

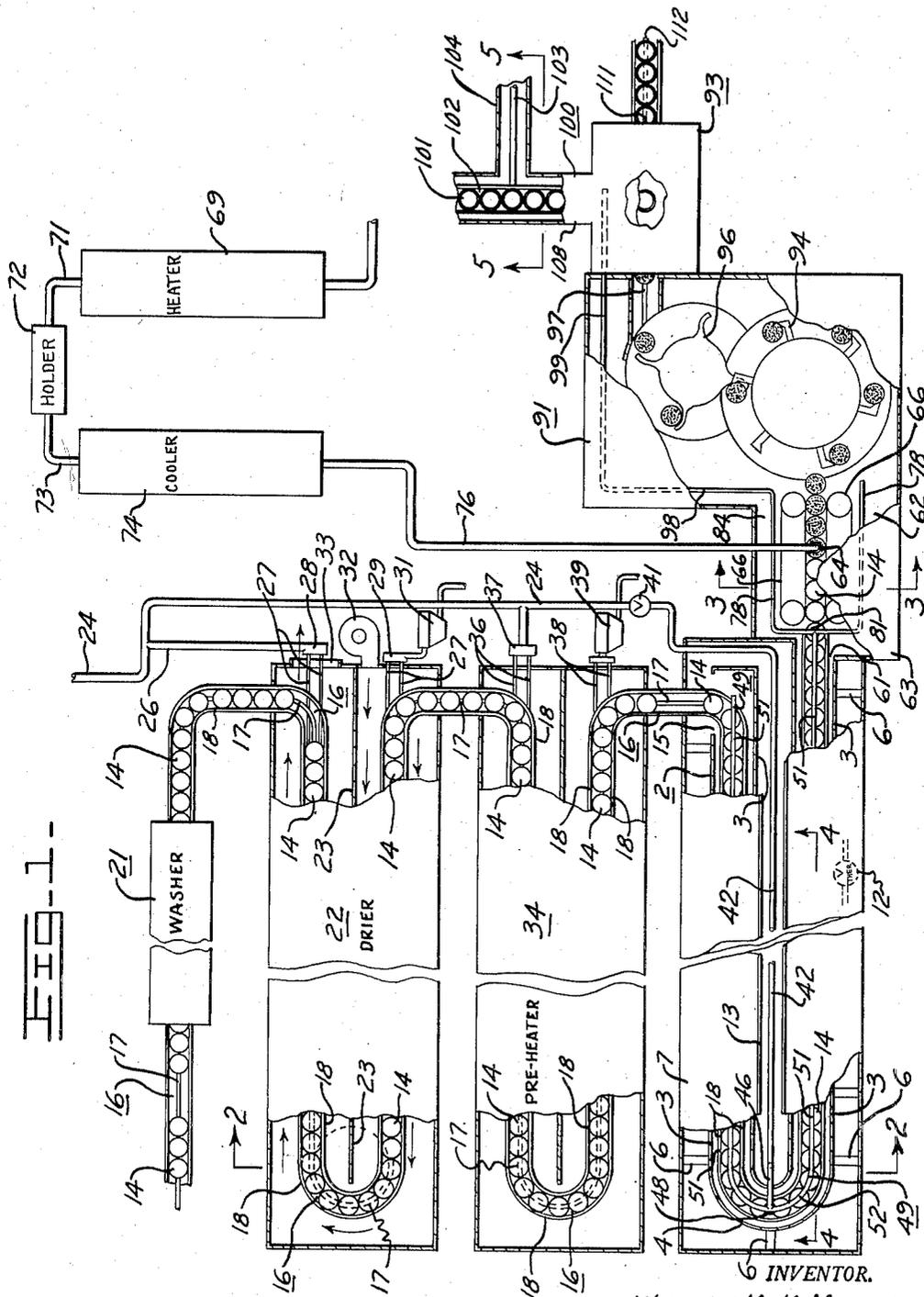
April 17, 1951

W. MCK. MARTIN
APPARATUS AND METHOD FOR PRESERVING
PRODUCTS IN SEALED CONTAINERS

2,549,216

Filed Aug. 9, 1947

3 Sheets-Sheet 1



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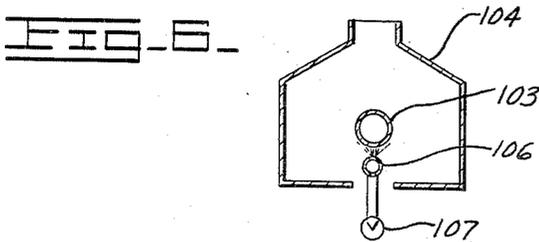
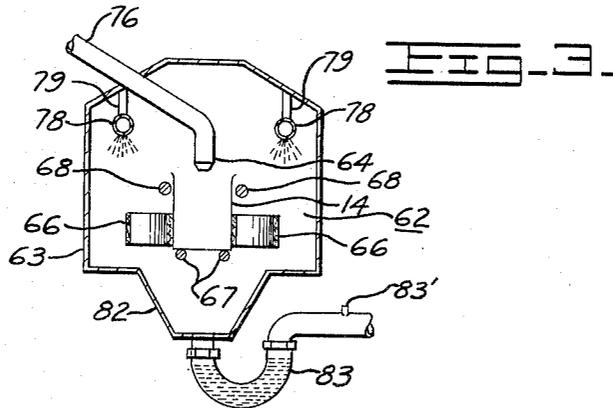
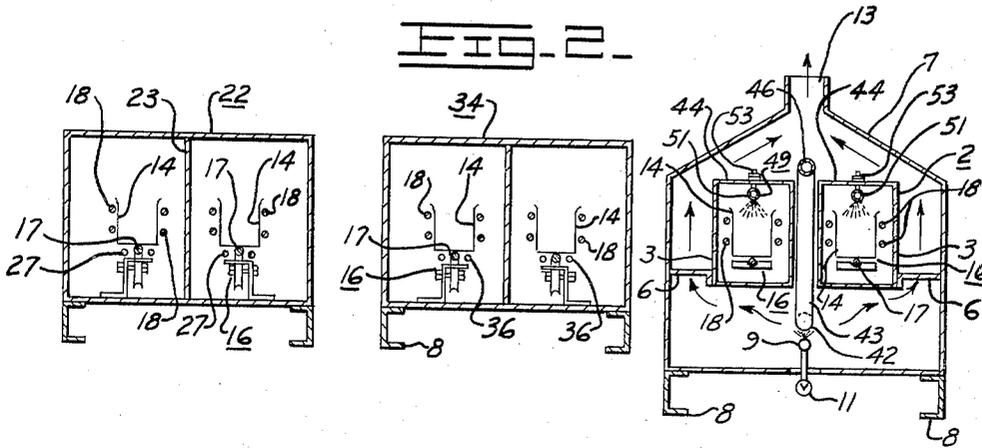
