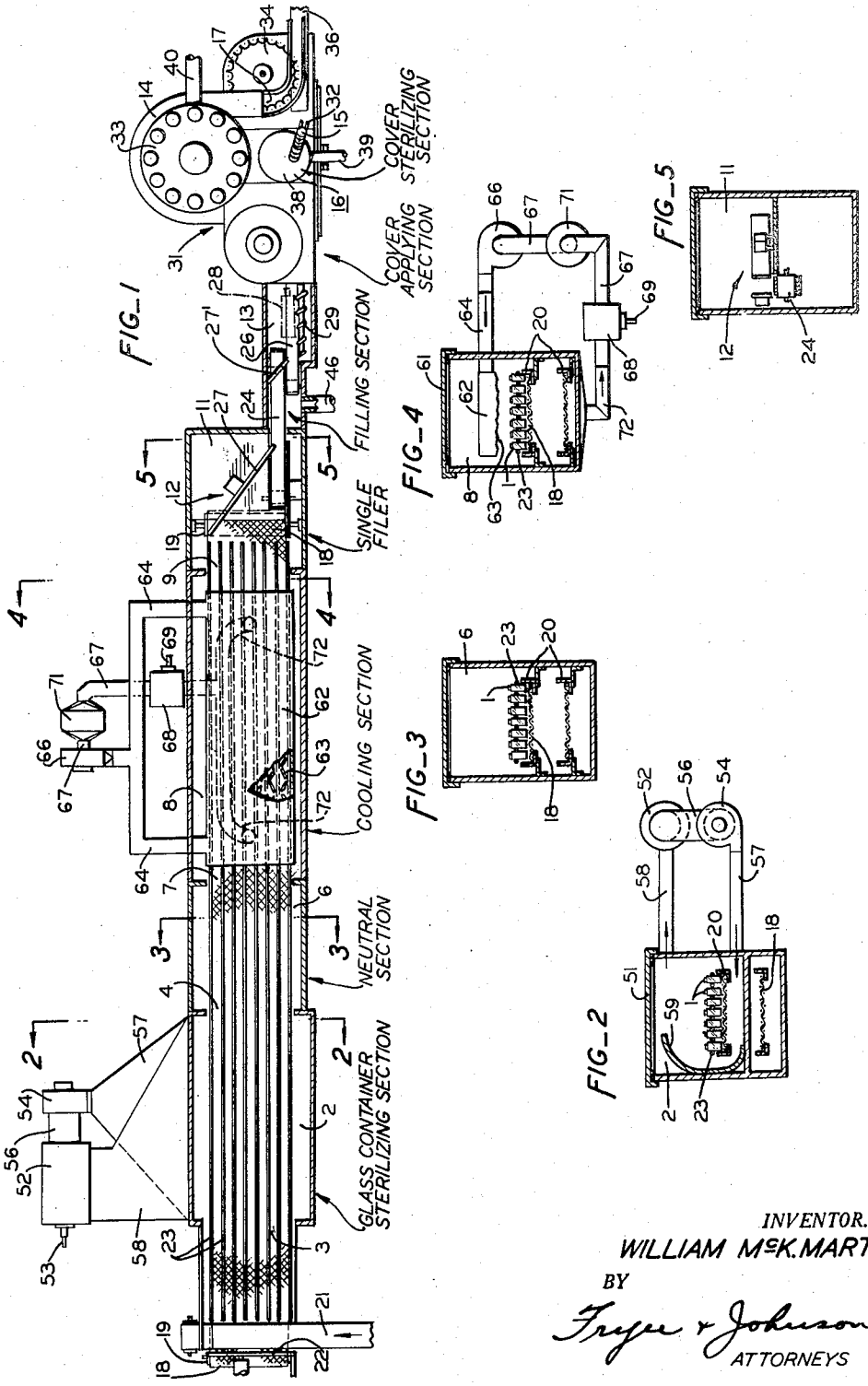
Jan. 20, 1959 W. McK. MARTIN 2,870,024

PRESERVING PRODUCTS IN SEALED CONTAINERS

Filed Dec. 16, 1954 2 Sheets-Sheet 1



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PRESERVING PRODUCTS IN SEALED CONTAINERS

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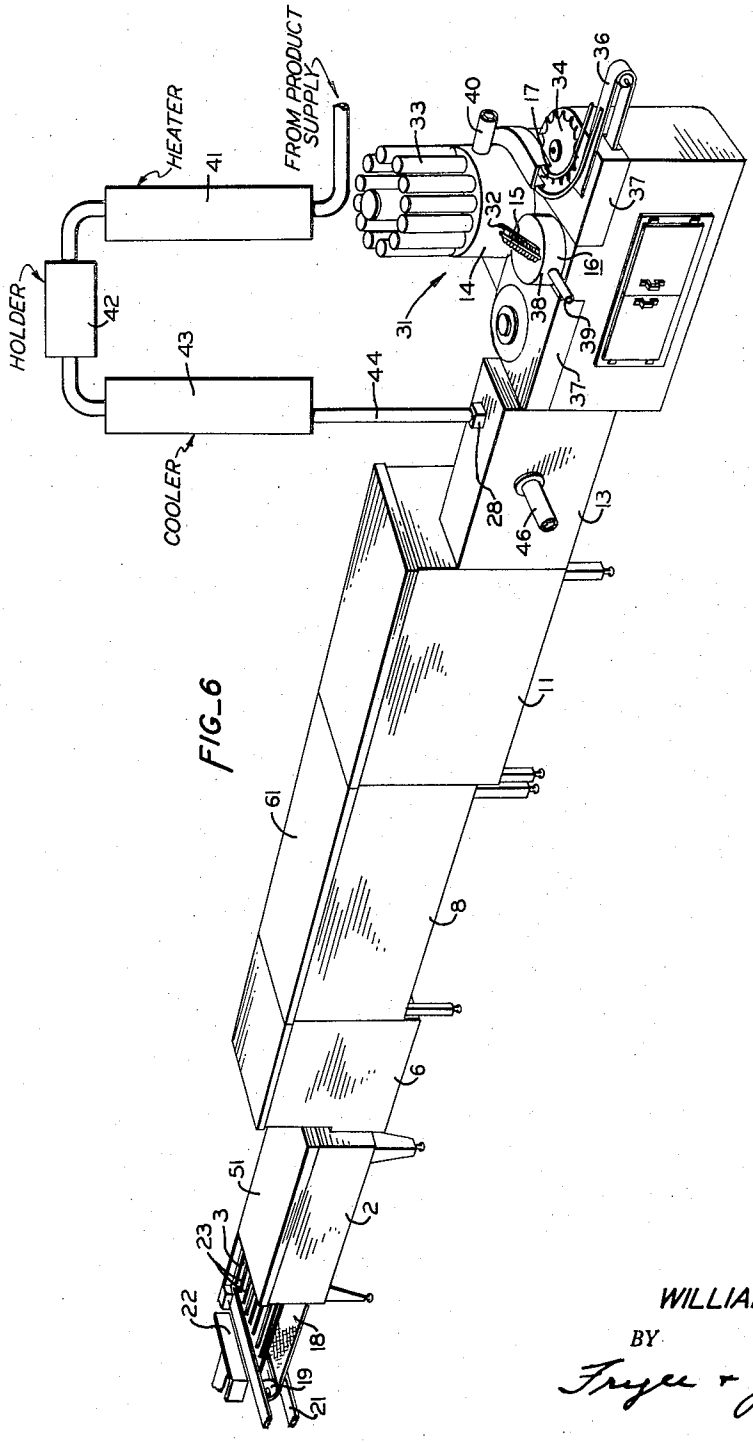

FIG_6

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PRESERVING PRODUCTS IN SEALED CONTAINERS

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Application December 16, 1954, Serial No. 475,615

7 Claims. (Cl. 99—182)

This invention relates to the packaging and preserving of products in sealed glass containers, hereinafter referred to as canning, and more particularly to an improved apparatus and method for canning a sterile product in glass containers, especially a food product, wherein 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 as disclosed in Patent No. 2,549,216, dated April 17, 1951. The present application is a continuation in part of co-pending application, Serial No. 427,099, filed May 3, 1954 for, "Method and Apparatus for Preserving Products in Sealed Containers."

As in the apparatus and method of such patent, the preferred operations herein are conducted in the apparatus at substantially atmospheric pressure; sterile conditions being maintained by a highly heated or super-heated gas heated by auxiliary heating means to impart external sensible heat thereto, to maintain a suitable sterilizing temperature above 212° F. for sterilizing the covers and the containers. At the same time, the continual flow of 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 preferred 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 the respective containers to become substantially uniformly filled as they pass by the filler which supplies a continuous flow or 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.

Although the apparatus and method of the aforementioned Patent No. 2,549,216 are applicable for filling the product in the usual commercial soft glass containers subsequently covered or capped with metal covers or lids, breakage of some of the glass containers may occur. This is so because the containers are heated in the container sterilizing section to a relatively high temperature by the superheated gas; and in the product filling section, a relatively cool pre-sterilized product is introduced into the heated containers. When the relatively cool pre-sterilized product contacts the relatively hot glass, breakage of some of the glass may occur from thermal shock.

To overcome such breakage, the improvement herein

for particular adaption with glass containers comprises providing an enclosed conditioning passageway between the container sterilizing zone and the filling zone, and effecting both reduction in temperature and transfer of heat between portions of the containers of unequal temperature as they travel through the passageway. The reduction in temperature is desirably accomplished by positively cooling the glass containers after leaving the container sterilizing zone but before they enter the filling zone, which is effected by subjecting the containers to a sterile cooling gas prior to filling of the containers in the filling zone.

Such gas can be any suitable sterile gas which will not form droplets of moisture on the surface of the glass containers, because if such droplets of moisture should form, breaking of some of the glass containers may occur. For this purpose, a mixture of sterile air carrying water in fog form incapable of forming droplets on the glass, may be employed. However, to obviate breakage, it is safer and preferable to employ an essentially non-aqueous gas as the cooling fluid for the containers after they have become sterilized by the heated gas.

Cooled combustion gas or a mixture of such gas with sterile air are preferred; combustion gas being the products of combustion of any combustible gas, such as natural fuel gas or artificial fuel gas. Although combustion gas or such gas mixed with sterile air contains moisture in vapor form, the cooling condenses substantially all of the moisture and therefore, such cooled gas is essentially non-aqueous. Any other type of sterile cooling gas may be utilized, such as cool sterile nitrogen or carbon dioxide, or even cool sterile air. For accomplishing the cooling efficaceously, a section or zone forming part of the aforementioned conditioning passageway is provided between and in communication with the container sterilizing zone and the filling zone into which the sterile cooling fluid is continuously supplied against the glass containers.

It is feasible to interpose the cooling section directly between the container sterilizing section and the filling section, but it is extremely desirable and consequently preferable to provide also as part of the conditioning passageway, a neutral section in communication with the exit of the containers from the container sterilizing section; the cooling section being directly between and in communication with the neutral section and the filling section. Gases are not directly introduced into this neutral section, but such section provides the important function of allowing transfer of heat between portions of the heated glass which are of different temperature when the glass leaves the container sterilizing section.

Also, it allows the hot gas from the container sterilizing section to intermix with the cooled gas from the cooling section, thus preventing transfer of excessive amounts of hot gas into the cooling section and cool gas into the container sterilizing section. When the glass containers become heated to a sterilizing temperature in the container sterilizing section, the bodies of the containers have portions both on the surface and in the interior of the glass walls which are of unequal temperature causing internal stresses in the glass. However, by passage through the neutral section, transfer of heat will occur between such portions of the glass of different temperature, and this will tend to equalize the temperature throughout the container bodies, thus minimizing internal stresses in the glass which might cause breakage when the containers enter the cooling section.

With respect to the gas introduced into the container sterilizing section, superheated steam, as described in the aforementioned patent, may be employed. Although some of the steam condenses on the glass containers, any moisture formed will not cause material breakage of

the containers because they are relatively cool when they first enter the container sterilizing section and as they become hotter upon passage through the container sterilizing section, the moisture is evaporated, thus reducing thermal shock to an acceptable level. In this connection, the containers are gradually brought up to sterilizing temperature in their passage through the container sterilizing section. It is preferred, however, to inject a continuous flow of highly heated combustion gas into the container sterilizing section, which gas becomes sterile as a result of the heat of combustion, but heated sterile nitrogen or even heated sterile air may be employed for sterilizing the containers.

The container covers are of metal and may be sterilized in an enclosed section in the manner disclosed in the aforementioned patent. The cover applying section includes a conventional so-called vacuum pack sealing machine; and the product filled containers have the covers automatically applied thereto by such machine which has its cover applying portions in an enclosed section, as disclosed in the aforementioned patent. In this connection, steam is the preferred sterilizing medium continuously introduced into the cover applying and cover sterilizing sections to create a vacuum in the conventional manner when the covers are sealed onto conventional glass containers by the well-known steam vacuum pack method.

Cooling of the glass containers before they are filled also aids in minimizing temperature rise of the cooled pre-sterilized product being filled into the containers, which might otherwise occur if the cooled product were filled into relatively hot containers. This temperature rise of the product, although it has no adverse affect insofar as the efficacy of the process is concerned, might cause an undesirable flavor effect. Furthermore, with respect to certain relatively heat sensitive food products, such as orange juice or milk, surface scorching thereof may occur if they are filled into relatively hot containers. The cooling of the containers before they are filled minimizes such scorching effect.

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 for preserving products in sealed containers which are particularly adapted for the handling of glass containers; whereby the containers are conditioned before the cooled pre-sterilized product enters or contacts the same, to obviate thermal shock and minimize damage of such glass containers by cracking, and also minimize temperature rise and scorching of heat sensitive products being filled into the containers. Other objects and further particulars of the invention will become apparent from the following description of a preferred embodiment, in which reference is made to the drawings wherein:

Fig. 1 is a schematic horizontal section of the apparatus, partly in elevation, and with parts broken away to shorten the view.

Fig. 2 is a transverse vertical section taken in a plane indicated by the line 2—2 in Fig. 1.

Fig. 3 is a transverse vertical section taken in a plane indicated by the line 3—3 in Fig. 1.

Fig. 4 is a transverse vertical section taken in a plane indicated by the line 4—4 in Fig. 1.

Fig. 5 is a transverse vertical section taken in a plane indicated by the line 5—5 in Fig. 1.

Fig. 6 is a schematic isometric assembly view illustrating the main parts of the apparatus.

The particular apparatus illustrated is for handling the well-known form of open mouth commercial soft glass jar containers 1, but it is to be understood that the principles of the invention are applicable to other types of glass containers. Such apparatus comprises enclosed container sterilizing section 2 having an entrance 3 open to the atmosphere into which empty containers to be sterilized are continuously conducted and through which

the containers are conveyed in upright position; the containers being conveyed through the rest of the apparatus in upright position. Such containers are previously washed, cleaned, and substantially dried, by any suitable means before they are introduced into the container sterilizing section.

Communicating with exit 4 of the container sterilizing section 2 is an enclosed neutral section 6; the exit 7 thereof communicating with enclosed container cooling section 8. Adjacent the exit 9 of the cooling section is an enclosed single filer section 11 which contains any suitable mechanism 12 for forming a plurality of rows of containers into one row. From the single filer section, which is also continuation of cooling section 8, the containers are conducted to enclosed filling section 13 wherein the containers are filled with a cooled sterile food product, such as various kinds of liquiform baby foods, soups, purees, or milk, or with other sterile products such as sterile drugs, for example, glucose solutions, vaccines or sterile water.

Filling section 13 communicates with enclosed cover applying section 14. Covers 15 for the containers are sterilized in enclosed cover sterilizing section 16 also communicating with cover applying section 14. After the covers are applied to the product filled containers, the sealed covered containers are discharged from exit 17 of the apparatus, which is open to the atmosphere.

Although the preferred system is one in which the entire apparatus is at substantially atmospheric pressure by virtue of open entrance 3 of container sterilizing section 2 and open exit 17, the principle of providing the aforementioned glass conditioning passageway between the container sterilizing section and the filling section 13 to condition the glass after heating so that it will not break when the cooled sterile product contacts it, is applicable to any other self-contained system of the type related irrespective of pressure conditions at which the containers and covers are sterilized. For example, the containers may be sterilized in a pressure sterilizer of the type disclosed in Ball Patent 2,660,513, dated November 24, 1953, which may be substituted for the preferred type of container sterilizing section 2 hereof.

Means is provided for continuously conducting a plurality of rows of containers in upright position, through container sterilizing section 2, neutral section 6, cooling section 8, and onto the single filer mechanism 12, comprising an endless belt conveyor 18 which is of an open mesh type in the form of a metal flexible screen to allow free passage of gases through the upper and lower reaches thereof. The reaches of conveyor 18 pass around suitable rollers 19 at the ends of the conveyor; and at suitable locations, its upper and lower reaches are supported on rails 20, the conveyor being driven by suitable means (not shown). Containers to be filled are conducted to conveyor 18 by a suitable cross conveyor 21 at which is located a movable push bar 22 to transfer the containers from cross conveyor 21 to conveyor 18.

Extending over the length of the upper reach of conveyor 18 is a plurality of spaced apart guide rails 23 which maintain the containers in a plurality of separate rows as they are conducted by the conveyor. For capacity purposes, it is desirable to conduct glass containers in a plurality of rows, rather than a single file, because as is pointed out more fully hereinafter, it is important that the glass containers be cooled gradually which requires a substantial time. Hence, capacity is increased by providing the rows of containers.

The containers are filled while moving at a much more rapid speed than their speed of travel through the preceding sections of the apparatus; and they are conducted from cooling section 8 through filling section 13 in a single file but by much faster moving endless conveyor belt 24 forming part of the single filer mechanism 12, and by belt 26 in filling section 13. Such single filer

mechanism is of any conventional construction, and includes obliquely arranged deflector 27 which directs the containers onto conveyor 24 from conveyor belt 18. From conveyor belt 24, the containers are guided by oblique deflector 27' onto belt 26 which moves the containers under a suitable filler 28 shown in phantom lines in Fig. 1. Any suitable continuous type filler may be employed, such as the filler of Patent No. 2,631,768 which is associated with a continually rotating worm 29 for maintaining the containers in properly spaced relationship during the filling operation as is disclosed in such Patent No. 2,631,768.

Conveyor 26 also forms part of the feed conveying mechanism of a conventional rotary type glass jar sealing machine 31 which automatically feeds well-known metal caps 15 for the jars, and applies them under a vacuum seal to the jars, in timed relationship. Machines of this character are well-known; and the type of machine schematically illustrated is an Anchor 16 Spindle, Rotary Vacuum Machine, manufactured by Anchor Hocking Glass Corporation of Lancaster, Ohio.

Such machine includes cap stacker 32, turret 33 by which the caps are applied to the jars, the previously mentioned discharge exit 17 from which the filled and capped jars are discharged to a rotary star wheel 34 which feeds the capped, product filled jars onto discharge conveyor 36.

In connecting such cover applying machine to filling section 13, all parts of the machine over which the containers travel and which are normally open, are provided with enclosing hood structures 37 through which the containers pass until after they are sealed with the sterile covers; and an enclosing hood structure 38 is provided about stacker 32 to form the cover sterilizing section 16. A superheated steam inlet pipe 39 is connected to hood 38 for maintaining a continual flow of superheated steam heated to a suitable sterilizing temperature above 212° F. for thoroughly sterilizing the covers prior to the time they are applied to the containers.

Also, a superheated steam inlet pipe 40 is connected to enclosure 14 to maintain sterile conditions in the cover applying section, and also provide the steam for creating a vacuum as it condenses in capped jars. Instead of superheated steam, any other superheated sterile gas may be employed to sterilize the covers. However, since the superheated steam is desirable to create the vacuum during sealing of the covers on the containers, steam is preferred for sterilizing the covers. The described cover sterilizing section 16 and cover applying section 14 function the same in principle as in the aforementioned Patent No. 2,549,216, and also Patent No. 2,685,520, dated August 3, 1954.

Referring to filling section 13, a cooled pre-sterilized product is continuously fed to filler 28. For effecting pre-sterilization of the product, a so-called "flask sterilization" system which is well-known in the art for sterilization of food products and which enables the product to be rapidly sterilized, is employed. Such "flask sterilization" system is illustrated schematically in Fig. 6 and includes a heater 41 which is maintained at such high temperature as to sterilize the product rapidly. Heater 41 is connected by piping to a so-called holder 42 where the temperature is maintained for a sufficient length of time to complete the sterilization; and holder 42 is connected by piping to a cooler 43, wherein the sterilized product is chilled or cooled. The cooled sterile product is conducted from cooler 43 to filler 28 in the filling section by piping 44. Usually, the product is cooled to a temperature of about 80° F. for filling thereof in the containers.

A superheated steam inlet pipe 46 is connected to filling section 13 for flow of superheated steam into such section. Steam is introduced directly into such section when operation of the apparatus is initiated to sterilize the interior of the filling section and all appurtenances therein, and such flow of steam is maintained while the apparatus is in operation. If desired, in place of steam, a cooled sterile gas may be introduced continuously into the filling section during operation, as in aforementioned Patent No. 2,685,520. All other parts of the apparatus are similarly pre-sterilized by the superheated gas before operation is commenced; and as previously related, any other suitable heated sterile gas may be employed instead of superheated steam, such as sterile nitrogen, sterile air, or sterile combustion gas.

For a more detailed explanation of the manner in which the described system is particularly adapted for handling of glass containers, reference is now made to the arrangement and operation of the container sterilizing section 2, and the glass conditioning passageway which includes neutral section 6 and cooling section 8. Bringing the glass containers up to a suitable sterilizing temperature, so that they will be sterile when they are filled with the sterile product, can be readily effected without setting up material stresses in the glass which may cause breaking of some of the containers, because such containers enter the container sterilizer section 2 relatively cool and are gradually brought up to a sterilizing temperature.

After the containers have been sterilized in sterilizing section 2, they are gradually cooled down to a much lower temperature so that subtsantially none will crack when the cooled sterile product (at about 80° F.) flows into them. In this connection, it has been found to be quite important with the conventional soft glass jar containers employed in the canning of various types of food products, that the temperature of the jar at the time it becomes filled with the cooled food product, should not have a temperature much more than 75° F. above the temperature of the product, so as to avoid breakage from thermal shock when the cooled product contacts the glass. In the cooling section, the glass is cooled down gradually to within such range.

Referring to container sterilizing section 2, its top 51 is sealed as indicated in Fig. 2; and such section is connected to a conventional combustion gas generator 52 having the usual combustion air inlet 53. Generator 52 is connected to a blower 54 by duct 56; the blower forcing hot sterilizing combustion gas into the container sterilizing section through duct 57 connected to the sterilizing section below the upper reach of the aforementioned open mesh conveyor 13. The upper end of sterilizing section 2 is connected to gas generator 52 by duct 58, so that a closed circuit is maintained for continual flow of the superheated combustion gas into the bottom of section 2 and out through the top; makeup air being controlled through air inlet 53 of generator 52. An arcuate baffle 59 is provided in section 2 to guide the flow of combustion gas in the manner described.

It will be noted that the hot combustion gas is introduced into container sterilizing section 2 against the outside surfaces of the containers therein. As a result, the inside surfaces of the containers will be maintained slightly cooler than their outside surfaces. Such slightly cooler temperature of the inside surfaces of the containers compared to the outside surfaces is important and extremely desirable because the differential in temperature places the outside of each container under compression and the inside under tension. The inside surface of a conventional commercial glass jar is stronger than the outside surface because it is a blown virgin surface. Therefore, the weaker outside skin or surface being under compression is fortified against any tendency for cracks to form; and the inside surface being inherently stronger is better able to resist formation of cracks even though under tension.

As is explained in the aforementioned Patents Nos. 2,549,216 and 2,685,520, sterilization of the containers is a function of time and temperature; the longer the residence time of the containers in the container sterilizing section, the lower the sterilizing temperature required.

It is only necessary that the containers be subjected to the sterilizing gas in the container sterilizing section at a sufficient temperature above 212° F. and for an adequate length of time to effect thorough sterilization thereof.

For example, effective sterilization of the containers when the residence time in the container sterilizing section is about 30 seconds, can be effected at a container temperature of about 500° F. If the container temperature is 550° F., the residence time would only be about 20 seconds. For commercial practicability, it is desirable that the residence time be relatively short. Therefore, higher sterilizing temperatures are preferred. In this connection, with respect to glass jar containers, longer residence times are desirable than with metal containers, to minimize thermal shock breakage.

It is for this reason that the apparatus is designed to handle a plurality of rows of the glass containers to thus provide for capacity, while at the same time allow ample residence time for bringing the glass up to maximum sterilizing temperature gradually. As an example, for sterilization of 200 x 309 (2" outside diameter and 3 9/16" high) so-called 5 oz. baby food jars, and also 208 x 401 (2 9/16" outside diameter and 4 1/16" high) so-called 8 oz. junior jars, a suitable temperature of the gas in the container sterilizing section is about 670° F. so that the container sterilizing section itself is approximately at that temperature. Conveyor 18 is moved at such speed as to provide a jar residence time in container sterilizing section of about 2 minutes, which brings the jars to a temperature of about 425° F.

In neutral section 6, no gases are directly introduced. Such section is very desirable, although not absolutely essential, because it provides a zone wherein hot gases from sterilizing section 2 intermingle with cool gases from cooling section 8. Thus, the neutral section also serves to prevent excessive transfer of gases from the sterilizing section into the cooling section, and vice versa. Also, as the glass jars travel through this neutral section, sufficient time is provided to allow the aforementioned transfer of heat between portions of the jar having unequal temperature, so that breakage will not occur when it enters the cooling section.

With jars of the character related, and with a sterilizing temperature of the temperature mentioned and the temperature in cooling section 8 described later, the average temperature of the neutral section is approximately 400° F.; and the neutral section is of such length as to provide a residence time of approximately 1 minute and 15 seconds for the jars.

Referring to Fig. 4, cooling section 8 is also provided with a sealed top 61; and cooled sterile combustion gas is introduced primarily against the inside surfaces of the containers through a distributing hood 62 having its bottom formed with a plurality of openings 63 for escape of the cooling gas. Because of introduction of the cool gas against the inside surfaces of the containers, such surfaces are maintained cooler than the outside surfaces for the purpose previously related. Hood 62 is connected by ducts 64 to a blower 66; blower 66 being connected by duct 67 to gas generator 68 having combustion air inlet 69. A suitable gas cooler 71 which also condenses moisture in the combustion gas, is connected in duct 67 between the blower and the gas generator to effect cooling of the gas. Cooler 71 may be of any suitable type, such as described in Patent No. 2,685,520. At its bottom, cooling section 8 is connected to generator 68 by ducts 72. Thus, cool gas is continually introduced into the top of the cooling section above the containers, so that it can flow first against the inside surfaces thereof, and is withdrawn from the bottom and recirculated; make-up air being controlled through combustion gas air inlet 69.

As the containers leave neutral section 6, they are at a temperature of approximately 405° F. The combustion gas is cooled to a temperature of approximately 90° F. so as to maintain the cooling section at a temperature of about 90° F. to 100° F. Sufficient residence time is provided for the containers in the cooling section to effect gradual cooling; and the length of the cooling section is such as to provide a residence time with containers of the type described, of about four minutes. This results in the temperature of the described containers being brought down from about 405° F. to about 145° F. In the single filer section 11, the containers are moved at a much faster speed providing a residence time of about 45 seconds. The temperature thereof is about 110° F. because some of the cooled gas escapes thereto and further serves to condition the containers. Thus, when the containers are filled with the cooled sterile product at a temperature of about 80° F., they are within the desirable 75° F. differential indicated above.

It has been found that for best results the residence times in the cooling section, sterilizing section and neutral section should be in the ratio of approximately 10, 5 and 3, respectively, although any suitable residence times, depending upon temperatures, may be employed as long as the rate of cooling is not so fast as to result in thermal shock breakage. In this connection, it will be noted that the conditioning treatment of the glass containers in the conditioning passageway comprising neutral section 6 and cooling section 8, is considerably longer than the time for sterilizing the glass containers in sterilizing section 2. The jars entering the cooling section are already sterilized. Therefore, the fact that the gases therein are not hot is immaterial as long as gases introduced into the cooling section are sterile. Also, an essentially non-aqueous gas is preferred for introduction into the cooling section because any essentially aqueous gas might form droplets on the glass, creating thermal shock resulting in breaking or cracking some of the containers. Since the covers for the containers are of metal, their sterilizing time and temperature may be the same as described in the aforementioned patents.

I claim:

1. Canning apparatus adapted for the canning of food products in glass containers comprising intercommunicating enclosure means containing 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 cooled food product, means for continually conveying containers through said sections in upright position, 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 sterile gas into said container sterilizing section and into said cover sterilizing section of said apparatus heated to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F., an enclosed container cooling section communicating with an entrance for the containers into said product filling section, an enclosed neutral section between and in communication with the container cooling section and the container sterilizing section, means for continually introducing a sterile essentially non-aqueous gas directly into said cooling section, and means for cooling said gas prior to introduction thereof into said cooling section.

2. The apparatus of claim 1 in which means is provided to introduce the heated gas against the outside surfaces of the containers in said container sterilizing section, and means is provided to introduce the cooled gas against the inside surfaces of the containers in said cooling section.

3. Canning apparatus adapted for the canning of food products in open mouth glass containers comprising in-

tercommunicating 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 pre-sterilized cooled food 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 continually introducing sterile gas into said container sterilizing section and into said cover sterilizing section of said apparatus heated to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; an enclosed container cooling section communicating with an entrance for the containers into said product filling section; an enclosed neutral section between and in communication with the container cooling section and the container sterilizing section; means for continually introducing a sterile essentially non-aqueous gas directly into said cooling section; means for cooling said gas prior to introduction thereof into said cooling section; means for continually conveying the containers through said sterilizing, neutral, and cooling sections in a plurality of rows and in upright position; and means interposed between said cooling section and said filling section for forming said plurality of rows of containers into a single row with said containers in upright position for conduction into said filling section.

4. Canning apparatus adapted for the canning of food products in open mouth glass containers 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 pre-sterilized cooled food 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 continually introducing sterile gas directly into said container sterilizing section and into said cover sterilizing section of said apparatus heated to a sterilizing temperature at atmospheric pressure substantially in excess of 212° F.; an enclosed container conditioning passageway between and communicating with said product filling section and said container sterilizing section; said conditioning passageway comprising an enclosed container cooling section communicating with an entrance for the containers into said product filling section, and an enclosed neutral section between and in communication with said cooling section and said container sterilizing section; means for continually introducing a sterile essentially non-aqueous gas directly into said conditioning passageway only through said cooling section of said passageway; and means for cooling said gas prior to introduction thereof into said cooling section whereby the heated gas introduced into said container sterilizing section and the cooled gas introduced into said cooling section flow from such respective sections into said neutral section and intermingle therein.

5. In the canning of food products with open mouth glass containers which when heated are subject to cracking upon being filled with a cooled product and wherein the containers are continuously moved in upright position through an enclosed system which includes an enclosed container sterilizing zone heated to a temperature substantially in excess of 212° F. for effecting sterilization of the containers and an enclosed sterile filling zone following said container sterilizing zone in which said sterilized containers are filled with a presterilized cooled food product, the method of minimizing cracking of glass from thermal shock which might otherwise result from the cooled product contacting the same which comprises prior to the time said glass containers enter said filling zone effecting both reduction in temperature of the containers and transfer of heat between portions of the containers of unequal temperature by providing an enclosed conditioning passageway between and communicating with said sterilizing and filling zones, moving said containers through said passageway and into said filling zone with the containers upright and their open mouths positioned uppermost, and providing in said passageway a gaseous sterile cooling medium in direct contact with said glass introduced into said passageway from a source exterior thereto and which is continuously maintained in said passageway to maintain sterile conditions therein and to give rapid cooling with reduction in temperature of said glass to below that at which breakage due to thermal shock upon contact with cool product is substantially eliminated.

6. In the canning of food products with open mouth glass containers which when heated are subject to cracking upon being filled with a cooled product and wherein the containers are continuously moved in upright position through an enclosed system which includes an enclosed container sterilizing zone heated to a temperature substantially in excess of 212° F. for effecting sterilization of the containers and an enclosed sterile filling zone following said container sterilizing zone in which said sterilized containers are filled with a presterilized cooled food product, the method of minimizing cracking of glass from thermal shock which might otherwise result from the cooled product contacting the same which comprises prior to the time said glass containers enter said filling zone effecting both reduction in temperature of the containers and transfer of heat between portions of the containers of unequal temperature by providing an enclosed conditioning passageway between and communicating with said sterilizing and filling zones, including an enclosed neutral zone in communication with an exit for the containers from said container sterilizing zone and an enclosed cooling zone between and in communication with said neutral zone and said filling zone, moving said containers through said neutral and cooling zones of said passageway and into said filling zone with the containers upright and their open mouths positioned uppermost, providing in said cooling zone of said passageway a gaseous sterile cooling medium in direct contact with said glass and introduced only into said cooling zone from a source exterior of said passageway and which is continuously maintained in said cooling zone to simultaneously prevent inflow of outside air into said passageway and maintain sterile conditions therein and to give rapid cooling with reduction of temperature of said glass to below that at which breakage due to thermal shock upon contact with the cooled product is substantially eliminated, and allowing hot gas from said container sterilizing zone and cool gas from said cooling zone to flow into and intermingle in said neutral zone.

7. The method of claim 5 wherein the cooling medium introduced into said conditioning passageway is an essentially non-aqueous gas which is cooled prior to introduction thereof into said conditioning passageway, said cooling gas is introduced against the inside surfaces of the containers, and wherein the containers in said container sterilizing section are heated by an essentially non-aqueous gas introduced into said container sterilizing section against the outside surfaces of the container therein.

References Cited in the file of this patent

UNITED STATES PATENTS

2,019,839	Batchell	Nov. 5, 1935
2,380,984	Moeller	Aug. 7, 1945
2,549,216	Martin	Apr. 17, 1951
2,645,557	Lewis et al.	July 14, 1953
2,685,520	Martin	Aug. 3, 1954

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,870,024 January 20, 1959

William McK. Martin

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

Column 5, line 55 and line 58, for "flask", each occurrence, read -- flash --; column 6, line 26, for "subtsantially" read -- substantially --; column 8, line 44, claim 1, before "sterilizing" insert -- a container --.

Signed and sealed this 5th day of May 1959.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents