section. It could be a channel iron or an I-beam. In FIG. 1, the hollow beam 20 has been indicated as being broken away and the intent of this is to indicate that it may also support, at positions leftwardly of the showing in FIG. 1, apparatus for forming into a closed and sealed form the cartons that are to be filled with liquid by the apparatus shown in FIG. 1. It will be understood that a sufficient number of pedestals 22 will be provided to support the apparatus shown in FIG. 1 and any other apparatus for supplying to the apparatus in FIG. 1 cartons ready for filling with a liquid.

As shown in FIGS. 2 and 5 the beam 20 supports a motor 24 which, through suitable reduction gearing 26 drives a pulley 28 over which passes one end of an endless belt 30. The belt 30 has been broken off at the left of FIGS. 1 and 2 to indicate that at a remote point at the left it would pass over an idler pulley and serve as a conveyer to bring cartons to the filling and sealing apparatus of FIG. 1.

As shown in FIGS. 1, 3, 4 and 6, the supporting beam 20 has secured thereto vertically extending posts 32 each of which is provided with a pair of spaced pivot pins 34. Each of the pivot pins 34 supports a link 36 which, at its opposite end, engages a pivot pin 38 that is secured to the liquid storage tank 40. The spacing of

the pivot pins 38 vertically of the tank 40 is the same as that of the pivot pins 34 on the posts 32, so that the links 36 form a parallel motion mechanism keeping an unvarying vertical alignment of the tank 40 as it is raised and lowered. The beam 20 also has secured thereto a post 42 at the upper end of which is pivotally mounted a cylinder 44 for operating by fluid pressure, such as compressed air, a piston contained therein. The free end of the piston rod carries a clevis 46 which is pivotally connected to a bracket 48 mounted on the exterior of the tank 40, generally intermediate its ends. It will be apparent that the tank 40 may be raised to its uppermost position by the application of fluid pressure to the lower face of the piston within the cylinder 44, and conversely that the tank may be brought to its lower position either by the application of fluid pressure to the upper surface of the piston when it is in its upper position, or by the release of pressure on its lower surface and the action of gravity upon the tank 40.

As is seen most clearly in FIG. 6, the posts 32 support, a distance below the lower pivot pins 34, brackets 50 which in turn support spaced rollers 52. The rollers 52 in turn support for movement forwardly and rearwardly of the apparatus or toward and away from the plane of movement of the tank 40 a traverse plate or pusher 54. The plate 54 is provided with a slot 55 through which the rod 42 supporting the cylinder 44 extends and which accommodates to and from movement of the plate 54.

At its inner or rearmost edge, the plate 54 is provided with an upstanding carton pusher fence 56 which extends from one end of plate 54 to the other.

As shown in FIG. 1 and also in FIG. 6, the cartons 58 that are to be filled with liquid are carried by the conveyer belt to the filling apparatus lying on their sides, extending transversely of the belt 30 in a balanced equilibrium, with the access orifice 60 facing upwardly. The position of the fence 56 on the plate 54 when the plate is in its extreme forward position, which is the position it is shown as occupying in FIGS. 4 and 6, is such that it is spaced a short distance from the ends of the cartons, perhaps a quarter of an inch, as they are carried into the filler apparatus and accumulate side by side on the moving conveyer belt 30.

The fence 56 carries at its upper edge a horizontally extending flange 62 which extends from one end of the plate 54 to the other, and the flange in turn has at its outer edge vertically extending fence 64. The flange 62 supports at its remote end relative to the direction of travel of the cartons 58, an electrical switch 66 with its operating plunger extending downwardly through an aperture in the flange 62 so as to be presented in the path of the cartons 58. At its near end, relative to the direction of travel of the cartons 58, the flange 62 carries, side by side, two electrical switches 68 and 70 similarly having their operating members extending downwardly through apertures in the flange 62 so as to be presented in the path of the moving cartons 58. Manifestly the height of the fence 56 of the pusher plate 54 is sufficient to permit the cartons 58 to pass underneath the flange 62.

For partially supporting the cartons as they are accumulated along the fence 56 of the pusher plate 54, and for fully supporting the cartons as they are moved from one to another of processing positions the apparatus is provided with a table or platform 71, extending the full

width of the carton filling and sealing apparatus and rearwardly at least far enough to support a row of cartons in the sealing position and preferably far enough to support one row of cartons that has been moved from the sealing position. The platform 71 is mounted in a position substantially level with the upper run of the conveyer belt 30. It is sufficiently close to the conveyer belt that cartons are partially supported by it, as well as by the conveyer belt while being accumulated. A front portion of the platform slopes downwardly beneath the upper run of the conveyer belt 30 and has secured thereto, in alignment with the switches 66, 68 and 70, wedge-shaped pads 73. The pads 73 furnish support for the conveyer belt 30 at the points where the switches 66, 68 and 70 are to be operated by cartons, so that operation of the switches shall not be thwarted by sagging of the conveyer belt.

As is shown most clearly in FIGS. 1, 3 and 4, the beam 20 has secured thereto a horizontally disposed frame member 72 which extends rearwardly of the apparatus and is stabilized by a post 74 (FIGS. 3 and 4). The beam 20 also supports a post 76 (FIGS. 1 and 2) which in turn carries a rail 78. The rail 78 is mounted above the conveyer belt 30 and the spacing is such that the cartons 58 will pass beneath the rail 78 with the end first encountered by the cartons close to the upper surfaces thereof. The rail 78 has a 90° twist, its end that is presented toward the approaching cartons being horizontal and the twist changing to a vertical attitude at the end most remote from the approaching cartons.

Turning now to FIG. 11 which shows the carton 58 and disregarding for the moment the sealing tape 80, the flap 82 that covers the orifice through which liquid is to be poured into the carton is shown in dotted lines beneath the tape 80. The straw 84 which has been attached to the inner surface of the flap 82 at a single point represented by the dot 86 is also shown by a dotted line. When the free end of the flap 82 is lifted the flap flexes about the point of its integral joinder with the carton 58. If the flap is lifted to a position perpendicular to the surface of the carton to which it is connected it perhaps may not remain at that angle because the paper of which the carton is formed has a certain amount of memory tending to return the flap 82 toward the plane of that side of the carton. Moreover, it is customary to coat the blanks of which cartons are to be formed with a substance rendering them impervious to liquids, such as polyethylene. This may tend to impart additional memory to the flap causing it to resist a portion of perpendicularity relative to the side of the carton to which it is attached.

