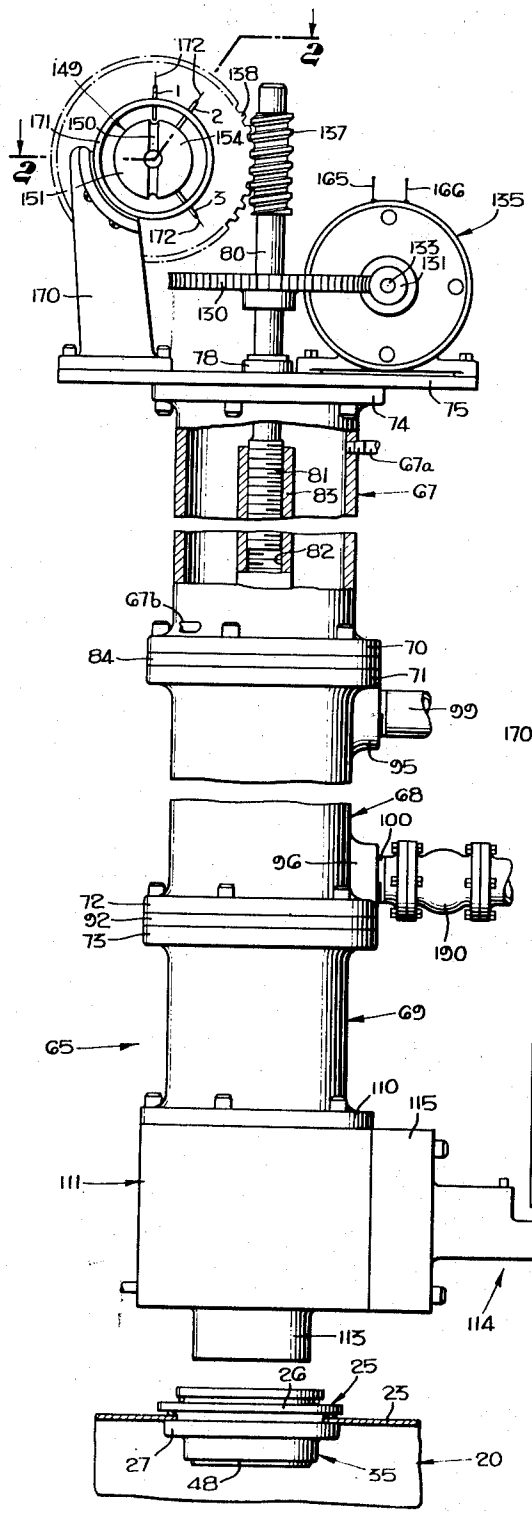
Sept. 4, 1956 E. B. FAIRCHILD 2,761,603

APPARATUS FOR THE ASEPTIC PACKAGING OF FOODS

Filed April 26, 1952

4 Sheets-Sheet 1



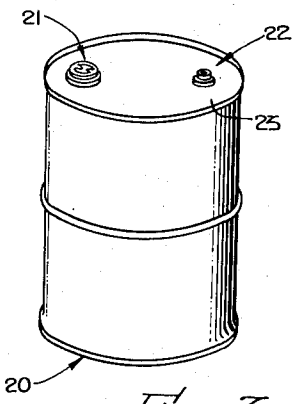


FIG. 3.

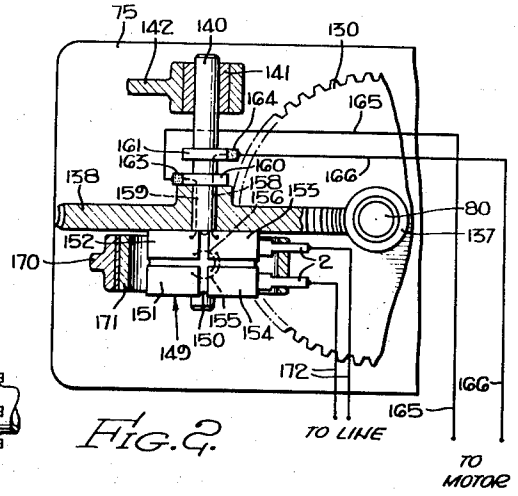


FIG. 2.

FIG. 1.

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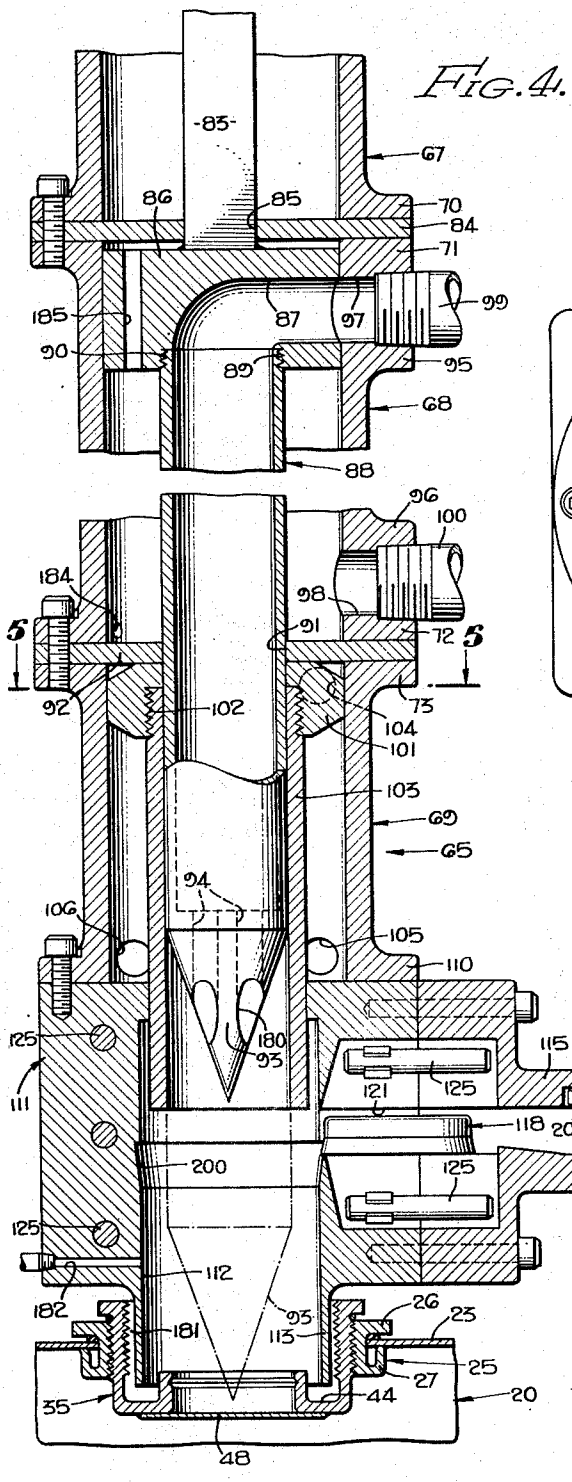
Sept. 4, 1956 E. B. FAIRCHILD 2,761,603

APPARATUS FOR THE ASEPTIC PACKAGING OF FOODS

Filed April 26, 1952 4 Sheets-Sheet 2

FIG. 4.



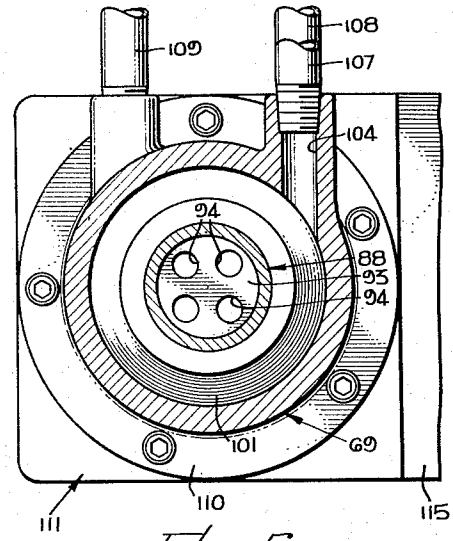


FIG. 5.

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Sept. 4, 1956 E. B. FAIRCHILD 2,761,603

APPARATUS FOR THE ASEPTIC PACKAGING OF FOODS

Filed April 26, 1952 4 Sheets-Sheet 3

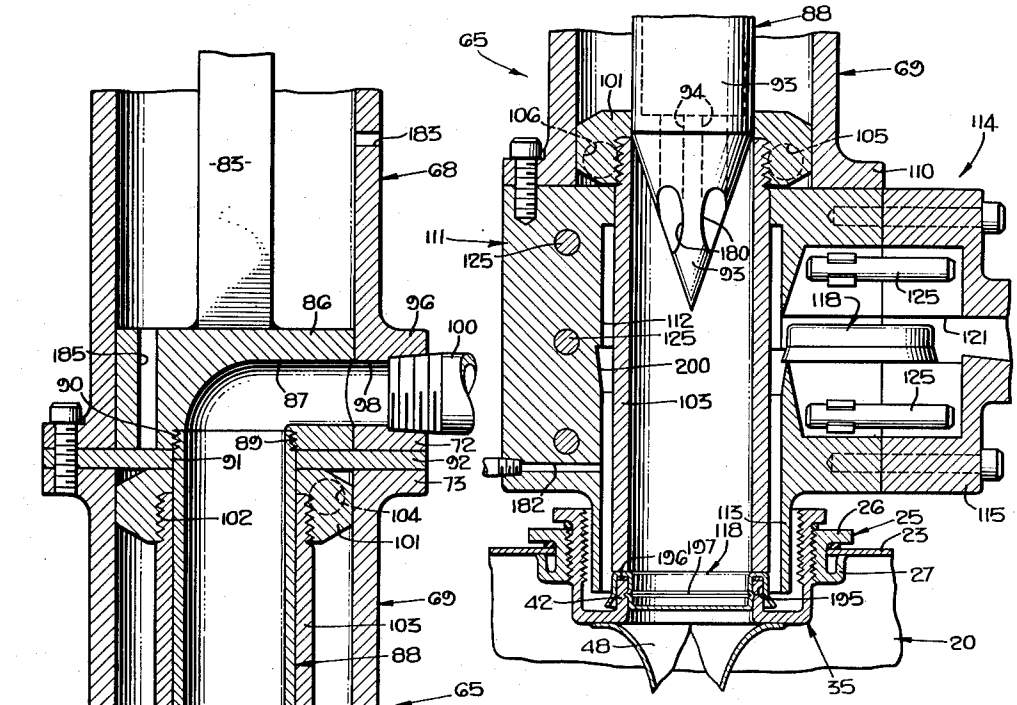

FIG. 7.

