Dec. 29, 1959 J. STOCKER 2,918,770

APPARATUS FOR STERILE PACKING OF STERILE SUBSTANCES

Filed March 13, 1958 3 Sheets-Sheet 1

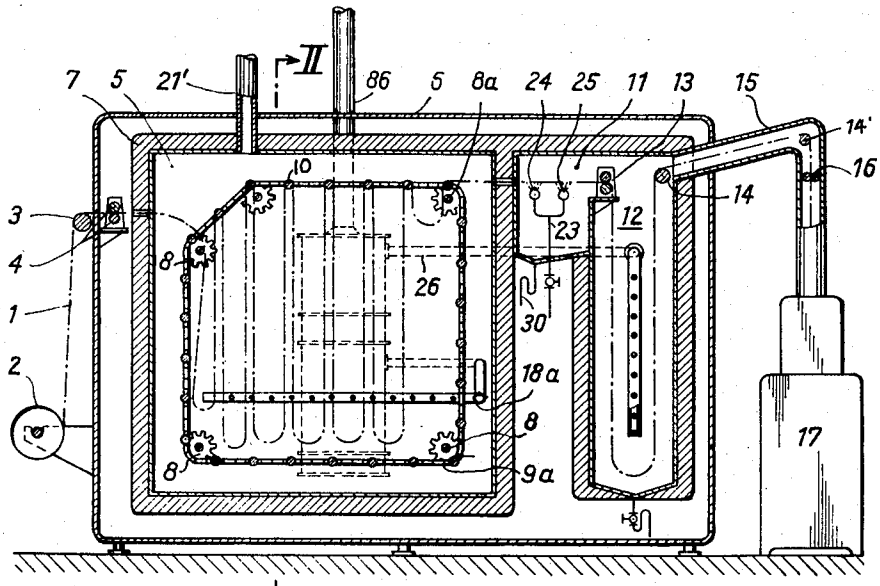

Fig. 1

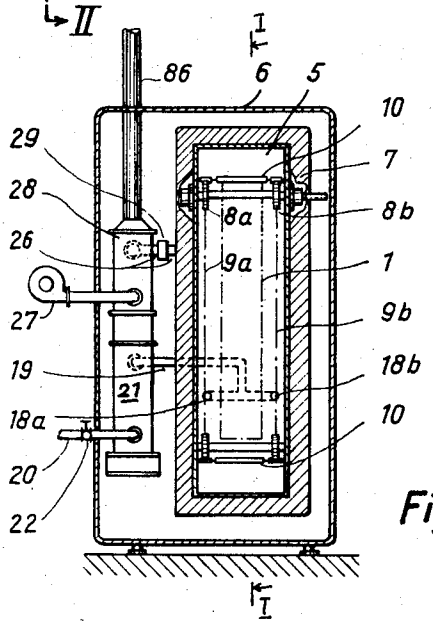

Fig. 2

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APPARATUS