Aug. 15, 1950 S. BERGSTEIN 2,519,102

METHOD AND APPARATUS FOR SEALING CONTAINERS

Filed Nov. 22, 1946 6 Sheets-Sheet 1

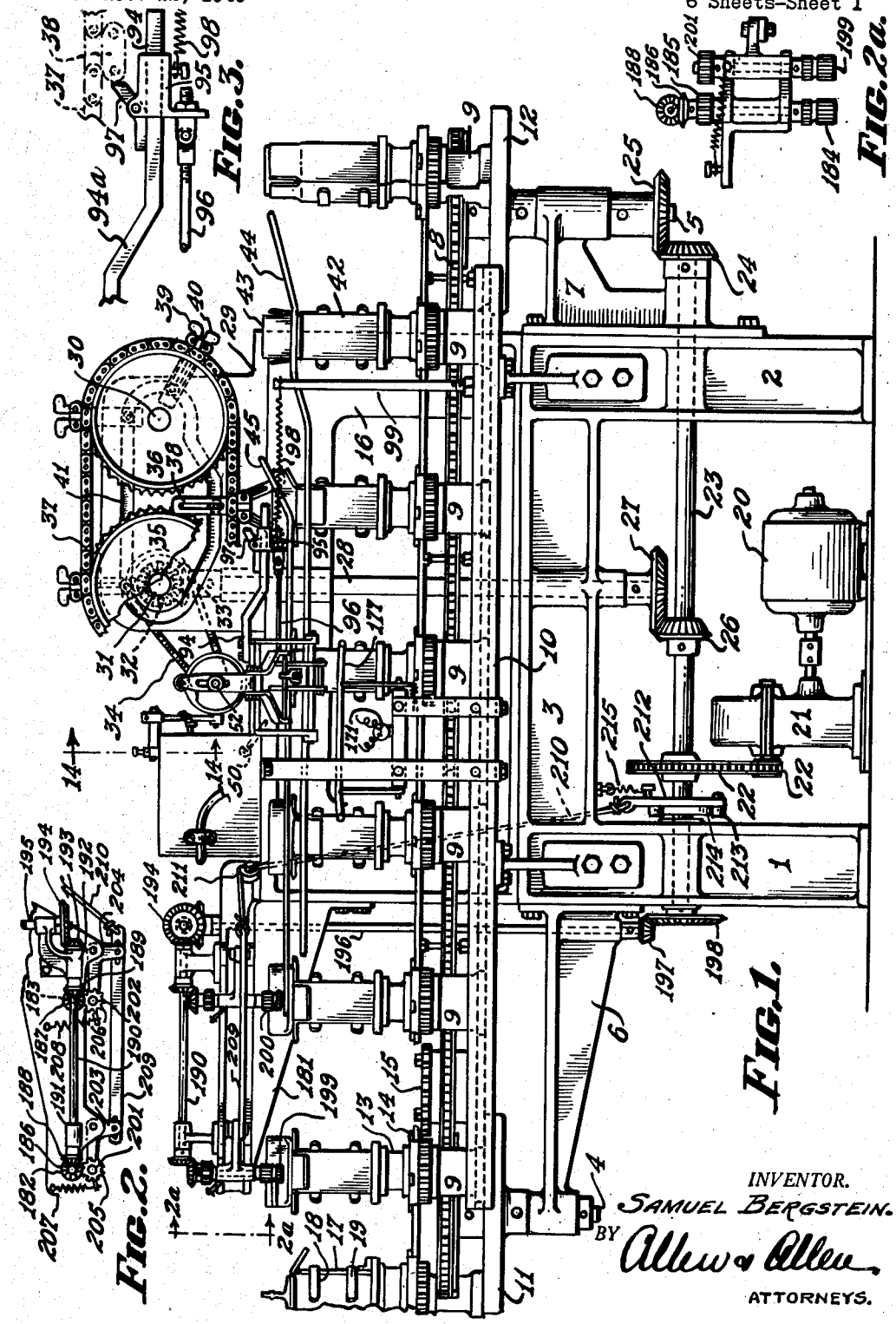


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 2a.

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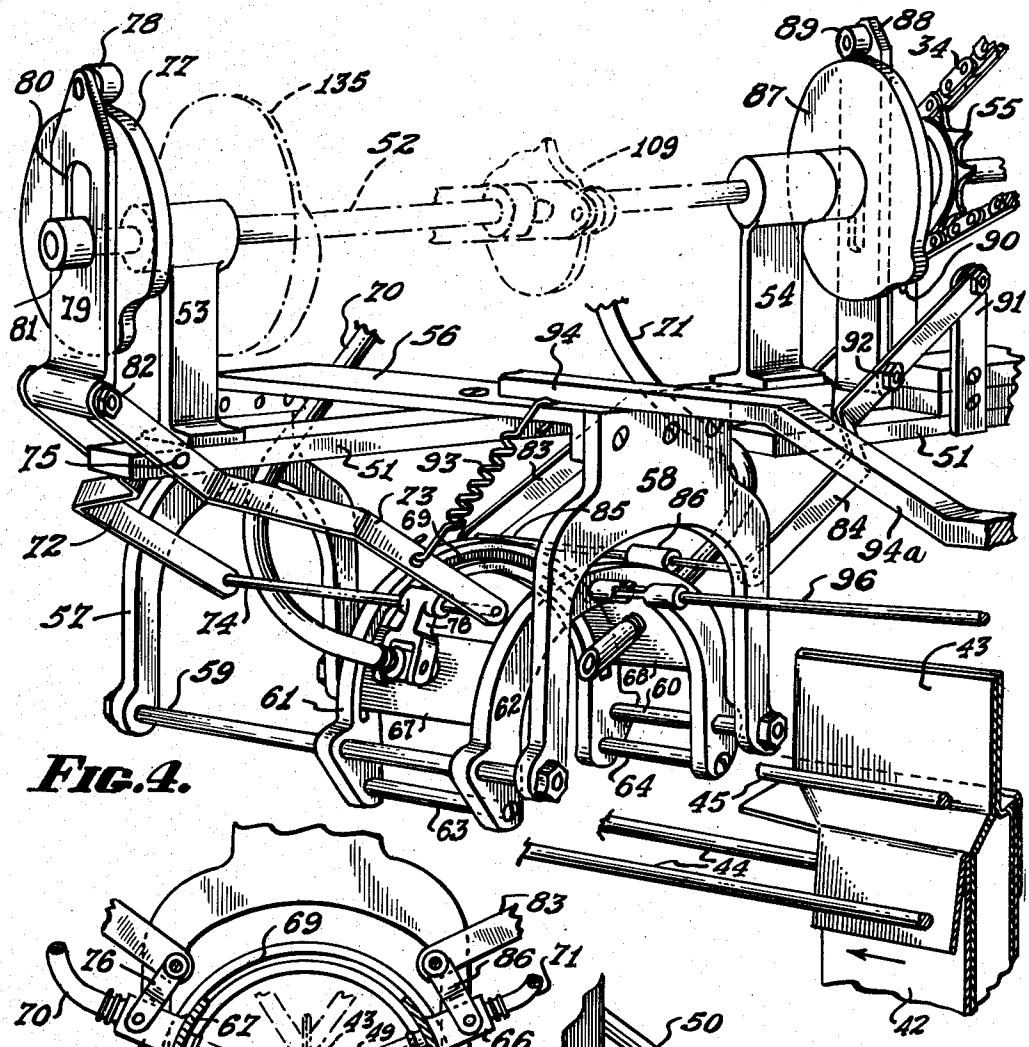


FIG. 4.

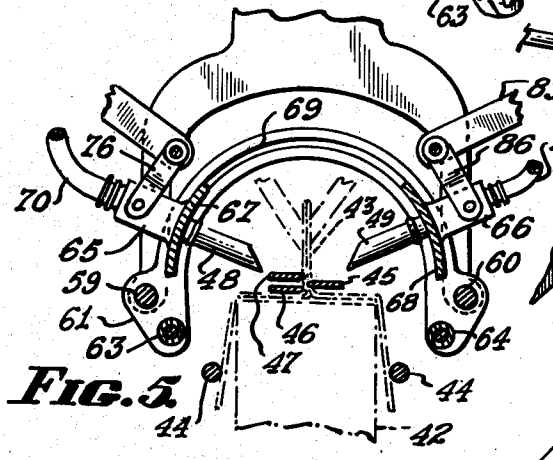


FIG. 5.

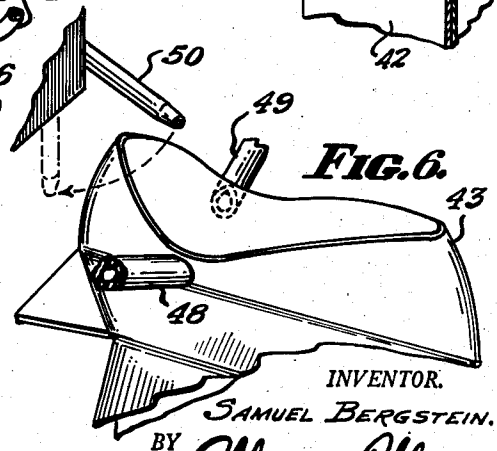


FIG. 6.

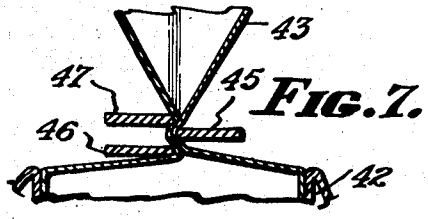


FIG. 7.

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METHOD AND APPARATUS FOR SEALING CONTAINERS

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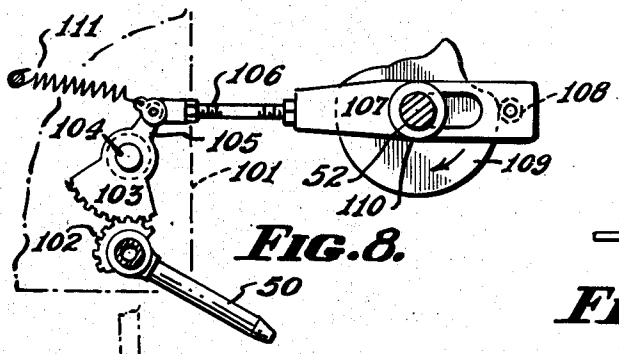


FIG. 8.

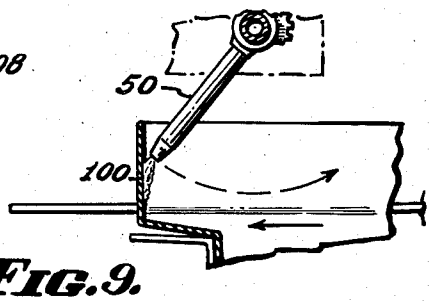


FIG. 9.

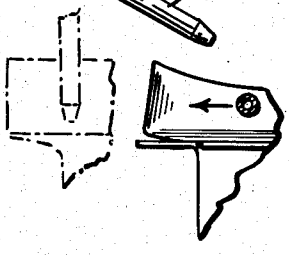
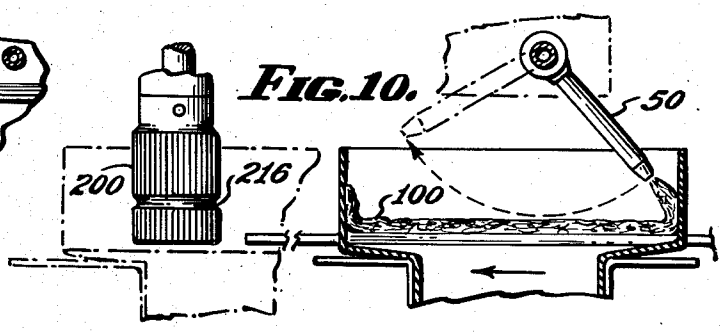


FIG. 10.



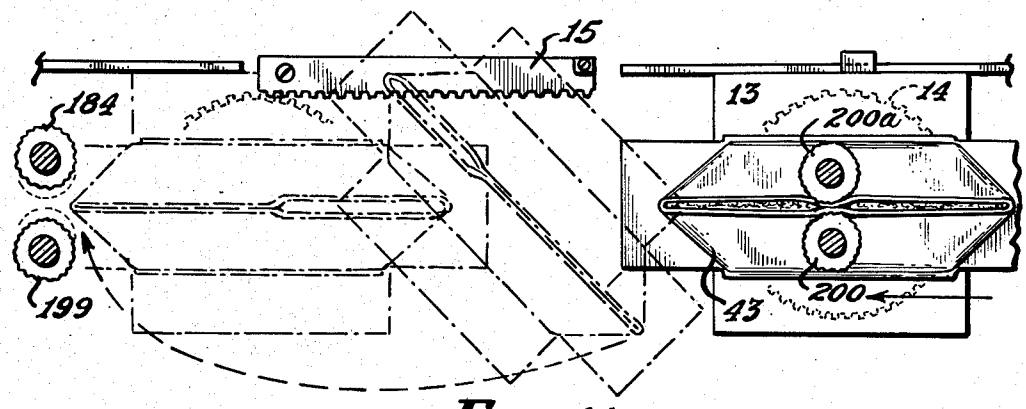


FIG. 11.

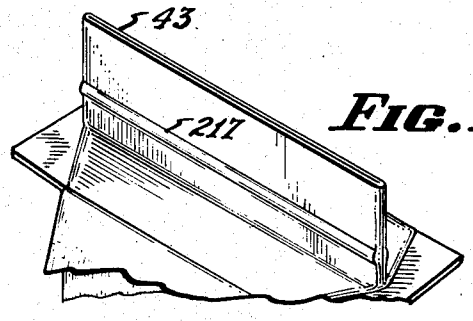


FIG. 12.

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METHOD AND APPARATUS FOR SEALING CONTAINERS

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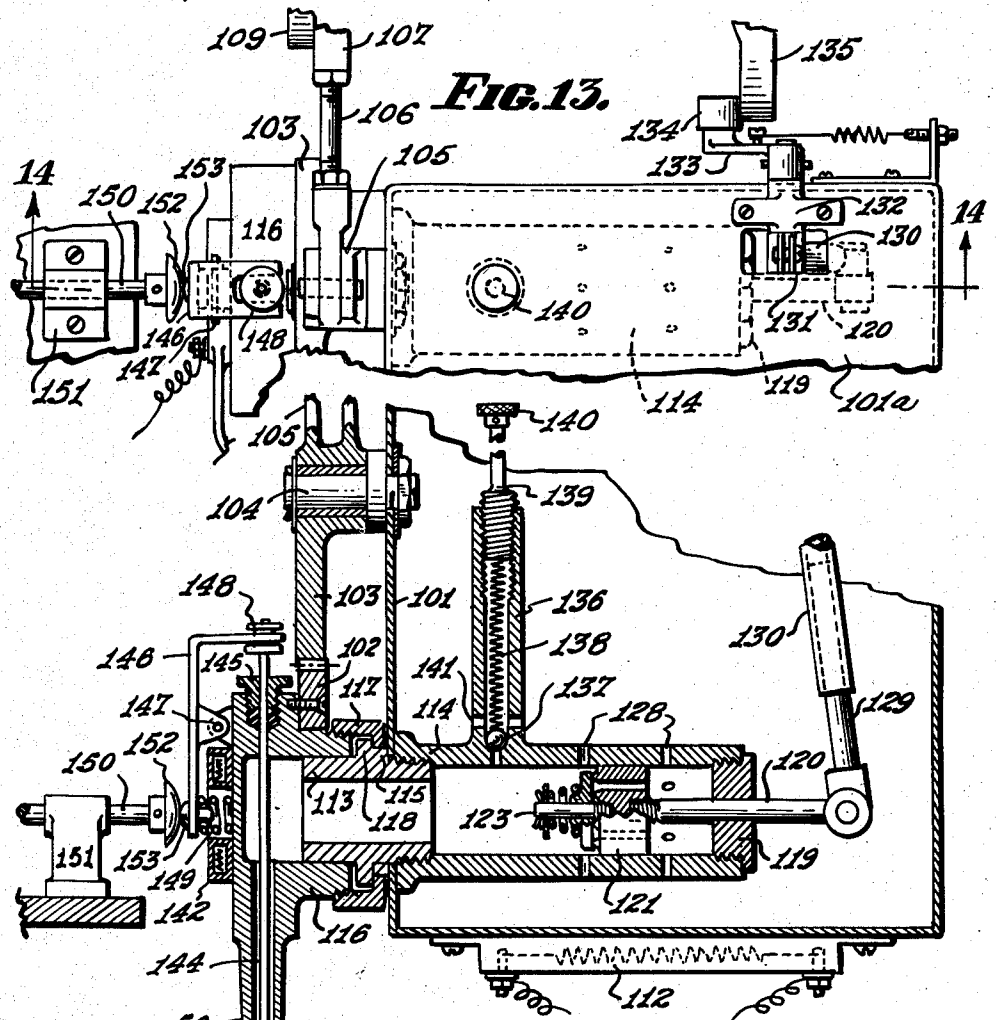


FIG. 13.

FIG. 14.

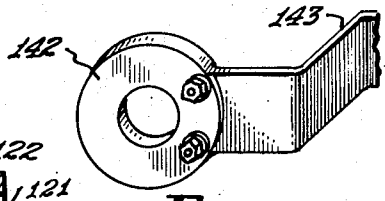


FIG. 17.

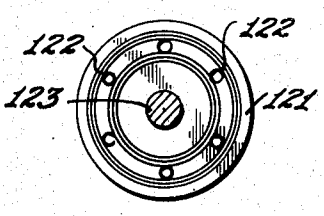


FIG. 16.

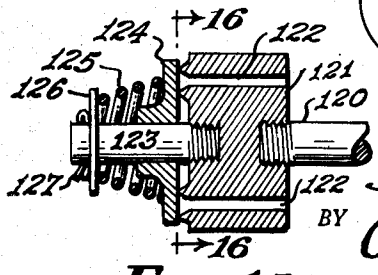


FIG. 15.

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METHOD AND APPARATUS FOR SEALING CONTAINERS

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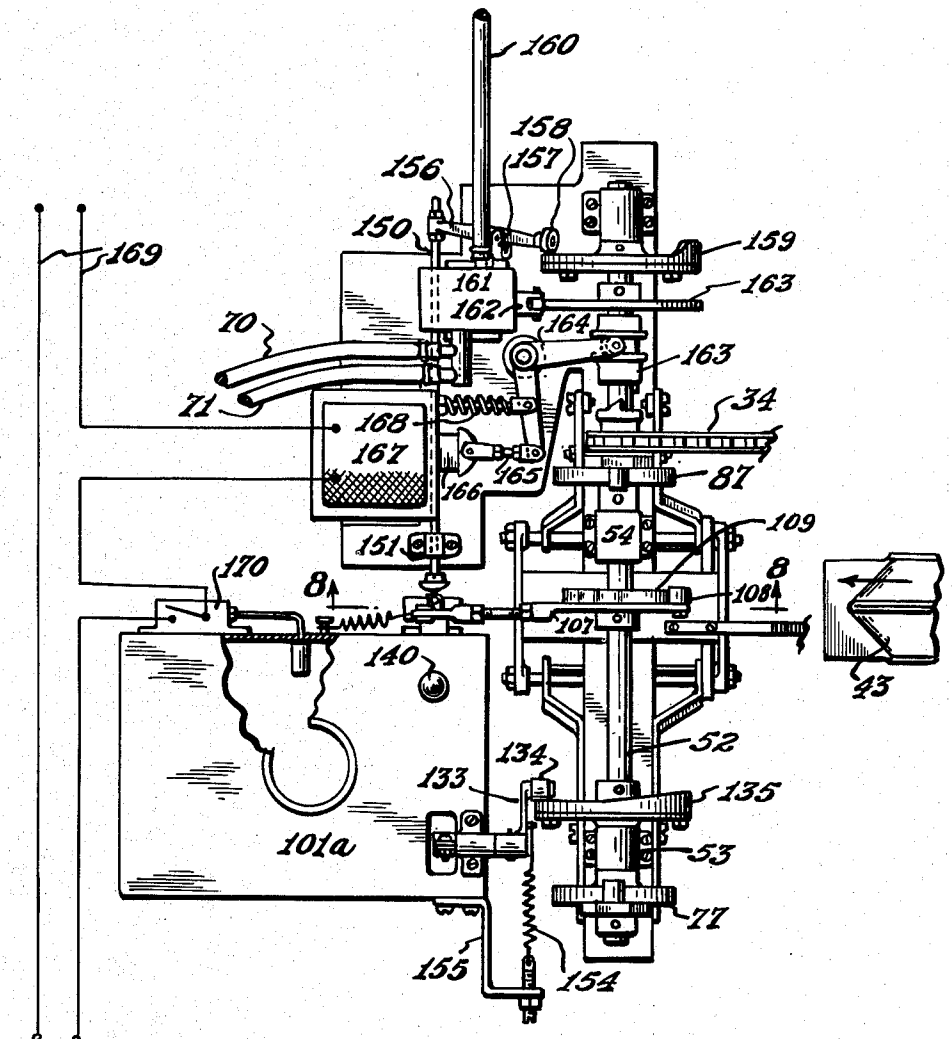
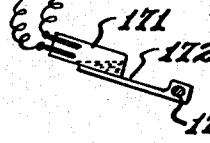


FIG. 18.



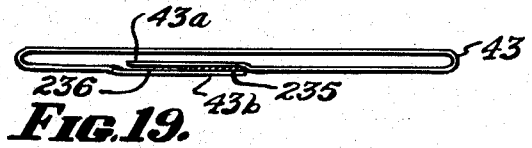


FIG. 19.

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METHOD AND APPARATUS FOR SEALING CONTAINERS

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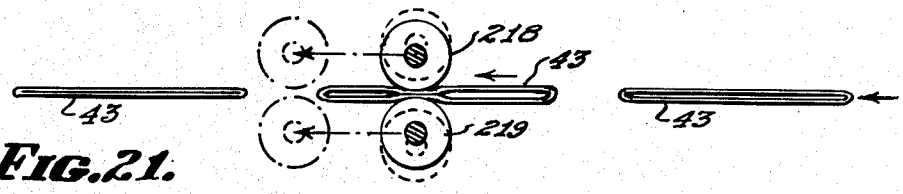


FIG. 21.

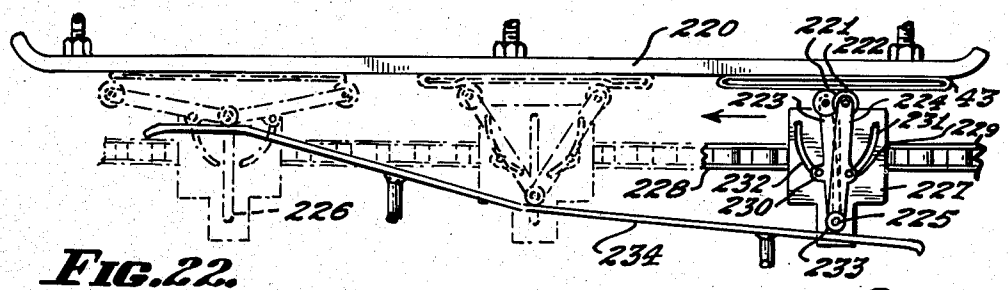


FIG. 22.

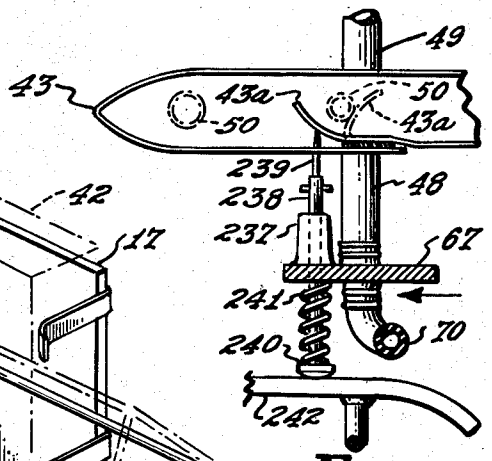


FIG. 20.

FIG. 23.

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Patented Aug. 15, 1950 2,519,102

UNITED STATES PATENT OFFICE

2,519,102

METHOD AND APPARATUS FOR SEALING CONTAINERS

Samuel Bergstein, Cincinnati, Ohio, assignor to Robert Morris Bergstein and Frank David Bergstein, as trustees

Application November 22, 1946, Serial No. 711,625

17 Claims. (Cl. 93—6)

1

In my copending application Serial No. 459,948 filed September 28, 1942, now Patent No. 2,412,862, and entitled Means and Method for Hermetic Bag and Tube Closure, I have described one mode of effecting a sealed closure in flexible walled containers by flattening the mouths thereof, clamping the containers, opening up the mouths beyond the line of clamping, and injecting a sealing substance into the opened mouths. This invention relates to injection sealing, and has for its principal object the provision of improvements in methods and apparatus for injection sealing.

One object of the invention is the provision of means and a method for securing proper distribution in the initial depositing of the injected sealing substance.

Another object of the invention is the provision of means and a method for securing improved ultimate distribution of the injected sealing substance by manipulation.

Still another object of the invention is the provision of means and a method for closing during sealing all passage ways from the interior of the container to the outer atmosphere, which would normally exist in tubular containers as commercially manufactured, in spite of the use of the previously suggested modes of injection sealing.

Other objects of the invention include the provision of improved mechanisms for carrying on all of the various steps involved in the sealing of containers as hereinabove briefly described.

These and other objects of the invention which will be set forth below in these specifications, or will be apparent to one skilled in the art upon reading them, I accomplish by those procedures and in those structures and arrangements of parts of which I shall now describe an exemplary embodiment. Reference is made to the accompanying drawings, wherein:

Figure 1 is a side elevation of my machine with certain parts cut away.

Figure 2 is a partial plan view of a mechanism employed to actuate manipulating rollers.

Figure 2a is an elevational view of the end of the same apparatus elements.

Figure 3 is a detail elevation showing a portion of means which I may employ for causing vacuum spreading elements to travel with a container.

Figure 4 is a perspective view of elements making up the vacuum spreader device, and means for actuating them.

Figure 5 is a sectional view through certain of the apparatus of Figure 4.

Figure 6 is a detail perspective showing a liner

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mouth opened by vacuum means, and the initial relation of an injection spout thereto.

Figure 7 is a partial sectional view of a container showing the mouth of the liner engaged by clamping means.

Figure 8 is a partial elevational view showing an injection nozzle and means for actuating it.

Figures 9 and 10 are elevational views with parts in section illustrating the mode of movement of an injection nozzle during the depositing of the sealing substance.

Figure 11 is a partial plan view illustrating the change in orientation of a container during the steps of manipulating injected sealing substance.

Figure 12 is a partial perspective view of a sealed liner mouth.

Figure 13 is a partial plan view of a container for sealing substance and various operating and adjustment elements associated therewith.

Figure 14 is a partial vertical section showing in particular the nozzle pump and associated parts.

Figures 15 and 16 are respectively a sectional view and an end elevation of a plunger for the pump.

Figure 17 is a partial perspective view of a heating element for the nozzle head, and mounting means for the heating element.

Figure 18 is a partial plan view showing a cam shaft and operating parts associated with it.

Figure 19 is a horizontal section through a liner element showing a passage way or channel normally existing in these elements in spite of the usual sealing operations.

Figure 20 is a partial plan view of elements employed by me to permit closure of the channel aforesaid.

Figure 21 is a diagrammatic plan view illustrating an alternative mode of motion of roller elements in manipulating an injected sealing substance.

Figure 22 is a partial plan view showing another arrangement and mode of actuating manipulating rollers.

Figure 23 is a partial perspective view illustrative of elements coacting to actuate a switch in the event a container is not present in a container-holding cage.

In Figure 1, I have shown a machine having legs or supports 1 and 2 upon which is mounted a main frame 3. The container elements to be operated upon are carried through the machine in cages which move continuously in an elongated path. At each end of the machine I journal vertical shafts 4 and 5 in brackets 6 and 7. The

upper ends of these shafts carry sprockets, around which pass an endless chain 8.

Various carriage elements 9 are fastened to the chain 8 and are moved by it. Side guide elements 10 are provided for the carriage along the sides of the machine; and at the ends of the machine where the carriages follow an arcuate path, they rest upon disc-like elements 11 and 12 fastened to the shafts 4 and 5. Each carriage element 9 has pivoted to it an upper carriage element 13, which is provided with a gear 14. The upper carriage elements bear cages for the containers to be operated upon. Rack elements 15, which may be mounted on the frame of the machine, may be employed to engage the gears 14 and by rotating them (usually through 90°), cause the containers to be presented to operating elements in various orientations from time to time.

The machine has a central upstanding bridge 16 upon which various elements for operating upon the containers are mounted. The machine as thus far described is similar to the machine of Patent No. 2,277,289, to which reference may be made for further details of construction, and for details of the elements for such operations as the closing and securing of carton flaps of a sealed liner end. In this case, I shall describe in connection with a machine of this character those elements which perform the sealing functions to which this invention is addressed; it being understood that other elements for other operations may be included in the machine.

I shall further describe my invention as applied to the exemplary problem of sealing the open ends of tubular liners, which liners are located in paperboard cartons. It will be understood, however, that the principles of the invention may be applied to the sealing of other structures, and in particular the mouths of bags, which may be or may not be included in outer boxes or cartons. I have herein illustrated cages for lined cartons in a simple fashion as comprising an upright 17 and arms 18 and 19 for engaging the cartons. The nature and construction of holding the means for the carton or other structures to be operated upon may be widely varied, and do not form a limitation upon the invention. For some specific constructions of cages, reference may be made to the copending application of myself and Louis J. Van Guelpen, Serial No. 450,704, filed July 13, 1942 and entitled Improved Packaging Method and Means, now Patent 2,443,293, issued June 15, 1948. It may be further pointed out that while I have shown herein elements for effecting a seal at one end of a container, the containers may be up-ended and passed again through the illustrated mechanism for effecting a seal at the other end, or the apparatus elements herein illustrated may be duplicated for the sealing of the other end.

In Figure 1, I have shown an electric motor 20 for driving my apparatus. This is connected to a gear reduction or change-speed apparatus 21, which is connected by a chain drive 22 to a main shaft 23 journaled below the base of the machine. A bevel gear 24 on one end of this shaft meshes with a bevel gear 25 on the vertical shaft 5, and by these means the main chain 8 of the machine is driven, causing the carriages 9 to move through their elongated path as set forth above. Drives for other parts of the machine are also connected to the main shaft 23. A bevel gear 26 on this shaft meshes with a bevel gear 27 on a vertical shaft 28 journaled in the machine frame and in the bridge 16 and serving to drive apparatus elements mounted on the bridge.

Certain of these apparatus elements comprise spreader fingers for the liner ends. In a bracket 29, mounted on the bridge, I journal short horizontal shafts 30 and 31. The latter of these bears a bevel gear 32 meshing with a bevel gear 33 on the horizontal shaft 28. The shaft 31 also bears a sprocket, which is connected by a chain 34 to a sprocket on a cam shaft illustrated in Figure 18 and hereinafter described in detail. The shafts 30 and 31 carry sprockets 35 and 36, around which passes an endless chain 37. Fixtures are mounted at intervals on this chain, the fixtures comprising slotted bodies 38 and slotted spreader fingers 39 and 40. The fixtures and pins engaging in slots in the fingers, and the inner ends of the fingers are pivoted together and provided with a pin which not only engages in the slot in the fixtures 38 but also provides a cam follower riding in a cam track 41 formed in the bracket 29. It will be noted that the lower part of the cam track has a central depression, and the action is such as to depress the spreader fingers and at the same time move their operating ends apart. For a fuller description of this mechanism, reference may be made to my Patent No. 2,277,289, noted above.

It will be understood that, in the particular embodiment shown, containers of the type described are placed in the various cages. The outer cartons forming part of these containers are in squared up or erected condition and are indicated at 42 in the drawings. They are lined cartons; and the projecting ends of tubular liners are indicated at 43. These liners are also squared up because their body portions are adhered to the respective body walls of the cartons, and the tubular liners thus open up when the cartons are erected.

As the cages move along on their carriages, a pair of folding rods, one of which is illustrated at 44, operates to engage and turn outwardly out of the way the then lateral flaps of the cartons; and these rods are continued through all that portion of the machine in which it is desired to hold these flaps out of the way. The moving container next comes beneath that portion of the apparatus involving the spreading fingers as described above. Through the action of the cam track 41 and the fixtures by which these fingers are mounted, the fingers are first caused to move downwardly so as to enter the mouths of the tubular liners. Then traveling with the containers, these fingers spread apart as they descend, flattening the projecting liner mouths and juxtaposing the walls thereof. This flattened condition of the liner mouths is illustrated in a number of the figures of this application.

A result of the flattening operation just described will be to bend the fore and aft flaps of the carton outwardly so that these may be engaged by folding elements, one of which is illustrated in Figure 1 at 45, and which operate to fold and hold the fore and aft flaps in a substantially horizontal plane.

It is desired to clamp or hold together the juxtaposed walls of the end of the tubular liner along a line spaced downwardly from the actual mouth of the liner. While other elements may be employed for this purpose, I find it possible to use the same folding rods for this purpose that I have used for folding and holding the fore and aft flaps. A preferred arrangement is illustrated in Figure 7 where the rod 45 is shown as lying on

one side of the liner end, while spaced rods 46 and 47 lie on the other. The disposition of these rods is such that the liner end 43 is displaced by these rods as shown. Hence, the juxtaposed walls of the liner are held so securely together that the mouth of the liner may be opened up above the line of holding or clamping pressure and material injected into the mouth without encountering the danger of having this material pass the line of holding pressure and enter the actual body of the liner.

Next in my apparatus, I provide means for opening up the mouth of the liner above the line of holding pressure so that a sealing material may be injected into it. This means preferably comprises vacuum elements which, engaging the juxtaposed walls of the liner mouth, then move apart so as to spread these walls to permit the entry of an injection nozzle. This is shown most clearly in Figure 6 where the liner mouth 43 is shown as engaged and spread by vacuum elements 48 and 49, while a nozzle 50, moving in the direction of the dotted arrow is shown as about to enter the liner mouth. During the action of spreading the liner mouth, the vacuum elements 48 and 49 must move along with the liner. After the nozzle has entered the liner mouth, the spreading action is no longer necessary and may be discontinued. It will be understood that the vacuum elements 48 and 49, which may be tubular elements of soft rubber, will release the walls of the liner mouth as soon as they have been disconnected from the vacuum tank or pump and connected to the open air. The mechanism for actuating the vacuum elements will be best appreciated from Figures 4 and 5.

A support 51 extends horizontally from the bridge 16. The cam shaft, hereinabove mentioned, but not otherwise identified, is indicated in Figure 4 at 52, and is journaled in brackets 53 and 54 on the support 51. It carries the sprocket 55 engaged by the chain 34.

A horizontal element 56 is fastened to the support 51 and extends parallel to the bridge 16. From the ends of this horizontal element, fork-like supports 57 and 58 depend. The ends of these supports are interconnected by rods 59 and 60. A pair of horseshoe members 61 and 62 is drilled to accept the rods 59 and 60 and is slidable on them. These horseshoe elements are formed into a frame by means of interconnecting rods 63 and 64, the frame being bodily slidable in the direction of movement of the containers, and reversely.

The vacuum elements 48 and 49, heretofore described, are mounted in tubular holders 65 and 66. These in turn are mounted upon plates 67 and 68. These plates are arcuate in cross section, and the ends of them are engaged in arcuate slots in the horseshoe members 61 and 62. One of these slots is indicated at 69. The holders 65 and 66 are shown as having connection with flexible conduits 70 and 71, by means of which the vacuum elements may be connected with a valve means, hereinafter described, and thence to a vacuum tank or pump, not shown.

It will be clear from Figures 4 and 5 that as the plates 67 and 68 slide upwardly in the arcuate slots 69, they will approach each other, bringing the vacuum elements against the flattened mouth of a liner 43 in the position shown in dotted lines in the latter figure. As the plates thereafter slide away from each other, they will cause the vacuum elements to spread the walls at the mouth of the liner as indicated in Figure 6; and thereafter they may be caused to release the liner mouth.

For moving the plates, I provide a mechanism next to be described. A frame comprising bars 72 and 73 and a connecting rod 74 is pivoted to the support 51 at 75. A forked member 76 has one of its ends pivoted and slidably mounted on the rod 74. Its forked end straddles the tubular member 65 and is pivoted thereto.

The cam shaft 52 bears at its end a cam 77. A cam follower 78 is mounted on a slotted member 79. The shaft 52 passes through the slot 80 in this member, and the member is retained by a collar 81. The lower end of the member is pivoted as shown at 82 to ends of the bars 72 and 73 projecting beyond their pivot point 75. It will be understood how the action of the cam 77 will be to rock the frame comprising bars 72 and 73 and to move the plate 67 through the action of the forked member 76.

On the opposite side of the apparatus I provide a similar frame consisting of bars 83 and 84, the lower ends of which are connected by a rod 85. This rod in turn is connected to the tubular member 66 by a forked link 86. I provide a cam 87 near the opposite end of the shaft 52 and again I provide a slotted, vertically movable member 88 with a cam follower 89 for moving the bars 83 and 84. Because the inner end of the support 51 is not free, I prefer to pivot the bars 83 and 84 at their extreme ends to brackets 90 and 91 on the support 51, and to pivot the vertically movable element 88 to the bars intermediate their ends as shown at 92. The cam 87 is similar to the cam 77 but of opposite hand, i. e., it has a protuberance where the other cam has a depression. Hence, the movement of the frames formed by the bars and rods 72, 73, 74 and 83, 84, 85, is equal and opposite. Spring means such as shown at 93 may be employed to hold the cam followers in contact with the cams.

It will be evident in Figure 4 that the mechanism comprising the frames 61 and 62, together with the vacuum devices 48 and 49 and their appurtenances, is movable by sliding on the rods 59 and 60. When this occurs, the members 76 and 86 can likewise slide on the rods 74 and 85. By moving these elements I can cause the vacuum devices to follow or travel with the cartons in the machine for a sufficient length of time to permit the vacuum devices to open up the end of the liner beyond the line of clamping pressure and to permit the nozzle 50 to enter the open end of the liner. I provide means for moving this structure automatically. A bar 94 (Figure 4) is affixed to the bracket or support 56 and extends toward the portion of the machine where the liner ends are spread. Intermediate its ends the bar 94 is bent downwardly as at 94a. Referring to Figures 1 and 3, it will be seen that a carriage 95 is slidably mounted on the free horizontal end of the bar 94. This carriage is connected with the framework supporting the vacuum members by a push-pull rod 96. This rod will preferably be provided with pivoted joints to prevent binding. The carriage 95 is moved to the left by the fixtures 38 of the spreader mechanism, or by other elements on the chain 37. Instead of engaging the carriage directly, however, such elements engage the upwardly extending end of a lever 97 pivoted on the bracket and having an opposite end lying along the bar 94. When the carriage 95 has been moved the desired distance to the left in Figure 1, the horizontal end of the lever 97 will encounter the upwardly sloping por-

tion 94a of the bar 94. The lever will be moved in a clockwise direction, lowering the upstanding end and bringing it out of contact with the element 38 or other abutment on the chain 37. This will release the carriage, whereupon a spring 98 engaging the carriage at one end and a suitable abutment such as the rod 99 at the other, will return the carriage to the starting position. The carriage construction is detailed in Figure 3. It will be understood that the latch lever 97 will be returned by gravity or by a spring to starting position so as to be engaged by the next abutment on the chain 37.

As hereinabove indicated, when the vacuum devices 48 and 49 open up the liner end, a nozzle for depositing sealing substance swings into it. This nozzle 50, as will hereinafter be more fully described, is pivoted. Its initial position is shown in Figure 6. When it first enters the open liner mouth it swings in a clockwise direction until it comes into a position to deposit sealing substance in the forward end of the liner opening. The direction of this swing is shown by the dotted arrow in Figure 6, and the position of the nozzle at the end of it is illustrated in Figure 9. The movements of the nozzle are coordinated with the movements of the carton and its liner. As soon as the nozzle has reached the position shown in Figure 9 and has deposited sealing substance at the forward end of the liner, it begins a reverse swing in the direction indicated by the dotted arrow in that figure. This, together with the forward movement of the carton, brings the nozzle finally to the position shown in solid lines in Figure 10, where it is depositing the sealing substance 100 at the extreme rear end of the liner mouth. Immediately thereafter, the nozzle begins a return swing in the first direction as indicated by the dotted arrow in Figure 10, until it assumes the position shown in dotted lines in that figure. Then the liner end can pass beneath the nozzle. As soon as the carton and its liner have cleared the nozzle, it then is returned to the initial position shown in Figure 6. Suitable means coordinate the flow of the sealing substance through the nozzle with the movements of the nozzle, as will be described.

The specific means for moving the nozzle are shown in Figure 8. The nozzle is pivoted upon a tank or container 101 for molten sealing substance, and the nozzle bears a gear segment 102 meshing with another gear segment 103, also pivoted on the tank at 104. An extension 105 on the latter gear segment is connected by a rod 106 to a slotted member 107 bearing a cam follower 108. The cam shaft 52 hereinabove described passes through the slot in the member 107. It carries a cam 109, against which the cam follower 108 bears. The member 107 is slidably confined between this cam and a collar 110 on the shaft. The circular portion of the surface of the cam represents the idle portion of the nozzle cycle; and the remainder of the cam is appropriately shaped to bring about the timed series of nozzle movements which has been detailed above. The cam follower is kept against the cam surface through the action of a spring 111.

Referring to Figures 13 and 14, the tank or container 101, which is suitably mounted on the bridge 16 of the machine, is provided with one or more heating devices 112 to keep the sealing material within the tank molten or injectable. At the point where the nozzle is mounted, a nipple 113 passes through a perforation in a wall of the container. A cylindrical fitting 114 on the

inside of the container is threaded onto the nipple, a tight joint with the container wall being obtained by compression between the end of the cylindrical fitting and a shoulder 115 on the nipple.

The nozzle 50 is formed with a hollow hub 116 which passes over the outer end of the nipple and is threaded, engaging a threaded collar 117, having an inturned end wall which is held against another shoulder 118 on the nipple. Packing may be used at this point if desired. In the manner just described, the nozzle is mounted rotatably on the container with its hollow interior in communication with the hollow interior of the cylindrical fitting 114.

The fitting 114 forms the cylinder of a pump to force molten sealing material from the interior of the container out through the end of the nozzle. The fitting is provided with a perforated end plug 119, through which a piston rod 120 passes. This piston rod threadably engages a piston 121, which is detailed in Figures 15 and 16 and which is perforated as shown at 122. A short threaded rod 123 affixed to the piston carries a sliding valve member 124, which is urged against the piston by a spring 125 engaging an abutment washer 126 held at the end of the rod 123 as by a cotter pin 127. The cylindrical fitting 114 is perforated as at 128 to permit the entry of the molten sealing substance, and it will be clear that a stroke of the piston to the left in Figure 14 beyond these perforations will tend to force the molten sealing substance out through the hollow of the nozzle. The piston valve arrangement, which has been described, permits the sealing material to pass through the perforations of the piston upon the return stroke. The piston rod 120 is shown as pivoted to a rod 129 which slides in a tubular lever 130. This lever passes through a perforation in the cover 101a of the container and is there affixed to a shaft 131 journaled in a bracket 132 on the cover, and bearing upon its opposite end a lever 133 with a cam follower 134 bearing against a cam 135 which is on the cam shaft 52. By these means the pump is operated in timed relation to the movements of the lined cartons.

The fitting 114 also has a hollow upward extension 136. The lower part of this extension is formed to provide a set for a ball 137. A spring 138 presses the ball against its set, in turn is controlled by a threaded rod 139 which passes through another perforation in the cover 101a of the container and carries a thumb nut or the like 140. Sidewise perforations 141 in the upward extension 136 permit the ball to act as a relief valve for the molten sealing substance should the passage of this substance through the nozzle be impeded.

To apply heat to the nozzle itself, I prefer to provide an electric heater 142 of circular form (see Figure 17), which by means of a bracket 143 affixed to the container, is held adjacent the hub portion of the nozzle while permitting the nozzle to swing on its pivot. The nozzle is also valved. A rod 144 acting as a needle valve at its end passes through the nozzle and leaves the hub portion thereof through a gland 145. A lever 146 pivoted at 147 on the nozzle hub has a forked end which engages abutments 148 on the end of the rod 144. A spring 149 engages between the lever and the hub, tending to urge the lever to valve closing position. The valve and its lever rotate with the nozzle; but they may be operated in any nozzle position by means of a push rod 150

slidably journaled in a bracket 151 and having a rounded head 152 which engages a similar rounded head 153 on the lever.

Figure 18 shows the cam shaft 52 and the various cams thereon. The cams hitherto described are identifiable by their index numerals. The cam follower 134 is held against the cam 135 by a spring 154 engaging the lever arm 133 and a bracket 155 affixed to the container 101.

The rod 150 which operates the nozzle valve is engaged by one end of a lever 156 pivoted as at 157 on the machine frame and carrying a cam follower 158. This follower bears against a cam 159 which is also affixed to the cam shaft 52 and which operates to control the nozzle flow valve in proper timed relationship with the movements of the machine. The flexible tubes 70 and 71 from the vacuum means are connected to a conduit 160 through a valve means 161. The plunger of this valve means bears against a cam 163 on the cam shaft 50, and in this way the vacuum means are caused to engage and release the walls of the liners 43 at proper timed intervals.

The sprocket 55 which is driven by the chain 34 is preferably affixed to the cam shaft 52 through the agency of a slidable clutch member 163. The clutch member is operated by a forked bell crank 164, pivoted on the machine and connected by a link 165 to the armature 166 of a solenoid 167. A rod and spring arrangement 168, or its equivalent, is employed to urge the bell crank to a position in which the clutch is open when the solenoid is de-energized. Thus, the energization of the solenoid is required for the operation of the cam shaft and all of the various machine operations which it controls.

The solenoid is energized by current from power leads 169, and will be controlled by a starting switch (not shown); but I also locate in the circuit of the solenoid 167 safety devices of various kinds which will operate to break the solenoid circuit upon the occurrence of unfavorable conditions of machine operations. One of these safety devices may be a thermostatic switch 170 which, in thermal contact with the container, will prevent the operation of the cam shaft unless the sealing material is at a proper temperature for use.

It will be clear, if a lined carton fails for some reason to be placed in one of the cages 17 of the machine, the discharge of sealing material from the nozzle should be prevented. I have shown a way of accomplishing this by locating a mercury switch 171 or its equivalent in the circuit of the solenoid, causing it to be actuated by mechanism best seen in Figure 23. Here the mercury switch 171 is carried by a lever 172 affixed to a shaft 173. The shaft is journaled in any suitable bracket means 174 and carries a pair of arms 175 and 176 to which are attached a light rod 177. It will be noted from Figure 23 that the rod 177 is located in such a position with respect to the carton cages 17, as these travel past in the direction of the arrow, that the carton 42 in the cage will raise the rod 177 to the position shown in dotted lines. This results in a lowering of the mercury switch 171 to the position also shown in dotted lines, and a consequent closing of the circuit through the switch. If, however, there is no carton in the cage, the rod 177 will assume the position shown in solid lines. It will be urged to this position by a spring 178 engaging an arm 179 on the shaft 173. The mercury switch 171 will be raised and the circuit, therefore, broken. The arrangement of parts is such that the rod 177 and its supporting arms will not interfere with the other mechanism in any position; and a stop 180 is used to define the lowermost position of the rod 177.

After the molten sealing material has been introduced into the open liner mouth in the way and by the mechanism aforesaid, I provide means for manipulating walls of the liner mouth so as to spread the sealing medium and insure an hermetic seal. These means are in the nature of rollers engaging the outer surfaces of the walls of the liner mouths. Since points of weakness in sealing may occur at the extreme ends of the flattened liners, I find it preferable to roll the liner walls progressively from the mid liner section to the ends thereof. There are several ways in which this may be accomplished. Reference is now made to Figures 1, 2 and 2*a*. In a bracket 181 on the machine bridge 16, I journal shafts 182 and 183. At their lower ends, these shafts carry rollers, one of which is indicated at 184 in Figure 2*a*. Intermediate their ends these shafts carry gears, one of which is indicated in the same figure at 185. At their upper ends, the shafts carry bevel gears 186 and 187. These gears mesh with bevel gears 188 and 189 on a shaft 190 journaled in brackets at 191 and 192. A bevel gear 193 meshes with another 194, on a horizontal shaft 195, which in turn is connected by bevel gearing to a vertical shaft 196. Bevel gears 197 and 198 connect the vertical shaft to the main drive shaft 23 of the machine.

The companion pressing rollers 199 and 200 are mounted on shafts 201 and 202, which are journaled in bell cranks 203 and 204. The upper ends of the shafts carry spur gears 205 and 206 which are capable of meshing with the spur gears 185 on the shafts 182 and 183. Springs 207 and 208 urge the bell cranks into such position that the pressing rollers will be brought together; and regulation of the springs will permit regulation of the pressing force. The bell cranks 203 and 204 are interconnected by a linkage 209. I have shown a cable 210 attached to the linkage which, passing over a sheave 211, extends downwardly and is attached to a slotted bar 212 slidably mounted on the shaft 23. The bar has a cam follower 213 which engages a cam 214 on the shaft. A spring 215 keeps the cam follower in contact with the cam. It will be evident a pull upon the cable will result in moving the pressing rollers 184, 199, etc. apart, while release of the cable will permit them to move together under spring pressure.

As best seen in Figure 10, the pressing rollers are preferably grooved as at 216, so as to form a bead of sealing substance as shown at 217 in Figure 12. This assists in the distribution of the sealing substance and makes for a more positive seal. Since the rollers are driven, they may also be fluted vertically (Figure 10) so as to increase their frictional contact with the walls of the liner mouth.

When the liner mouths have been flattened, clamped by the rods 45, 46, and 47, opened up by the vacuum devices, and injected with sealing substance, the pressing and distributing action occurs which will be best appreciated in Figure 11. The liner 43 comes into the position shown in solid lines at the right, while the pressing rollers 200 and 200*a* lie apart. Then these rollers, through the action of the mechanism hereinabove described, come together at about the mid-section of the liner end. They are driven, and the lined carton is also being moved by the cage in the direction of the solid arrow in this figure.

The result is a rolling and distribution of the still softened sealing material from the mid-section of the liner mouth toward the trailing end thereof. Next the gear 14 on the cage base 13 engages the rack 15 on the frame and the entire cage, with the carton and liner, is rotated through 180° on a vertical pivot, as will be clear from the showings in dotted lines in Figure 11. The former trailing edge is now the leading edge, and is about to pass between the separated rolls 184 and 189 of the second set. These rollers will come together at about the mid-section of the liner mouth and complete the rolling and distribution of the sealing substance by rolling the unrolled portion of the liner end. During or immediately following the rolling operation, the sealing substance will have set; the seal is now effected, and the liner end may be folded and the carton may be closed by methods and mechanism hitherto known in the art and set forth in patents referred to above.

Other ways of pressing and distributing the sealing substance may be employed. In the showing of Figure 21, a pair of pressing rollers 218 and 219 are first brought together as shown near the mid-section of the liner end. Then the shafts upon which these rollers are mounted are first moved forwardly in the direction of the solid arrows at a speed faster than the speed of travel of the liner. This will result in rolling the liner from its mid-section to its forward end. Thereupon, the movement of the roller shafts in a forward direction is halted, the rotation of the shafts reversed, and the liner will be rolled in one operation from the leading end to the trailing end.

In Figure 22, I have shown a mechanism in which the liners travel along a bar 220. A pair of pressing rollers 221 and 222, located on the other side of the liners, is mounted on levers 223 and 224. At their opposite ends, these levers are pivoted together at 225 by means of a pin which travels in a longitudinal slot 226 in a plate 227. The plate is fastened to a chain 228 which moves the mechanism along with the liners. Intermediate the length of the levers, they are provided with pins 229 and 230, which ride in arcuate slots 231 and 232 in the plate 227. A roller or cam follower 233 on the pin 225 engages a cam bar 234. The action of this bar is to move the roller 233 toward the liners, resulting in a spreading of the levers 223 and 224 so that the rollers 221 and 222 roll the liners from their mid-sections toward their ends as will be clear from the dotted line showing in Figure 22.

In Figure 19, I have shown in flattened form the end of a liner 43 which has been formed by tubing a strip of suitable material so that its ends 43*a* and 43*b* are lapped and are joined by a strip of suitable adhesive 235. In commercial tubing operations it is not always feasible to apply the adhesive in such a fashion that it comes out to the very edge of the portion 43*a*. As a consequence, there may be along the seam a more or less continuous area where the sheet portions are lapped without the interposition of adhesive. This is shown in a somewhat exaggerated fashion at 236 in Figure 19. In spite of the distribution of the sealing substance by rolling as aforesaid, it is not always certain that the sealing substance will flow between lapped but unjoined portions of the liner. If not, it will be evident that a channel will remain at 236 leading from the outer atmosphere through the seal to the interior of the liner. I prefer, therefore, to provide a means for positively introducing sealing substance into the aforesaid channel.

These means are detailed in Figure 20. Here the mouth of the liner 43 is being opened by the vacuum means 48 and 49 preparatory to the introduction of the nozzle 50. It will be remembered that the walls of the liner mouth are held together below the opened portion by the rod members 45, 46, and 47, or other clamping means. In a boss 237 on the mounting plate 67, I slidably mount a rod 238 which bears a perforating point 239 at one end. The other end of the rod carries a head 240; and the rod is urged outwardly by a spring 241. A cam bar 242 operates to move the rod inwardly because of the adjacent support furnished by the vacuum member 48, the point 239 is able to perforate the wall of the liner as shown; but it simply pushes inwardly the unattached portion 43*a* because this portion is unsupported. As the nozzle enters the liner and starts on that movement which is illustrated in Figure 9, it will engage behind the displaced portion 43*a* and move it to the position shown in dotted lines in Figure 20. The result will be a depositing of the molten sealing substance both beneath and above the unattached portion 43*a*, as will be clear, and a dependable seal will result. The point 239 will, of course, be withdrawn after the nozzle has engaged behind the portion 43*a*.

When the injected sealing substance is at the time of initial displacement thinly fluid, it is advantageous to apply rolling pressure toward the free flap 43*a*. This has an effect in squeezing the sealing substance into the space between this flap and the outer wall of the liner. It may be accomplished in a rolling system such as illustrated in Figures 1, 2, and 2*a* by so making the bag or liner that the longitudinal seam lies well to one side of the mid-section of the bag or liner with the free flap 43*a* directed toward the mid-section.

I have spoken hereinabove of molten sealing substance. I prefer to use a heat softenable substance because it congeals by cooling and does not involve the elimination of a solvent. I am not, however, so limited, and may use any of the solvent softened adhesives. A promising class of adhesives or sealing substances is that of the latices or water dispersions of rubbery or resinous materials or both. Here a high degree of fluidity can be obtained with a very high content of solvents. Also the pressure applied by the manipulating rollers will in many instances press the water vehicle out of the mass to the extent of bringing about a sufficient initial adhesion or setting up, prior to actual volatilization of the vehicle. When using any of the available sealing adhesives I am not limited to any particular consistencies at the time of injection. The material may be plastic but not freely flowable as injected or it may be heated or otherwise softened to a highly fluid condition, the latter being preferred in many instances, especially where there is a problem of closing an unadhered inner portion of a longitudinal seam in the liner. Nor is my invention limited as to the substance of the sealing adhesive, this being selectable in the light of the particular qualities of proofness desired in the closure.

Modifications may be made in my invention without departing from the spirit of it. Having thus described my invention in an exemplary em-

bodiment, what I claim as new and desire to secure by Letters Patent is:

1. A method of closing and sealing a flexible tubular structure which comprises juxtaposing wall portions thereof and holding said portions together along a line spaced from the end of said structure, opening up the wall portions beyond said line of holding, injecting a softened sealing substance between the walls, and distributing the said substance by rolling the walls together, the said rolling being done from the mid-section of said walls toward outlying end portions.

2. A process of closing and sealing tubular structures which comprises juxtaposing wall portions of said structures, injecting a sealing substance between the juxtaposed walls, then rolling the walls together to distribute said substance the rolling being effective in direction from the mid-section of the juxtaposed walls toward and beyond outlying portions thereof.

3. The process of closing and sealing tubular structures which comprises juxtaposing the walls thereof and holding the said walls together along a line spaced from the end of the structures, opening up the walls beyond the line of holding, injecting sealing substance between said walls, rolling the outer surfaces of said walls at the mid-section thereof and rolling said walls in one direction, thereafter reversing the structure bringing rolls together against the outer surfaces of said walls at the mid-section and rolling said walls in the opposite direction.

4. A process of closing and sealing a tubular structure which comprises moving the structure in a path, flattening the walls thereof to juxtapose them in a fin extending in the direction of said movement, holding said walls together along a line spaced from the end of said tubular structure, opening up said walls beyond the line of holding, injecting sealing substance therein, and during a continuation of said movement bringing pressing rolls against said walls at their mid-section and rolling said walls in a direction contrary to their direction of movement, thereafter turning said structure so as to reverse the effective direction of movement, bringing rolls against said walls at the mid-section and rolling the remainder of the walls, so as to distribute the sealing substance.

5. A process of closing and sealing a tubular structure which comprises moving the structure in a path, flattening the walls thereof to juxtapose them in a fin extending in the direction of said movement, holding said walls together along a line spaced from the end of said tubular structure, opening up said walls beyond the line of holding, injecting sealing substance therein, and during a continuation of said movement bringing pressing rolls against said walls at their mid-section and rolling said walls in a direction contrary to their direction of movement, thereafter turning said structure so as to reverse the effective direction of movement, bringing rolls against said walls at the mid-section and rolling the remainder of the walls, so as to distribute the sealing substance, and forming a bead in the distributed sealing substance by the use of grooved rolls.

6. A process of closing and sealing a tubular structure which comprises moving the structure in a path, flattening the walls thereof to juxtapose them in a fin extending in the direction of said movement, holding said walls together along a line spaced from the end of said tubular structure, opening up said walls beyond the line of holding, injecting sealing substance therein, and rolling the flattened walls of said tubular structure so as to distribute the sealing substance therein by bringing rolls against the mid-section of said flattened walls and effectively causing said rolls to roll the flattened walls in directions away from said mid-section.

7. A process of closing and sealing a tubular structure which comprises moving the structure in a path, flattening the walls thereof to juxtapose them in a fin extending in the direction of said movement, holding said walls together along a line spaced from the end of said tubular structure, opening up said walls beyond the line of holding, injecting sealing substance therein, and during a continuation of said movement bringing a pair of rolls together against the outer surfaces of said walls, moving said rolls ahead faster than the movement of the tubular structure so as to roll the juxtaposed walls in a forward direction from the mid-section, and thereafter passing the juxtaposed walls entirely through the rolls so as to roll them in an opposite direction from the mid-section.

8. A process of closing and sealing a tubular structure having a lapped, adhesively secured longitudinal seam, there being a free flap of unsecured material within the tube, said process comprising the steps of juxtaposing the walls of said structure, holding the walls together along a line spaced from the end of the structure, opening up said walls beyond said line and injecting a sealing substance between the opened walls by means of a nozzle having movement relative to said walls, and displacing said flap inwardly from the wall at which it is attached so as to permit said nozzle to deposit sealing substance behind said flap.

9. A process of closing and sealing a tubular structure having a lapped, adhesively secured longitudinal seam, there being a free flap of unsecured material within the tube, said process comprising the steps of juxtaposing the walls of said structure, holding the walls together along a line spaced from the end of the structure, opening up said walls beyond said line and injecting a sealing substance between the opened walls by means of a nozzle having movement relative to said walls, and displacing said flap inwardly from the wall at which it is attached so as to permit said nozzle to deposit sealing substance behind said flap, said displacement serving to bring said flap into the path of movement of said nozzle and causing said nozzle further to displace said flap during its movement and afterward to release said flap.

10. A process of closing and sealing a tubular flexible structure which comprises flattening and juxtaposing walls of said structure to form a fin, holding said walls together along a line spaced from the end of the structure, opening up said walls beyond said line, injecting sealing material between said walls, and thereafter distributing said sealing material by rolling pressure applied to external surfaces of said walls, said pressure being applied from the mid-section of said fin toward and to the ends of said fin so as to force the sealing material into the ends of said fin.

11. In a machine of the character described, means for holding and moving a tubular flexible structure in a path, means for flattening the walls of said structure, means for holding said walls together along a line spaced from the end of said structure, means moving with the structure for opening up the walls beyond said line, a nozzle pivoted in a fixed position, means for mov-

ing said nozzle about its pivot so as to turn it into the space between the opened walls and cause it to move so as to distribute a sealing substance all along said line of holding and thereafter to turn said nozzle out of the way, and coordinated means for controlling a flow of sealing substance through said nozzle in accordance with its movements, a pair of rolls, means for moving said rolls to bring them into contact with the flattened walls at their mid-section, means for causing said rolls to roll the flattened walls toward the rear, means for reversing the position of said flattened walls, a second pair of rolls, means for bringing the second pair of rolls against the mid-section of the flattened walls and means for causing said rolls to roll said walls rearwardly whereby to roll the previously unrolled portions thereof.

12. In a machine of the character described for closing and sealing flexible tubular structures, means for moving a flexible structure with the ends of its walls juxtaposed and sealing material positioned therebetween, spaced pairs of rolls, means for driving said rolls, means coordinating with the movements of the said tubular structures to bring said rolls together against the mid-section of the walls thereof and means intermediate the pairs of rolls for reversing the positions of the tubular structures.

13. In a machine of the character described for closing and sealing flexible tubular structures, a container for sealing substance, a hollow nozzle pivoted to said container, a pump within said container and connected to said nozzle, means for operating said pump, means for operating said nozzle by swinging it about its pivot, means for moving tubular structures in a path beneath said nozzle, and means for coordinating the operating means for said pump and for said nozzle with the movements of said tubular structures.

14. In a machine of the character described, a container for heating sealing substance, a hollow nozzle pivoted on said container, a pump within said container in communication with a hollow nozzle, means for operating said pump to eject material from the container through the hollow nozzle and means for swinging said hollow nozzle on its pivot.

15. In a machine of the character described, a container for heating sealing substance, a hollow nozzle pivoted on said container, a pump within said container in communication with the hollow nozzle, means for operating said pump to eject material from the container through the hollow nozzle and means for swinging said hollow nozzle on its pivot, valve means for said nozzle comprising a needle valve rod passing therethrough,

operating means for said rod mounted on said nozzle and having an end located for actuation along the axis of the pivot of said nozzle, and relief valve means in connection with said pump.

16. In a machine of the character described, means for opening up beyond a line of pressure the juxtaposed walls of a moving flexible tubular structure, said means comprising a frame, means slidably mounting the frame for travel with a tubular structure, means for causing the frame to travel with said tubular structure, movable mounting means on said frame, vacuum elements on said mounting means and means effective despite the movement of said frame for bringing said vacuum elements together against the juxtaposed walls of a tubular structure and then moving them apart whereby to separate said walls, said tubular structures having lapped adhesively secured longitudinal seams characterized by a free internal flap, one of said mounting means carrying a movable perforating means adjacent its vacuum element, and means for moving said perforating means to cause it to puncture one of said walls and engage the said flap, displacing it so that an injecting sealing material can get behind it.

17. In a machine of the character described, means for holding and moving tubular flexible structures, means moving with said structures for juxtaposing the walls thereof at an end, means engaging said walls along a line spaced from said end to hold them together, means moving with the structures for opening up the walls beyond said line of holding, a pivot nozzle for injecting a sealing substance between the opened walls, a spaced pair of rolls, means for bringing said rolls together, means for driving said rolls, means for reversing the position of said tubular structure located intermediate said rolls, and means for coordinating the movements of said several instrumentalities.

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