It may be assumed that the equipment that forms the carton will be provided with means for lifting the free end of the flap 82 before the carton is delivered by the conveyer belt 30 to the apparatus for filling the carton, so that the cartons will approach the rail 78 lifted, with their attached straws, sufficiently that the flap and straw will pass above the rail 78 as the carton passes underneath the rail. Due to the 90° twist in the rail 78 the straw and flap to which it is attached will be brought to a position substantially perpendicular to the surface of the carton. The end of the rail 78 that is remote from the approaching cartons is sufficiently close to the end of the fence 64 on flange 62 of the pusher plate 54 that the fence 64 will take over from the rail 78 and maintain the flaps 82 and their attached straws 84 in an erect position as shown in FIG. 6.

As shown in FIGS. 3, 4, 5 and 6, the beam 20 has secured thereto a pair of brackets 85 to which is connected, by means of a pin or bolt 87 one end of an air cylinder actuator device 88. The piston rod 90 of the air cylinder 88 is provided at its free end with a clevis 92 which is connected to a depending apron 94 at the front edge of pusher plate 54. The location of the air cylinder device 88 laterally of the platform 54 is about midway between the ends and therefore is somewhat to the left of the slot 55 as viewed in FIGS. 1 and 2.

The function of the air cylinder actuator 88 is to move the plate 54 from the position shown in FIG. 4, in which position cartons 58 are being accumulated along the fence 56, to the position shown in FIG. 3, to place the row of cartons 58 in position below the liquid storage tank 40, to be filled with liquid. It will be understood that in the sequence of operations occurring in the apparatus the tank 40 must of necessity be in its elevated position at the time that the plate 54 moves the cartons 58 into position below the tank. As will be described hereinafter the electrical switches 66, 68 and 70 function cooperatively to determine when a full row of cartons has been accumulated and to initiate the movement of the plate 54 to present the row of cartons to be filled. The plate 54 is provided with a baffle plate 95 facing in the direction from which the cartons approach to be accumulated. When the plate 54 is moved to transfer the accumulated cartons into position to be filled the baffle plate 95 is moved into blocking relation to the cartons that continue to approach the plate 54 on the conveyer belt 30, and thus the cartons begin to accumulate to the left of the baffle plate 95 as viewed in FIG. 1.

The tank 40 that stores the liquid to be dispensed into the cartons is generally rectangular in cross-section, both transversely and longitudinally and is provided with a cover 102. As shown in FIGS. 6, 7 and 8, the tank has a true bottom 104 and a false bottom 106. At one end of the tank the end wall or panel 108 is extended downwardly a substantial distance below the true bottom and the latter is extended downwardly in a slope toward the elongated end panel 108 to produce a constriction at 110, and then slopes in the opposite direction away from the end panel 108 providing an inverted funnel portion of generally rectangular cross-section. A flat bottom for the inverted funnel section is provided with a fitting 112 to receive a flexible fluid conduit or hose. The details of this structure are most clearly shown in FIGS. 7 and 8.

As shown in FIG. 6, the false bottom 106 is an inverted U-shaped channel, preferably of sheet metal, the depending sides of which merely rest on the true bottom 104 so that the false bottom can be lifted out.

The false bottom 106 is provided with a plurality of apertures 114 spaced from one another in accordance with spacing of the access orifices (FIGS. 7, 8 and 9) in the cartons 58 when they have been moved into position below the tank 40. The false bottom 106 slideably supports a valving plate 116 which preferably is made of polytetrafluoroethylene, identified by one producer by the brand name TEFLON, and is provided with apertures 118 the spacing of which along the plate 116 matches the spacing of the apertures 114 in the false bottom 106. At one of its ends, the valving plate 116 is connected to the piston rod 120 of an air cylinder device 121 mounted exteriorly of the tank on one end thereof, with the piston rod 120 operating through a

liquid-tight fitting 119 carried by the tank. The extent of movement of the piston rod 120 by the piston in the air cylinder device 121 is sufficient to move the apertures 118 in the valving plate 116 into and out of registry with the apertures 114 in the false bottom 106.

The true bottom 104 of the tank 40 is provided with apertures in alignment with the apertures 114 in the false bottom and extending through these apertures in liquid-tight relation and secured to the false bottom are spout-like tube assemblies 120 for draining liquid into cartons positioned below their mouths. The spout-like assemblies 120 are comprised of outer and inner tubes 122 and 124 respectively. In the cross-section that appears in FIGS. 7 and 8, the tubes 124 taper downwardly for at least a part of their lengths and the outer tubes also taper and have their walls spaced from the walls of the inner tubes 124 to provide passages between the walls of the two tubes. In a section taken at right angles, to the ones in FIGS. 7 and 8, which is the section shown in FIG. 6, the walls of the inner tubes 124 are parallel and the walls of the outer tubes have their inner surfaces in surface contact with the outer surfaces of the corresponding walls of the inner tubes, and the contacting walls of the inner and outer tubes are secured together as by spot welding. At their upper ends the inner tubes 124 protrude from the outer tubes 122 and are provided with deflectors or baffles 126 generally shielding the passages between the walls of the inner and outer tubes. At their lower ends the inner tubes 124 also protrude from the outer tubes so that the inner tubes may enter the cartons 58 when the tank 40 is lowered, as indicated in FIG. 8, while the outer tubes 122 terminate above the upper surfaces of the cartons. A seal may be effected between the spout-like assembly 120 and the carton 58 by providing a band of elastomer 128 surrounding the lower end of the outer tube 122 and extending slightly below the lower end of that tube so that it may be compressed slightly against the surface of the carton when the tank 40 is lowered into position to fill the cartons 58.

As previously mentioned, the reference numeral 112, designates a fitting for a fluid conduit. Instead of showing the actual conduit, a recirculation path for liquid is indicated by the directional arrows 130 and 132 to the input side of a pump 134, represented schematically. The output of the pump is connected to the remainder of the recirculation path, represented by the directional arrows 136, 138 and 140, to a conduit 142 that enters the top of the tank 40.

The false bottom 106 of the tank divides the tank into upper and lower compartments or chambers as will be most apparent from FIG. 6. Because the upper chamber is open to the recirculation path at the right hand end of the tank as viewed in FIG. 7, and with the pump 134 in operation there will be a continuous recirculation of liquid and flow of liquid through the constriction at 110. The throat-like constriction 110 produces a venturi effect, in which the velocity of liquid through the constriction increases and the pressure decreases. The lower compartment or chamber of the tank, which receives liquid from the upper compartment when the valving plate 116 is moved to the left as viewed in FIGS. 7, 8 and 9 to superimpose the apertures 118 upon the apertures 114, is in communication with both the inner tubes 124 and the outer tubes 122 of the spout-like assemblies 120 and is also in communication

with the recirculation path at the point of constriction 110.

The description now reverts to the point in the sequence of operations at which a group of cartons has been presented beneath the tank 40. Following the presentation of the cartons the compressed air cylinder device 88 is reactivated to withdraw the pusher plate 54 to its outermost position to permit another group of cartons to be accumulated. With the retraction of the fence 64, there may be some tendency for the closure flaps 82 and their attached straws 84 to rock in a clockwise direction about the point of connection of the table to the upper wall of the carton. Such tendency results from the inherent memory in the paper stock of which the carton is made as well as from the inherent memory of the polyethylene coating on the carton. However, the tendency to return under the influence of the inherent memories has been found to be somewhat slow in developing, so that the flaps 82 and the attached straws 84 do not tend to move into position to be crushed by the spoutlike assembly 120 before the tank 40 has been lowered, which is the next operation in the sequence, a sufficient distance to hold the straws in a substantially vertical position.

In the event that the flaps and straws should be found to move away from their erect position too quickly, an arrangement such as that shown in FIG. 14 may be provided for holding the flaps 82 and the attached straws 84 in an erect position after they have been delivered to the liquid receiving position by the fence 64 associated with the pusher plate 54. It comprises a bar or plate 145 supported in close proximity to the erect positions of the closure flaps of the cartons 58 when the cartons are in their liquid receiving position and carrying on its face that is presented toward the flaps 82 small suction cups 146 dimensioned to engage the surface of the flap 82 in a substantially air-tight contact. There is a suction cup on the mounting bar 145 for the flap of each of the cartons presented for simultaneous filling, and the interior of each of the suction cups is in communication with a manifold 147 mounted on the plate 145. A light vacuum or suction may be continuously applied to the manifold 147 by a suction pump (not shown), and as each group of cartons 58 is delivered to the fluid receiving position, the fence 64 on the pusher plate 54 will move the flaps 82 into sufficiently close contact with the suction cups 146 for the flaps 82 to be gripped and held. After the cartons 58 have been filled and they are moved leftwardly to be sealed, as will be described hereinafter, the movement of the cartons causes the flaps to be rocked by the mounting plate 145 toward their carton closure positions. Because only a light suction is required to hold the flaps 82 in the desired position it may be maintained continuously because movement of the carton will effect easy breaking of the seal without distortion of the flap or the straw.

The tank moves downwardly until the lower ends of the inner tubes 124 have been inserted into the cartons and the resilient band 128 around the outer tubes 122 have been brought into contact with the surface of the carton. The next operation in the sequence is the energization of the air cylinder device 121 to shift the valving plate 116 leftwardly as viewed in FIGS. 7 and 8 and permit liquid to flow by gravity from the upper compartment or chamber of the tank to the lower compartment. Because the open upper ends of the inner tubes

124 are positioned directly below the apertures in the false bottom 106 of the tank the principal direction of flow of the liquid will be downwardly through the inner tubes 124 and into the cartons 58. However, because the open ends of the inner tubes 124 are spaced downwardly from the false bottom 106 to place the lower compartment in communication with the upper compartment some of the liquid will strike the diverter vanes 126 on the inner tubes 124 and flow laterally.

The flow of liquid from the upper tank through the constriction at 110 in the recirculation path will, by venturi action, create a suction in the point of communication of the lower chamber with the recirculation path and this suction will cause the liquid that does not enter the inner tubes 124 to be drawn into the recirculation path and join the stream of fluid that is flowing from the upper chamber.

In accordance with a preferred embodiment of the invention, the recirculation path is arranged to produce a flow of liquid in that path at the rate of approximately 40 gallons of liquid per minute. The structure of the point of access of the lower chamber to the recirculation path and the configuration of the constriction in that path are such as to produce a suction in the lower chamber equivalent to a liquid flow at the rate of approximately 20 gallons per minute. Some liquids have a tendency to froth to a considerable extent when poured or permitted to flow from an open ended tube, and milk at a temperature in the neighborhood of 40° F. has a marked tendency to froth. The froth that is produced within the cartons as the liquid accumulates in the cartons floats on the surface of the liquid and, of course, rises toward the top as the quantity of liquid in the carton increases. The suction that is produced in the lower compartment of the tank by the venturi action in the recirculation path is sufficient to draw the froth upwardly through the outer tubes 122 of the spout-like assemblies 120 and into the lower compartment of the tank where it rejoins the liquid that has not found its way into the inner tubes 124 and flows into the recirculation path. The vanes or diverters 126 have a limiting effect upon the entry of liquid into the open upper ends of the outer tubes 122 and thereby facilitate the drawing off of the froth.

As will be described in greater detail hereinafter, a timer is set in operation when the valving plate 116 is moved to the open position and when it has timed out it causes the air cylinder device 121 to restore the valving plate 116 to its rightward position as viewed in FIGS. 7 and 8, thereby cutting off the flow of liquid from the upper to the lower compartment of the tank 40. With the cutting-off of the flow of liquid from the upper chamber of the tank 40, any liquid that has accumulated in the lower chamber quickly drains into the recirculation path, so that the cartons 58 do not overfill.