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

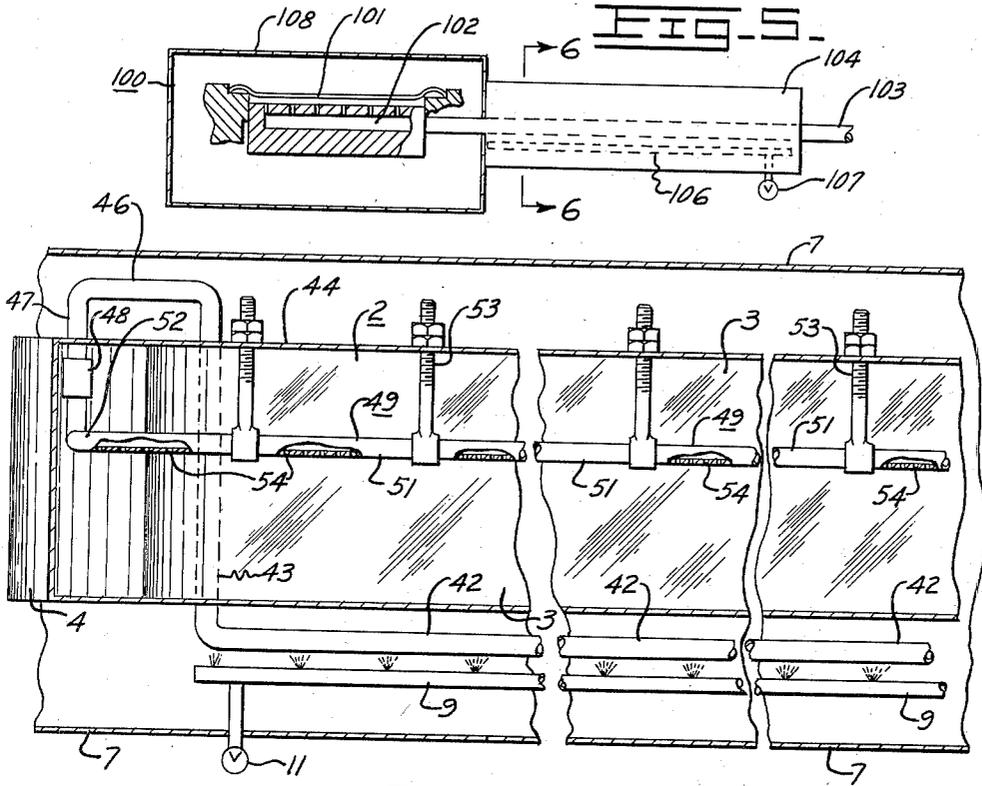


FIG-4-

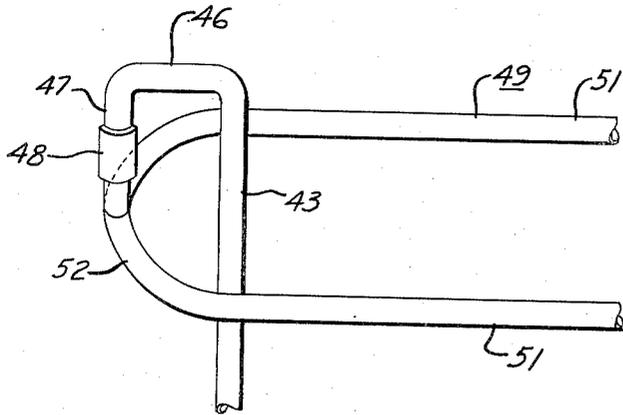


FIG-7-

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UNITED STATES PATENT OFFICE

2,549,216

APPARATUS AND METHOD FOR PRESERVING PRODUCTS IN SEALED CONTAINERS

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Application August 9, 1947, Serial No. 767,726

