Aug. 3, 1954

W. McK. MARTIN

APPARATUS AND METHOD FOR PRESERVING PRODUCTS IN SEALED CONTAINERS

2,685,520

Filed July 23, 1951

4 Sheets-Sheet 1

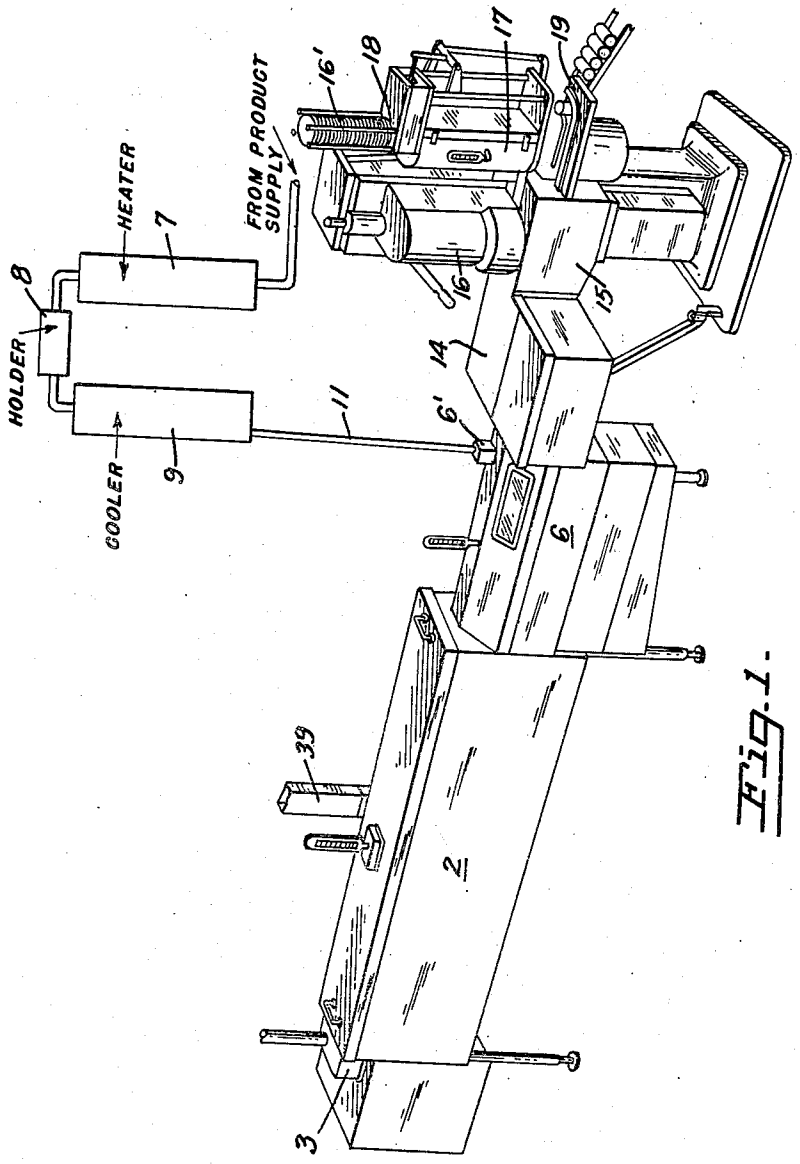

Fig. 1.