It is a widely used practice to provide that cartons to contain liquid to be taken directly into the mouth from the carton shall have a capacity of one third quart which is approximately 10.7 fluid ounces. In one embodiment of the present invention, it has been found that an interval of approximately 3.5 seconds is required for this quantity of liquid to flow into a carton by gravity, which is at the rate of approximately 17 cartons per minute without allowance of any time for moving cartons into and out of registry with a spout, or valving a stream of liquid on and off. This, multiplied

by the number of spouts provided for the simultaneous filling of cartons, would give the absolute maximum number of cartons per minute that could be filled.

In the embodiment of the invention shown in the drawings, and referring particularly to FIG. 7, it will be noted that 16 spouts have been provided and thus that 16 cartons may be filled at the same time. If the cartons were to be delivered to the carton filling apparatus at the rate of four per second, 16 would be accumulated in 4 seconds which would leave a margin of 1/2 second for raising the tank, moving the accumulated 16 cartons into position to be filled, and lowering the tank. The output of the apparatus would be 240 cartons per minute which is 15 groups of 16 cartons. Better operating margins, and less abrupt motions, are achieved by limiting the rate of delivery of cartons to the carton filling apparatus to about 200 per minute. At that rate, there are 12½ groups per minute. The interval per group is thus approximately 4.8 seconds which leaves approximately 1.3 seconds between pourings, and this has been found to be a reasonable interval in which to do the carton handling. Manifestly, the output rate could be increased by increasing the size of the access orifice in the carton and correspondingly enlarging the spouts, or by increasing the number of cartons that can be filled at one time. The former would make the handling of an opened carton without spilling the contents more difficult. The latter would result in lengthening of the tank and all other carton handling components. Other complexities might also be introduced, such as the possible necessity of providing a more elaborate conveyer system for the more rapid handling and feeding of the light, empty cartons.

After the cartons have been filled with liquid, they must be sealed. The portion of the apparatus that performs this function will now be described. The previously identified, rearwardly extending, horizontally disposed frame member 72 stabilized by a post 74 and a companion rearwardly extending, horizontally disposed frame member 152 and its stabilizing post 154 support bearing plates 156 and 158 respectively, which rotatably support a cutter blade roll 160 and a cutter anvil roll 162 and which also support, at a distance below the anvil roll 162 and in elongated slots 164, to accommodate its raising and lowering in a vertical direction, a non-rotative bar 166.

The cutter blade roll 160 may be supported by end shafts keyed or otherwise secured to it which pass through and are journaled or are otherwise rotatably supported in the bearing plates 156 and 158 and the extremities of these shafts have keyed or otherwise secured to them the gears 170 and 172. The anvil roll 162 is similarly supported and has keyed or otherwise secured to its supporting shafts the gears 174 and 176 which are in mesh with the gears 170 and 172. Below the gears 174 and 176, the bearing plates 156 and 158 support for free rotation thereon, the gears 178 and 180 which do not mesh with the gears 174 and 176 respectively. However, the bearing plates 156 and 158 rotatably support the idler gears 182 and 184, the former of which is in mesh with both of the gears 178 and 174 to transmit rotation to the gear 174 and the anvil roll 162 in the same direction as the gear 178 and the latter, the idler 184, is arranged to impart rotation similarly from the gear 180 to the gear 176 and roll 162.

The non-rotative bar 166 has been shown as being cylindrical in form, but its principal requirements are

rigidity and weight, and a bar in rod form is suitable for the purpose. Outboard of the bearing plates 156 and 158, the bar 166 has extensions 186 and 188, preferably presenting a cylindrical surface at the tops, which support racks 190 and 192 that are pivotally connected to a bar 193 extending across and secured to the underside of the carton traverse plate 54. When the bar 166 is in the lower limit of its mounting slots 164 in the bearing plates 156 and 158 the teeth of the racks 190 and 192 are not in engagement with the pinion gears 178 and 180. However, when the bar 166 is lifted to its upper limit in the slots 164 the racks 190 and 192 are lifted into meshing engagement with the pinion gears 178 and 180 respectively, so that for whatever interval of time such engagement is maintained movement of the pusher plate 54 by its operating air cylinder device 88 will be translated into rotation of the cutter roll 160 and cutter anvil roll 162.

Below the rack-supporting hub-like members 186 and 188, the bar 166 is provided with extensions 194 and 196. Above the cutter blade roll 160 a pair of spaced bars 200 extend between and are secured to the bearing plates 156 and 158. The bars 200 pivotally support the lever arms 202 and 204 which extend outwardly from their pivotal mountings 201 and 203 through slots in the bearing plates 156 and 158 and terminate above and in alignment with the extensions 194 and 196 on bar 166. Near their points of pivotal mounting on the bar 200, the levers 202 and 204 engage pressure shoes 206 and 208 respectively, the lower faces of which have a curvature matching the cylindrical curvature of the cutter blade roll 160 and they rest upon that roll. As shown in FIG. 10, with particular reference to the lever 202, it is drilled to receive a retainer pin 210 which enters a matching drilling in the pressure shoe 206, and a set screw 212 engages the end of retainer pin 210, the set screw being threaded into the lever 202. The lever 204 may have a similar retaining connection with the pressure shoe 208.

The levers 202 and 204 extend through slots 216 in the bearing plates 156 and 158 and project outwardly beyond these plates about the same distance as the extensions 194 and 196 of bar 166. The outer ends of the levers 202 and 204 are slotted in a vertical plane to receive sleeves 218 pivotally supported on trunnions 220, and the bores of the sleeves are in alignment with drillings in the extensions 194 and 196 of the bar 166. Tie-rods 222 interconnect the levers 202 and 204 with the bar 166 by extending through this sleeve 218 and through the drillings in the extensions 194 and 196 of the bar 166, and the tie-rods 222 may be threaded at both ends to receive nuts 224 for retaining the tie-rods 222 and for adjustably associating the levers 202 and 204 with the bar 166.