7 Claims. (Cl. 99—182)

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My invention relates to the packing 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 product and sealing the product filled containers are conducted under sterile or aseptic conditions in a unitary self-contained apparatus.

Such type of apparatus has heretofore been employed as is exemplified in the patent to Ball, No. 2,029,303, February 4, 1936, which teaches an apparatus wherein live steam is maintained at a sufficiently high sterilizing temperature by being confined at a considerable pressure above atmospheric pressure. Because of the necessity of having to maintain the steam at superatmospheric pressure, the apparatus and method require sealing of all operations from the outside atmosphere; otherwise, the steam would expand to atmospheric pressure and hence fall to a temperature of 212° F., which is not sufficient for sterilizing purposes of the containers and their covers. Such sealing of the apparatus necessitates the utilization of complicated valves which not only materially increase the cost and maintenance of the apparatus but present mechanical difficulties in operation, which are aggravated at the elevated temperature of the apparatus in operation.

My invention is designed to obviate the foregoing problems encountered in apparatus and methods of the type related wherein sealing means is required to maintain the steam at superatmospheric pressure. It, therefore, has as its objects, among others, the provision of an improved apparatus and method of the character related above wherein all of the operations of sterilizing the containers, their covers, filling the containers under sterile conditions, and sealing them with the covers under sterile conditions, can be conducted at substantially atmospheric pressure thus eliminating all valve means in the apparatus for maintaining superatmospheric pressure therein; which apparatus and method are relatively inexpensive and are easy to operate; and in which conventional so-called open-top cans or similar containers can be employed and handled by conventional means. Other ob-

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jects of my invention will become apparent from a perusal of the following description thereof.

In general, the apparatus of my invention comprises intercommunicating enclosure means providing a container sterilizing zone or section communicating with a container filling zone or section in turn communicating with a zone or section wherein covers are sealed onto the product filled containers; the latter zone in turn communicating with a container cover sterilizing zone or section. The intercommunication between all of these zones is through non-valved openings; and the enclosure means is unsealed to the atmosphere whereby all the zones will be at substantially atmospheric pressure. In this connection, the containers to be filled are introduced into the sterilizing zone through an entrance opening which is unsealed to the atmosphere. Likewise the containers sealed with their covers are discharged from the sealing zone of the apparatus through an exit opening which is unsealed to the atmosphere; and the container covers are introduced into the cover sterilizing zone through an entrance opening unsealed to the atmosphere.

The containers, as pointed out above, may be of conventional construction, being generally of the well-known wide open-top or -mouth type, and may be either so-called tin cans, or glass, or any other suitable material; and the operations of filling the containers with the product and sealing the filled containers with the container covers are conducted in a conventional manner, with the containers in upright position during the filling and sealing of the filled containers, which is an important feature of my invention as such handling requires no special technique.

Even though the operations are conducted in the described unitary or self-contained apparatus in which no seals are provided to maintain the inside of the apparatus at superatmospheric pressure, I have found that sterilizing conditions can be maintained in the apparatus by continuously causing and maintaining a flow of a sterile scavenging gas, such as steam, nitrogen or sterile air, through the apparatus, which sterile gas fills the apparatus and prevents entrance of outside bacteria-laden air through the entrance and exit and all other openings that may exist in the apparatus enclosure means. At the same time,

such sterile scavenging gas which is at substantially atmospheric pressure within the apparatus, is heated by outside heating means to maintain an adequate sterilizing temperature in the apparatus.

Steam, because of its availability and economy, is the preferred scavenging gas; and in the preferred embodiment of my apparatus and method, exterior or outside heat is applied to a portion of the apparatus to heat such portion to a sterilizing temperature, and also superheat the steam therein while at substantially atmospheric pressure to a suitable sterilizing temperature for the containers and their covers, for example 350° F. to 500° F., which sterilization conditions are maintained by the heat. Although it is preferred to apply the heat directly to the apparatus as will be described more fully hereinafter, the sterilizing temperature may be obtained in the case of steam by imparting additional heat to it by any suitable super-heater after it leaves the boiler, so that the steam will have more heat energy at any given pressure than it would have merely by virtue of its heat of vaporization resulting from mere generation of the steam in the boiler, and introducing such super-heated steam into the apparatus. In the case of any other sterile scavenging gas, a similar operation may be also performed, namely, heating of the gas to the desired temperature before it is introduced into the apparatus. However, the direct heating of the apparatus itself is preferred because this is more practical and efficient.

Although not essential for the functioning of my apparatus and method, it is desirable to use in conjunction with the apparatus means for washing the containers, drying them and pre-heating them before the containers are introduced into the sterilizing zone. The pre-heating has been found to reduce the time which would otherwise be required for sterilization by avoiding condensation of moisture on the surface of the containers in the sterilizing zone which might otherwise occur in the entrance portion thereof were the containers to be introduced cold and hence require more time and heat energy for the sterilization.

Reference is now made to the drawings for a more detailed description of a preferred embodiment of my invention, in which:

Fig. 1 is a schematic view of the entire apparatus, parts being shown broken away and other parts being omitted from the view to illustrate more clearly the invention;

Fig. 2 is a schematic section taken in a plane indicated by line 2—2 in Fig. 1;

Fig. 3 is a schematic section through the container filling zone of my apparatus, taken in the plane indicated by line 3—3 in Fig. 1;

Fig. 4 is a detail view, partly schematic, of the means for introducing the scavenging gas into the sterilizing zone of the apparatus; the plane of the section being indicated by line 4—4 in Fig. 1, and parts being omitted from the view to illustrate more clearly the construction;

Fig. 5 is a fragmentary sectional elevation, partly schematic, of the container cover sterilizing means embodied in my apparatus; the plane of the section being indicated by line 5—5 in Fig. 1;

Fig. 6 is a schematic section taken in the plane indicated by line 6—6 in Fig. 5; and

Fig. 7 is a fragmentary isometric view illustrating the means for introducing steam into the

container sterilizing zone of the preferred embodiment of my invention.

The container sterilizer 2, which provides the container sterilizing zone of my invention, is preferably tortuous, as can be seen from Fig. 1, to conserve space although it could be straight if so desired. Because of its tortuous shape, the sterilizer includes substantially parallel branches 3 joined by curved portion 4; and all of these portions are supported on suitably spaced brackets 6 attached to the side walls of heating unit chamber 7 which is in turn supported on suitable foundation framework 8. For a purpose to be explained more fully hereinafter, an elongated gas burner 9, preferably of the ribbon burner type, is positioned at the bottom of heating unit 7, and extends substantially along the entire length and between the branches 3 of the sterilizer 2 which is located above the burner.

Inlet of gas to the burner is automatically controlled by a suitable valve 11 through thermostat 12 located inside of heating chamber 7; and the burning gas from the burner passes around the walls of the container sterilizer 2, as indicated by the direction arrows in Fig. 2, and out through stack 13; the spacing between supporting brackets 6 permitting passage of such gases. From the preceding, it is seen that the container sterilizer is thoroughly heated to the desired temperature by the means described. Although gas heat is disclosed because of its greater convenience, availability and economy in most localities, it will be apparent that any other suitable means, such as electrical or steam means, may be employed in conjunction with the sterilizer for heating the same.

The containers 14, which for purposes of illustration are shown as so-called tin cans of the wide open-mouth or open-top type, are continually introduced in a continuous line into sterilizer 2 through entrance opening 15 by any suitable conveyer means 16 which is operated at the desired speed. Such conveyer means is conveniently of an endless traveling cable type, and includes cable 17 upon which the containers 14 are supported for movement therewith, and also stationary side guide rods 18. Such type of conveyer is of conventional construction and as is usual therein the cable 17 makes all turns around suitable sheaves or pulleys.

In order to prepare the containers 14 for sterilization and thereby shorten the time of the sterilization treatment, I preferably pre-heat them before they are introduced into the sterilizer 2; and before pre-heating the containers, they are preferably washed and dried. Such equipment comprises washer 21, which may be of any suitable construction (the details of which are unimportant for the purposes of this invention) into which the containers are continuously introduced by the conveyer 16. From the washer 21 the containers are conducted into a drier 22 through which the conveyer 16 has a long U turn to conserve space; the branches of the conveyer in the drier 22 being separated by baffle wall 23. For effecting the drying of the containers, live boiler steam from main steam supply pipe 24 is conducted into branch pipe 25 which is in turn connected to two smaller pipes 27 by means of manifold 28.

As can be seen from Fig. 2, these smaller steam pipes 27 are closely adjacent to the bottoms of the containers as they are conducted through the drier, so as to enhance the drying operation. The discharge ends of steam pipes 27 are con-

ected to manifold 29 from which the steam condensate discharges into steam trap 31. To cooperate in drying the containers, I prefer to employ a suitable fan 32 which blows air as indicated by the direction arrows in Fig. 1 about baffle wall 23 and out through air discharge opening 33.

After the containers leave the drier 22, they are further heated by passage through pre-heater 34 and are conducted therethrough in the same manner described with respect to drier 22. In this connection, heating of the pre-heater is effected by means of branch steam pipes 36 connected to manifold 37 in turn connected to main steam supply pipe 24; and such branch steam pipes 36 pass all the way along and underneath the containers as they are conducted through the pre-heater, as can be seen more clearly from Fig. 2, to heat the containers effectively. The discharge ends 38 of pipes 36 are connected to a suitable steam trap 39.

From the preceding, it is seen that the pre-heated containers are conducted in a continuous line by conveyer 16, through an unsealed opening in a wall of heating chamber 7, and through the entrance opening 15 into sterilizer 2. Even though at atmospheric pressure, the sterilizer is maintained free of contamination by bacteria from the outside atmosphere, and at the same time the containers are thoroughly sterilized at any desired temperature above 212° F., by means of introduction of steam which will exist at substantially atmospheric pressure in the sterilizer but to which outside heat is imparted.

The steam is introduced into the sterilizer from main steam supply pipe 24 which has connected therein a suitable reducing valve 41 so that the steam is substantially at atmospheric pressure when introduced. In practice, I have found it desirable that the steam be just slightly above atmospheric pressure, for example a few hundredths of a pound, so that there is a steady outflow of steam from all openings in the sterilizer and from all openings in the remainder of the enclosure means of the apparatus, which will be described more fully hereinafter, so as to maintain the enclosure means filled with flowing steam which as it escapes through the openings prevents the entrance of outside bacteria-laden air into the apparatus.

However, the steam can be introduced at atmospheric pressure because the injection velocity thereof will provide the necessary factor in keeping the air out by the flowing steam which thus acts as a thorough scavenging agent. In this connection, the steam can be introduced at superatmospheric pressure but it will fall down immediately to substantially atmospheric pressure because the sterilizer and all other portions of the apparatus are unsealed to the atmosphere. Introducing the steam at such high pressure is not, however, as desirable because the containers are apt to be knocked over unless special means is provided to prevent such occurrence, and, furthermore, the steam would expand considerably thereby absorbing heat with resulting lowering of the temperature.

As can be seen more clearly from Figs. 1, 2, 4 and 7, steam pipe 24 is connected to a branch 42 which is positioned in close heat transferring relation, directly above gas burner 9; so that as the steam passes through portion 42 it becomes super-heated above 212° F. at substantially atmospheric pressure. Pipe 42 is connected to an upright branch 43 located between the parallel

portions 3 of sterilizer 2 adjacent its curved portion 4. The upper end portion of branch 43 extends above the top wall 44 of the sterilizer, and is connected to a relatively short laterally extending branch 46 which passes over the top wall of curved portion 4 of the sterilizer, and is joined to a downwardly extending portion 47 which passes through such wall.

The lower end of portion 47 is connected through a telescopic adjustable coupling 48 with steam injection piping 49 in the sterilizer. As can be seen more clearly from Figs. 1 and 2, injection piping 49 comprises parallel branches 51 which are joined together by bend 52 to which pipe portion 47 is directly connected. These branches 51 and bend 52 are positioned in the branches 3 and curved part 4 of the sterilizer, respectively, adjacent the top wall thereof; and all the piping 49 is adjustably supported as to height by means of adjustable bracket supports 53, which adjustment is automatically permitted by the above described adjustable coupling 48. Thus, by the described arrangement, piping 49 including all of its branches may be readily adjusted to the proper height to permit passage thereunder of containers 14 of differing height, and still be closely positioned adjacent the tops of such containers, so that the steam ejected from the piping can efficaciously scavenge the inside of the containers.

As can be seen best from Fig. 4, the under-surface of steam injection piping 49 is formed with a large number of spaced perforations 54 extending along the entire length of the piping directly over the containers, and which permit the ejection of steam from the piping in a substantially continuous spray along the entire line of the containers, into the open mouths of the containers as well as into the sterilizer. By the described introduction of steam into injection piping 49 at its bend portion 52, no pockets obtain and, consequently, the steam will have a steady flow from one end of the sterilizer to the other. At the same time, steam will be directly injected from perforations 54 into the wide openings which are provided in the top of the customary containers 14 as they are moved through the sterilizing zone passageway in a continuous line.

Hence, any air in the containers will be thoroughly scavenged by the steam; and the containers will be thoroughly sterilized. The flow of escaping steam from entrance opening 15 in the sterilizer and other openings in the system to be described will carry out all air from the sterilizer and at the same time absolutely prevent air-borne bacteria from entering the system. The steam will be heated to the desired sterilizing temperature above 212° F. not only by virtue of direct contact of the gases of combustion with piping 42 above burner 9, but also because, as can be noted from Fig. 2, the heated gases of combustion envelope and pass by the walls of the sterilizer, thereby imparting heat thereto and maintaining such walls, the conveying means in the sterilizer, and the scavenging steam at a sterilizing temperature. The desired temperature control can be readily automatically obtained by means of thermostat 12 automatically controlling the quantity of gas issuing past control valve 11.

Any suitable sterilizing effect can be obtained by adjusting the speed of operation of conveyer 16 and consequent rate of travel of the line of containers 14 to be sterilized in accordance with the particular temperature above 212° F. in the

sterilizer. Under most conditions, a temperature of 350° F. to 500° F. will effect thorough sterilization of the containers when they are maintained in the sterilizer for about thirty (30) seconds to one (1) minute.

From the exit opening 61 of the sterilizer passageway, the containers 14 are conducted into filler unit zone 62 of the apparatus in upright position therein. This zone comprises completely enclosed chamber 63 in direct communication with the exit opening 61 of the sterilizer, and contains any suitable well-known filling mechanism which per se forms no part of the present invention. The filling mechanism is schematically illustrated by discharge spout 64 under and past which the containers are conducted in upright position, preferably by conveying mechanism including endless traveling belts 66 engaging the sides of the containers which are supported on stationary support rods 67. Side guide rods 68 are positioned adjacent the tops of the containers to cooperate with the endless belts in guiding the containers past discharge spout 64 where they are filled in upright position with the product to be canned.

It is necessary that the product to be canned be sterile when it is introduced into the container. Any suitable means may be employed for sterilizing the product to be canned, but as my apparatus and method of canning are primarily designed for producing a fast canning operation thereby resulting in economy, I preferably employ in association with the apparatus so-called "flash sterilization" which is well-known in the art for the sterilization of fluid products, and by which the product canned is rapidly sterilized. Such "flash sterilization" system is illustrated schematically in Fig. 1 wherein the heater 69 is maintained at such high temperature as to sterilize the product rapidly. From the heater, the product is conducted by suitable piping 71 to holder 72 where the temperature is maintained for a sufficient length of time to complete the sterilization. Holder 72 is connected through piping 73 with cooler 74 wherein the sterilized product is chilled or cooled, and is now ready to be introduced into the containers, the sterile product being conducted from cooler 74 into discharge spout 64 of the filler by means of piping 76. Although I have illustrated a "flash sterilization" system particularly adapted for sterilizing fluid products, it is to be understood that my apparatus and method may be employed with non-fluid products, it being only necessary to sterilize the product for introduction into the filler zone by any suitable method, irrespective of whether it is fluid or non-fluid.

Inasmuch as by the time the containers arrive at the filling zone 62 they are completely sterilized, and since the product introduced into the containers in the filling zone 62 is completely sterilized, it is unnecessary to apply any sterilizing heat to the filling zone. Air-borne bacteria are prevented from entering the filling zone through any openings in the enclosure means of the apparatus because of the flow of steam from sterilizing zone exit 61 which fills the filling zone with an atmosphere of flowing steam which, because the sterilization is complete, need not be above 212° F. for sterilization purposes. However, it is desirable to maintain the temperature in the filling zone 62 above 212° F. and also in all other succeeding parts of the apparatus to prevent condensation of moisture which if occurring would be objectionable.

For the latter purpose, the inside surfaces of the filling zone 62 and succeeding zones may be heated by outside or exterior heating means. In the embodiment illustrated, I employ steam piping positioned in the filling zone closely adjacent the roof thereof to prevent condensation of steam on the inside surfaces of the filling zone. Such piping as can be seen more clearly from Figs. 1 and 3 comprises parallel perforated branches 78 which are supported from the top by any suitable brackets 79. Branches 78 are spaced apart so that the containers pass in the space therebetween. Hence, the branches 78 can offer no interference to the movement of the containers through the filler zone. Therefore, pipe branches 78 need not be adjustably mounted. As can be seen from Fig. 1, branches 78 are connected to one of the branches 51 of steam injection piping 49 in the sterilizer; and the steam ejected from branch piping 78 into the filling zone cooperates to maintain the apparatus filled with flowing steam to keep out outside air. So as not to interfere with the adjustable mounting of steam injection piping 49 in the sterilizer, the connection with branches 78 is through any suitable adjustable telescopic coupling indicated at 81 (Fig. 1).

As the containers are conducted through the filling zone they are filled with the sterile product; and any overflow of such product is collected in sump 82 and flows out through goose neck trap 83 in which a level of the product is maintained, thereby forming a seal and preventing entrance of air-borne bacteria through the trap; a suitable vent 83' being preferably provided in the trap 83 to prevent syphoning. At the same time, the filler zone is bathed in an atmosphere of the scavenging steam which flows outwardly from the exit opening 84 into a container transfer unit 91, from which the containers are conducted by suitable conventional transfer mechanism into the container sealing zone 93. Such transfer mechanism includes the rotating transfer wheels 94 and 95 of any suitable well-known construction which conduct the containers in properly spaced relationship onto the discharge conveyer 97 of any suitable construction which conducts the filled containers into the sealing zone 93.

As with respect to filling zone 62, the transfer unit 91 is completely enclosed; and to prevent possible leakage of air-borne bacteria into the transfer unit, it is also filled with flowing steam. In this connection, steam from the filling zone can flow through opening 84 into the transfer unit; and to insure against condensation of moisture, steam piping is also provided in the transfer unit adjacent the top of its housing. Such piping, which contains perforations for ejection of steam, is supported from the top wall of the transfer unit and comprises L-shaped branch 98 having an end portion 99 which extends into the sealing zone 93 in communication with transfer unit 91.

Any suitable sealing mechanism of well-known construction wherein the container covers are fed successively into the unit in timed co-relation with the filled containers, and which contains automatic means for sealing the covers on the containers in upright position, may be employed. Hence, such sealing mechanism is illustrated merely schematically in Fig. 1. The sealing zone 93 is also completely enclosed, and is filled with flowing scavenging steam by the piping

99 previously described and steam escaping from the transfer unit 91.

To prevent contamination of the sterile product in the sterile containers as they reach the sealing zone, it is necessary that the container covers 101 be completely sterilized by the time they reach the sealing zone. For this purpose, as can be observed more clearly from Figs. 5 and 6, the covers are sterilized beforehand in an enclosed cover sterilizing zone 100 by being conducted over a perforated piping in the form of perforated support manifold 102 into which steam at substantially atmospheric pressure is introduced but which is super-heated to a temperature above 212° F. by means of heating the steam inlet pipe 103 which is connected to manifold 102 and passes through heater 104 having burner 106 underneath pipe 103, the burner being provided with gas control valve 107 by which the temperature of the steam may be controlled. Thus outside heating means is also applied to the cover sterilizing zone 100 to maintain sterile conditions therein. In this connection, the covers may be washed, dried and pre-heated before they are introduced into the cover sterilizing zone, in a manner analogous to that described for the containers.

It is to be noted that the support manifold 102 is completely enclosed in chamber 108; and as the container covers 101 are conducted over the manifold 102 by any suitable conveyer means, they are bathed completely in an atmosphere of steam at a sterilizing temperature above 212° F. at substantially atmospheric pressure. The flowing steam which escapes through the entrance opening in chamber 108 for the covers has a sufficient velocity flow to prevent entrance of air-borne bacteria into the container cover sterilizer zone. By the time the container covers reach the sealing zone 93, they are completely sterilized and after being sealed on the product filled containers, the sealed containers are discharged from the sealing zone at exit opening 111, by means of conveyer 112; and as with respect to all other openings in the apparatus, the steady flow of steam from the exit opening at 111 prevents the entrance of air-borne bacteria.

From the preceding description, it is seen that the apparatus and method of my invention are simple and economical in that no valve means is required to maintain the inside of such apparatus at super-atmospheric pressure. Because of not requiring pressurized equipment, it is relatively compact and can hence occupy a relatively small space; and the containers are filled and sealed in upright position thereby requiring no special means for these operations. Also, it will be noted that the container sterilizing section has ample clearance above the containers, so that there is no danger of the tops of the containers being caught against the top of such section as the containers are being moved by the conveying mechanism in the apparatus. In addition, this prevents build-up of pressure in the containers and allows the superheated scavenging gas to sweep out previously pocketed air from the containers being sterilized. The product which is sealed in the containers is not subject to air-borne bacteria because all parts of the intercommunicating enclosure means of the apparatus are maintained completely filled with sterile gas which keeps out air from all openings that may exist in the enclosure means; and at the same time thoroughly sterile conditions are maintained by the heat of the container and cover sterilizing

zones, so that the product is filled and sealed under sterile conditions.

The apparatus illustrated in the preferred embodiment of my invention is particularly adapted for the canning of fluid type products such as milk, milk products, cream style corn, cream soups, and fruit and vegetable juices. However, it is to be understood that the principle thereof is applicable to other types of products because it is only necessary that the product, before it is introduced into the filling zone, be completely sterilized at this point; and any suitable sterilizing method depending upon the physical character of the product can be employed for this purpose.

An important feature of the invention is the thorough manner in which the relatively wide mouth standard type containers of either the so-called tin type or glass containers are completely scavenged and heated to a sterilizing temperature with the heated scavenging steam as they pass in a continuous line with their mouths exposed to the substantially continuous steam spray from steam injection pipes 51 in the sterilizing zone passageway; these pipes being adjustable with respect to the height of the containers to insure that the injection steam will efficaciously scavenge and also thoroughly heat the inside surfaces of such containers so that by the time they leave the container sterilizing zone they will be completely sterile.

Although steam which is heated by outside means to a suitable sterilizing temperature above 212° F. is the preferred scavenging agent, it is to be understood, as was previously related, that other sterile scavenging gas which may be externally heated as with respect to the steam can be employed in place of steam. For example, sterile nitrogen or carbon dioxide gas or even sterile air could be employed in my apparatus and method for this purpose. However, steam is preferred because of its availability and economy, thus making it more practical. Furthermore, steam has a better heat transfer and, consequently, more penetrating effect.

In this connection, it is to be understood that in starting the apparatus for operation, the scavenging gas heated to sterilizing temperature is run through the apparatus to bring it up to the desired sterilizing temperature before the containers, their covers and the product are introduced therein. After the apparatus has been thus sterilized, the canning operation described can be conducted continuously until the apparatus is shut down for any purpose.

Any suitable material may be employed for constructing the apparatus, but I preferably utilize metal. Although I have illustrated one form of apparatus in connection with an explanation of the preferred method, it is to be understood that various changes may be made without departing from the spirit and scope of the invention as is expressed by the claims.

I claim:

1. Canning apparatus comprising intercommunicating enclosure means having 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 closing the product filled containers with covers and having an exit for the covered containers; said entrance and exit being open to the atmosphere whereby steam introduced into the apparatus will

exist at substantially atmospheric pressure; means for conveying the containers in upright position from said entrance and out through said exit; said container sterilizing section being provided with substantial clearance above the tops of the conveyed containers whereby said containers can not contact the top of said container sterilizing section; means for introducing flow of steam into said enclosure means for preventing inflow of outside air through all openings in said enclosure means; and heating mechanism for imparting external sensible heat to said steam to superheat said steam to a temperature at atmospheric pressure substantially in excess of 212° F. whereby said containers and said covers can be rapidly sterilized in said container and cover sterilizing sections.

2. Canning apparatus comprising intercommunicating enclosure means having 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 closing the product filled containers with covers and having an exit for the covered containers; said entrance and exit being open to the atmosphere whereby steam introduced into the apparatus will exist at substantially atmospheric pressure; means for conveying the containers in upright position from said entrance and out through said exit; said container sterilizing section being provided with substantial clearance above the tops of the conveyed containers whereby said containers can not contact the top of said container sterilizing section; means for introducing flow of steam into said enclosure means for preventing inflow of outside air through all openings in said enclosure means; and heating mechanism for imparting external sensible heat to said steam to superheat said steam to a temperature at atmospheric pressure substantially in excess of 212° F. whereby said containers and said covers can be rapidly sterilized in said container and cover sterilizing sections, said heating mechanism including a heater directly adjacent said container sterilizing section to apply heat directly thereto and to the steam therein.

3. A method of canning which comprises the operations of sterilizing containers, filling them with a pre-sterilized product, sterilizing container covers, and securing such covers to the containers; conducting all of said operations in intercommunicating enclosed zones unsealed to the atmosphere; providing substantial clearance above the containers in the container sterilizing zone as they are being sterilized; and sterilizing said containers and said covers and maintaining sterile conditions in such zones by heating steam to impart external sensible heat thereto to thereby superheat said steam to a temperature at atmospheric pressure substantially in excess of 212° F., and by introducing a continuous flow of said superheated steam through such zones to prevent inflow of outside air into said zones whereby said sterilization of said containers and said covers can be rapidly effected.

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; means for conveying the containers from said entrance and out through said exit; said container sterilizing section being provided with substantial clearance above the conveyed containers whereby said containers can not contact the top of said container sterilizing section as they are being sterilized; means for introducing flow of sterile gas into said enclosure means preventing inflow of outside air through said entrance and exit and all other openings in said enclosure means; and heating mechanism for imparting external sensible heat to said gas to superheat said gas to a temperature at atmospheric pressure substantially in excess of 212° F. whereby said containers and said covers can be rapidly sterilized in said container and cover sterilizing sections.

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-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 enclosure means being open to the atmosphere at said entrance and said exit; means for conveying the containers from said entrance and out through said exit; said container sterilizing section being provided with substantial clearance above the conveyed containers whereby said containers can not contact the top of said container sterilizing section as they are being sterilized; means for introducing into and effecting flow of scavenging gas in said enclosure means for filling the same and preventing inflow of outside air through said entrance and exit and all other openings in said enclosure means; and heating mechanism directly adjacent said apparatus for imparting external sensible heat to said gas to superheat said gas to a temperature at atmospheric pressure substantially in excess of 212° F. whereby said containers and said covers can be rapidly sterilized in said container and cover sterilizing sections.

6. In canning apparatus of the class described, enclosure means providing a container sterilizing passageway unsealed to the atmosphere whereby a scavenging gas introduced therein will exist at substantially atmospheric pressure, said passageway having an entrance for a substantially continuous line of containers adapted to be conducted through said passageway into a product filling section communicating with said passageway and having means therein for filling the containers with a pre-sterilized product, means for conveying the containers through said passageway, said passageway being provided with substantial clearance above the conveyed containers whereby said containers can not contact the top of said passageway as they are being sterilized, means for introducing flow of scavenging gas into said passageway and into said containers therein, and heating mechanism for imparting external sensible heat to said gas to superheat said gas to a temperature at atmospheric pressure substantially in excess of 212° F. whereby said containers in said passageway can be rapidly sterilized.

7. A method of canning which comprises the operations of sterilizing containers, filling them with a pre-sterilized product, sterilizing container covers, and securing such covers to the con-

tainers; conducting all of said operations in intercommunicating enclosed zones unsealed to the atmosphere; providing substantial clearance above the containers in the container sterilizing zone as they are being sterilized; and sterilizing said containers and said covers and maintaining sterile conditions in such zones by heating gas to impart external sensible heat thereto to thereby superheat said gas to a temperature at atmospheric pressure substantially in excess of 212° F., and by introducing a continuous flow of said superheated gas through such zones to prevent inflow of outside air into said zones, whereby said sterilization of said containers and said covers can be rapidly effected.

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