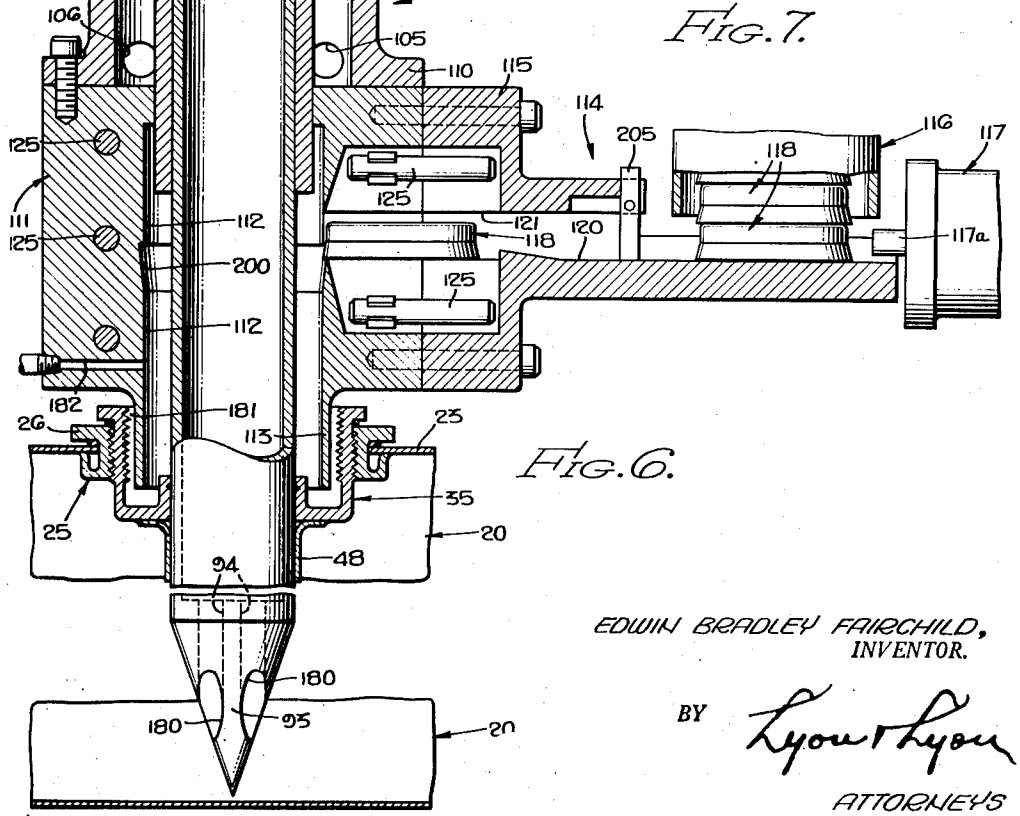

FIG. 6.

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Sept. 4, 1956 E. B. FAIRCHILD 2,761,603

APPARATUS FOR THE ASEPTIC PACKAGING OF FOODS

Filed April 26, 1952 4 Sheets-Sheet 4

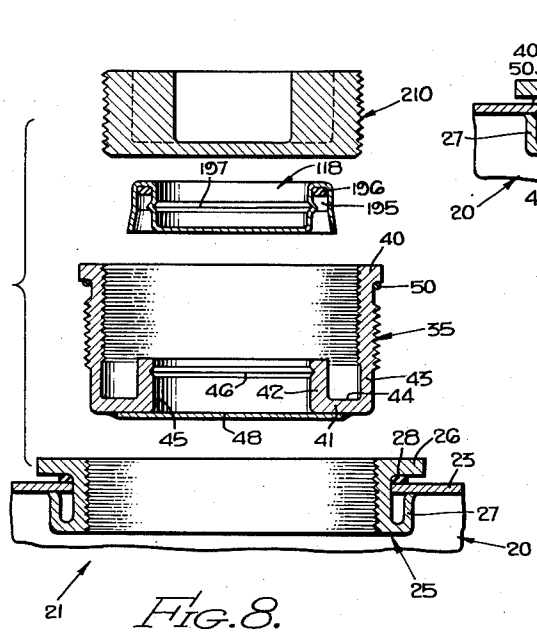

FIG. 8.

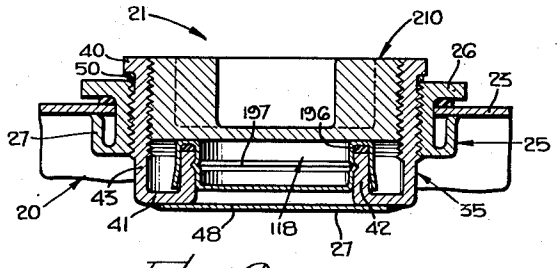

FIG. 9.

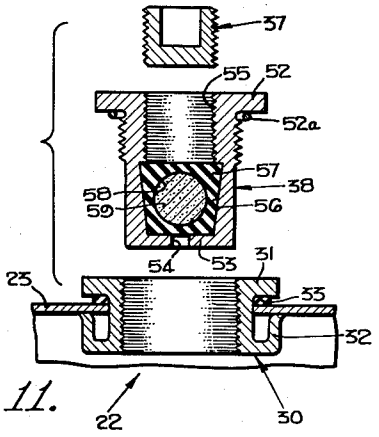

FIG. 11.

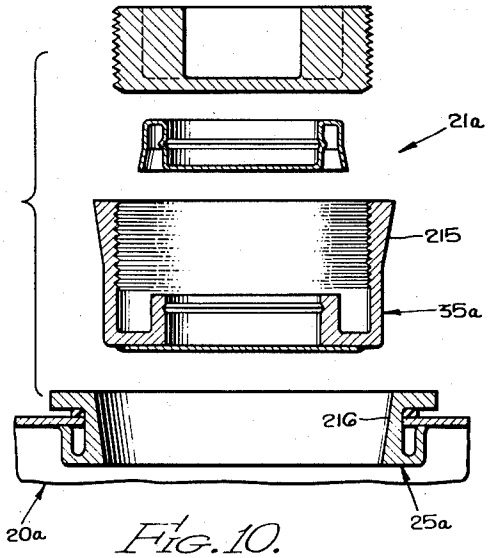

FIG. 10.

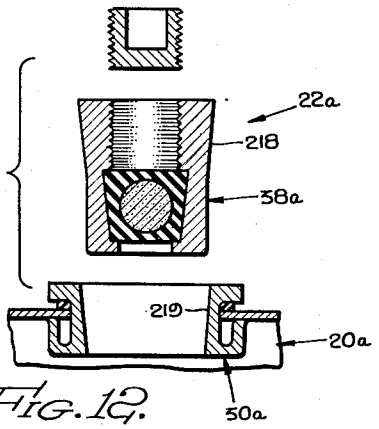

FIG. 12.

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ATTORNEYS

United States Patent Office 2,761,603
Patented Sept. 4, 1956

2,761,603

APPARATUS FOR THE ASEPTIC PACKAGING OF FOODS

Edwin Bradley Fairchild, Palo Alto, Calif., assignor of one-half to Beverly E. Williams, San Mateo, Calif.

Application April 26, 1952, Serial No. 284,587

18 Claims. (Cl. 226—68)

This invention relates to the art of food processing and has particular reference to a process and apparatus for the packaging of fluid foods under aseptic conditions.

One of the objects of this invention is to provide a novel and improved process and apparatus for the packaging of fluid foods under aseptic conditions.

Another object of this invention is to provide a process and apparatus for the aseptic packaging of fluid foods in standard or commercially available steel drums or barrels.

Another object of this invention is to provide a process and apparatus of the character described in which the drums or barrels to be filled are pre-sterilized and sealed to be used immediately, or stored and later used in accordance with the demand for same.

Yet another object of this invention is to provide a process and apparatus which permit fluid foods to be quickly packaged in standard drums or the like, under conditions of sterility such that the packaged product may be maintained in a fresh and palatable state for extremely long periods of time without the necessity for refrigeration.

In my copending application, Serial Number 232,960, filed June 22, 1951 on "Process and Apparatus for Sterilizing and Filling Containers" now Patent No. 2,698,120 is disclosed a device and method for steam sterilization of bulk containers, for filling the containers with a sterile fluid food under aseptic conditions and for sealing the same without contamination of the product. The invention disclosed herein differs broadly from that of said copending application in that here the containers are first pre-sterilized with the use of a hot gas, such as, for example, oxygen-free combustion gas, and steam sterilization is used only as an adjunct to the filling operation for sterilization of the container closure fittings and of the surfaces of the filling mechanism which are contacted by the fluid to be packaged. This eliminates the necessity for containers capable of withstanding pressures substantially above atmospheric, and further eliminates the formation of steam condensate which is objectionable in some cases in that some dilution of the packaged product results.

Briefly, then, this invention contemplates as a first step the pre-sterilization of a container such as a standard 55 gallon steel drum. The sterilized empty drum is then sealed with special closure members, one of which contains a thin, readily-pierceable diaphragm. A drum filling and capping apparatus is provided and includes a filling tube carrying a tool adapted to cut through the diaphragm to establish communication with the interior of the barrel and to deliver sterile fluid thereto for packaging. Upon completion of the filling operation, the tool is withdrawn and the diaphragm-containing member is capped to seal the contents against contamination. In ths manner, fluid foods including fresh milk may be practically and economically packaged in bulk quantities,

and maintained in a fresh condition for long periods of time without refrigeration.

Other objects and advantages of this invention, it is believed, will be readily apparent from the following detailed description of preferred embodiments thereof when read in connection with the accompanying drawings.

In the drawings:

Figure 1 is a front elevation of a filling and capping mechanism which comprises a preferred embodiment of the invention.

Figure 2 is a sectional elevation taken substantially on the line 2—2 of Figure 1.

Figure 3 is a perspective view, on a reduced scale, of a standard drum provided with my special closure fittings.

Figure 4 is a fragmentary vertical sectional elevation of the filling and capping mechanism, illustrating the filling tube and tool in retracted position.

Figure 5 is a sectional elevation taken substantially on the line 5—5 of Figure 4.

Figure 6 is a sectional elevation similar to Figure 4, but illustrating the filling tube and tool in filling position.

Figure 7 is a sectional elevation similar to Figure 4, but illustrating the capping cylinder in operative position.

Figure 8 is an exploded vertical sectional elevation of the diaphragm-containing filler fitting.

Figure 9 is a vertical sectional elevation of the capped diaphragm-containing filler fitting.

Figure 10 is an exploded vertical sectional elevation of a modified form of diaphragm-containing filler fitting.

Figure 11 is an exploded vertical sectional elevation of the tester fitting.

Figure 12 is an exploded vertical sectional elevation of a modified form of tester fitting.

Referring now to the drawings, in Figure 3 is illustrated a conventional or standard 55 gallon steel drum **20**, which is provided with the special fittings which embody features of this invention. Generally indicated at **21** is the diaphragm-containing filler fitting and generally indicated at **22** is the tester fitting, each suitably connected in a manner described in more detail below, to one of the drum heads **23**. It will be understood that the drum **20** is of stainless steel or is provided with a lining (not shown) of material which is not subject to corrosive attack by the fluid material to be packaged. The filler fitting **21** includes an internally-threaded flange member **25** having an outer flange **26** and an inner flange **27** crimped against the inner surface of the drum head **23** to rigidly connect the member **25** thereto (see Figure 8). An annular resilient gasket **28** is provided between the flange **26** and the outer surface of the drum head to insure against leakage into or from the interior of the drum. Likewise, the tester fitting **22** includes a similar, but preferably smaller, flange member **30** having an outer flange **31**, and internal flange **32** crimped against the inner surface of the drum head, and a sealing gasket **33** (see Figure 11).

As the first step in the process of this invention the drum **20** is pre-sterilized. That is, the interior of the empty drum, provided with the flange members **25** and **30** as described above, is sterilized and the empty sterile drum is then sealed. The sterilization may be accomplished by heating, in any convenient manner, all of the air contained in the drum to a sterilizing temperature of approximately 300° F. A more efficient and preferred method is to replace the air with an oxygen-free gas, such as combustion gas, at a sterilizing temperature. This gas is introduced into the drum through the flange member **25** and exhausted through the flange member **30** until the inner surfaces of the drum have reached the sterilizing temperature. In order to seal the sterilized drum, the flange member **21** is closed by threadedly en-

gaging therewith the preheated and sterilized closure member generally indicated 35 in Figure 8. Likewise, the flange member 22 is sealed by means of the preheated and sterilized plug 37 and closure member generally indicated 38 in Figure 11, described in more detail below.

The closure member 35 is generally cylindrical, having internal and external threads. The member is provided at the upper end thereof with a flange 40 and at the lower end thereof with an inwardly and radially directed annular wall 41 merging with a re-entrant cylinder 42, the outer wall 43 of the closure member forming with the wall 41 and cylinder 42 an annular recess or channel 44 for a purpose to be described in more detail below. The wall of the central opening 45 of the cylinder 42 is provided with an annular groove 46 in the upper portion thereof, and the opening is closed and sealed at the lower end thereof by means of a relatively thin, preferably metallic, diaphragm 48. The diaphragm is preferably secured to the wall 41 by welding. An annular gasket 50 is provided on the underside of the flange 40 in position for sealing contact with the upper surface of the flange 26 (see Figure 9).

The closure member 38 is generally cylindrical having an upper flange 52, gasket 52*a*, a lower end wall 53 having a central opening 54, and external threads for engagement with the internal threads of the flange member 22. Internal threads are provided in the central opening 55 which communicates with a cavity 56 in which is contained a rubber or rubber-like plug 57 inserted therein by compression. The plug 57 is provided with an internal well 58 in which is received a supply 59 of self-sealing compound or swellant for the material of the plug. This structure permits the contents of the drum to be tested from time to time by obtaining a sample by means of insertion of a hypodermic needle or the like through the plug 57, central opening 54 and thence into the drum contents. A sample may be withdrawn by applying suction pressure to the external end of the needle. Upon completion of the sampling and withdrawal of the needle, the sealing compound, together with the inherent self-sealing characteristics of the plug material, will cause the needle puncture to be closed, preventing entrance of contamination. It will be understood that the metallic externally-threaded plug 37 will, at all times after sterilization of the empty drum, be normally engaged with the internal threads of the closure member 35 to prevent exposure of the plug 57 to air and foreign matter. The plug 37 will, of course, be removed each time a sample is taken in the manner described above.

After sterilization of the empty drum as described above, the closing and sealing of the drum by the closure members 35 and 38 takes place while all parts and surfaces of the drum including the flange members 25 and 30 are at an elevated temperature, such that any residual contamination introduced during the closing and sealing operation is destroyed before the drum and associated parts cool to non-lethal temperatures.

The sterilized and sealed drum is now ready to be filled under aseptic conditions with the sterile fluid food. If desired, the drum may be filled immediately, or it may be stored empty without contamination for an indeterminate length of time before use.

Referring now to Figures 1 to 7, the filling and capping device which embodies important features of this invention is generally indicated 65. It is to be understood that the device 65 is, or a plurality of the same are, supported on a frame (not shown) which may be similar to that shown and described in my copending application Serial Number 232,960 referred to hereinabove. The device 65 is supported so that drums to be filled may be positioned underneath the device with the flange member 25 in the position indicated in the drawings.

The filling and capping device includes a worm cylinder 67, a filling tube cylinder 68, and a capping tube cylinder 69, connected in sequence by means of bolted flanges 70, 71, 72 and 73 so that the three cylinders are coaxial and substantially vertically disposed. Secured to the upper flange 74 on the worm cylinder 67 is a plate 75 which is provided with a central aperture (not shown) defined by a bearing member 78. Extending vertically downwardly through the central aperture and journaled in the bearing member 78 is a shaft 80 having a threaded portion 81 at its lower end engaged in the threaded central opening 82 in the non-cylindrical elongated bar 83 (see Figure 1).

The worm cylinder 67 and filling tube cylinder 68 are spaced by means of a horizontal plate 84, and the bar 83 extends downwardly through a correspondingly-shaped central aperture 85 in the plate 84. The bar is secured at its lower end by means of welding, or the like, to a piston member 86 which is provided with a passage 87 leading from the side of the piston to the lower face thereof. The filling tube 88 is carried by the piston member 86 by means of the internal threads 89 in the piston member and the external threads 90 on the upper portion of the filling tube. The filling tube extends vertically downwardly through the cylinder 68 and thence through a circular central opening 91 in a plate 92 which separates the cylinders 68 and 69. At the lower end thereof, the filling tube is provided with a piercing tool or lance 93 of generally conical shape and having a sharply-pointed end. Product passages 94 extend downwardly through the lance and establish communication between the interior of the filling tube and the exterior of the lance.

The filling tube cylinder 68 is provided with bosses 95 and 96 having steam inlet passage 97 and product inlet passage 98 therein, respectively. Steam line 99 and product line 100 communicate with the respective passages.

A piston member 101 is provided within the cylinder 69 and is provided with a central threaded opening 102 for supporting the capping tube 103 which encompasses the filling tube 88. The piston member 101 and capping tube are actuated through the opening of steam ports 104 and 105 and steam condensate port 106 in the cylinder 69. Steam lines 107, 108 and 109 lead to the respective steam ports 104 and 105 and condensate port 106 (see Figure 5).

Bolted to the lower flange 110 of the cylinder 69 is a nozzle head generally indicated 111 provided with a central bore 112. Extending downwardly therefrom and forming a continuation of the central bore is the nozzle proper 113. Bolted to one side of the nozzle head is a cap feeder mechanism 114 which includes a block 115 upon which is supported a cap magazine 116 and at one end of which is carried a solenoid device 117, including an armature 117*a* for feeding the caps 118 from the magazine, through the passages 120 and 121 in the block 115 and head 110, respectively, and into the central bore 112. A plurality of electrical heating units 125 is provided for maintaining the nozzle head and associated parts at a temperature of about 300° F. to insure sterility of the surfaces.

It will be understood from the above description that the filling tube is vertically reciprocated with respect to the cylinders 68 and 69 by rotation of the shaft 80 which is threadedly engaged with the bar 83, which bar is held against rotation by contact with the walls defining the non-circular aperture 85 in the plate 84. As shown in Figures 1 and 2, a gear 130 is provided on the shaft and is engaged with a driving gear 131 on the shaft 133 of a reversible electric motor 135 mounted on the plate 75.

As will be more fully explained below, it is desired to move the filling tube into three positions: (1) the fully retracted position, as shown in Figure 4; (2) the filling position, wherein the tube is fully extended as shown in Figure 6; and (3) the draining position, wherein the tube

is partially retracted as shown by the phantom lines of Figure 4.

Means are provided for controlling the energization and direction of rotation of the motor **135** so that the actuation and position of the filling tube may be controlled. As shown in Figures 1 and 2, these means may include the worm **137** on the upper end of the shaft **80**, which is engaged in driving relation with a gear **138**. The gear **138** is carried on a stub shaft **140** journaled in suitable bearings **141** on an arm **142** secured to the plate **75**. The gear ratio between worm **137** and gear **138** is such that the gear **138** will make one-half revolution to the number of times it will take for the shaft **80** to cause the filling tube to travel the full distance between the fully retracted and fully extended positions.

Secured to one face of the gear **138** is a contact member generally indicated **149** and divided radially into right and left halves separated by a break **150**. Both halves are split vertically to form semi-circular members **151**, **152**, **153** and **154**, each insulated from the other and from the shaft **140**. The members **151** and **153** are electrically connected by means of conductor **155**, and likewise the members **152** and **154** are connected by means of conductor **156** (see Figure 2). Conductors **158** and **159** connect the members **151**, **153** and **152**, **154** respectively to collector rings **160** and **161** carried on the shaft **140**. Brushes **163** and **164** contact the respective rings **160** and **161** and lead wires **165** and **166** extend from the brushes to the motor **135**.

An arm **170** is carried on the plate **75** and supports a stationary ring **171**. These pairs, **1**, **2** and **3** of brushes are carried on the ring **171**, one pair for each of the three filling tube positions referred to above. Conductors **172** extend from each pair of brushes to a source of current, through a suitable switch (not shown). Accordingly, when any pair of brushes is energized by actuation of the appropriate switch, the motor is energized to rotate its shaft in one direction or the other, depending upon which side of the break **150** the appropriate pair of brushes **1**, **2** or **3** happens to be. Rotation of the motor shaft will, of course, cause the gear **138** and contact member **149** to be rotated a distance sufficient to bring one of the other pairs of brushes into contact with the insulated break **150**, thereby breaking the flow of current and stopping the motor and hence the filling tube in the desired position.

In operation, a sterilized and sealed drum **20** is brought into position under the filling device **65** either by lifting the drum or by bodily lowering the device **65**, with the nozzle **113** extending partially into the annular recess **44** of the closure member **35** as shown in Figure 4. At this point, the filling tube is in the "number 1" or fully retracted position, and as shown in Figure 4, the passage **87** of the piston member **86** and hence the filling tube itself is in communication with the steam port **97**. Steam at sterilizing pressure and temperature is then admitted at **97** and flows through the filling tube and out the openings **180** in the lance to sterilize the filling tube, lance, all parts of the capping tube **103**, and all the exposed surfaces of the closure member **35**, including the diaphragm **48**. In so doing, the steam flows down through the tube **103**, bore **112** and thence into the annular recess **44**. It will be understood that the lower end of the nozzle **113**, which extends into the recess **44**, forms with the walls of the recess a U-shaped circuitous path for the passage of steam to insure full coverage of the surfaces. The steam exhausts upwardly through the annular channel **181** formed between the nozzle **113** and closure member **35**. Upon completion of this sterilization step, steam through **97** is cut off by means of a valve (not shown), but a small flow of steam is continued through a port **182** in the nozzle head **111**.

The outer surfaces of the filling tube are maintained in a sterile condition at all times by an influx of steam to the cylinder **68** through a port **183** (see Figure 6), a condensate drain **184** also being provided in the cylinder **68**. A passage **185** is provided in the piston member **86** to permit equalization of pressure on either side of the piston member. Likewise, the bar **83** and shaft **80** are maintained in a sterile condition by means of steam which is admitted to cylinder **67** through line **67***a*, condensate being removed through drain line **67***b*.

After the initial sterilization step performed with steam from port **97**, as described above, the piston member **86** and filling tube **88** are lowered to the "number 2" or fully extended position past that illustrated in Figure 6. This is accomplished by energizing the brushes **2** described above, to cause appropriate rotation of the motor shaft **133** and shaft **80**. As the filling tube moves downwardly, the lance **93** punctures the diaphragm **48**, and with continued downward movement of the lance, the metal of the diaphragm is torn and rolled downwardly as shown in Figure 6. The openings **180** in the lance facilitate this action. In the fully extended position, the passage **87** of the piston member is directly opposite and in communication with the product port **98**, so that communication is established between the product line **100** and the interior of the drum **20**. In the fully extended position, the filling tube carries the lance **93** to the bottom of drum **20** so that product will fill while the lance is submerged and will not therefore foam.

A product valve (not shown) in the line **100** is then opened and the product to be packaged flows through the filling tube and into the drum. A check valve **190** is provided in the product line **100** to permit inflow of product and to prevent outflow of steam when the filling tube is in positions other than the filling or fully extended position.

Upon filling of the drum, the product valve is closed and the filling tube raised to the "number 3" position indicated by the phantom lines in Figure 4 wherein the openings **180** just clear the puncture in the diaphragm **5**. At this point, the passage **87** in the piston **86** is in communication with the port **183** in the cylinder **68**, and sufficient steam is admitted therethrough to clear the filling tube of product, after which the tube is retracted to the position illustrated by the full lines of Figure 4.

The full drum is then sealed with one of the caps **118**. Each of the caps **118** is provided with an annular channel **195** having at the upper portion thereof an annular adhesive gasket **196**. The inner cylindrical wall of the cap is provided with an annular protrusion **197** adapted to be snapped into place in the annular groove **46** of the cylinder **42** of the closure member. In operation of the capping device, a cap **118** is fed from the magazine **116**, by means of the armature **117***a*, first into the passage **120** and then into the bore **112** which is provided with a frusto-conical recess **200** which is oversize with respect to the cap diameter to permit proper alignment of the cap in the bore. The timing of the capping device is such that, during the filling operation, a cap **118** is in the passage **121** undergoing sterilization by the heat from the elements **125**, with gate **205** to the passage **121** in the closed position. As the filling tube **88** is retracted after the filling and draining operations described above, the armature **117***a*, is actuated to push a cap **118** out of the magazine **116**, through swinging gate **205** and into passage **120** where it in turn pushes another cap **118**, which is already present in the passage **121** and which was sterilized therein, into the recess **200**. The capping tube **103** is immediately brought down, by admitting steam through the port **104**, to force the cap **118** downwardly through the bore **112** and onto the cylinder **42** of the closure member **35**, as shown in Figure 7. The puncture in the diaphragm **48** is thus effectively capped and sealed.

The filled and sealed drum is then removed from the filling and capping device **65** and a plug member **210** is threadedly engaged with the internal threads of the closure member **35**, bearing down on the cap **118** so that

the temporary seal of the gasket **196** is made permanent. The completely assembled filler fitting is shown in Figure 9.

Modified forms of filler fitting **21***a* and tester fitting **22***a* are illustrated in Figures 10 and 12, respectively. These fittings are adapted for use in a non-reusable drum **20***a*. The fitting **21***a* is identical to the fitting **21** with the exception that the closure member **35***a* is adapted to be welded to the flange member **25***a*, the respective members being provided with tapered contact surfaces **215** and **216**, respectively. Here, it should be noted, the gasket **50** is dispensed with. Likewise, the tester fitting **22***a* is identical to the fitting **22**, with the exception that the closure member **38***a* is adapted to be welded to the flange member **30***a*, the respective members being provided with tapered contact surfaces **218** and **219**, respectively. Here again, the gasket **52***a* is not necessary.

Having fully described my invention, it is to be understood that I do not wish to be limited to the details set forth, but my invention is of the full scope of the appended claims.

I claim:

1. In apparatus for filling a sterilized container having a closure member including a pierceable diaphragm, the combination of a head member adapted to substantially enclose said closure member; heating means for sterilizing and maintaining a sterile atmosphere in said head member and surrounding said closure member; a filling tube operably connected to said head member; and means for reciprocating said tube with respect to said head, said filling tube including a lance element adapted to penetrate through said diaphragm to establish communication with the interior of said container.

2. In apparatus for filling a sterilized container having a closure member including a pierceable diaphragm, the combination of a head member adapted to substantially enclose said closure member; heating means for sterilizing and maintaining a sterile atmosphere in said head member and surrounding said closure member; a filling tube operably connected to said head member; and means for reciprocating said tube with respect to said head, said filling tube including a cone-shaped lance element having a sharpened lower end and adapted to penetrate through said diaphragm to establish communication with the interior of said container.

3. In apparatus for filling a sterilized container having a closure member including a pierceable diaphragm, the combination of a head member having a central bore adapted to substantially enclose said closure member; heating means for sterilizing and maintaining a sterile atmosphere in said central bore and surrounding said closure member; a filling tube operably connected to said nozzle head member; and means for reciprocating said tube with respect to said head, said filling tube including a lance element adapted to penetrate through said diaphragm to establish communication with the interior of said container.

4. In apparatus for filling a sterilized container having a closure member including a pierceable diaphragm, the combination of a head member having a central bore adapted to substantially enclose said closure member; means for sterilizing and maintaining a sterile atmosphere in said central bore and surrounding said closure member, said means including a plurality of heating elements in said head; a filling tube operably connected to said head member; and means for reciprocating said tube with respect to said head, said filling tube including a lance element adapted to penetrate through said diaphragm to establish communication with the interior of said container.

5. In apparatus for filling sterilized containers each having a closure member including a pierceable diaphragm, the combination of a head member having a central bore adapted to substantially enclose said closure member; means for sterilizing and maintaining a sterile atmosphere in said central bore and surrounding said closure member; a filling tube operably connected to said head member; means for reciprocating said tube with respect to said head, said filling tube including a lance element adapted to penetrate through said diaphragm to establish communication with the interior of said container; means for feeding caps for said closure members to the central bore of said head member; and means operably connected to said head member for affixing one of said caps to each of said closure members.

6. In apparatus for filling sterilized containers each having a closure member including a pierceable diaphragm, the combination of a head member having a central bore adapted to substantially enclose said closure member; means for sterilizing and maintaining a sterile atmosphere in said central bore and surrounding said closure member; a filling tube operably connected to said head member; means for reciprocating said tube with respect to said head, said filling tube including a lance element adapted to penetrate through said diaphragm to establish communication with the interior of said container; means for feeding caps for said closure members to the central bore of said head member; and means operably connected to said head member for affixing one of said caps to each of said closure members, said last means including a tube operable in timed relation with said filling tube for reciprocation in said central bore.

7. In apparatus for filling a sterilized container having a closure member with cylindrical walls, a cylindrical reentrant portion forming with the cylindrical walls an annular recess, and a pierceable diaphragm closing said reentrant portion, the combination of a nozzle head; a nozzle member extending downwardly from said nozzle head and adapted to substantially enclose said closure member, said nozzle member extending into said annular groove; means for sterilizing and maintaining a sterile atmosphere in said nozzle member and surrounding said closure member; a filling tube operably connected to said nozzle member; and means for reciprocating said tube with respect to said head, said filling tube including a lance element adapted to penetrate through said diaphragm to establish communication with the interior of said container.

8. In apparatus for filling with a product a container having a closure member including a pierceable diaphragm, the combination of a cylinder member having a product delivery inlet and a steam inlet; a head member supported by said cylinder member and adapted to substantially enclose said closure member, said head member having a central bore communicating with said cylinder member; means for sterilizing and maintaining a sterile atmosphere in said central bore and surrounding said closure member; a filling tube operably connected to said cylinder member, said filling tube having at the lower end thereof a lance element extending into said central bore, said lance element being provided with a product outlet passage and being adapted to penetrate through said diaphragm to establish communication with the interior of said container; and means for reciprocating said filling tube and lance element from a sterilizing position wherein the upper portion of said filling tube is in communication with said steam inlet to a filling position wherein said upper portion is in communication with said product inlet and wherein said lance element is in communcation with the interior of said container.

9. In apparatus for filling with a product a container having a closure member including a pierceable diaphragm, the combination of a cylinder member having a product delivery inlet and a steam inlet; a head member supported by said cylinder member and adapted to substantially enclose said closure member, said head member having a central bore communicating with said cylinder member; means for sterilizing and maintaining a sterile atmosphere in said central bore and surrounding said

closure member; a filling tube operably connected to said cylinder member, said filling tube having at the lower end thereof a lance element extending into said central bore, said lance element being provided with a product outlet passage and being adapted to penetrate through said diaphragm to establish communication with the interior of said container; means for reciprocating said filling tube and lance element from a sterilizing position wherein the upper portion of said filling tube is in communication with said steam inlet to a filling position wherein said upper portion is in communication with said product inlet and wherein said lance element is in communication with the interior of said container; and means for feeding caps for said closure members to the central bore of said head member, said means being operable in timed relation with the reciprocation of said filling tube.

10. In apparatus of the character described, the combination of a container having an opening; a closure member secured to said container in said opening, said closure member having a central opening; a pierceable diaphragm sealing said central opening; a head member adapted to substantially enclose said closure member; heating means for sterilizing and maintining a sterile atmosphere in said head member and surrounding said closure member; a filling tube operably connected to said head member; and means for reciprocating said tube with respect to said head, said filling tube including a lance element adapted to penetrate through said diaphragm to establish communication with the interior of said container.

11. In apparatus of the character described, the combination of a container having an opening; a closure member secured to said container in said opening, said closure member having a central opening; a pierceable diaphragm sealing said central opening; a head member having a central bore adapted to substantially enclose said closure member; means for sterilizing and maintaining a sterile atmosphere in, said central bore and surrounding said closure member; a filling tube operably connected to said head member for reciprocation with respect thereto, said filling tube including a lance element adapted to penetrate through said diaphragm to establish communication with the interior of said container; means for feeding caps for said closure members to the central bore of said head member; and means operably connected to said head member for affixing one of said caps to each of said closure members.

12. In apparatus of the character described, the combination of a container having an opening, a closure member secured to said container in said opening, said closure member having generally cylindrical walls and having a cylindrical reentrant portion coaxial with said cylindrical walls, said reentrant portion defining a central opening and further defining with said cylindrical walls an annular recess, and a pierceable diaphragm sealing said central opening.

13. In apparatus of the character described, the combination of a container having an opening, a closure member secured to said container in said opening, said closure member having generally cylindrical walls and having a cylindrical reentrant portion coaxial with said cylindrical walls, said reentrant portion defining a central opening and further defining with said cylindrical walls an annular recess, a pierceable diaphragm sealing said central opening, and means on said closure member for the reception of a cap member for sealing the central opening after said diaphragm is pierced.

14. In apparatus of the character described, the combination of a container having an opening, a closure member secured to said container in said opening, said closure member having generally cylindrical walls and having a cylindrical reentrant portion coaxial with said cylindrical walls, said reentrant portion defining a central opening and further defining with said cylindrical walls an annular recess, a pierceable diaphragm sealing said central opening, said reentrant portion having an annular groove on the inner wall thereof, and a cap member adapted to be secured to said reentrant portion to seal the central opening after said diaphragm is pierced, said cap member having an annular protrusion adapted to resiliently seat in said annular groove.

15. In apparatus of the character described, the combination of a container having a pair of openings, a closure member secured to said container in one of said openings, said closure member having a central opening, a pierceable diaphragm sealing said central opening, means on said closure member for the reception of a cap member for sealing the central opening after said diaphragm is pierced, a second closure member secured to said container in the other of said openings, said second closure member having a central opening, and a plug of self-sealing material sealing said latter central opening.

16. In apparatus of the character described, the combination of a container having an opening, a closure member secured to said container, said closure member having a central opening, the upper portion of said central opening being threaded and the lower portion thereof constituting a recess, a plug of rubber-like material sealed in said recess, said plug having a central chamber adapted to receive a supply of liquid self-sealing material, and a plug member threadedly engaged in the threaded portion of said central opening.

17. In a fitting adapted for use in a container of the type having an opening, the combination of a closure member adapted to be secured to said container in said opening, said closure member having generally cylindrical walls and having a cylindrical reentrant portion coaxial with said cylindrical walls, said reentrant portion defining a central opening and further defining with said cylindrical walls an annular recess, and a pierceable diaphragm sealing said central opening.

18. In a fitting adapted for use in a container of the type having an opening, the combination of a closure member adapted to be secured to said container in said opening, said closure member having generally cylindrical walls and having a cylindrical reentrant portion coaxial with said cylindrical walls, said reentrant portion defining a central opening and further defining with said cylindrical walls an annular recess, a pierceable diaphragm sealing said central opening, said reentrant portion having an annular groove on the inner wall thereof, and a cap member adapted to be secured to said reentrant portion to seal the central opening after said diaphragm is pierced, said cap member having an annular protrusion adapted to resiliently seat in said annular groove.

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