The bracket 84 attached to the beam 20, and previously identified as supporting the air cylinder device 88 for operating the pusher plate 54, also supports by means of a pin or bolt 225 a vertically extending compressed air cylinder device 226 the piston rod 228 of which engages the underside of the bar 166 substantially at its midpoint.

It will be apparent that when the air cylinder device 226 is activated to move the bar 166 upwardly the tie-rods 222 will lift the outer ends of the levers 202 and 204 which will rock counter-clockwise and clockwise respectively about their pivots 201 and 203, thereby to relieve the pressure applied by the pressure shoes 206

and 208 to the cutter blade roll 160. The bar 166, in being lifted by the air cylinder device 226, lifts the racks 190 and 192 to bring their teeth into mesh with the gears 178 and 180 connected to the roll 162. The timing of the lifting of bar 166 by the air cylinder 226 is coordinated with the movement of pusher plate 54 by the air cylinder 88, as will be described hereinafter, so that as the plate 54 is moved leftwardly as viewed in FIG. 3 to move an accumulation of empty cartons into registry with the tank 40, and to move the group of cartons that have just been filled leftwardly, the pinions 178 and 180 will be rotated, the rotation of the pinion 178 being clockwise, as viewed in FIG. 3, the idler gear 182 with which the pinion 178 is meshed will be rotated counterclockwise and the gear 174 will be rotated clockwise, and with it the roll 162 to which it is connected. The gear 170 secured to the cutter blade roll 160 will be rotated in counter-clockwise direction.

The bearing plates 156 and 158 have secured thereto at their upper ends, the arms 230 extending leftwardly as viewed in FIGS. 3, 4 and 6. A pair of rods 232 and 234 extend across from one to the other of the two arms 230, and the rod 232 that is supported near the free ends of the arms 230 carries roller sleeves 240 flanked by discs 242 for supporting rolls of tape 244 for sealing the access orifice of each filled carton. The rod 232 also supports spacer sleeves 246 to separate the discs 242 of adjacent rolls of tape 244 and position the tapes in alignment with the access orifices the cartons, it being understood that there are as many rolls of tape 244 as the number of cartons that are simultaneously filled from the tank 40. The rod 234 is also provided with roller sleeves 248, preferably one for each roll of tape 244, and the roller sleeves 240 and 248 serve as two points of support for each roll of tape, the roll not being otherwise supported and therefore being readily replaceable when a roll of tape has been exhausted and the supply must be replenished. When such replenishment is required, the leading end of the new roll may be spliced to the end of the exhausted roll of tape, or threaded into place. Tape from each roll 244 is threaded between the cutter blade roll 160 and the roll 162 and is brought around the roll 162 to be applied to a carton as it passes beneath the roll 162.

In the embodiment of the invention shown in the drawings, and having reference particularly to FIG. 6, the cutter blade 160 is provided with 4 cutter blades 250 mounted in grooves 252 parallel to the axis of cutter blade roll 160 and extending the full length of the roll to span all of the tapes passing between the rolls 160 and 162. In the rest condition of the cutter blade roll 160, one of the blades faces the top of the roll 162. Moreover, in this condition the bar 166 is at the bottom of its supporting slots in the bearing plates 156 and 158 because the fluid pressure device 226 has its piston at the bottom of its stroke. Accordingly, the bar 166 is pulling downwardly on the tie-rods 222 and on the outer ends of the levers 202 and 204. Thus pressure is being applied downwardly by the pressure shoes 206 and 208. The bearings for the cutter blade roll 160 confine the axis of the bar within the customary tolerances and are not intended to afford any vertical movement of the roll. However, the bearing plates are at least 32 inches apart to accommodate the passage of 16 cartons, and with 16 tapes interposed between the rolls 160 and 162 there may be some tendency of the roll 160 to bow upwardly toward its center. The tendency

may be very slight, and nevertheless, be sufficient to interfere with the cutting of the tapes cleanly. The pressure shoes 206 and 208 counteract any tendency of the cutter bar roll 160 to bow. It will be noted that the pressure shoes 206 and 208 are close to the pivots that support the levers 202 and 204, in terms of the overall length of the levers, so that the downward force applied to the levers 202 and 204 at their outer ends by the tie-rods 222 is multiplied.

In order that the cutting edge of the cutter bar 250 shall have reasonable durability the angle between the two surfaces that intersect to define the cutting edge is relatively broad. In fact the cutter blade bars may be of square cross-section, preferably of tool steel and removably retained in the grooves in the rolls 160 by retainer rings at the ends of the roll, so that they may be turned to bring any one of the four edges into position as a cutting edge. In order for the cutter blade bars 250 to perform their function most effectively, the two sides or faces defining a cutting edge should intersect in a true knife edge, without radius.

The roll 162 is of the same diameter as the roll 160 and accordingly it will, in its rest position, have two severed segments of tape, one following the other, wrapped around the half of its cylindrical surface that is presented in the direction from which the cartons approach. In order to maintain these tape segments properly aligned and in engagement with the cylindrical surface with the roll 162, a block 256 of substantially the same length as the roll 162 and presenting toward the roll a concave surface matching the curvature of the roll 162 is mounted in close proximity to the roll to guide the tape segments and maintain them in engagement with the roll so that they will be fed when the roll is rotated. It will be understood that a single block 256 may be employed, or it may be divided into segments, up to the number of cartons simultaneously processed.

Since the carton is coated with a substance to render it impervious to liquids, preferably polyethylene, it is appropriate to use a polyethylene coated tape for sealing the access orifice of the carton and as previously stated, a seal may be effected by the application of heat to the surface of the carton and to the surface of the tape that is to be applied to the carton. Accordingly, the block 256 is preferably of a substance that readily conducts heat, such as aluminum, and is provided with a bore 258 to receive a heating element. Because polyethylene that has been softened by heat has some affinity for aluminum, adherence of the tape on the surface of the carton to the block 256 may be prevented by attaching a layer of polytetrafluoroethylene to the curved and the lower surface of the block 256, as indicated at 259 and 261.