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4 Sheets-Sheet 2

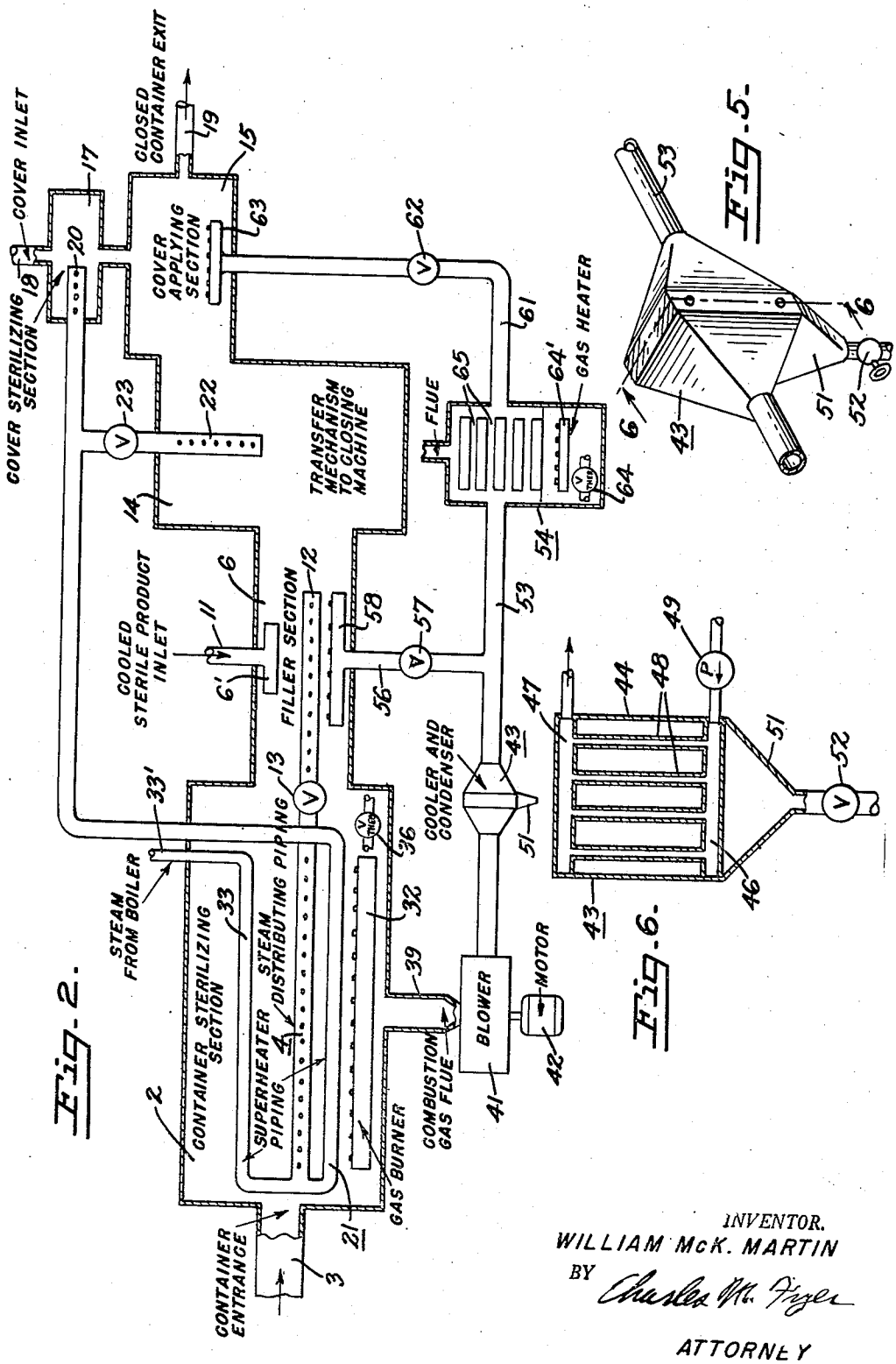

Fig. 2.

Fig. 5.

Fig. 6.

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4 Sheets-Sheet 3

Fig. 3.

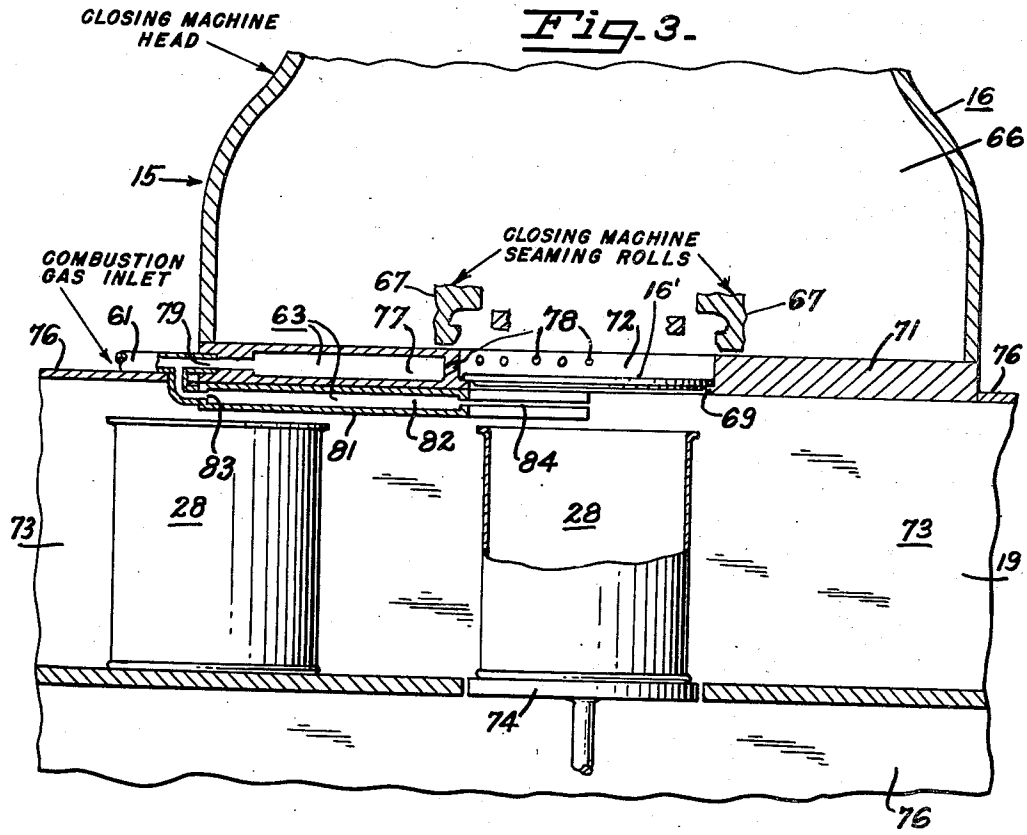
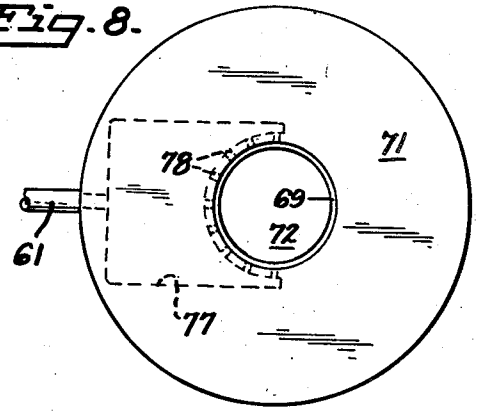


Fig. 8.



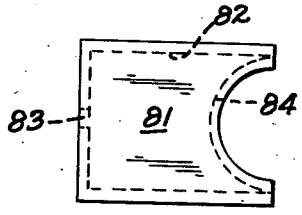


Fig. 4.

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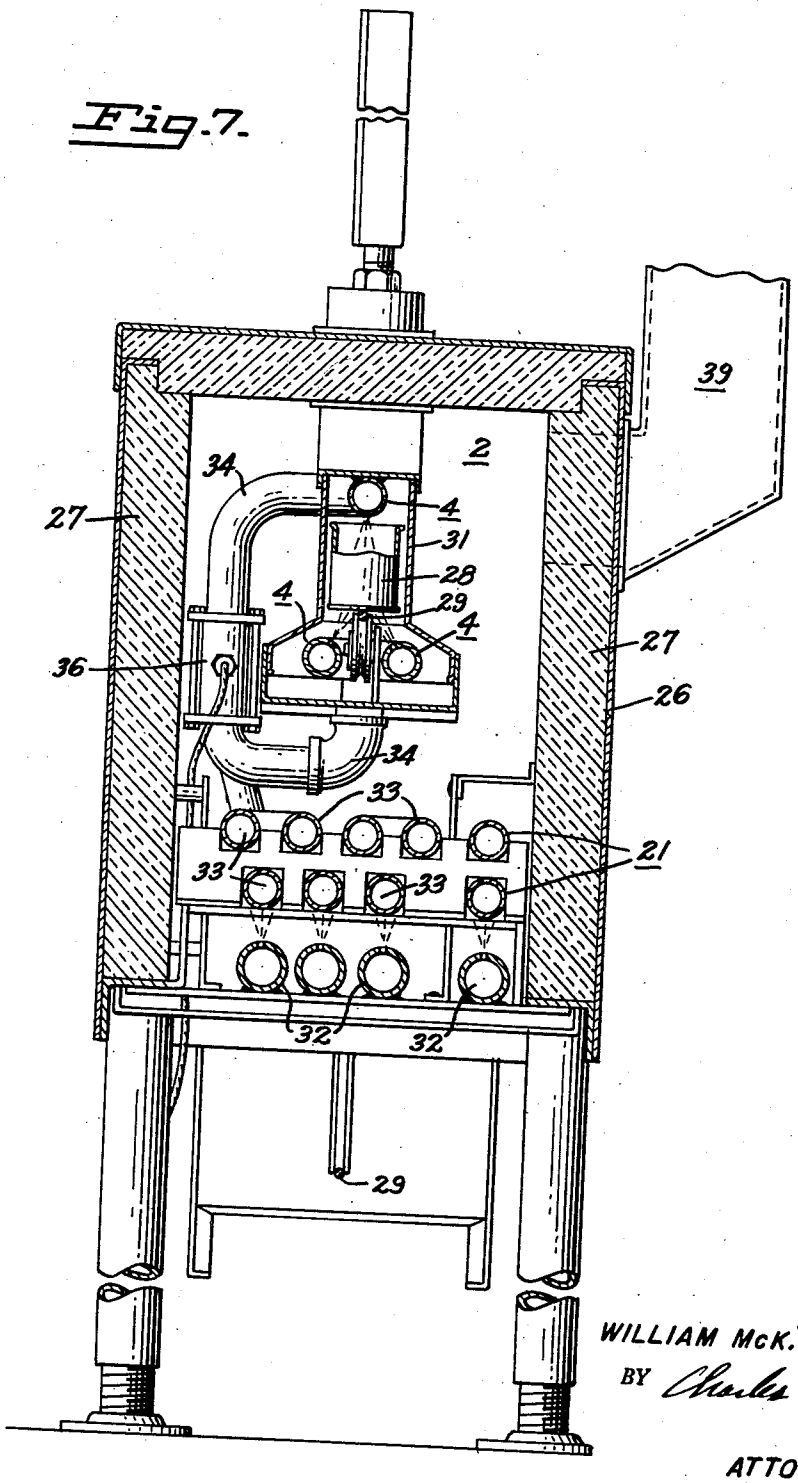
Fig. 7.



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Patented Aug. 3, 1954

2,685,520

UNITED STATES PATENT OFFICE

2,685,520

APPARATUS AND METHOD FOR PRESERVING PRODUCTS IN SEALED CONTAINERS

William McK. Martin, San Mateo, Calif., assignor to James Dole Engineering Co., San Francisco, Calif., a corporation of Nevada

Application July 23, 1951, Serial No. 238,060

17 Claims. (Cl. 99—182)

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This invention relates to the packaging and preserving of products in sealed containers, hereinafter referred to as canning, and more particularly to an improved apparatus and method for canning a sterile product wherein all operations of sterilization of the containers and their covers, filling the containers with the sterile product and applying the sterile covers to the containers are conducted under sterile or aseptic conditions in a unitary self-contained apparatus embodying the principles of assignee's Patent No. 2,549,216, dated April 17, 1951.

As in the apparatus and process of such patent, the operations herein are conducted in the apparatus at substantially atmospheric pressure; sterile conditions being maintained by a superheated gas, heated by auxiliary heating means to impart external sensible heat thereto, to maintain a suitable sterilizing temperature above 212° F. At the same time, the flow of superheated gas into the apparatus serves as a scavenging agent to prevent inflow of outside air through all openings in the apparatus, and thereby prevent bacterial contamination in the apparatus.

Summarizing this invention, the apparatus comprises enclosure means having intercommunicating zones including a container sterilizing section provided with an entrance for containers to be filled, a product filling section having means therein for filling the containers with a pre-sterilized product, a cover sterilizing section, and a section having means therein for applying covers to the product filled containers and having an exit for the covered containers. Means is provided for continuously conveying a line of empty containers through the container sterilizing section where they become sterilized, and at such speed with reference to a filler in the filler section as to cause each container to become substantially completely filled as it passes by the filler which supplies a continuous stream of the pre-sterilized product into the containers.

From the filler section, the product filled containers are conducted to the cover applying section which contains a conventional closing machine for applying sterile covers to the product filled containers; the covers having been previously sterilized in the cover sterilizing section which communicates with the cover applying section.

Steam is the preferred gas herein for effecting sterilization of the containers and their covers. However, with respect to some products, such as milk, and which have been cooled in the pre-sterilization of the product, flow of superheated

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steam into the filler section while the product is being filled in the containers, may cause an undesirable temperature rise of the cooled product. This temperature rise, although it has no adverse effect insofar as the efficacy of the process is concerned, may cause an undesirable flavor effect. It is, therefore, desirable with respect to such products to obviate the temperature rise of the product in the filler section. The temperature rise is particularly accelerated by the superheated steam because of its high heat of condensation, which may cause marked heating up of the product should any of the steam condense on the conventional open mouth containers into which the product is filled.

Also, in the cover applying section, steam, which becomes entrapped in the head space of the containers after the covers have been sealed thereon, condenses in the cover sealed containers. This produces an extremely high vacuum which causes so-called "paneling" of the containers. Such paneling is a caving in of the sides of the containers and naturally may become particularly aggravating with respect to relatively large size containers, and is undesirable.