FOR STERILE PACKING OF STERILE SUBSTANCES

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Fig. 3

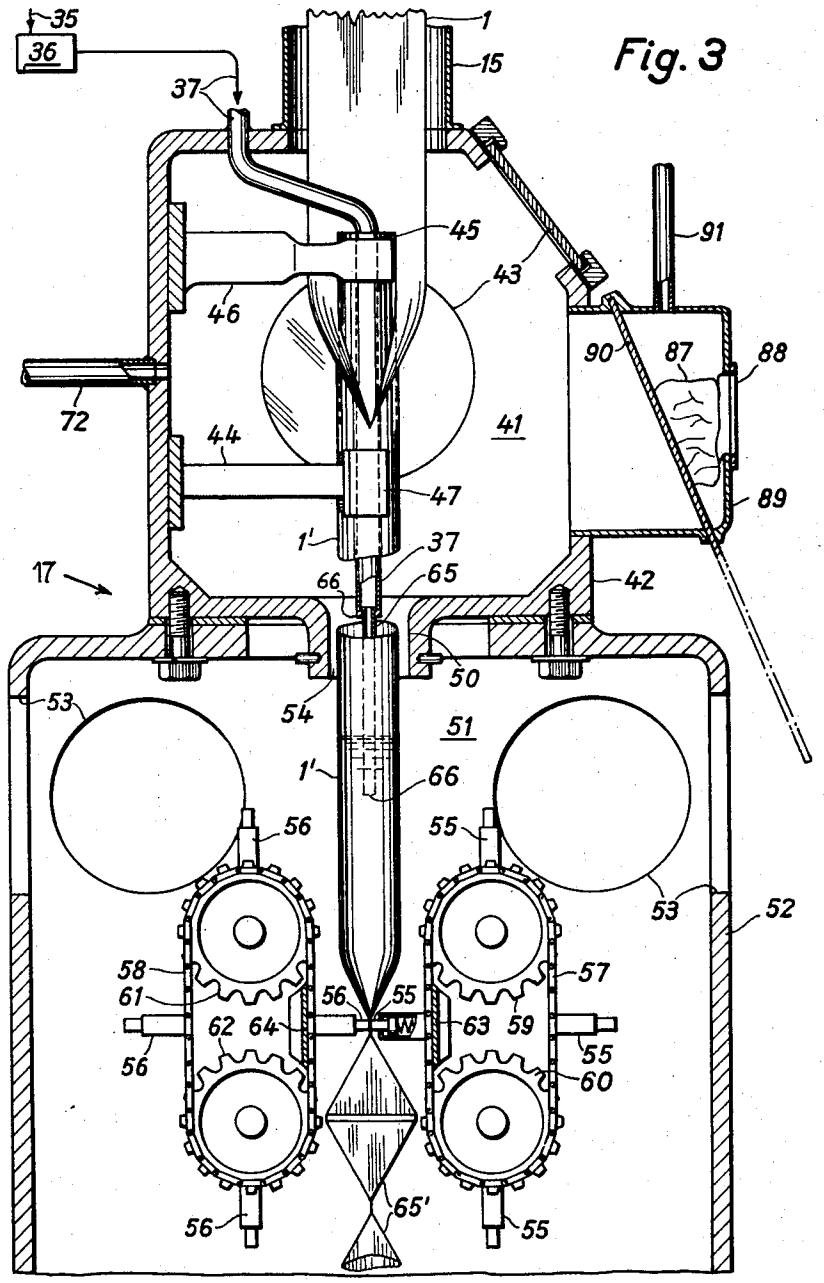

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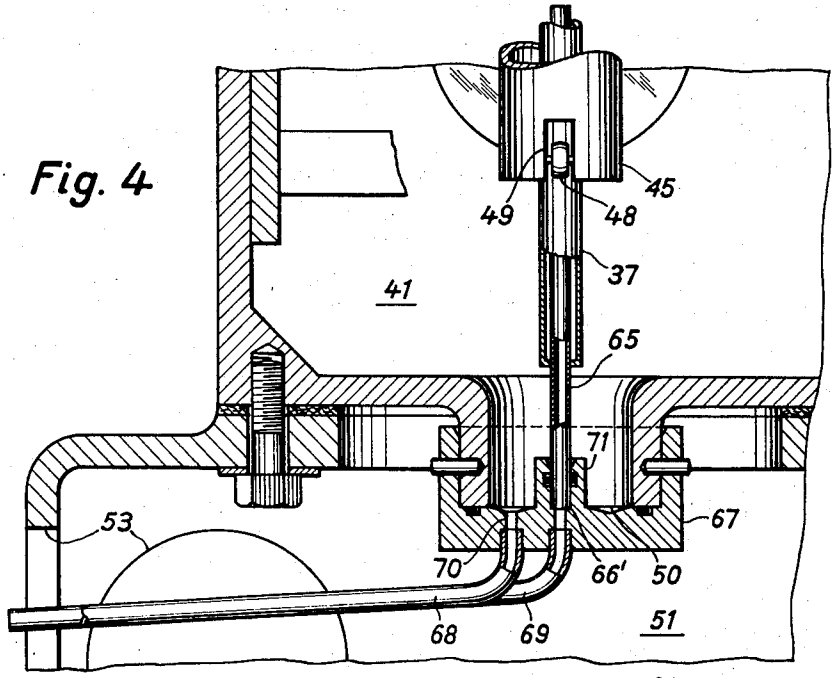
Fig. 4



