Sept. 18, 1956 C. L. DAY ET AL 2,763,107

METHOD AND APPARATUS FOR SEALING CONTAINERS

Filed May 14, 1954 6 Sheets-Sheet 1

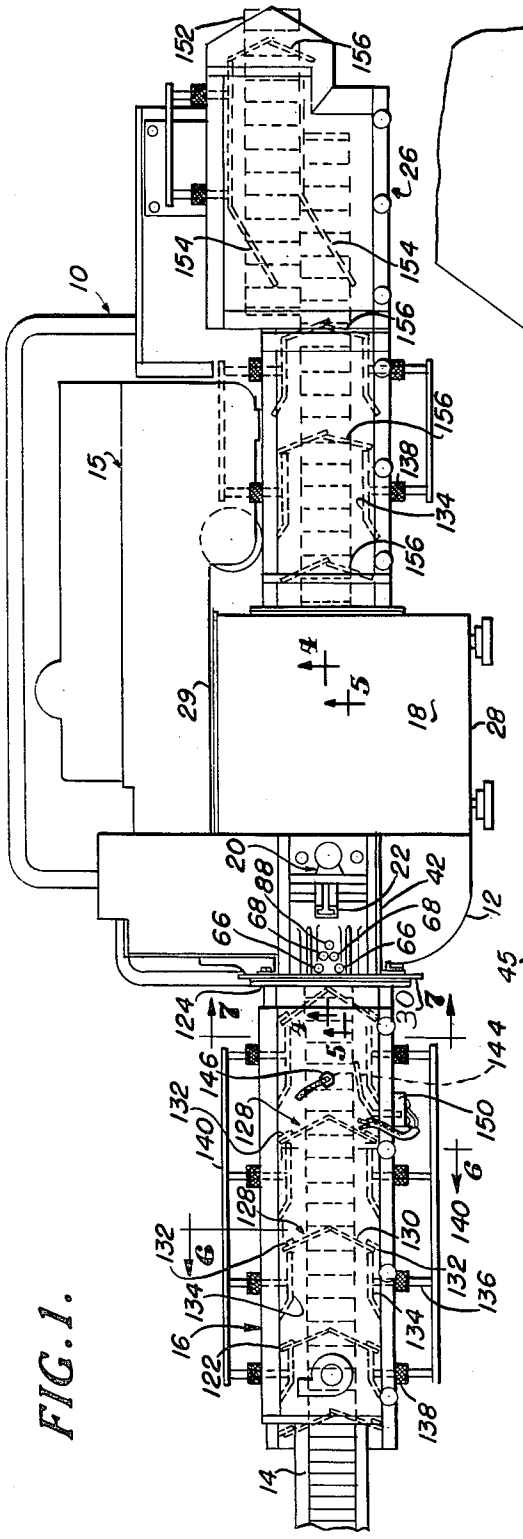


FIG. 1.

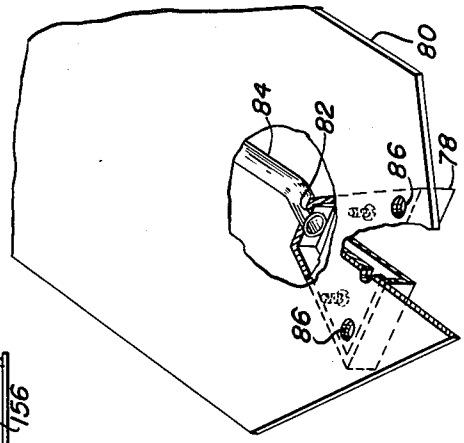


FIG. 9.

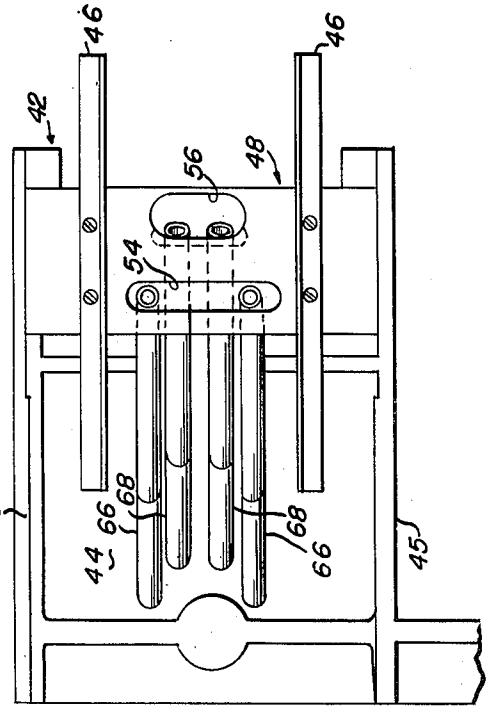


FIG. 8.

INVENTORS
Carl L. Day
Ransom C. Albrecht
Frederick E. Fauth

BY Cushman, Darby & Cushman
ATTORNEYS

Sept. 18, 1956 C. L. DAY ET AL 2,763,107

METHOD AND APPARATUS FOR SEALING CONTAINERS

Filed May 14, 1954 6 Sheets-Sheet 2

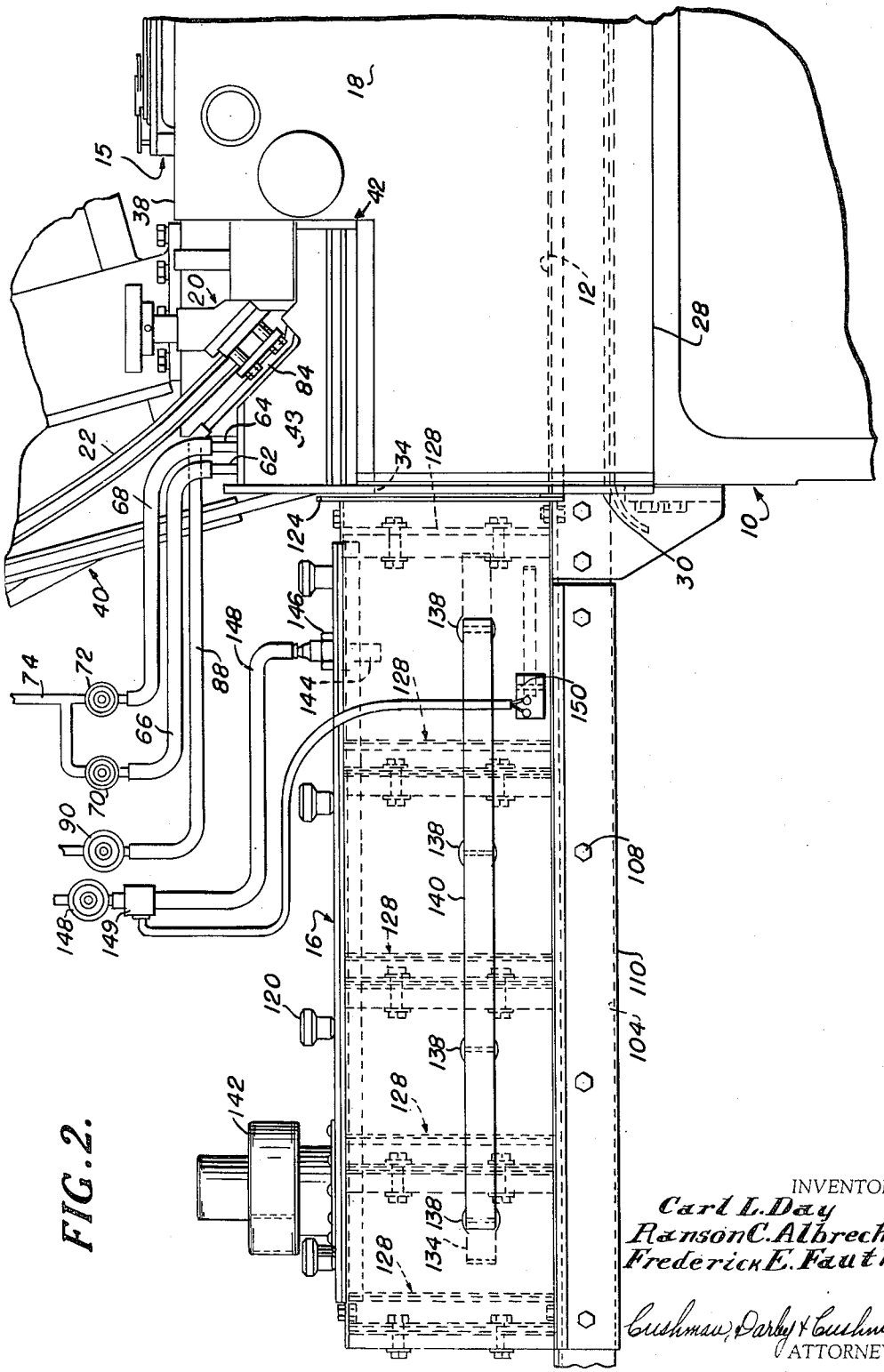


FIG. 2.