A sealing sequence will now be described without regard to the specific instrumentalities that effect the timing of the operation. As shown in FIG. 11, the flap that closes the access orifice of the carton 58 is shorter in length than one half the length of the carton and its point of integral attachment to the carton is nearer to the trailing end of the carton than the leading end, having regard to the direction of movement of the carton into and out of liquid receiving relation to the tank 40. In order to effect an adequate seal, it is desirable that the leading end of the severed tape segment be applied to the surface of the carton beginning a short distance to the left of the end of the flap, as viewed in FIG. 11.

It will now be assumed that the filling of a row of cartons has been completed, that the accumulation of another row of cartons has been completed and that the pusher plate 54 is moved in the direction of the tank 40 to move the row of empty cartons into position to be filled and to move the filled cartons away from the carton filling position. The filled cartons pass underneath the roll 162. It will be assumed that this is the beginning of a run of filling and sealing cartons, and that there are none to be moved by the cartons that have just been filled. Accordingly, the filled cartons will be moved into position beneath the roll 162 and no concern will be given at this point to operation of the rolls 160 and 162. During the time that the row of empty cartons is being filled, the row of filled cartons is stationary beneath the block 256, so that the polyethylene coating on the surface of the carton is being softened preparatory to application of the coated tape thereto, and the leading segment of tape around the right hand half of the roll 162 is being heated. Because a portion of the block 256 extends around and confines the trailing severed segment of tape, preparatory heating of that segment will be taking place also. It will be noted that the point on the carton at which the application of sealing tape is to begin is at or near the bottom of the roll 162.

Upon completion of the filling of a second row of cartons and the accumulation of a third row of empty cartons the pusher plate 54 again moves all of the cartons. Those that are positioned beneath the roll 162 immediately require the application of the sealing tape and the timing of the operation of the apparatus is such that the air cylinder device 226 is operated to lift the bar 166, thereby engaging the racks 190 and 192 with the pinions 178 and 180 and also lifting the tie-bars 222 to relieve the pressure of the pressure shoes 206 on the cutter bar roll 160 and permit its free rotation. Since the bar 166 extends across the table or platform 71 beneath it, the platform 71 may be so positioned relative to the movement of the bar 166 that just before the bar reaches the upper limit of its travel it engages the platform and flexes it upwardly a very small distance; just enough to press the upper surface of the carton against the segment of sealing tape, backed by the roll 162 that is feeding the tape to the carton. This will assure transfer of the tape to the carton. As the roll 162 rotates clockwise as viewed in FIG. 6, and the carton positioned beneath it moves leftwardly, the leading segment of severed tape, which has been heated, is pressed down upon the surface of the moving carton by the roll 162. Preferably, the circumferential velocity of the roll 162 matches the linear velocity of the carton so that there will be little or no sliding relative movement between the carton and the tape. As indicated in FIG. 11, the severed segment of tape is preferably of sufficient length that a portion of it will extend beyond the trailing end of the carton far enough to enable it to be gripped by the fingers of the user for the purpose of lifting the tape and thus the closure tab 82 in order to gain access to the carton. When the rolls 160 and 162 have rotated through a quarter revolution the air cylinder device 226 is reversed, permitting the bar 166 to drop, thereby permitting the release of the racks 190 and 192 from engagement with the pinions 182 and 184 and applying pressure to the cutter bar roll 160 through the tie-bars 222 and pressure shoes 206 and 208 to effect a severance of tape segments from the supply rolls. In order that there shall be sufficient frictional engage-

ment with the leading end of the supply of tape to cause it to be advanced preparatory to the cutting of another segment upon the next quarter revolution of the rolls 160 and 162, the grooves 252 in the cutter bar roll 160 may be provided with fillers 264 of elastomer to be compressed as the rolls begin to rotate and pinch the leading end of the tape.

After the rolls 160 and 162 have completed one quarter revolution and come to rest, the movement of the cartons leftwardly, as viewed in FIG. 6, continues until the cartons that have been sealed have moved clear of the rolls and the cartons to be sealed have been brought into position beneath roll 162.

FIGS. 15 and 16 show an alternative arrangement for applying a sealing tape over the closure flap of a filled carton. To the left of the tape segment feeding roll 162 as viewed in FIG. 15, a bar 271 is mounted on the bearing plates 156 and 158 and spans the space between the plates. The bar 271 mounts heater shoes 273, the lower faces of which are located about the same distance above platform 71 as the lower face of the combination tape guiding and heating bar 256 in FIG. 6. Each heater shoe is slightly wider than the sealing tape, is positioned to cover a tape segment applied to a carton, and there are as many of the shoes 273 as the number of cartons simultaneously processed by the carton filling apparatus. Extending transversely of all of the heater shoes 273 and accordingly common to all of them is a heating platen 275 which is recessed into the lower faces of the shoes 273 so that its lower surface is substantially flush with the lower surfaces of the shoes 273. The heating platen 275 may contain resistance wires for generating heat electrically. As indicated in FIG. 15 rolls 277 for confining the tape segments in surface engagement with the roll 162 may be provided as a substitute for the combination tape confining and heating block 256. A layer of polytetrafluoroethylene 279 may be applied to the lower surfaces of the shoes 273 and the heating platen 275, to be the surface contacting melted polyethylene.

With the arrangement shown in FIGS. 15 and 16, and having in mind that, as previously stated, the cylindrical bar 166 may, when in its uppermost position, flex the platform 71 upward slightly to press the upper surfaces of the cartons against the tape segments, cartons that have been filled and have been moved into position beneath the roll 162 each to receive a length of sealing tape, will not be heated at that point nor will the tapes be heated. As the roll 162 is rotated clockwise incident to the advancement of the cartons that are beneath the roll the leading ends of the tapes that are to be applied to the cartons will slide beneath the righthand ends of the shoes 273, as viewed in FIG. 15, as the cartons are advanced to the left, and will travel with the cartons to a position in which the segments of tape are beneath the heater platen 275. While the cartons rest in this position during the filling of another set of cartons heat will be applied to and through the tape segments to melt the polyethylene coating on the inner surfaces of the tapes and on the outer surfaces of the cartons to provide for adhesive attachment of the tapes to the cartons. When the next shifting of cartons takes place the flexing of the platform 71 by the bar 166 will cause the cartons that have been resting beneath the shoes 273 to be pressed upwardly against the shoes and the heating platen as the cartons are moved leftwardly and clear of the shoes, and this application of pressure dur-

ing movement of the cartons will cause a firm attachment of the tapes to the cartons.

Although the substitution of the tape retaining rolls 277 in FIG. 15 for the tape retaining bar 256 in FIG. 6 has been indicated it will be understood that it may be desirable to retain the block 256, rather than to employ the rolls 277, for the purpose of guiding and retaining the tapes as they pass around the roll 162. Also it may be found desirable to retain a heating unit in the bore 258 to provide some preliminary heating of the tapes and carton surfaces providing for final and more intensive heating by means of the platen 275.

As has been indicated hereinbefore, the initiation of various cyclic operations in the apparatus is controlled by electrical switches, some of which have been identified, namely: the switches 66, 68 and 70 mounted on the flange 62 at the top of the fence 56 of the plate 54. Not previously identified are the switches 270 and 272 (FIGS. 1, 3 and 4) mounted on the outer surface of the bearing plate 156, and operable by a pin 274 mounted on the liquid storage tank 40, the pin being engageable with the actuator for the switch 270 when the tank is in its lower position and being engageable with the actuator for the switch 272 when the tank has been raised to its upper position. Also there is a switch 276 (FIG. 6) mounted on the pusher plate 54 and having its actuator engageable with the bracket 50 which supports the rolls 52 for the plate 54. There is a switch 278, shown in FIG. 6 as being mounted on the bearing plate 158 and operable by protruding pins 280 on the cutter blade roll 160, the roll 162 being annularly grooved to clear the pins 280. Finally, there is a switch 282 (FIG. 6) that is mounted on traverse plate 54 and is adapted to have its actuator operated as the plate 54 completes the delivery of a group of cartons into position beneath the tank 40.

FIG. 12 shows schematically the composition of any one of the air cylinder actuators 44, 88 and 226. It is comprised of a cylinder 284 housing a piston 286 that is movable to and fro between input ducts through which fluid under pressure, such as compressed air, may enter the cylinder 284. The input ducts have valves 288 and 290 operable by solenoids 292 and 294 respectively. As long as a solenoid remains energized its associated valve is open and fluid pressure is holding the piston 286 in its limit position toward the other end of the cylinder. When the solenoid is de-energized the valve is closed, and the valve may be arranged to vent the cylinder to the atmosphere, relieving the pressure therein. However, the piston will remain in the position to which it has been operated until the other valve is operated by the energization of its solenoid to move the piston 286 in the opposite direction. Fluid pressure devices of this type are well known and FIG. 12 has been included for the purpose of rendering the wiring diagram and the timing aspects of the carton filling apparatus more easily understood.

In the idle condition of the apparatus, preparatory to starting a run, the relationships among the components are as shown in FIG. 4, namely the pusher plate 54 is in its outermost position, prepared to receive cartons, the tank 40 is in its down position and the bar 166 is also in its down position. FIG. 13 is a schematic wiring diagram, and the switches previously identified by reference numerals have the same reference numerals in FIG. 13. The switches are snap-action devices having normal and off normal conditions, and when they have

been operated to the off normal condition they are self-restoring to the normal condition. The only switch in the circuitry that is off normal in an idle condition of the apparatus is the switch 270 which is held off normal by the pin 274 on tank 40 because the tank is in its lower position. This switch is holding closed the alternating current connection for operating the timer. Only one other circuit is found to be complete, which is from a voltage source through the normal contacts of the switches 276 and 70, and conductor 302 to the winding of the control solenoid 304 for the air cylinder device 44, and this solenoid controls the lowering of the tank 40.

As each carton passes the operators for the switches 70 and 68, it operates those switches momentarily to their off normal conditions. The spacing of the switches is such that one carton cannot operate the two switches simultaneously. When the first carton moves down to the end, it operates the switch 66 but this effects no change in the operative conditions, the solenoid 304 having its energizing circuit repetitiously interrupted and re-established through the switch 70 in its normal condition or through the switch 70 in the off normal condition and the switch 68 in the normal condition as cartons pass beneath the two switches. When all but the last of the sixteen cartons have been accumulated the switches 66 and 68 will have been operated to their off normal conditions and as the last carton moves into place it operates the switch 70 to its off normal condition, and the three switches 70, 68 and 66, in their off normal conditions, register the accumulation of a complete group of cartons. From this it will be apparent that the switches 70, 68 and 66 form an AND gate. The path over which the solenoid 304 was previously operated is now transferred through the off normal contacts of the three switches 70, 68 and 66 in series and over conductor 306 to the winding of solenoid 308 which initiates the operation of the air cylinder device 44 to raise the tank 40 to its upper position. As soon as the tank 40 begins to rise the pin 274 permits the switch 270 to open and this switch opens a circuit for supplying power to operate the timer 310, the function of which, when it is activated, is to initiate and then suspend the flow of liquid from the tank 40 into the cartons after they have been placed in position beneath the tank. Timers of various types are commercially available and FIG. 13 merely indicates that the timer, upon being activated, closes and after a timed interval re-opens the contacts of a switch 312, and thereafter recycles, perhaps upon the next opening of the switch 270. When the tank 40 reaches its upper position, it closes the contacts of switch 272, thereby extending an operating voltage connection over conductors 314 and 316 to the winding of solenoid 318 which initiates the operation of air cylinder device 88 to transfer the cartons from the position in which they were assembled to a liquid receiving position beneath the tank 40. The connection is also extended from conductor 314 over conductor 318 to the winding of a solenoid 320 which initiates the operation of air cylinder device 226 to effect the raising of the racks 190 and 192 into engagement with their respective pinions 178 and 180 to cause the advancement of tape from the tape supply rolls 242. Shortly after it begins its travel the traverse plate 54 operates the contacts 276 to interrupt the circuits over which the solenoids 318 and 320 were operated, and to prepare an operating path for the solenoid

322, the function of which is to control the return of the air cylinder device 226 to its normal condition.