To obviate these problems, flow of a sterile gas other than steam, namely an essentially non-aqueous gas, is continuously introduced into the filler section to displace the steam therefrom; and this gas is preferably cooled so as to minimize as much as possible temperature rise of the cooled sterile product being filled into the containers. Also, a similar sterile gas is continuously introduced into the cover applying section to displace steam therefrom, and thereby obviate the high degree of vacuum which would otherwise occur in the containers as steam condenses therein after the containers have been sealed. Introduction of the essentially non-aqueous gas into cover applying section also obviates temperature rise of the product, which might otherwise result from the high heat of condensation of steam.

The gas introduced into the cover applying section is preferably continuously heated to insure maintaining of sterile conditions of the mechanical parts of the closing machine located in that section. In this connection, the gas introduced into the filler section need not be heated because after sterile conditions are once created in such section, the flow of any sterile gas therein whether heated or cooled, will maintain such sterile conditions by preventing inflow of outside air through any openings in the filler section. Although it is desirable to introduce

the essentially non-aqueous sterile gas into both the filler section and the cover applying section to displace steam from both of these sections, such gas may be introduced only into either one of such sections but without obtaining the full advantages of introducing the gas into both sections.

Any suitable sterile gas substantially non-condensable at operating temperatures of the apparatus, such as sterile nitrogen or carbon dioxide, or even sterile air may be employed to displace the steam from the sections previously mentioned. It is preferred to utilize an inert or non-oxygen containing gas as the oxygen may produce an adverse taste effect on the product, and also may promote corrosion of metallic containers. In the particular embodiment of the invention described herein, the steam is superheated by means of a gas burner located in an enclosure containing a container sterilizing unit through which the empty containers are conducted. Advantage is taken of this arrangement, by utilization of combustion gases from the ignited gas issuing from the burner, as the source of inert gas for the displacement of the steam from the filler and the cover applying sections of the apparatus.

From the preceding summary, it is seen that this invention has as its objects, among others, the provision of an improved and economical apparatus and method of the character disclosed in the aforementioned patent, embodying means for obviating temperature rise of the cooled product being filled into the containers, or means to displace steam from the containers in the cover applying section to avoid so-called paneling of the containers and hold down temperature rise of the product, or embodying both of such means. Other objects and further particulars of the invention will become apparent from the following description in which reference is made to the drawings. In such drawings:

Fig. 1 is a more or less schematic assembly view illustrating the main parts of the apparatus;

Fig. 2 is a schematic outline of the apparatus for depicting the process in flow sheet form;

Fig. 3 is a fragmentary schematic vertical sectional view of conventional parts of a conventional can closing machine, illustrating the manner in which the inert gas is introduced into the cover applying section of the apparatus;

Fig. 4 is a schematic plan view of a gas diffuser employed in the cover applying section;

Fig. 5 is an isometric schematic view illustrating a cooler and condenser embodied in the apparatus for cooling the combustion gas and condensing the moisture therefrom.

Fig. 6 is a vertical sectional view taken in a plane indicated by line 6—6 in Fig. 5;

Fig. 7 is a transverse vertical section of a preferred form of container sterilizer section of the apparatus, in which hot combustion gases are utilized to superheat steam;

Fig. 8 is a schematic plan view of the closing machine base.

The apparatus is of the same type disclosed in the aforementioned patent and comprises container sterilizing section 2 having an entrance 3 into which empty containers to be sterilized are continuously conducted and through which the containers are conveyed in upright position by any suitable conveying means. Steam distributing piping 4 having steam ejection orifices is provided in the container sterilizing section from which flow of superheated steam is continually ejected at substantially atmospheric pressure to sterilize the containers as they pass through the container sterilizing section. Under most conditions, a temperature of between 350° F. to 500° F. will effect thorough sterilization of the containers in the container sterilizing section when the time of travel of containers therethrough is about one minute to thirty seconds, respectively; the longer the residence time of the containers in the container sterilizing section, the lower the sterilizing temperature required.

For example, effective sterilization of the containers when the residence time in the container sterilizing section is about thirty seconds can be effected at a temperature of about 500° F. If the temperature is 550° F., the residence time would only be about twenty seconds. For commercial practicability, it is desirable that the residence time be relatively short. Therefore, higher sterilizing temperatures are preferred.

Container sterilizing section 2 communicates with filler section 6. The filler section is preferably of the type disclosed in applicant's copending application, Serial No. 104,074, filed July 11, 1949 for "Apparatus and Method for Filling Products in Containers," and is hence only generally referred to herein. A cooled pre-sterilized product is continuously fed to a filler 6' in filler section 6, which is of the type disclosed in the aforementioned application. For effecting pre-sterilization of the product, a so-called "flash sterilization" system which is well known in the art for sterilization of food products, is employed, which enables the product to be rapidly sterilized.

The "flash sterilization" system is illustrated schematically in Fig. 1, and includes a heater 7 which is maintained at such high temperature as to sterilize the product rapidly. Heater 7 is connected by piping to a so-called holder 8 where the temperature is maintained for a sufficient length of time to complete the sterilization; and holder 8 is connected by piping to a cooler 9 wherein the sterilized product is chilled or cooled. The cooled sterile product is conducted from cooler 9 to the filler 6' in the filler section by piping 11.

Superheated steam distributing piping 12 is also provided in filler section 6, and is connected to steam distributing piping 4 in container sterilizing section 2. A valve 13 is provided to control flow of superheated steam from piping 4 into piping 12. During normal operation of the embodiment of the invention hereof, flow of steam from piping 4 to piping 12 is shut off by valve 13. The superheated steam is introduced directly into the filler section only when operation of the apparatus is initiated to sterilize the interior of the filler section and all the appurtenances therein. After such initial sterilization is effected, the direct flow of superheated steam from piping 12 is shut off but sterile conditions are maintained in the filler section by introduction of the inert sterile gas into the filler section in a manner to be described.