INVENTORS
Carl L. Day
Ranson C. Albrecht
Frederick E. Fauth

Cushman, Darby & Cushman
ATTORNEYS

Sept. 18, 1956 C. L. DAY ET AL 2,763,107

METHOD AND APPARATUS FOR SEALING CONTAINERS

Filed May 14, 1954 6 Sheets-Sheet 3

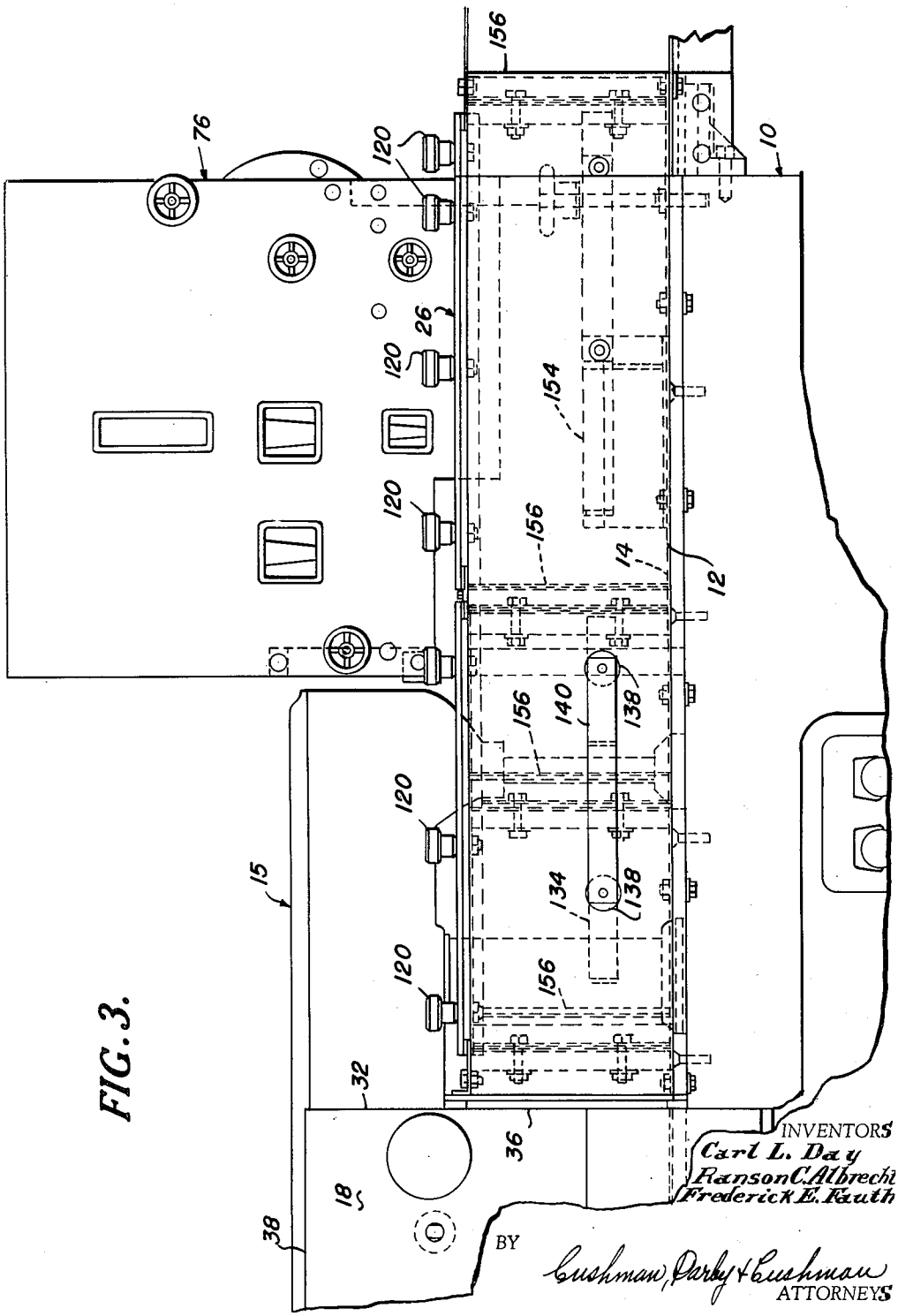


FIG. 3.

INVENTORS
Carl L. Day
Ranson C. Albrecht
Frederick E. Fauth

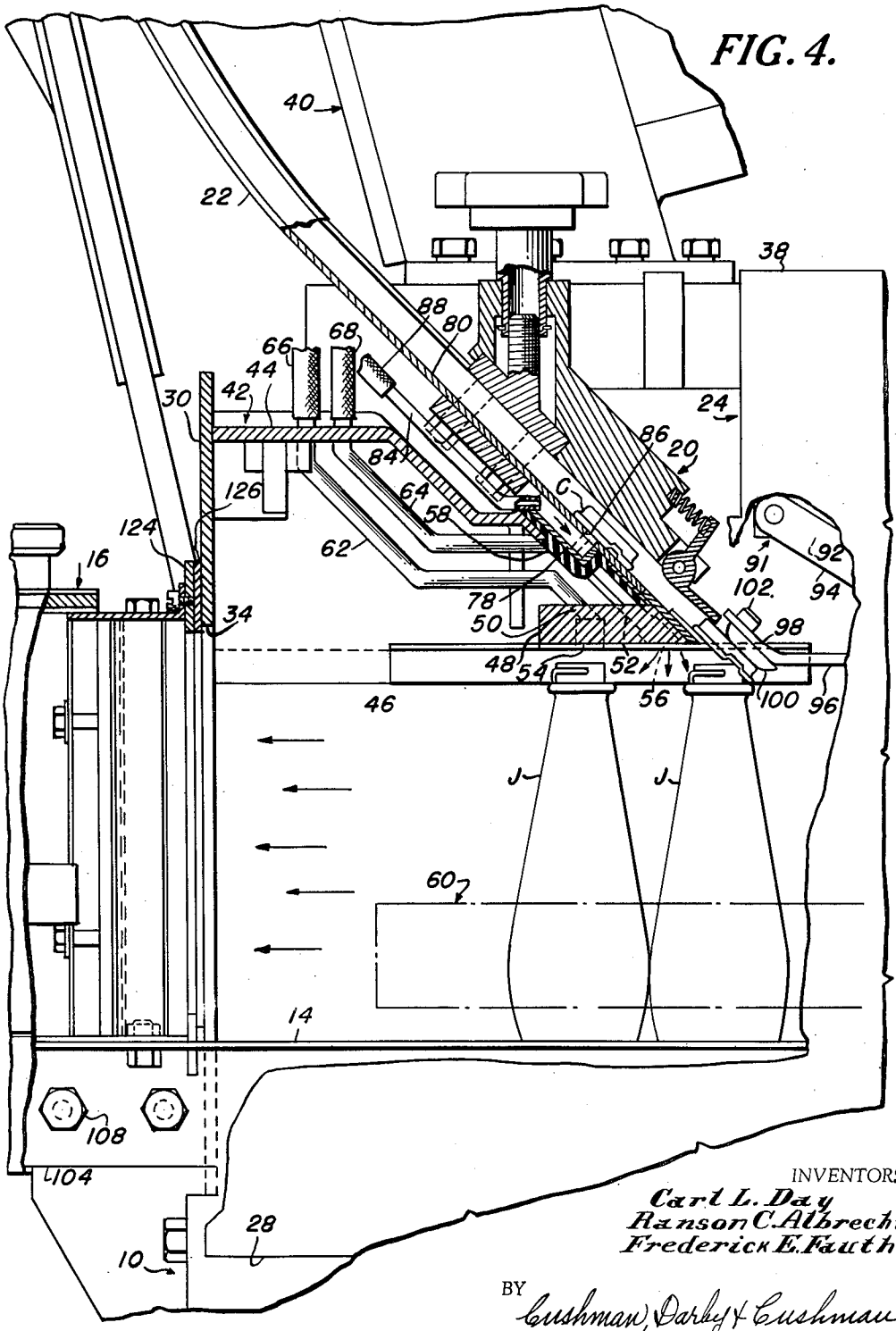
BY Cushman, Darby & Cushman
ATTORNEYS

Sept. 18, 1956 C. L. DAY ET AL 2,763,107

METHOD AND APPARATUS FOR SEALING CONTAINERS

Filed May 14, 1954 6 Sheets-Sheet 4

FIG. 4.



INVENTORS
Carl L. Day
Ranson C. Albrecht
Frederick E. Fauth

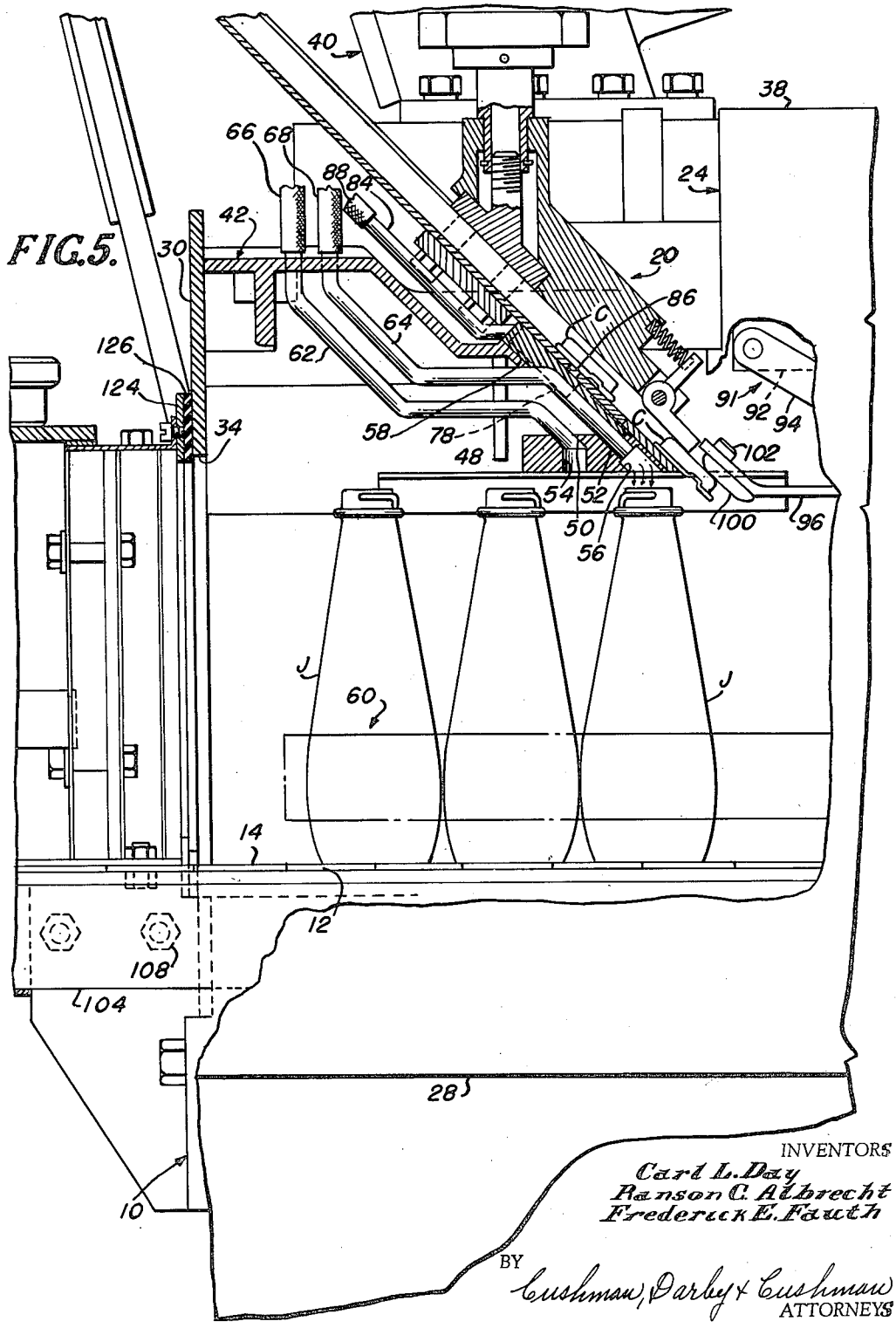
BY Cushman, Darby & Cushman
ATTORNEYS

Sept. 18, 1956 C. L. DAY ET AL 2,763,107

METHOD AND APPARATUS FOR SEALING CONTAINERS

Filed May 14, 1954 6 Sheets-Sheet 5

FIG. 5.



INVENTORS:
Carl L. Day
Ranson C. Albrecht
Frederick E. Fauth

BY
Cushman, Darby & Cushman
ATTORNEYS

Sept. 18, 1956 C. L. DAY ET AL 2,763,107

METHOD AND APPARATUS FOR SEALING CONTAINERS

Filed May 14, 1954 6 Sheets-Sheet 6

FIG.6.

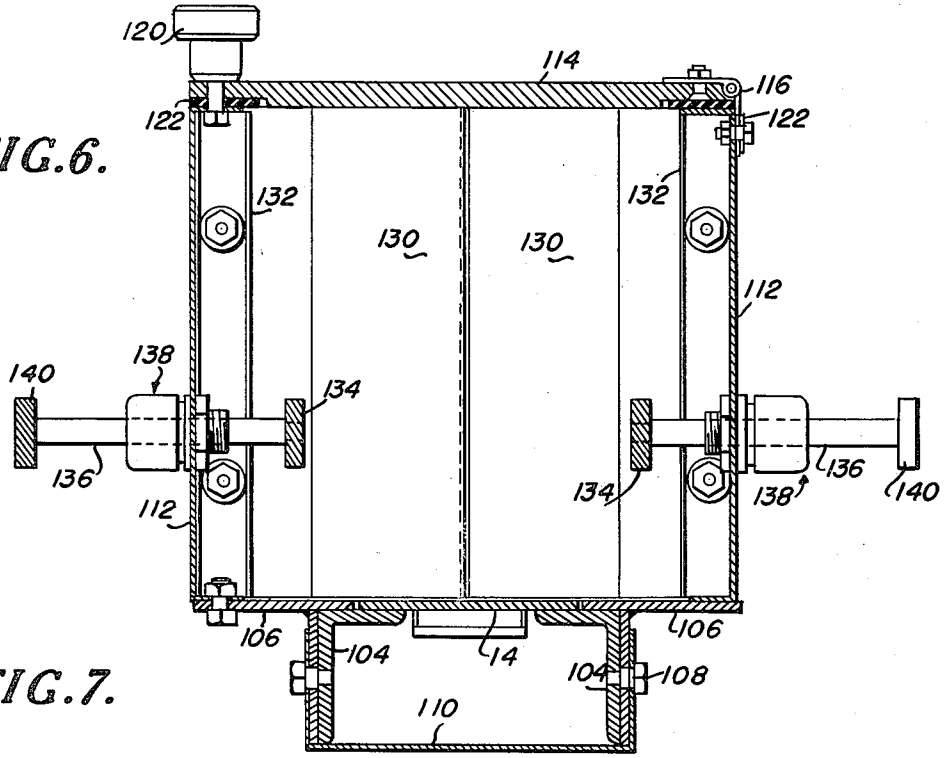
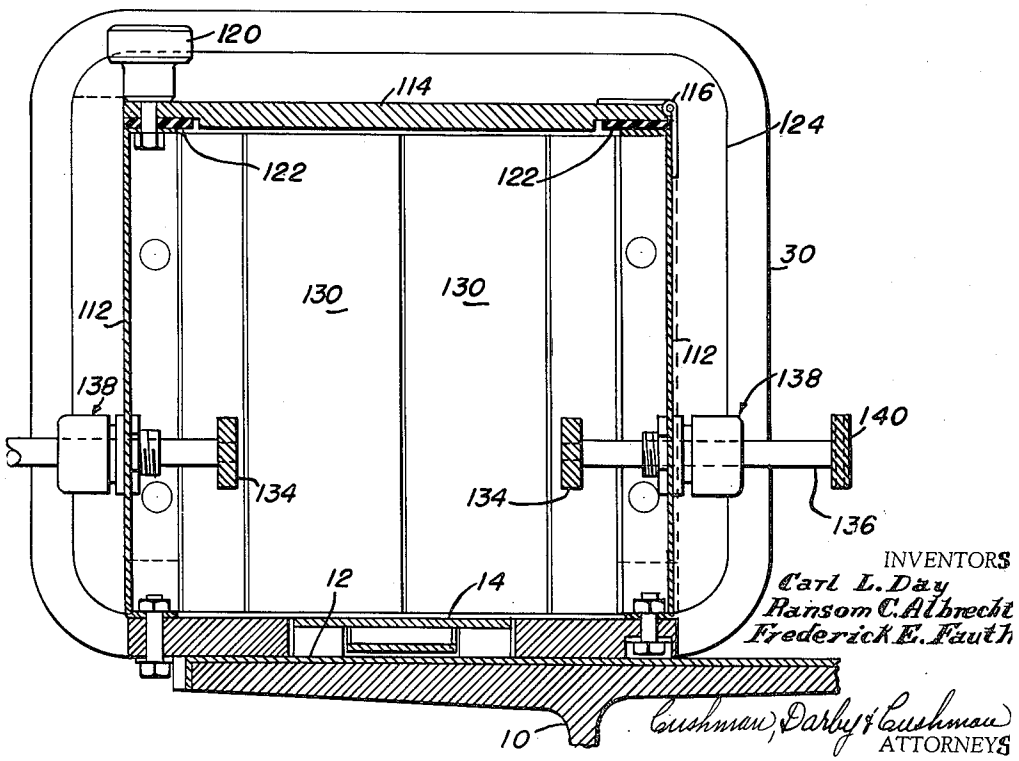