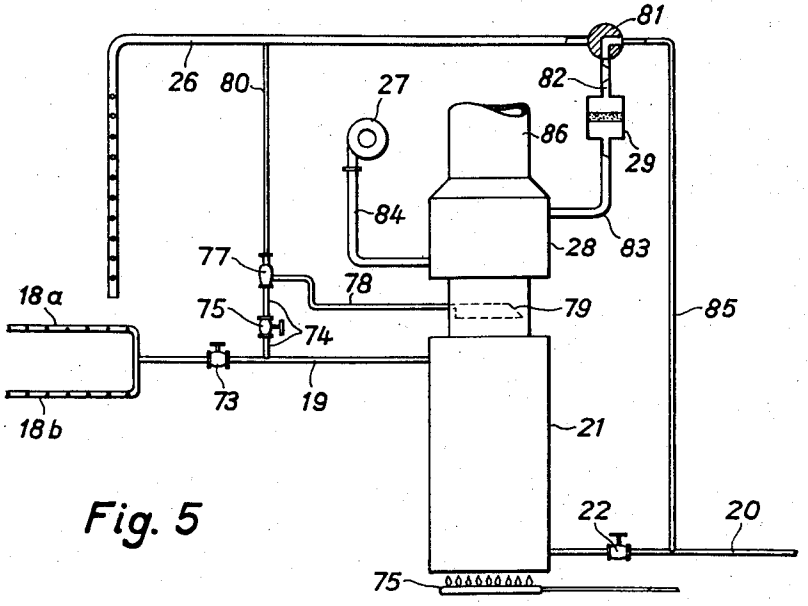


Fig. 5

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APPARATUS FOR STERILE PACKING OF STERILE SUBSTANCES

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Claims priority, application Switzerland March 14, 1957

6 Claims. (Cl. 53—180)

The present invention relates to a method and apparatus for sterile packing of sterile substances.

The present invention is an improvement of a method and apparatus for sterile packing of sterile substances in which a sterile flexible band-like material is transformed into a tube which is filled with the substance to be packed and closed at axially spaced localities by compressing the tube in a direction normal to the longitudinal axis of the tube to form a container between the compressed portions of the tube. According to the invention the tube is formed in a chamber which is sterilized, prior to starting of the apparatus, by introducing a heat carrier having sterilization temperature into the chamber, compression of spaced portions of the tube being effected outside of said chamber.

The apparatus according to the invention includes a sterile chamber containing means for transforming a sterile flexible band-like material which is continuously introduced into the sterile chamber, into a tube. A wall of the chamber has an aperture through which the formed tube enters a second chamber which contains means for compressing the tube to form a closed container, the sterile food to be packed being filled through a pipe extending from the outside through the sterile chamber into the tube as soon as the tube is formed.

Preferably, means are provided through which a sterile medium in the gas or vapor phase and having a slightly superatmospheric pressure can be introduced into the chamber. The aperture through which the newly formed tube leaves the sterile chamber preferably is slightly larger than the cross section of the tube, leaving a space between the tube and the wall in which the aperture is provided through which space the sterilizing medium leaves the sterile chamber and passes into the second chamber wherefrom it may escape into the atmosphere. The pipe for filling the substance to be packed into the tube preferably extends into the interior of the tube. The pipe is advantageously provided with a telescoping end portion so that the filling pipe may be so far extended into the tube as to end outside of the wall of the sterile chamber in which the aperture is provided through which the tube passes. A closure or cover is preferably provided for the aperture which cover has outlet means for the sterilizing medium which is supplied to the sterile chamber and into the filling pipe prior to starting the apparatus. The outlet means may include two separate outlet channels one of which is connected with the sterile chamber, the other being adapted to receive the free end of the telescoping end portion of the filling pipe and to provide a seat for said free end.