From filler section 6, the containers filled with the sterile product are conducted into a housing 14 containing suitable mechinism for transferring the containers to a cover applying section 15 having a conventional closing machine 16 for applying sterilized covers 16' to the product filled containers. The covers are sterilized by super-

heated steam in a cover sterilizing section 17 which is in communication with cover applying section 15 to which the sterilized covers are conducted by suitable means. A cover inlet opening 18 is provided in cover sterilizing section 17; and the covered product filled containers are discharged from cover applying section 15, through exit 19. The cover sterilizing section is preferably of the type disclosed in applicant's copending application, Serial No. 178,116, filed August 7, 1950 for "Apparatus and Method for Sterilizing Container Covers."

The temperature of the superheated steam introduced into cover sterilizing section 17 and the length of time for sterilizing the covers are of substantially the same order as that employed for sterilization of the containers. Superheated steam distributing piping 20 is provided in cover sterlizing section 17; such piping being connected to piping 21 in the container sterilizing section 2 in which the steam is superheated. Also connected to piping 21, is steam distributing piping 22 which extends into transfer housing 14; a valve 23 being provided in piping 22 for allowing superheated steam to be introduced into the transfer housing to sterilize the interior thereof when the operation of the apparatus is initiated. As with respect to valve 13, valve 23 may be shut off after the entire apparatus has been sterilized, and is operating.

As previously mentioned, combustion gases are provided for superheating the steam. For this purpose, a gas burner is associated directly with the container sterilizing section 2 to superheat the steam. The type of container sterilizer disclosed in applicant's copending application, Serial No. 199,020, filed December 4, 1950 for "Apparatus and Method for Sterilizing Containers" is employed herein. Since such container sterilizer is described in detail in the aforementioned application, Serial No. 199,020, it will be described only generally herein.

Referring to Fig. 7, the container sterilizing section 2 comprises an elongated enclosure 26 having insulated walls 27 and which is mounted on suitable supports. The entrance 3 for containers 28 is provided in one end wall. An endless cable 29, driven by suitable drive means, supports and conducts containers 28 through the container sterilizing section in upright position. Superheated steam distributing piping 4 includes a branch mounted above the tops of the containers to introduce jets of superheated heat directly into the mouths of the containers, and a pair of branches located below the bottoms of the containers to direct jets of the superheated steam directly against the bottoms to thereby thoroughly sterilize the seams of the containers.

The containers are conducted through a sterilizing unit 31 supported in enclosure 26 and which is in the form of an elongated hood which houses steam distributing piping 4. Conventional gas burner tubes 32 mounted adjacent the bottom of enclosure 26 superheat steam as it passes through coiled superheater piping 33 connected at 33' (Fig. 2) to any suitable steam generating source, such as a boiler. Piping 33 is connected to the steam distributing piping 4 by piping including connecting elbows 34; and a thermostat control 36 is connected in any usual manner to the control valve of gas burner 32 for automatically controlling the sterilizing temperature in the container sterilizing section. For the sterilization of the covers in the cover sterilizing section 17, the steam superheater comprises the previously mentioned piping 21 in the form of a coil which is in the container sterilizing section above one of gas burner tubes 32.

From the preceding, it is seen that the superheater piping 21 and 33 is heated by the combustion gases from burner tubes 32. These combustion gases pass around sterilizer unit 31, and escape from enclosure 26 through flue 39. Connected to flue 39 is an exhaust blower 41 driven in any suitable manner by electric motor 42. The blower discharges the exhaust combustion gases into a moisture condensing and gas cooling unit 43 of conventional construction wherein the combustion gases are cooled, and wherein the moisture in the combustion gases is also condensed to water which drains from the cooled combustion gases. The condenser and cooling unit comprises a housing 44 connected to blower 41 and which contains a condenser unit comprising a lower tank 46 and an upper tank 47 connected by tubing 48. Cooling fluid, such as water, is circulated to the lower tank 46 by any suitable means such as pump 49 and flows out through upper tank 47 to the usual cooler tower for cooling the water which has exchanged heat with the combustion gases.

In the preferred embodiment of the invention, the combustion gases entering condensing and cooling unit 43 are at substantially atmospheric pressure. It is desirable that the temperature of the cooling water be such that the combustion gases be cooled to any suitable temperature below 212° F., preferably to at least 165° F., so that substantially all the moisture in the combustion gases be condensed to water which is collected in sump 51 of cooler housing 44 and can be drained from time to time through valve 52. In this connection, the usual combustion gases contain about 72% of nitrogen which is inert, about 9% carbon dioxide which is also inert and about 19% of moisture in the form of steam. Also, such gases may contain traces of oxygen, carbon monoxide, and other gases. Elimination of substantially all the moisture from the combustion gases is desirable for most efficient results, this obviates the high latent heat of condensation which might otherwise be imparted to the containers should the steam in the combustion gases condense thereon. However, cooling of the combustion gases to condense moisture therefrom is not essential as any flow of sterile gas into the sections of the apparatus where it is desired to displace steam for the purposes previously related, will accomplish the desired effects to some extent.

Connected to the outlet end of cooler and condensing unit 43 by piping 53, is a suitable heater 54 for reheating the combustion gases after they have been cooled and the moisture has been removed therefrom, for a purpose to be explained. A portion of the cooled combustion gases is introduced directly into filler section 6 through piping 56 connected to piping 53 and containing control valve 57; piping 56 being connected to perforated distributor pipe 58 mounted in the filler section. Thus, by virtue of the continual flow of the cool combustion gases into filler section 6 from distributor piping 58, very little, if any, steam will enter such filler section through either end thereof, as the cooled combustion gases displace and prevent inflow of steam into the filler section. As a result, excessive temperature rise of the cooled sterile product as it is introduced into the heated containers from the container sterilizing section is obviated. In this connection, it will be apparent that for displacing super-

heated steam from filler section 6 for the purpose related, any other sterile inert gas besides combustion gases, can be continuously introduced into such section.