FIG.7.



INVENTORS
Carl L. Day
Ransom C. Albrecht
Frederick E. Fauth

Cushman, Darby & Cushman
ATTORNEYS

United States Patent Office 2,763,107 Patented Sept. 18, 1956

2,763,107

METHOD AND APPARATUS FOR SEALING CONTAINERS

Carl L. Day, Ransom C. Albrecht, and Frederick E. Fauth, Baltimore, Md., assignors to Crown Cork & Seal Company, Inc., Baltimore, Md., a corporation of New York

Application May 14, 1954, Serial No. 429,744

32 Claims. (Cl. 53—7)

The present invention relates to a method and apparatus for sealing containers and, more particularly, to a method and apparatus for replacing the air in the headspace of a filled container with an inert gas and then sealing the same.

It has long been recognized that oxygen, heat and light have a deleterious effect on practically all packaged food product. Consequently, numerous machines have been heretofore proposed for reducing the oxygen concentration in the headspace of packaged food products. Vacuum packaging has had wide use in recent years to reduce the residual oxygen content in the headspace of cans or glass jars. While this method has been a step in the right direction and has proved to be generally successful, it has also been found advantageous in certain situations to pack food and other products in an atmosphere of an inert gas, such as nitrogen. By removing the air from the headspace of a filled container and thus removing any oxygen content therefrom, and replacing the same with an inert gas, there will be no reaction between the product in the container and the inert gas. Consequently, the shelf life of a filled sealed container will be increased and the contents of the container will remain as fresh as when packed.

An object of the present invention is to provide a machine which will remove the air from the headspace of a filled container replacing the same with an inert gas, such as nitrogen and then sealing the container in an atmosphere of the inert gas.

Another object of the invention is to provide an apparatus which will preliminarily subject the filled container to a plurality of chambers containing varying concentrations of an inert gas whereby the air in the headspace of the container is removed and then transferring the container to a container sealing chamber wherein the container is sealed in an atmosphere of the inert gas.

A further object of the present invention is the provision of an apparatus wherein caps provided with a skirt or the like are completely purged of air by directing a blast or jet of inert gas against the under surface of the caps as the caps are delivered to the container sealing chamber.

A still further object of the present invention is the provision of an apparatus of such design that it can be readily adjustable for various sizes and shapes of bottles.

Ancillary to the preceding object, it is an object of the present invention to provide means to completely remove the air in the headspace of narrow neck containers.

Still another object of the present invention is to provide a tunnel of such arrangement that a diffused atmosphere of an inert gas will flow therethrough counter-current to the direction of travel of the filled containers.

A still further object of the present invention is to provide a tunnel forward of the container sealing chest having a plurality of chambers therein of increasing inert gas concentration from the infeed end thereof to the delivery end thereof.

Another object of the present invention is to provide a method for replacing the air in the headspace of a filled container with an inert gas or the like by gradually subjecting the container to increased concentration of an inert gas and then applying a cap to the container and sealing the container in an atmosphere of the inert gas.

A still further object of the present invention is the provision of an apparatus which seals containers in an atmosphere of an inert gas and then transfers the sealed containers through a tunnel having an atmosphere of inert gas which decreases in concentration toward the outlet of the discharge end thereof.

These and other objects and advantages of the present invention will be apparent from the following specification and accompanying drawings, in which:

Figure 1 is a top plan view of the apparatus of the present invention, the view omitting the cap feeding mechanism;

Figure 2 is a side elevational view of the left-hand portion of the apparatus disclosed in Figure 1, the view including the infeed tunnel and portions of the container sealing chest and cap feeding mechanism;

Figure 3 is an enlarged side elevational view of the right-hand portion of the apparatus disclosed in Figure 1 and is a continuation of the view in Figure 2, the view shows a portion of the container sealing chest, the outfeed tunnel and the control panel of the apparatus;

Figure 4 is an enlarged fragmental cross-sectional view of the container sealing chest taken on the line 4—4 of Figure 1, the view showing in detail the inert gas diffuser and cap applying means and a portion of the cap feeding mechanism;

Figure 5 is a view similar to Figure 4 but taken on the line 5—5 of Figure 1;

Figure 6 is a cross-sectional view of the infeed tunnel taken on the line 6—6 of Figure 1 and disclosing the details of the container guiding means and the tunnel locks;

Figure 7 is a cross-sectional view of the infeed tunnel taken on the line 7—7 of Figure 1 and discloses in detail the connection of the delivery end of the infeed tunnel to the container sealing chest;

Figure 8 is a bottom view looking up of the diffuser shown in Figures 4 and 5; and

Figure 9 is an enlarged fragmental perspective view of the bottom plate of the lower portion of the cap feeding chute, showing the portion of the diffuser for purging the air from a cap.

General description

The construction and operation of the machine illustrated in the application as embodying the invention generally may be described as follows:

Referring to Figures 1 to 3 inclusive, the apparatus includes a body casing or housing **10** including an upper surface or work table **12** across which the top run of a straight line conveyor **14** moves jars J or other containers from the left to the right of each figure. Mounted above the upper surface of work table **14** is a superstructure **15** of the machine which includes a cap securing mechanism **24**, a cap applying mechanism **20** and a cap feeding mechanism **40**. Superstructure **15** is substantially similar to that disclosed in the Carl L. Day and Frederick E. Fauth application Serial No. 295,024 filed June 23, 1952, and is adaptable for vertical movement with respect to the top surface of table **14** so as to accommodate containers of various sizes. The mechanisms for driving conveyor **14**, cap feeding mechanism **40**, and cap securing mechanism **24**, as well as the detail design of these mechanisms and the cap applying mechanism, will be found in the aforementioned application, as well as in the Carl L. Day and Frederick E. Fauth application Serial No. 405,195, filed January 20, 1954. Therefore, it will suffice to say that the subject matter of the aforementioned applications pertaining to the mechanism just previously described will not

be repeated herein, it being understood that these applications are referred to as disclosing mechanisms which would be used with the present invention, and to that extent they form a part of the present disclosure.

A chest **18** is provided on superstructure **15** and is adapted to completely enclose cap securing mechanism **24**, cap applying mechanism **20**, the delivery end of cap feed chute **22** of the cap feeding mechanism **40** and the portion of conveyor **14** positioned below the aforementioned mechanisms. For the present, it will suffice to say that means are provided for supplying an inert gas, such as nitrogen, to the chamber defined by chest **18**. A more detailed description of the diffuser for the inert gas feed will appear later in the specification.

Chest **18** which will be referred to hereafter as the container sealing chest is provided with an inlet for receiving unsealed containers and an outlet for delivering sealed containers. Supported by table **12** on the infeed side of container sealing chest **18** is an infeed tunnel **16** which has its delivery end in communication with the infeed of container sealing chest **18**. Infeed tunnel **16** is adapted to completely enclose a portion of conveyor **14** forward of container sealing chest **18** and is provided with a plurality of compartments or chambers which are substantially air-tight with respect to one another. Supported by table **12** on the discharge side of container sealing chest **18** is an outfeed tunnel **26** having its infeed end in communication with the discharge end of container sealing chest **18**. Outfeed tunnel **26** is similar to infeed tunnel **16** in that it also is provided with a plurality of chambers which are substantially air-tight with respect to one another and it also encloses a portion of conveyor **14** on the discharge side of container sealing chest **18**. Details of tunnels **16** and **26** respectively will follow later in the specification.

Filled containers J being transferred in a straight line on conveyor **14**, which are to be sealed, will first pass through the plurality of chambers in infeed tunnel **16** and be progressively subjected to an increased concentration of the inert gas flowing through the machine. The unsealed containers J passing through tunnel **16** will have the air within the headspace of the container substantially displaced by the inert gas in the chambers of the infeed tunnel.

After containers J leave tunnel **16**, they immediately proceed into the container sealing chamber of chest **18**, where a cap C is loosely applied thereto by cap applying mechanism **20** which receives the caps from chute **22**. Figures 4 and 5 best disclose the feeding of caps C to containers J in container sealing chest **18** as the containers are moved forward on conveyor **14**. Cap applying mechanism **20**, which is positioned above and in alignment with conveyor **14**, is as previously stated, of the type as shown in Carl L. Day and Frederick E. Fauth application Serial No. 405,195, filed January 20, 1954. Of course, it is well within the scope of the present invention that a cap applying mechanism other than that generally shown in this application and described in detail in the abovementioned Day and Fauth application may be used with the apparatus and method of this particular invention. After cap C has been loosely applied to the container, the container and cap will be transferred to the cap securing mechanism **24**, such as disclosed in the Carl L. Day and Frederick E. Fauth application Serial No. 295,024 filed June 23, 1952. Cap securing mechanism generally indicated at **24** in Figures 4 and 5 and enclosed in the chest **18** will tightly secure the cap to the container. After the cap has been secured tightly to the container, conveyor **14** will transfer the capped or sealed container from container sealing chest **18** to outfeed tunnel **26** where it will pass through the plurality of chambers therein. Outfeed tunnel **26** will also be filled with an inert gas but the concentration of gas in tunnel **26** will decrease from its infeed end toward its delivery end. The purpose of providing a tunnel on the discharge side of container sealing chest **18** is to prevent air from leaking into the chamber of chest **18** and, thus, the inert gas content within the chest can be maintained at a maximum or a predetermined concentration.

Details of container sealing chest **18** and the inert gas diffuser in its chamber will follow immediately in the specification under the heading "Container Sealing Chest and Diffuser," while details of infeed and outfeed tunnels **16** and **26**, respectively, will be found later in the specification under the heading "Infeed and Outfeed Tunnels."

Container sealing chest and diffuser

Positioned on work table **12** and adapted to completely enclose a portion of conveyor **14** is the container sealing chest **18** supported by superstructure **15**. Container sealing chest **18** is provided with a side wall **28** extending upwardly from the side surface of table **12** and end walls **30** and **32** also extending upwardly from work table **12**. The lower portions of side wall **28** and end walls **30** and **32** are adapted to overlap the side of table **12** and form a substantially air-tight seal therewith. However, side wall **28** and end walls **30** and **32** are not rigidly secured to work table **12** as they must move relative thereto when the superstructure **15** is moved vertically to adjust for different size containers. In other words, container sealing chest **18**, which is supported by superstructure **15**, must move with the superstructure and, therefore, its walls must overlap work table **12** so that it forms a seal therewith regardless of its position. The rear wall **29** of container sealing chest **18** is part of the superstructure which also overlaps a portion of work table **12** and forms a seal therewith. However, a separate side wall in place of the rear wall **29** may be provided without departing from the scope of the invention as in any event, the container sealing chest must be of such size and shape as to enclose the necessary mechanism for sealing a container. The walls **30** and **32** are provided with inlet and outlet openings **34** and **36** respectively through which containers can enter and leave the chest on conveyor **14**. As is evident from Figures 2 and 3, the inlet tunnel is connected in sealing engagement and in alignment with the inlet **34** in end wall **30**, while the outlet tunnel **26** is connected in sealing engagement with the outlet **36** in end wall **32**.

Container sealing chest **18** is provided with a top surface generally indicated at **38** and, as previously stated, provides a substantially air-tight chamber enclosing a portion of conveyor **14**. The top surface of the chest is of any suitable configuration so as to accommodate the various mechanisms supported within the chest. Cap feeding device **40**, such as disclosed in the Carl L. Day and Frederick E. Fauth application Serial No. 405,195 filed January 20, 1954, is positioned on superstructure **15** of frame **10** and is provided with the chute **22** which enters the top of the chest through surface **38** and has its delivery end positioned within the chamber defined by the chest. The lower end of cap chute **22** is provided with the cap applying mechanism **20** which is substantially similar to the mechanism disclosed in the aforementioned Day and Fauth application Serial No. 405,195. Cap applying mechanism **20** supplies caps C on demand and applies them loosely to containers J passing therebelow. Forward movement of the container will cause it to pick off a cap from the cap applying mechanism as best shown in Figures 4 and 5.

Mounted within chest **18** and forward of the delivery end of cap chute **22** is a diffuser assembly generally indicated **42**. Diffuser assembly **42** includes a cast element **43** having a top wall **44** and downwardly depending side walls **45** as best shown in Figure 8. Diffuser **42** is supported by chest **18** and is positioned below and forward of cap chute **22**. It also provides a portion of top wall **38** as it forms a seal therewith. Casting **43** is adapted to support a manifold block **48** between its side walls **45**. Manifold block **48** is positioned above and in alignment with conveyor **14** and is provided with downwardly open-

ing tandem manifolds 54 and 56 which are transverse to the conveyor. Passages 50 and 52 in block 48 communicate with manifolds 54 and 56 respectively and extend upwardly and outwardly therefrom. A pair of spaced angle members 46 are connected to the under surface of block 48 and are positioned on either side of manifolds 54 and 56 in longitudinal alignment with conveyor 14. Angle members 46 provide downwardly depending flanges and are so arranged that the mouth of a container passing under block 48 will be positioned therebetween. By providing the flanges on block 48, the inert gas being flowed from ports or manifolds 54 and 56 will be concentrated within the area where the cap is applied to the container.

As best shown in Figure 8, forward port 54 in manifold block 48 is wider than the rearward port 56 and is for use when wide mouth containers are being capped. The smaller port 56 is used for small necked or small mouth containers and provides a concentrated blast of inert gas.

Connected to the passageways 50 and 52 in block 48 are tubes 62 and 64 which extend out through the top wall 44 of casting element 43. The tubes 62 and 64 are then connected to the flexible hoses 66 and 68 which in turn are connected to the shut-off valves 70 and 72 respectively. Shut-off valves 70 and 72 are connected to a common manifold 74 which leads to the control panel generally indicated at 76 where a source of inert gas is supplied to the diffuser. It will be seen that by the provision of shut-off valves 70 and 72 the inert gas may be directed to flow from either the ports 54 or 58 dependent upon the size of the container being capped. Suitable controls are provided in control panel 76 to regulate the flow through the ports 54 or 56 in any desired quantity and means are also provided for flowing a limited amount of inert gas through the aforementioned ports when no containers are travelling through the machine. The purpose of flowing a limited amount of inert gas through the diffuser assembly when the machine is not in operation is to keep a diffused atmosphere in the chest so that when the machine is started, there is no delay in waiting for the chest to become filled with the inert gas. In Figure 2, the valves 70 and 72 are shown separate from control panel 76, but it will be understood that the valves are preferably located on control panel 76.

Since the inert gas flowing from either of the ports 54 or 56, depending on the size of container passing through the machine, will fill the chamber of chest 18, the inert gas will also be forced into the headspace of the container displacing the air therefrom so that the product within the container when sealed will have contact only with an inert gas rather than air containing a portion of oxygen. However, since the caps used to seal the containers are of the type having a skirt with threads, lugs, or other sealing means thereon, it is necessary for the air trapped on the under surface of the cap by its skirt, to be purged therefrom as the cap is being fed down chute 22. To accomplish this, the diffuser is provided with a second manifold block 78 which is welded to the under surface of a plate 80 which forms the bottom of the lower portion of chute 22. Block 78 is substantially hollow and is provided with an aperture 82 on one end thereof in which hollow tube 84 is welded. The open upper face of the hollow block 78 is positioned adjacent the under surface of chute plate 80 so that an inert gas being supplied through tube 84 can pass through the ports 86 provided in plate 80. Ports or nozzles 86 will direct the inert gas upwardly into the chute and as the caps slide down chute 22, they will pass over the nozzles 86 and a blast of nitrogen will purge the air from the cap.

Plate 80, which also forms part of chute 22, is adapted to be supported on an inclined portion of the top surface 44 of the diffuser assembly 42. Since it is necessary to provide a seal between plate 80 and the diffuser, a sponge rubber pad 58 is placed between plate 80 and the diffuser. As is shown in Figure 4, when chute 22 is properly positioned, plate 80 will compress pad 58 forming an air-tight seal between the plate and diffuser.

Hollow tube 84, which extends out of the top of diffuser assembly 42, is provided with a flexible hose 88 which in turn is connected to a shut-off valve 90 and from there runs to the control panel 76 where it is connected to the source of inert gas supplied. In like manner to the control for ports 54 and 56, suitable means are provided to control and supply inert gas to the nozzle 86. It is preferred that inert gas be continuously supplied through the nozzles 86 so that the chute 22 will be filled with the inert gas and, thus, air can not enter the chamber of chest 18 through cap feed chute 22.

As previously stated, the particular embodiment of the invention disclosed shows threaded or lug type of caps being applied to jars by a suitable threading mechanism such as disclosed in the aforementioned Carl L. Day and Frederick E. Fauth application Serial No. 295,024. In that application, it will be noted that as soon as the containers enter the steam chest they are centered and transferred through the cap applying and cap securing mechanisms by horizontally arranged and opposed endless belts. The endless belts grip the container on opposite sides with sufficient pressure to prevent the container from rotating when the cap is threaded thereon. In the present invention, similar opposed belts 60 are provided and are diagrammatically shown in Figures 4 and 5. Belts 60 will convey the containers beneath cap applying mechanism 20 where caps C are picked off of the end of chute 22 by the containers. The cap is pressed downwardly on the container by a pressing mechanism that is adapted to impart a slight impact to center the cap. In the just-mentioned Day et al. application, the pressing mechanism is disclosed as a bar fixed to the superstructure and adapted to extend longitudinally of and above the conveyor. A pair of presser members arranged in tandem beneath the bar and including lower horizontal surfaces are pivotally connected to the bar by means of a series of links. Mounted on the forwardmost presser bar at is forward or infeed end is a horizontally and transversely disposed cap engaging roller, the periphery of said roller projecting below the lower surface of the presser bar. The roller will first engage the cap as it is being picked up by the jar and will cause the presser member to impart an impact on the cap when the roller leaves the cap. Then the presser members exert pressure on the cap as the container is moved through the cap securing mechanism.

In the present invention and as disclosed in Figures 4 and 5, a similar but improved mechanism 91 is provided to press the caps on the containers. Only the improved portion of the presser mechanism is disclosed in Figures 4 and 5, the remaining portion being the same as in the aforementioned Day and Fauth application. The presser mechanism includes the longitudinally extending bar 92. Connected to the superstructure of the cap applying mechanism, a plurality of links 94 pivoted thereto and a pair of presser bars 96 pivoted to links 94. Each of the presser bars 96 extends horizontally of and above conveyor 14 in longitudinal alignment therewith. The forward end of the front presser bar is provided with an inclined portion 98. Mounted on the under surface of the inclined portion 98 is a transversely disposed shoe or step 100, which normally has its lower end positioned below the horizontal under surface of presser bars 96. Since the amount of impact necessary to properly tap the cap on a jar depends on the size of the cap and jar, an adjustment means including the stud 102 is provided to adjust the relative position of the lower end of step 100 with the lower surface of presser bar 96. Stud 102 is adapted to be threaded into step or shoe 100 and the step or shoe can slide vertically along the inclined surface of presser bar 96 when stud 102 is loosened. Of course, longitudinally extending slots are provided in the inclined portion 98 of presser bar 96 to receive studs 102.

Infeed and outfeed tunnels

Extending forward of container sealing chest **18** and in open communication with the interior of chest **18** through its inlet **34** is the infeed tunnel **16**. As best shown in Figures 2 and 6, a pair of L-shaped angle members **104** is rigidly connected to frame **10** and extend along each side of conveyor **14**. The angle members **104** provide means for supporting tunnel **16** which encloses the portion of conveyor **14** on the infeed side of chest **18**. Tunnel **16** includes a bottom member **106** which is bolted to the angle members **104** as shown at **103**. A channel-shaped plate **110** is provided to close off the area beneath conveyor **16** and it also forms a part of the bottom **106** of tunnel **16** and closes off the conveyor so that air cannot seep into the interior of tunnel **16**. Side walls **112** extend upwardly from each edge of the bottom wall **106**. A top wall **114** is pivotally connected along one of its longitudinal edges as shown at **116** to one of the side walls **112**. Suitable handles **120** are provided in the top wall so that it may be pivoted to an open position to give access to the interior of the tunnel. Further, top wall **114** is preferably made of a transparent material so that the operator of the machine may at all times observe the filled uncapped containers passing through the tunnel. Suitable seals are provided between the top wall and side walls so that there will be no leakage to the surrounding atmosphere. Such seals may be strips of rubber or neoprene such as indicated at **122**.

Tunnel **16** is provided at its delivery end with an adaptor member **124** which is a plate adapted to seal around the opening of inlet **34** in chest **38**. Plate **124** is provided on its surface with a rubber gasket **126** to insure a fluid-tight seal at the junction of the tunnel with chest **18**. As has been previously mentioned, container sealing chest **18** is attached to superstructure **15** and moves vertically with respect to conveyor **14** when an adjustment for container height is made. Consequently, chest **18** will move vertically with respect to tunnel **16** because the tunnel is fixed to frame **10** through the angle members **104**. Even though chest **18** is moved vertically, there will always be a seal between the chest and the tunnel because of the sealing strip **126** attached to the flange type adaptor member **124**.

The interior of the tunnel is provided with a plurality of tandem arranged chambers through which containers J travelling on conveyor **14** must progressively pass. The chambers in tunnel **16** are defined by a plurality of spaced locks **128**. Each lock **128** includes a pair of doors **130** mounted on vertical hinges as indicated at **132** to the side walls of chest **16**. Hinges **132** are strips of rubber or the like connected to one of the vertical edges of the door and to the side wall. The reason for providing a strip of rubber or like material which extends the entire length of door **30** is so that each hinge will also act as a seal between the door and the side wall of tunnel **16**. Further, the doors, which are slightly larger than half the width of tunnel **16**, are adapted to be closed due to the resiliency of the rubber type of hinge. Although the above-mentioned means for hinging doors **130** to the side walls of tunnel **16** are the preferred embodiment of the invention, it will be realized that the doors could be hinged to the side walls by conventional hinges with a seal being provided between the wall and door. Also, resilient means such as springs could be utilized to close the doors. Doors **130** are arranged to open toward chest **18** upon engagement by a container J travelling on conveyor **14**. As clearly shown in Figure 1, five locks are provided in tunnel **16** forming four closed chambers through which containers must pass.

Since tunnel **16** is normally made of such dimensions as to accommodate the larger type of container to be used by the machine, means are provided to guide smaller containers through the tunnel. Guide rails **134** are provided in each chamber and include a support shaft **136** which is adapted to extend transversely through side wall **112** and through an air-tight lock fitting **138**. The outer ends of each of the shafts **136** are connected by means of a longitudinally and horizontally extending bar **140**. When it is desired to adjust the effective width of the tunnel, it is merely necessary to loosen the air-tight lock fittings **138** and by movement of handle or bar **140** each of the guide members **134** on one side is correspondingly moved.

In certain instances where a high degree of concentration of inert gas is desired in tunnel **16** or where it is desired to increase the flow of inert gas through tunnel **16**, the top wall of the tunnel is provided with an aperture at the inlet end thereof. A fan or blower **142** is mounted on top wall **114** and is adapted to have its inlet communicate with the interior of the first chamber in the tunnel through the aperture. Fan **142** will exhaust air from the first chamber in tunnel **16** and will cause a greater flow of inert gas through the tunnel countercurrent to the direction of travel of containers. In other words, the fan or blower **142** will exhaust any air that is in the tunnel and at the same time will cause positive withdrawing of the inert gas from container sealing chest **18**. Of course, the only time that the flow will actually occur is when a container travelling on conveyor **14** opens the locks **128**.

In certain instances where bottles having long narrow necks are being fed through the machine, it is necessary to provide a blast of inert gas directly into the neck of the bottle so as to remove or purge the air from the headspace adjacent the filled product in the bottle. In other words, narrow neck containers oftentimes have the fill level a considerable distance from the mouth of the container and the air immediately adjacent the top of the filled product is not removed by merely bringing the container into contact with the inert gas in the tunnel. Consequently, a jet of the inert gas must be trained directly on the mouth of the container in addition and prior to the jet supplied in container sealing chest **18**. To accomplish this, a nozzle **144** is mounted in the chamber of tunnel **16** immediately adjacent chest **18**. Nozzle **144** extends through the top **114** of tunnel **16** and is held in position by a lock nut **146**. The end of the nozzle which is external of tunnel **16** is provided with a flexible tube **148** which is connected to a solenoid operated valve **149**. The inlet side of solenoid operated valve **149** is connected to control means on control panel **76** wherein the source of flow of the inert gas is provided. Solenoid operated valve **149** is electrically connected to a micro switch or the like **150** mounted in the path of containers J in the tunnel **16** adjacent chest **18**. In other words, when a container reaches the delivery end of tunnel **16** and actuates switch **150**, the container will be positioned substantially beneath nozzle **14**. The switch will cause the solenoid valve to open permitting a blast of the inert gas through nozzle **144** into the headspace of the container.

In the treatment of wide mouth jars or containers, it is not necessary to have nozzle **144** in addition to the nozzles or ports **54** and **56** in the diffuser. The normal flow of inert gas through tunnel **16** is sufficient to remove the air from the headspace of a wide mouth container and should there be any air left therein, the final blast received by the container travelling under ports **54** or **56**, depending on which is used, will remove the remaining amount of air from the headspace.

It is now evident that under normal conditions the inert gas dispensed from the diffuser in chest **18** will travel through the inlet **34** and become diffused with the air in each of the chambers in tunnel **16**. In certain instances, this flow is increased by providing exhaust blower **142** on the inlet end of the tunnel. However, it is important to note that the purpose of having the tunnel divided into a plurality of chambers is so that the container travelling through the tunnel will be subjected to gradually increased concentrations of inert gas. In other words, the chamber adjacent the entrance of tunnel

16 will have a concentration of inert gas considerably less than the chamber adjacent the exit of tunnel 16.

Outfeed tunnel 26 is of a construction substantially similar to that of infeed tunnel 18. However, tunnel 26 must be so designed as to provide for an outfeed conveyor 152 which is positioned parallel to and in overlapped relationship with the end of conveyor 14. In other words, capped containers passing from chest 18 will travel in a straight line on conveyor 14 until they reach the guide members 154. Guide members 154 will transfer the containers from conveyor 14 to the outfeed conveyor 152 which in turn transfers the containers to suitable labeling or packaging machines. It will be noted that outfeed tunnel 26 is also provided with a plurality of chambers, each defined by a plurality of locks 156. The locks are of the same design as the locks of tunnel 16 so a detailed description of locks 156 will not be repeated. It will suffice to say that the locks are actuated by containers as they travel on conveyors 14 and 152 and will define chambers wherein the inert gas concentration decreases from the infeed end of tunnel 26 toward the delivery end of tunnel 26. Tunnel 26 is provided on the outfeed side of chest 18 so that no air will be permitted to enter and contaminate the atmosphere of inert gas in the chamber of chest 18.

The terminology used in the specification is for the purpose of description and not limitation, the scope of the invention being defined in the claims.

We claim:

1. In a container sealing apparatus, a container conveyor, container sealing means positioned above and in alignment with said conveyor, a chest enclosing said container sealing means and the portion of said container conveyor below said container sealing means, said chest being provided with an inlet and an outlet for containers travelling on said container conveyor and defining an enclosed container sealing chamber, means for supplying an inert gas to said chest, a tunnel connected to the inlet of said chest, valve means dividing said tunnel into a plurality of separate substantially air-tight chambers, the containers travelling on said container conveyor passing through each of the chambers prior to entry into the container sealing chamber of said chest, and means for supplying inert gas to the chambers of said tunnel.

2. A container sealing apparatus of the character described in claim 1 wherein said inert gas supplied to said chest is nitrogen and wherein a portion of the inert gas supplied to said chest is transferred to the chambers in said tunnel.

3. A container sealing apparatus of the character described in claim 2 wherein the nitrogen concentration in the chambers in said tunnel progressively decreases from the delivery end thereof toward the inlet end thereof.

4. In a container sealing apparatus, a container conveyor, container sealing means positioned above and in alignment with said conveyor, a chest enclosing said container sealing means and the portion of said conveyor positioned beneath said container sealing means, said chest being provided with an inlet and an outlet for containers travelling on said conveyor and defining a container sealing chamber, means for supplying an inert gas to said chest, a tunnel having its delivery end connected to the inlet of said chest, said tunnel being provided with a plurality of separate chambers through which containers travelling on said conveyor progressively pass, a second tunnel connected to the outlet of said chest and being provided with a plurality of chambers through which sealed containers being delivered from said container sealing chamber progressively pass, and each of said tunnels being provided with inert gas delivered from said chest.

5. A container sealing apparatus of the character described in claim 4 wherein the concentration of inert gas in said inlet tunnel progressively decreases from its container delivery end to its inlet end and wherein the concentration of inert gas in said outlet tunnel decreases from its container inlet end to its delivery end.

6. A container sealing apparatus of the character described in claim 4 wherein the inert gas supplied to said chest is nitrogen.

7. In a container sealing apparatus, a container conveyor, container sealing means positioned above and in alignment with said conveyor, a chest enclosing said container sealing means and the portion of the conveyor positioned below said container sealing means, said chest being provided with an inlet and outlet for containers travelling on said conveyor and defining a container sealing chamber, a tunnel connected to the inlet of said chest and including a bottom wall and depending side walls and a top wall, said tunnel enclosing a portion of said conveyor on the inlet side of said chest, a plurality of locks defining a plurality of chambers in said tunnel, said locks being operable by containers passing therethrough, and means for supplying a gas to said chest and tunnel.

8. A container sealing apparatus of the character described in claim 7 wherein each of said locks includes a pair of doors hinged at their outer edge and adapted to swing outwardly toward said container sealing chamber upon actuation by a container passing therethrough.

9. A container sealing apparatus of the character described in claim 7 wherein means are provided in each of the chambers defined by locks for guiding containers passing therethrough.

10. A container sealing apparatus of the character described in claim 9 wherein the means in each of said chambers for guiding containers therethrough is adjustable for various width containers by a single adjustment means.

11. A container sealing apparatus of the character described in claim 7 wherein the top of said tunnel is pivotally connected to one of said side walls thereby giving access to the inside of said tunnel.

12. A container sealing apparatus of the character described in claim 7 wherein the top wall of said tunnel is made of a transparent material whereby the inside of said tunnel may be viewed by an operator of the apparatus.

13. A container sealing apparatus of the character described in claim 7 wherein means are provided on said tunnel adjacent its inlet to cause flow of the inert gas through said tunnel counter to the direction of travel of containers.

14. A container sealing apparatus of the character described in claim 13 wherein said means include an exhaust fan mounted adjacent the inlet of said tunnel.

15. In an apparatus for providing the headspace of filled containers with an inert gas, a container conveyor, a tunnel enclosing said container conveyor, said tunnel being provided with a plurality of locks defining a plurality of chambers therein, an enclosed container sealing mechanism positioned adjacent the delivery end of said tunnel for sealing containers in an atmosphere substantially free of air, and means for supplying said tunnel with an inert gas flowing from the delivery end of said tunnel toward the inlet end of said tunnel.

16. An apparatus of the character described in claim 15 wherein each of said locks includes a pair of doors hinged at their outer end and normally closed, said doors being opened toward the delivery end of said tunnel by movement of containers through said tunnel.

17. An apparatus of the character described in claim 15 wherein means are provided in each of the chambers defined by said locks for guiding containers through said tunnel, said means in each of said chambers being adjustable for various width containers by a single adjustment means.

18. An apparatus of the character described in claim 15 wherein said tunnel includes side walls and a transparent top wall.

19. An apparatus of the character described in claim 15

wherein the concentration of inert gas in each of the chambers of said tunnel progressively decreases from the delivery end of said tunnel to the container inlet end of said tunnel.

20. In an apparatus for capping containers in an atmosphere of an inert gas, a container conveyor, a chest member enclosing a portion of the container conveyor and having an inlet for receiving filled uncapped containers and an outlet for delivery of filled capped containers, means positioned within said chest for securing the caps to containers passing therethrough, means for feeding caps including a cap feed chute having its delivery end positioned within said chest and in alignment with said conveyor whereby containers being moved thereon will pick off a cap from the delivery end of said chute, a diffuser member mounted within said chest and including an upwardly directed nozzle extending through the cap supply chute and spaced from the delivery end thereof and two downwardly facing transversely extending ports, said nozzle being supplied with an inert gas to wash the caps in said supply chute, each of said transversely extending ports being connected to a source of inert gas, and means for selectively directing the gas through one of said ports.

21. In an apparatus for capping containers in an atmosphere of inert gas, a container conveyor, a chest member enclosing a portion of the container conveyor and having an inlet for receiving filled uncapped containers and an outlet for delivery of filled capped containers, means positioned within said chest for securing the caps to the containers passing therethrough, means for feeding caps including a cap feed chute including a bottom cap supporting plate and having its delivery end positioned within said chest and in alignment with said conveyor whereby containers being moved thereon will pick off a cap from the delivery end of said chute, a diffuser member mounted within said chest, said diffuser member including a block element positioned above said conveyor and in alignment therewith, said block element being provided with a plurality of downwardly facing and transversely extending ports, each of said ports being connected to a source of inert gas, means for selectively directing the gas through one of said ports dependent upon the width of a mouth of a container passing through the chest, means mounted on the undersurface of said block element to concentrate the flow of inert gas from the ports in said block, said diffuser member also including an upwardly directed nozzle extending through the bottom plate of said cap supply chute and spaced from the delivery end thereof, said nozzle being connected to a source of inert gas and adapted to wash air from the caps being supplied down said chute.

22. In an apparatus for capping containers in an atmosphere of an inert gas, a container conveyor, a chest member enclosing a portion of the container conveyor and having an inlet for receiving filled uncapped containers and an outlet for delivery of filled containers, means positioned within said chest for securing the caps to the containers passing therethrough, means for feeding caps including a cap feed chute having its delivery end in said chest whereby caps will be picked off by containers moving through said chest and will be loosely applied to the containers, means for washing air from the caps by an inert gas before the caps reach the delivery end of said cap feed chute, means for blanketing the containers and providing the headspace of the containers with an inert gas prior to receiving a cap, means to engage the cap to urge the cap element downwardly on the container as it is being picked off from the cap feed chute by the container, said last-mentioned means including a cap impact member, said cap impact member including a presser member positioned longitudinally of and above said conveyor and being adapted for vertical movement, said presser member having its forward end inclined upwardly and provided with an adjustable step element on its underside and normally extending below the plane of the underside of said presser member and means to seal the cap on the container.

23. A method of sealing containers comprising subjecting uncapped filled containers to a plurality of separate zones substantially sealed from one another and each being of progressively increasing concentration of an inert gas, then applying inert gas directly to the head space of the containers, and finally applying caps to the containers in a concentrated zone of inert gas.

24. A method of sealing filled containers comprising transferring filled uncapped containers through successive zones substantially sealed from one another and each of said zones being of progressively increasing concentration of an inert gas, jetting an inert gas directly into the head space of the uncapped containers in at least one of said zones, washing the caps by an inert gas to remove the air therefrom, then applying the caps to the mouths of the containers, and then sealing the caps on the containers.

25. A method of sealing a container comprising transferring an unsealed container through a plurality of separate zones and gradually subjecting the container to an increased concentration of nitrogen in successive zones, providing flow of nitrogen direct to the headspace of the container in at least one of said zones, washing the air from a container cap by a jet of nitrogen, applying the container cap to the unsealed container and sealing the container and then transferring the sealed container through a plurality of separate zones of successive decreasing concentration of nitrogen.

26. In a container sealing apparatus, a container conveyor, container sealing means positioned above and in alignment with said conveyor, a chest enclosing said container sealing means and the portion of said container conveyor below said container sealing means, said chest being provided with an inlet and an outlet for containers travelling on said container conveyor and defining an enclosed container sealing chamber, means for supplying inert gas to said chest, a tunnel connected to the inlet of said chest, said tunnel being provided with a plurality of separate substantially air-tight chambers through which containers travelling on said container conveyor progressively pass prior to entry into the container sealing chamber of said chest, a nozzle projecting downwardly into one of the chambers of said tunnel and positioned above and in alignment with said container conveyor, and means to supply a jet of inert gas to said nozzle.

27. A container sealing apparatus of the character described in claim 26 wherein the nozzle projecting downwardly into one of the chambers of said tunnel is adjustable vertically.

28. A container sealing apparatus of the character described in claim 26 wherein the means of supplying an inert gas to said nozzle is actuated by a container in the chamber where said nozzle is positioned.

29. In a container sealing apparatus, a container conveyor, a chest member enclosing a portion of the container conveyor and having an inlet for receiving filled uncapped containers and an outlet for delivery of filled capped containers, cap feeding means including a cap feed chute having its delivery end in said chest whereby caps are picked therefrom by containers moving through said chest and loosely applied thereto, means enclosed in said chest for securing the loosely applied caps to the containers, means for supplying an inert gas to said cap feed chute forward of the delivery end thereof for washing the caps, means for supplying an inert gas to the chamber of said chest above containers passing therethrough, and a tunnel connected to the inlet of said chest, said tunnel being provided with a plurality of substantially air-tight chamber through which containers travelling on said container conveyor progressively pass prior to entry into said chest, said tunnel being provided with a nozzle in the chamber adjacent said chest, said nozzle being positioned above and in alignment with said container

conveyor, and means for supplying a jet of inert gas to said nozzle, said last-mentioned means being operative by a container positioned beneath said nozzle.

30. In a mechanism to secure a cap provided with threaded type engaging means to a threaded type container mouth, a supporting frame, a container supporting conveyor to move containers in a straight line, means on said frame positioned above and in alignment with said conveyor for loosely applying caps to containers moving beneath the same, downwardly urged means supported on said frame above and in alignment with said conveyor for applying an impact and pressure to the loosely applied cap on the container, said downwardly urged means including a bar fixed to said supporting frame and extending longitudinally of and above said conveyor, a pair of presser members arranged in tandem beneath said bar and including horizontal lower surfaces, the forwardmost one of said presser members having its forward end portion inclined upwardly, a step element extending transversely of and adjustably connected to the underside of the inclined forward end portion, said step element having its lower transverse edge extending below the plane of the underside of said pressure members, a series of links pivotally connecting said presser members for vertical movement relative to said bar and to maintain the presser members parallel to the surface of said conveyor, means to urge said presser members downwardly, and means for tightly securing the cap to the container.

31. In a container sealing apparatus, a container conveyor, container sealing means positioned above and in alignment with said conveyor, a chest enclosing said container sealing means and the portion of the conveyor positioned below said container sealing means, said chest being provided with an inlet and outlet for containers travelling on said conveyor and defining a container sealing chamber, a tunnel connected to one side of said chest and including a bottom wall and depending side walls and a top wall, said tunnel enclosing a portion of said conveyor, a plurality of locks defining a plurality of chambers in said tunnel, said locks being operable by containers passing therethrough and means for supplying a gas to said chest and tunnel.

32. A container sealing apparatus of the character described in claim 31 wherein each of said locks includes a pair of doors hinged at their outer edge and adapted to swing outwardly upon actuation by a container passing therethrough.

References Cited in the file of this patent

UNITED STATES PATENTS

2,543,280	Everett	Feb. 27, 1951
2,561,404	Nordquist	July 24, 1951
2,583,866	Mero	Jan. 29, 1952
2,620,112	Hohl et al.	Dec. 2, 1952
2,656,084	Filander	Oct. 20, 1953
2,658,654	Schweizer	Nov. 10, 1953
2,692,715	Doudera	Oct. 26, 1954