When the racks 190 and 192 have traveled a sufficient distance to effect one-quarter revolution of the rolls 162 and 160 one of the pins 280 on the cutter blade roll 160 operates the switch 278 which completes the circuit for the solenoid 322 that was prepared at the switch 276. The solenoid 322 reverses the air cylinder device which restores the bar 166 to its lower position, and the racks are thus disengaged from the pinions that they operate and rotation of the rolls 162 and 160 is arrested, although the plate 54 and the racks which it drives continue to move in the direction to complete the delivery of the cartons.

As the plate 54 completes its travel, it operates the switch 282 to complete the energizing circuit for the solenoid 324 which is associated with the air cylinder device 88 and initiates the return of the plate 54 to its normal position. As soon as the plate 54 begins to return to its normal position, the switches 70, 68 and 66 are withdrawn from engagement with the tops of the cartons and they return to their normal condition, preparing an energizing circuit for the solenoid 304 associated with the air cylinder device 44. Shortly before the plate 54 completes its return it permits the switch 276 to restore to its normal condition. With the switches 276, 70, 68 and 66, again in their normal conditions, the energizing circuit for the solenoid 304 is completed to cause the activation of the fluid pressure device 44 to lower the tank to its lower position. As it reaches this position the tank 40 recloses the switch 270, thereby reactivating the timer 310 which completes an operating circuit through the switch 312 for the solenoid 326 that activates the air cylinder device 122 to initiate the flow of liquid from the tank 40 into the cartons. When the timer 310 completes its timing operations 312, it opens the circuit through switch 312. In accordance with one embodiment of the invention, the air cylinder device 122, instead of being double acting, in the sense that fluid pressure is used to move the piston to and fro, as in the case of the air cylinder devices 44, 88 and 226, the device 122 is single acting, with the spring return, indicated schematically in FIG. 13 as a compression spring 328 contained within the cylinder.

As previously set forth, the interval required for the accumulation of 16 cartons exceeds the interval required to fill the cartons positioned beneath the tank 40 so that the flow of liquid from the tank 40 will be cut off before the plate 54 begins its next cycle of operation. In that cycle, the cartons that are to be filled will move the cartons that have been filled beneath the roll 162 and sealing tapes will be applied to the filled cartons in the manner previously described. In the case of the advancement of the sealing tapes incident to the delivery of the first group of cartons to be filled, there would be no cartons in position to receive sealing tapes and the tapes would merely fall free and should be discarded before the delivery of the first group of filled cartons to receive sealing tapes.

What is claimed is:

1. In an apparatus for transferring fluent material to cartons having a single access orifice:
means for delivering empty cartons to said apparatus with the access orifice facing upwardly;

an accumulation station for receiving and accumulating side by side a plurality of cartons delivered by said delivering means;

means for storing said fluent material having a plurality of spout-like appendages through which to deliver fluent material to said cartons;

a stationary platform disposed beneath said fluent material storing means;

reciprocably movable pusher means for moving a plurality of accumulated cartons onto said stationary platform in positions of registry of their access orifices with said spout-like appendages and acting through the instrumentality of the empty cartons being moved into positions of registry of their access orifices with the spout-like appendages to move the filled cartons out of registry with the appendages and withdrawable to accommodate the accumulation of additional cartons side by side;

means for causing the transfer of fluent material from the storing means through said spout-like appendages and orifices;

means for driving said pusher means to and fro in reciprocatory movement;

a roll for applying a length of orifice-closure tape over the access orifices of the filled cartons during movement of the filled cartons by the pusher means through the intermediate instrumentality of the empty cartons, said roll having a circumference at least as great as the length of the orifice-closure tape to be applied to a carton;

means for preparatorily holding said lengths of tape in surface contact with the periphery of the roll; and

means for imparting rotation to said roll at a peripheral velocity matching the linear velocity of the cartons for effecting a transfer of the lengths of tape from the roll to the cartons.

2. Apparatus in accordance with claim 1 in which the orifice-closure tape has a coating of heat-energizable adhesive substance on the surface to be applied to the carton and the carton has a coating of heat-energizable adhesive substance at least in the area to which the length of tape is to be applied, and wherein said means for preparatorily holding the lengths of tape in surface contact with the periphery of the roll comprises:

a heat conductive body having a concave surface complementing the convexity of said roll for preparatorily heating the adhesive substance on the lengths of tape and a flat surface disposed above and in close proximity to the upper surface of waiting filled cartons for preparatorily heating the adhesive substance thereon; and

means for heating said heat conductive body.

3. Apparatus in accordance with claim 2 in which: the location of the heat conductive body relative to the location of the fluent material storing means is such that the filled cartons in being moved out of registry with the spout-like appendages of the storing means by the pusher means through the intermediate instrumentality of the empty cartons are moved into heat-receiving association with the heat conductive body.

4. Apparatus in accordance with claim 1 in which: the means for imparting rotation to the roll includes a driving connection establishable between said pusher means and said roll to cause operation of said roll by said carton pusher means.

5. Apparatus in accordance with claim 4 wherein said establishable driving connection comprises:

at least one pinion gear coaxially associated with said roll;

a rack linked to said pusher means for imparting rotation to said pinion gear; and

means for rendering said pinion gear effective to impart rotation to said roll only incident to movement of the pusher means in the direction in which it moves empty cartons into fluent material receiving relation to said fluent material storing means.

6. Apparatus in accordance with claim 5 wherein: the pinion gear is secured to said roll; the rack is so articulated to the pusher means as to accommodate presentation of the rack into and out of operative engagement with the pinion gear; and the means for rendering the pinion gear effective to impart rotation to the roll comprises an instrumentality for presenting the rack in engagement with the pinion gear incident to carton moving movement of the pusher means and for disengaging the rack from the pinion gear incident to withdrawal of the pusher means.

* * * * *

50

55

60

65