As previously related, in initiating operation of the apparatus, the filler section is first completely sterilized by introduction of superheated steam therein from superheated steam distributing piping 12, which is subsequently shut off after the filler section has become sterile and the apparatus is ready for actual operation. When this occurs, the combustion gases are introduced into the filler section by opening valve 57; and since such gases are sterile the continual flow thereof into the filler section will maintain sterile conditions therein. If the product is of such character that temperature rise thereof will not adversely affect its taste, valve 57 may be shut off, and valve 13 for steam distributing piping 12 may be kept open to allow continual flow of superheated steam into the filler section.

From heater 54, the reheated combustion gases are conducted to the cover applying section 15 by piping 61 containing control valve 62, and connected to suitable distributing means 63 in the cover applying section. It is desirable that the moisture free combustion gases be reheated to a sufficiently high sterilizing temperature to maintain sterile the mechanism of the closing machine 16 in the cover applying section. In this connection, the gases should be reheated to a temperature sufficient for this purpose which is in the previously mentioned range of between 350° F. to 500° F.; the temperature being preferably around the higher limit.

Heater 54 is preferably a gas burner tube heater of the type employed in the container sterilizing section but may be of any other type such as an electric heater. The temperature of the heater is preferably automatically controlled by means of thermostat 64 which controls a gas burner valve (not shown) connected to gas burner tubing 64'. Also, heater 54 is provided with suitable heat exchange tubing 65 through which the cooled combustion gases from piping 53 pass, and about which the combustion gases from heater 54 pass.

As is illustrated in Fig. 3, the conventional closing machine comprises a head 66 containing rotatable seaming rolls 67, which, when the conventional open mouth flanged metal container 28 is brought into seaming position in relation thereto, seam together such flange and the container cover 16'. In this operation, cover 16' for the container is brought into position by conventional mechanism of such machine (not shown) onto a substantially circular lip 69 formed on the base 71 of head 66, about a substantially circular aperture 72 in the base.

The containers 28 are conducted along a passageway 73 provided below head 66, in proper spaced and timed relationship and with an intermittent motion, by conventional conveying mechanism. When each container comes to rest on a lift 74 below aperture 72, the mechanism is timed to move lift 74 upwardly and lift such container upwardly into engagement with a cover 16' supported on lip 69 and which has been deposited on the lift by suitable timed feeding mechanism. After engagement of the container with the cover, both are moved further by the lift into seaming relationship with respect to the seaming rolls 67. When the seaming operation is completed, lift 74 is automatically lowered and the seamed container is then discharged from the closing machine through exit 19 of passageway 73. In this connection, in the apparatus of this invention, passageway 73 is shrouded by metal shrouding 76 forming part of the wall of the cover applying section 15 into which the superheated scavenging gas is introduced.

For maintaining the seaming mechanism in head 66 sterile, base 71 of the head is formed with a hollow space 77 forming part of the previously mentioned combustion gas distributing means 63 and which communicates with a plurality of discharge orifices 78 extending partially around lip 69. An inlet orifice 79 is provided in base 71 and communicates with space 77 to provide for the introduction of the heated combustion gas therein; inlet orifice 79 being connected to the previously mentioned piping 61. Thus, the flow of heated combustion gas into head 66 not only maintains the seaming mechanism sterile but also maintains the top of cover 16' sterile which has been previously sterilized in the cover sterilizing section and conducted into the cover applying section by suitable mechanism.

Sterility of the underside of cover 16' is maintained and flow of heated combustion gas is introduced into passageway 73 to prevent inflow of outside air therein, by means of a distributor 81 also forming part of the previously mentioned combustion gas distributing means 63 and which is fixedly attached below base 71 in the top of passageway 73. Distributor 81 has an interior space 82 communicating with gas inlet orifice 83 connected to the previously mentioned piping 61; and it is also provided with a discharge slit 84 for the combustion gases extending partially around aperture 72.

Inasmuch as flow of the heated combustion gases is continuously introduced into cover applying section 15, it will displace substantially completely any superheated steam which is being continuously introduced into cover sterilizing section 17 and into other sections of the apparatus during operation thereof. Thus, there will be no problem of such steam condensation in the head spaces of the sealed containers, thereby obviating the formation of excessive vacuum which sometimes results in the caving in or paneling of the containers, which is particularly aggravating with respect to large size containers. At the same time, the heated combustion gases will maintain sterile conditions in the cover applying section. In this connection, no steam will condense from moisture contained in the combustion gases because of the moisture having been removed by passage through the cooler and condenser 43. As with respect to the filler section 6, sterile gas other than combustion gases can be introduced into the cover applying section 15, and any moisture in such gas need not be removed therefrom. However, the removal of moisture from the combustion gases or any other moisture containing gas that may be employed, is advantageous to prevent formation of the vacuum in the covered containers that might otherwise be caused from condensation of moisture in the gas.

The apparatus and method of this invention function the same as described in the aforementioned Patent No. 2,549,216; the difference being in that instead of the preferred steam of the patent introduced throughout the entire apparatus and which is superheated to an adequate sterilizing temperature above 212° F. at atmospheric pressure, the combustion gases for superheating the steam in the container sterilizing section 2 are utilized in the filler section 6 and in

the cover applying section 15 to displace superheated steam therefrom for the purpose related.

In preparing the apparatus for operation, superheated steam is introduced directly into all sections of the apparatus, except the cover applying section 15; valve 13 being open at first to cause filler section 6 to become sterilized by the superheated steam. The cover applying section 15 will become sterilized by the heated combustion gases. After the apparatus has become completely sterilized, valve 13 is closed and valve 57 is opened to introduce the combustion gases into filler section 6. After the apparatus has been thus sterilized, the canning operation can be conducted continuously until the apparatus is shut down for any purpose, with superheated steam injected directly into the container sterilizing section 2 and cover sterilizing section 17, and with the combustion gases introduced into filler section 6 and cover applying section 15. Valve 23 which controls the flow of superheated steam into transfer section 14 may be left open or closed during actual operation of the apparatus inasmuch as such section when once sterilized by the superheated steam will remain sterile by flow of gas throughout the entire apparatus.

I claim:

1. Canning apparatus comprising intercommunicating enclosure means containing a container sterilizing section having an entrance for containers to be filled, a product filling section having means therein for filling the containers with a pre-sterilized product, a cover sterilizing section, and a section having means therein for applying container covers to the product filled containers and having an exit for covered containers; said entrance and exit being open to the atmosphere whereby gas introduced into the apparatus will be at substantially atmospheric pressure; means for introducing steam into said apparatus; heating mechanism for imparting external sensible heat to said steam to superheat said steam to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; and piping in addition to steam piping connected to said product filling section for conducting flow of an essentially non-aqueous gas into said product filling section simultaneously with introduction of said steam into said apparatus.

2. Canning apparatus comprising intercommunicating enclosure means containing a container sterilizing section having an entrance for containers to be filled, a product filling section having means therein for filling the containers with a pre-sterilized product, a cover sterilizing section, and a section having means therein for applying container covers to the product filled containers and having an exit for covered containers; said entrance and exit being open to the atmosphere whereby gas introduced into the apparatus will be at substantially atmospheric pressure; means for introducing steam into said apparatus; heating mechanism for imparting external sensible heat to said steam to superheat said steam to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; and piping in addition to steam piping connected to said cover applying section for conducting flow of an essentially non-aqueous gas into said cover applying section simultaneously with introduction of said steam into said apparatus.

3. Canning apparatus comprising intercommunicating enclosure means containing a container sterilizing section having an entrance for containers to be filled, a product filling section having means therein for filling the containers with a pre-sterilized product, a cover sterilizing section, and a section having means therein for applying container covers to the product filled containers and having an exit for covered containers; said entrance and exit being open to the atmosphere whereby gas introduced into the apparatus will be at substantially atmospheric pressure; means for introducing steam into said apparatus; heating mechanism for imparting external sensible heat to said steam to superheat said steam to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; piping in addition to steam piping connected to said product filling section for conducting flow of an essentially non-aqueous gas into said product filling section simultaneously with introduction of said steam into said apparatus; and piping in addition to said steam piping connected to said cover applying section for conducting flow of an essentially non-aqueous gas into said cover applying section simultaneously with introduction of said steam into said apparatus.

4. Canning apparatus comprising intercommunicating enclosure means containing a container sterilizing section having an entrance for containers to be filled, a product filling section having means therein for filling the containers with a pre-sterilized product, a cover sterilizing section, and a section having means therein for applying container covers to the product filled containers and having an exit for covered containers; said entrance and exit being open to the atmosphere whereby gas introduced into the apparatus will be at substantially atmospheric pressure; means for introducing steam into said apparatus; heating mechanism for imparting external sensible heat to said steam to superheat said steam to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; means for effecting flow of an essentially non-aqueous gas into said product filling section; means for cooling said gas prior to introduction thereof into said product filling section; means for effecting flow of an essentially non-aqueous gas into said cover applying section; and means for heating the latter gas prior to introduction thereof into said cover applying section.

5. Canning apparatus comprising intercommunicating enclosure means containing a container sterilizing section having an entrance for containers to be filled, a product filling section having means therein for filling the containers with a pre-sterlized product, a cover sterilizing section, and a section having means therein for applying container covers to the product filled containers and having an exit for covered containers; said entrance and exit being open to the atmosphere whereby gas introduced into the apparatus will be at substantially atmospheric pressure; means for introducing steam into said apparatus; a gas burner for imparting external sensible heat to said steam to superheat said steam to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; and means for effecting flow of the combustion gas from the gas burner into the cover applying section.

6. Canning apparatus comprising intercommunicating enclosure means containing a container sterilizing section having an entrance for containers to be filled, a product filling section having means therein for filling the containers with a pre-sterilized product, a cover sterilizing section, and a section having means therein for applying container covers to the product filled

containers and having an exit for covered containers; said entrance and exit being open to the atmosphere whereby gas introduced into the apparatus will be at substantially atmospheric pressure; means for introducing steam into said apparatus; a gas burner for imparting external sensible heat to said steam to superheat said steam to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; means for effecting flow of the combustion gas from the gas burner into the cover applying section; and means for heating said combustion gas prior to introduction thereof into said cover applying section.

7. Canning apparatus comprising intercommunicating enclosure means containing a container sterilizing section having an entrance for containers to be filled, a product filling section having means therein for filling the containers with a pre-sterilized product, a cover sterilizing section, and a section having means therein for applying container covers to the product filled containers and having an exit for covered containers; said entrance and exit being open to the atmosphere whereby gas introduced into the apparatus will be at substantially atmospheric pressure; means for introducing steam into said apparatus; a gas burner for imparting external sensible heat to said steam to superheat said steam to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; means for effecting flow of the combustion gas from the burner into the cover applying section; means for cooling said combustion gas prior to introduction thereof into said cover applying section to a temperature at which the moisture in said gas will condense; and means for heating said cooled combustion gas prior to introduction thereof into said cover applying section.

8. Canning apparatus comprising intercommunicating enclosure means containing a container sterilizing section having an entrance for containers to be filled, a product filling section having means therein for filling the containers with a pre-sterilized product, a cover sterilizing section, and a section having means therein for applying container covers to the product filled containers and having an exit for covered containers; said entrance and exit being open to the atmosphere whereby gas introduced into the apparatus will be at substantially atmospheric pressure; said container sterilizing section having a hood providing a passageway through which the containers to be sterilized are conducted; steam distributing piping in said hood; steam piping outside the hood connected to said distributing piping; a gas burner associated with said latter piping for imparting external sensible heat to steam in said latter piping to superheat said steam to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; and means for effecting flow of the combustion gas from the gas burner into another section of the apparatus.

9. Canning apparatus comprising intercommunicating enclosure means containing a container sterilizing section having an entrance for containers to be filled, a product filling section having means therein for filling the containers with a pre-sterilized product, a cover sterilizing section, and a section having means therein for applying container covers to the product filled containers and having an exit for covered containers; said entrance and exit being open to the atmosphere whereby gas introduced into the apparatus will be at substantially atmospheric pressure; said container sterilizing section having a hood providing a passageway through which the containers to be sterilized are conducted; steam distributing piping in said hood; steam piping outside the hood connected to said distributing piping; a gas burner associated with said latter piping for imparting external sensible heat to steam in said latter piping to superheat said steam to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; and means for effecting flow of the combustion gas from the gas burner into said product filling and said cover applying sections.

10. Canning apparatus comprising intercommunicating enclosure means containing a container sterilizing section having an entrance for containers to be filled, a product filling section having means therein for filling the containers with a pre-sterilized product, a cover sterilizing section, and a section having means therein for applying container covers to the product filled containers and having an exit for covered containers; said entrance and exit being open to the atmosphere whereby gas introduced into the apparatus will be at substantially atmospheric pressure; said container sterilizing section having a hood providing a passageway through which the containers to be sterilized are conducted; steam distributing piping in said hood; steam piping outside the hood connected to said distributing piping; a gas burner associated with said latter piping for imparting external sensible heat to steam in said latter piping to superheat said steam to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; means for effecting flow of the combustion gas from the gas burner into said product filling and said cover applying sections to displace steam therefrom; means for cooling said gas prior to introduction thereof into said sections; and means for heating said gas prior to introduction thereof into said cover applying section.

11. In the method of canning wherein a continuous flow of steam superheated to a temperature at atmospheric pressure substantially in excess of 212° F. is introduced into an enclosed system open to the atmosphere and including a container sterilizing zone, a zone in which a pre-sterilized cooled product is filled into said containers, a cover sterilizing zone, and a zone in which the covers are applied to the filled containers, all of said zones being in intercommunication, the step of continuously displacing said steam in said product filling zone to minimize rise in temperature of said cooled product by continuously introducing into said product filling zone an essentially non-aqueous and sterile gas while simultaneously maintaining independent flow of said superheated steam in said system.

12. In the method of canning wherein a continuous flow of steam superheated to a temperature at atmospheric pressure substantially in excess of 212° F. is introduced into an enclosed system open to the atmosphere and including a container sterilizing zone, a zone in which a pre-sterilized cooled product is filled into said containers, a cover sterilizing zone, and a zone in which the covers are applied to the filled containers, all of said zones being in intercommunication, the step of continuously displacing said steam in said cover applying zone to minimize rise in temperature of said cooled product and to minimize paneling of said containers by continuously introducing into said cover applying zone

an essentially non-aqueous and sterile gas while simultaneously maintaining independent flow of said superheated steam in said system.

13. In the method of canning wherein a continuous flow of steam superheated to a temperature at atmospheric pressure substantially in excess of 212° F. is introduced into an enclosed system open to the atmosphere and including a container sterilizing zone, a zone in which a pre-sterilized cooled product is filled into said containers, a cover sterilizing zone, and a zone in which the covers are applied to the filled containers, all of said zones being in intercommunication, the steps of continuously displacing said steam in said cover applying zone to minimize rise in temperature of said cooled product and to minimize paneling of said containers by continuously introducing into said cover applying zone an essentially non-aqueous and sterile gas while simultaneously maintaining independent flow of said superheated steam in said system, and heating said gas prior to introduction thereof into said cover applying zone.

14. In the method of canning wherein a continuous flow of steam superheated to a temperature at atmospheric pressure substantially in excess of 212° F. is introduced into an enclosed system open to the atmosphere and including a container sterilizing zone, a zone in which a pre-sterilized cooled product is filled into said containers, a cover sterilizing zone, and a zone in which the covers are applied to the filled containers, all of said zones being in intercommunication, the steps of continuously introducing into said product filling and said cover applying zones an essentially non-aqueous and sterile gas to displace steam therefrom and thereby minimize rise in temperature of said cooled product and minimize paneling of said containers, while simultaneously maintaining independent flow of said superheated steam in said system, cooling said gas prior to introduction thereof into said product filling zone, and heating said gas prior to introduction thereof into said cover applying zone.

15. Canning apparatus comprising intercommunicating enclosure means containing a container sterilizing section having an entrance for containers to be filled, a product filling section having means therein for filling the containers with a pre-sterilized product, a cover sterilizing section, and a section having means therein for applying container covers to the product filled containers and having an exit for covered containers; said entrance and exit being open to the atmosphere whereby gas introduced into the apparatus will be at substantially atmospheric pressure; means for introducing steam into said apparatus; a gas burner for imparting external sensible heat to said steam to superheat said steam to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; and means for effecting flow of the combustion gas from the gas burner into said product filling section.

16. Canning apparatus comprising intercommunicating enclosure means containing a container sterilizing section having an entrance for containers to be filled, a product filling section having means therein for filling the containers with a pre-sterilized product, a cover sterilizing section, and a section having means therein for applying container covers to the product filled containers and having an exit for covered containers; said entrance and exit being open to the atmosphere whereby gas introduced into the apparatus will be at substantially atmospheric pressure; means for introducing steam into said apparatus; a gas burner for imparting external sensible heat to said steam to superheat said steam to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; means for effecting flow of the combustion gas from the gas burner into said product filling section; and means for cooling said combustion gas prior to introduction thereof into said product filling section.

17. In the method of canning wherein a continuous flow of steam superheated to a temperature at atmospheric pressure substantially in excess of 212° F. is introduced into an enclosed system open to the atmosphere and including a container sterilizing zone, a zone in which a pre-sterilized cooled product is filled into said containers, a cover sterilizing zone, and a zone in which the covers are applied to the filled containers, all of said zones being in intercommunication, the steps of continuously displacing said steam in said product filling zone to minimize rise in temperature of said cooled product by continuously introducing into said product filling zone an essentially non-aqueous and sterile gas while simultaneously maintaining independent flow of said superheated steam in said apparatus, and cooling said gas prior to introduction thereof into said product filling zone.

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