The novel features which are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, and additional objects and advantages thereof will best be understood from the following description of an embodiment thereof when read in connection with the accompanying drawing in which:

Fig. 1 is a diagrammatic part sectional elevation of

a plant for sterilizing a flexible band-like material, for forming containers from the material, and for filling and closing the containers.

Fig. 2 is a cross sectional view along line II—II of the plant shown in Fig. 1.

Fig. 3 is a part sectional view of a portion of the plant shown in Fig. 1 in which portion the containers are formed and filled.

Fig. 4 is a large scale sectional view of a part of the apparatus shown in Fig. 3 in position prior to starting the plant according to the invention.

Fig. 5 is a diagram showing the apparatus for preparing and supplying the sterilizing medium.

Like parts are designated by like numerals in the drawing.

The flexible band-like material from which the packages are made according to the invention consists preferably of paper carrying a layer of synthetic material, for example, polyethylene on one side. The paper is sterilized in an apparatus shown in Figs. 1 and 2 and thereafter transformed into packages into which a sterile substance, for example, solid or liquid foodstuff is filled.

Referring more particularly to Figs. 1 and 2 of the drawing, the band-like material 1 which is covered on one side by a film of synthetic material is pulled from a roll 2 over a roller 3 and between two clamping rollers 4 into a sterilizing chamber 5 located within a housing 6. The sterilizing chamber 5 is surrounded by walls 7 which consist in part of heat insulating material. Shafts individually carrying a pair of sprocket wheels 8 are placed within the sterilizing chamber, the shaft carrying the sprocket wheels 8*a* and 8*b* being rotated by means, not shown. Two endless chains 9*a* and 9*b* are laid over the sprocket wheels 8 and are moved upon rotation of the sprocket wheels 8*a* and 8*b*. The chains 9*a* and 9*b* are interconnected by equally spaced parallel and horizontal carrying rods 10.

The band-like material 1 pulled from the roll 2 is supported and guided by the carrying rods 10 so that the interior of the sterilizing chamber 5 is filled with a plurality of hairpin loops formed by the band-like material and freely hanging down from the support rods 10. The paper side of the material rests on the guide or support rods, the layer of synthetic material being on the other side of the band. Due to movement of the rods 10 with the chains 9*a* and 9*b* the loops of band-like material travel from the left to the right in the chamber 5. The band-like material is conducted from the chamber 5 into a moistening chamber 11 and therefrom into a drying chamber 12, by means of a clamping roller pair 13 which may be driven by means, not shown. The material is guided out of the drying chamber 12 by means of a roller 14 and into a duct 15 in which there is an additional guide roller 14' and a driving clamp roller pair 16. The duct 15 terminates in a package forming and filling machine 17.

Distributing pipes 18*a* and 18*b* which are provided with apertures are placed in the sterilizing chamber 5. The pipes 18*a* and 18*b* are supplied through a conduit 19 with steam from a pipe 20 which steam is superheated in a superheater 21. The superheated steam leaves the distributing pipes 18*a* and 18*b* at a temperature of about 400° C. and at slightly superatmospheric pressure. The steam is withdrawn from the top of the sterilizing chamber 5 through a conduit 21'. Supply of the steam serving as sterilizing heat carrier is controlled by means of a valve 22 in the pipe 20. Because of the expansion of the steam in the sterilizing chamber and because of heat losses the average sterilizing temperature in the chamber is about 200° C.

Sterile water is sprayed from nozzles in pipes 24 and 25 against the paper side of the band-like material mov-

ing through the moistening chamber 11. The pipes 24 and 25 are supplied with sterile water through a pipe 23 from a source, not shown. By spraying sterile water on the paper side of the material the latter is cooled and moistened.

The band-like material passes through the drying chamber 12 in the form of a hairpin loop freely hanging down from the rollers 13 and 14. During normal operation sterile drying air is introduced into the interior of the chamber 12 through a pipe 26. The air is taken from the atmosphere by a blower 27, heated in a heater 28, and degerminated in a sterile filter 29 before it is conducted into the pipe 26. The sterile air passes from the drying chamber 12 into and through the duct 15 in the same direction as the band-like material passes into and through the duct. The sterile air escapes from the container forming and filling machine 17 as will be described later. The water collecting in the moistening chamber 11 is removed through a pipe 30 forming a siphon, preventing entry of air from the outside which air may contain germs.

For the sake of this description it is assumed that the substance to be packed is milk. The milk is passed from a conduit 35, as seen in Fig. 3, through a conventional degerminating apparatus 36 which is not shown in detail and in which it is briefly, i.e., during a fraction of a second, heated to a temperature of at least 150° C., for example, by introduction of superheated steam and is cooled immediately thereafter. The treated milk flows through a supply pipe 37 into the package forming and filling machine 17.

The machine 17 includes a sterile chamber 41 which is connected with the lower end of the duct 15. The sterile chamber 41 is formed by a housing 42 provided with hermetically closed observation windows 43. A cylindrical forming element 45 is located within the chamber 41 and supported by means of a carrier 46 mounted to the inside of the housing 42. The band-like material 1 continuously arriving from the duct 15 is so guided around the forming element 45 that it is transformed into a tube 1' whereby the layer of synthetic material faces the element 45. The longitudinal marginal portions of the band-like material 1 overlap, forming part of the formed tube. A heating shoe 47 mounted on a carrier 44 is pressed onto the overlapping portions of the band, the so heated layer of synthetic material producing a tight seal. The shoe 47 is electrically heated. A roller 48 is rotatably supported in a recess 49 (Fig. 4) of the element 45 and presses at the inside of the formed tube against the shoe 47 which is outside of the tube.

The newly formed tube passes from the sterile chamber 41 through an aperture 50 into a second chamber 51 which is separated from the sterile chamber by a wall in which the aperture 50 is provided. The second chamber 51 is formed by a housing 52 which is bolted to the housing 42. The housing 52 is provided with openings 53 and contains the machinery for periodically compressing the tube 1' normal to the longitudinal axis of the tube at predetermined localities and thereby forming closed containers. The area of the aperture 50 is larger than the cross sectional area of the tube 1', leaving a space 54 through which the sterilized air coming from the chamber 12 through the duct 15 into the chamber 41 escapes into the chamber 51.

The apparatus compressing the tube 1' at a right angle to the longitudinal axis of the tube includes electrically heated pairs of pressure elements 55 and 56 which are individually mounted on endless chains 57 and 58. The latter are guided by sprocket wheels 59, 60 and 61, 62, respectively, the wheels 59 and 61 being rotated by means, not shown. Additional pairs of pressure elements operate in a direction normal to the plane of the drawing so that the continuously downward moving tube 1' is alternately compressed at spaced localities in directions which are normal to each other. The chains 57 and 58 are backed up by elements 63 and 64, respectively, at the localities where the compression elements 55 and 56 act on the tube 1'. The latter is transformed into individual closed containers 65' by the action of the aforedescribed heated compression elements.

The substance to be filled, for example, milk is introduced into the chamber 41 through the pipe 37 which is gas-tightly connected with the wall of the chamber. The free end portion of the pipe 37 extends through the interior of the forming element 45 into the formed tube 1'.

An outlet tube 65 is telescopingly connected with the free end portion of the pipe 37. The telescoping outlet tube can be pushed so far up into the pipe 37 that the outlet end 66 of the outlet tube 65 is above the aperture 60 and within the sterile chamber 41. As shown in Fig. 4 the aperture 50 can be closed by means of a closure or cover 67 which can be introduced through one of the openings 53 and applied from the chamber 51. The closure 67 is connected with the bottom wall of the chamber 41 by means of a bayonet catch. The cover 67 has an aperture 70 to which a pipe 68 is connected. The cover 67 has a central boss 71 having a bore adapted to receive the telescoping tube 65. The bore is provided with a shoulder 66' forming a seat for the lower end of the tube 65. A pipe 69 connected with the cover 67 communicates with the bore in the boss 71. Aside from the purposes of the pipes 68 and 69, which will be described later, these pipees serve as a handle when introducing the cover 67 into the chamber 51 and applying it to the lower wall of the chamber 41 for closing the aperture 50. The telescoping tube 65 is thereby pushed into the lower end of the pipe 37.

Prior to starting operation of the aforedescribed apparatus the cover 67 is applied and the apparatus is sterilzed by means of a heat carrier which has at least the sterilization temperature. Superheated steam or a mixture of combustion gases and steam may be used as heat carrier. A temperature of about 400° C. has been found most suitable to reliably destroy germs including germs which are very heat resisting. The steam is preferably superheated in the superheater 21 (Fig. 2) and combustion gases are admixed to the steam which are produced by a gas burner used for heating the superheater. The heat carrier is introduced through the conduit 26 into the drying chamber 12 wherefrom the heat carrier enters the moistening chamber 11. The heat carrier passes also through the duct 15 into the chamber 41 of the package forming and filling machine 17 and leaves the chamber 41 through the bore 70 in the cover 67 and through the pipe 68.

The pipe for supplying the milk to be packed is also sterilized prior to starting normal operation of the plant. For this purpose a heat carrier, for example, superheated steam which has the sterilization temperature is passed through the pipe 37 and removed through the bore in the boss 71 of the cover 67 and through the pipe 69. The time needed for completely sterilizing the apparatus is about half an hour. If desired, additional superheated steam may be introduced into the chamber 41 through a pipe 72. The chamber 51 and the mechanism contained therein is not sterilized.

After the sterilization is completed the aforedescribed supply of heat carrier is stopped and sterile air is now introduced through the conduit 26 into the drying chamber 12. The cover 67 is now removed from the aperture 50 so that sterile air can leave the apparatus through the aperture 50 and the openings 53.

Fig. 5 diagrammatically illustrates the devices and conduits for effecting the aforedescribed sterilization. The pipe 20 which is supplied with saturated steam from a source, not shown, and which is controlled by a valve 22, terminates in the steam superheater 21. The latter is heated by a gas burner 73. The outlet of the super-

heater is connected by means of the conduit **19** and a valve **73** with the distributing pipes **18***a* and **18***b* in the sterilization chamber **5**. A conduit **74** controlled by a valve **75** and including an injector **77** is connected with the conduit **19** for receiving superheated steam therefrom. The suction side of the injector **77** is connected through a conduit **78** with a scoop **79** extending into the flue through which the hot combustion gases leave the steam superheater **21**. A pipe **80** is connected with the discharge side of the injector **77** and terminates in the pipe **26** which supplies sterilizing medium into the drying chamber **12**. A three-way valve **81** is connected with the pipe **26** upstream of the connection with the pipe **80**. A pipe **82** connects the sterile filter **29** with the three-way valve **81**. The inlet side of the filter **29** is connected through a conduit **83** with the outlet of the air heater **28**. The latter receives air from tthe outside through the blower **27** and a conduit **84**. The three-way valve **81** is also connected with the saturated steam supply line **20** through a pipe **85**. The combustion gases emerging from the steam superheater **21** are used for indirectly heating the air heater **28** and emerge from the latter through a stack **86**.

For sterilizing the apparatus prior to starting the package forming and filling operation the valve **73** is closed and the valve **75** is opened so that steam superheated in the superheater **21** is conducted to the injector **77**. The three-way valve **81** is placed in the illustrated position whereby the conduit **85** is connected with the conduit **82**. The injector **77** draws combustion gases leaving the superheater **21** and mixes the gases with superheated steam. The mixture flows through the pipes **80** and **26** into the drying chamber **11** and therefrom through the duct **15** into the chamber **41**. Simultaneously, saturated steam flows through the pipes **85** and **82** and through the sterile filter **29**, sterilizing these parts of the plant. After completion of the sterilization the valve **75** is closed and the valve **73** is opened; the three-way valve **81** is so set that the pipe **82** is connected with the pipe **26** whereupon the blower **27** is started. With the setting of the valves superheated steam flows through the distributing pipes **18***a* and **18***b* into the sterilization chamber **5** while air is taken from the atmosphere by the blower **27**, heated in the air heater **28**, degerminated in the sterile filter **29**, and conducted through the pipe **26** into the drying chamber **12** and therefrom through the duct **15** into the sterile chamber **41**.

The beginning of the band-like material **1** is now taken to the nip of the rollers **4** and introduced into the sterilizing chamber **5** through which it travels while forming depending hairpin-like loops. The sterilized material is moistened and thereby cooled in the moistening chamber **11**. Thereupon the moistened and cooled material is dried in the drying chamber **12** and travels through the duct **15** in a sterile atmosphere into the chamber **41** in which the starting end of the band-like material is laid around the forming element **45** by hand. To avoid infection of the sterilized parts of the apparatus gloves **87** are used for the last mentioned operation. These gloves are gas-tightly connected with the wall of a chamber **89** which is connected to and communicates with the chamber **41** and has openings **88** through which a hand can be introduced into a glove **87**. The chamber **89** can be separated from the sterile chamber **41** by means of a slide **90**. In order to also sterilize the gloves **87** the slide **90** is closed and saturated steam is supplied to the chamber **89** through a pipe **91** which may be connected with the pipe **20** shown in Fig. 5. When sterilization of the gloves is completed the slide **90** is moved into the position shown in dash-dot lines in Fig. 3 whereupon the operator of the apparatus can put his hands into the gloves **87** and manipulate the band-like material **1** to form a tube around the supply pipe **37**.

After compressing the tube **1'** by a pair of compression shoes **55, 56** sterilized milk is filled through the pipe **37** into the tube **1'** whose bottom end is now closed. The supply of the milk is so adjusted that the tube **1'** is always partly filled with milk and the compression shoes **55, 56** are always below the level of the milk in the tube whereby the produced packages are completely filled with milk.

Although the chamber **51** and the apparatus contained therein are not sterile, no reinfection of the substance to be packaged can take place because the portion of the tube **1'** extending into the chamber **51** is completely closed. Germs cannot enter through the space **54** into the sterile chamber **41** because sterile air flows continuously through the duct **15**, the chamber **41** and through the space **54** to the outside of the chamber **41**. The described apparatus assures completely sterile packaging of sterile substances, for example, milk, without sterilization of the chamber **51**. Heating of the chamber **51** and of the machinery contained therein would be difficult particularly in view of the many lubricated parts of this machinery. No moving parts requiring lubrication are in the sterile chamber **41**.

I claim:

1. In a system for sterile packing a sterile substance, a flexible band-like material, into a tube in said chamber, a second chamber adjacent to said sterile chamber, a wall separating said two chambers, an aperture in said wall for passing the newly formed tube from said sterile chamber into said second chamber, means in said second chamber for compressing said tube normal to the longitudinal axis of said tube, means connected with said sterile chamber for filling the sterile substance into said tube, and means connected with said sterile chamber for introducing a heat carrier having sterilizing temperature into said sterile chamber prior to starting the apparatus.

2. In a system as defined in claim 1 and wherein the cross section of said aperture is greater than that of said tube, leaving an open space between said tube and said wall for passing the heat carrier from said sterile chamber into said second chamber after formation of said tube has begun.

3. In a system according to claim 1, a closure for closing said aperture prior to starting the normal operation of the system, said closure having a first aperture for relieving the heat carrier from said sterile chamber, said closure having a second aperture connectable with said means for filling the sterile substance into said tube for passing a sterile heat carrier through said filling means prior to starting normal operation of the system.

4. In a system as defined in claim 1 and wherein said means for filling the sterile substance into said tube consist of a pipe extending from the outside into said sterile chamber and into said tube.

5. In a system according to claim 4 and wherein said pipe has an end portion having an outlet end which is within said sterile chamber, an outlet tube being telescopingly connected with said end portion for selectively placing the outlet of said outlet tube in said sterile chamber or in said second chamber.

6. In a system according to claim 5, a closure for closing said aperture prior to starting normal operation of the system, said closure having a first aperture for relieving the heat carrier from said sterile chamber, said closure having a second aperture connectable with the outlet of said outlet tube when said outlet is in said sterile chamber.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,918,770 December 29, 1959

Josef Stocker

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 26, after "material," insert -- a sterile chamber, means in said chamber for transforming said band-like material --.

Signed and sealed this 1st day of October 1963.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents