July 30, 1940. C. O. BALL 2,209,315

METHOD OF CANNING

Filed May 26, 1938 2 Sheets-Sheet 1

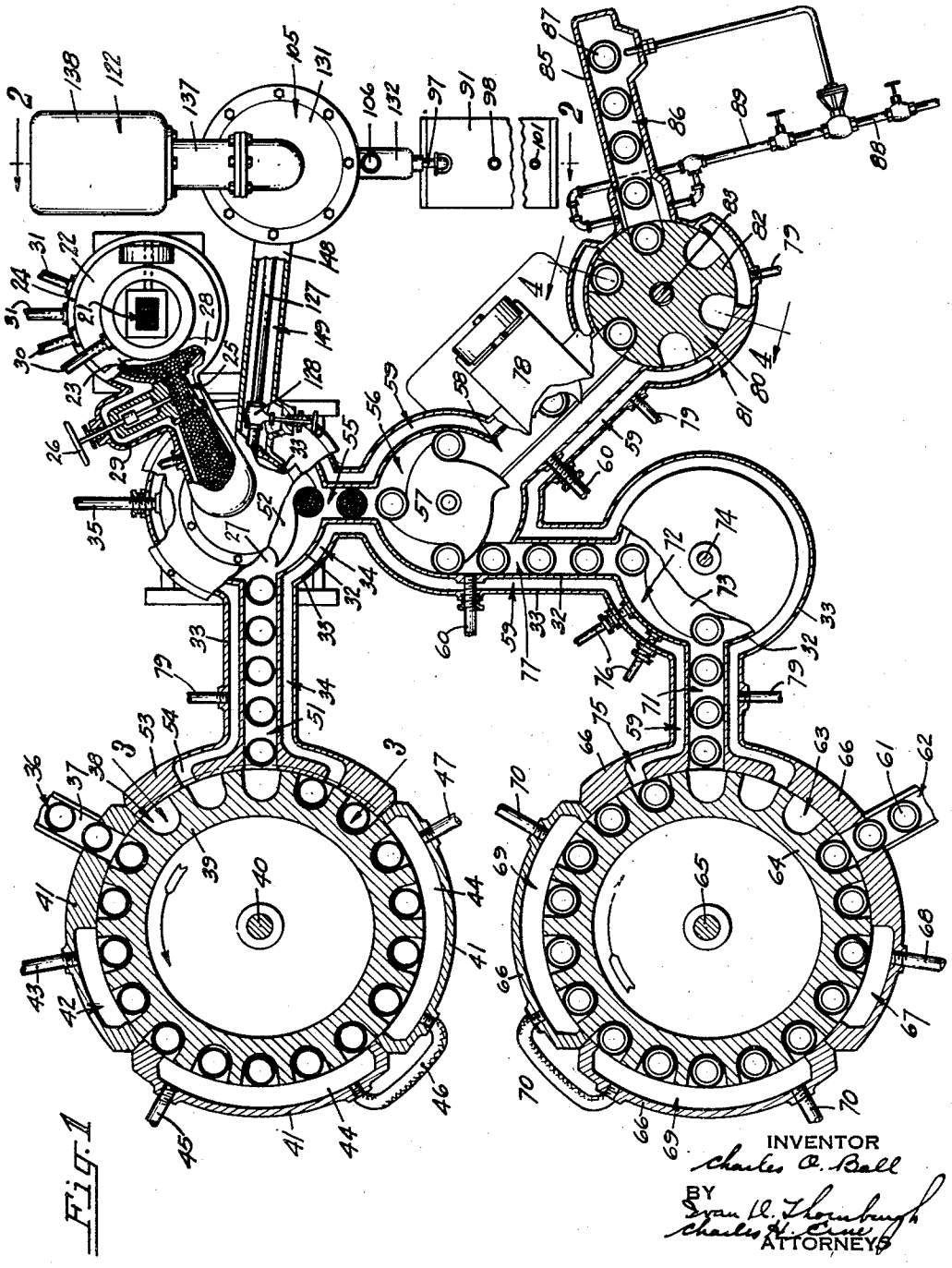


Fig. 1

INVENTOR
Charles O. Ball
BY
Evan W. Thornburgh
Charles H. Ernst
ATTORNEYS

July 30, 1940. C. O. BALL 2,209,315

METHOD OF CANNING

Filed May 26, 1938 2 Sheets-Sheet 2

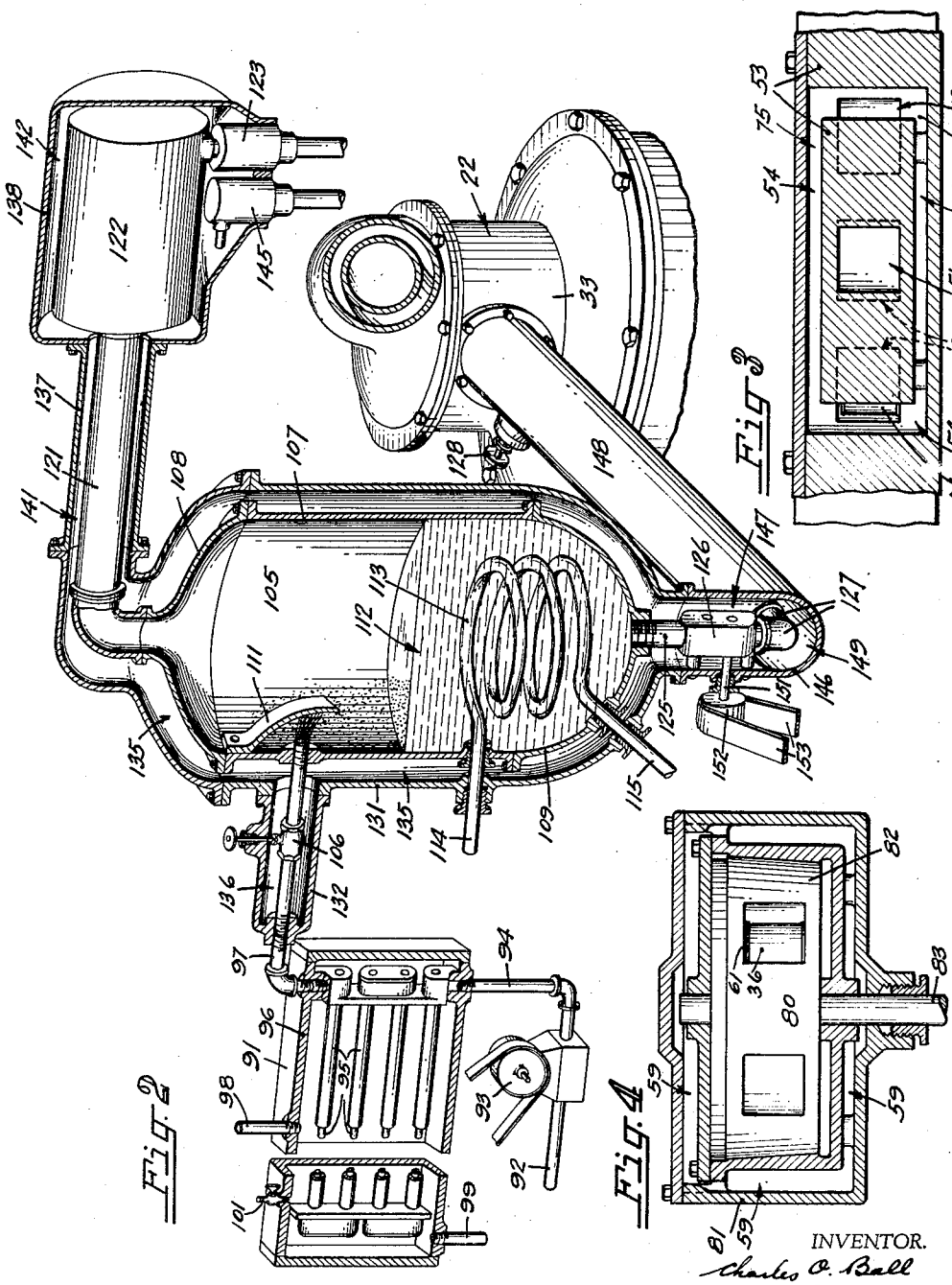


Fig. 2

Fig. 3

Fig. 4

INVENTOR.
Charles O. Ball

BY Ivan O. Thornburgh
Charles H. Camp
ATTORNEYS

Patented July 30, 1940

2,209,315

UNITED STATES PATENT OFFICE

2,209,315

METHOD OF CANNING

Charles O. Ball, Oak Park, Ill., assignor to American Can Company, New York, N. Y., a corporation of New Jersey

Application May 26, 1938, Serial No. 210,281

8 Claims. (Cl. 99—182)

The present invention relates in general to an improved method of canning and has particular reference to protecting a product of liquiform or of discrete particle nature against bacterial or other contamination while the same is being subjected to steps of treatment as for example during or following sterilization, storage, handling or other procedure incident to canning. In some respects the invention is an improvement upon my Patent 2,029,303, issued by the United States Patent Office on February 4, 1936.

In my former patent which treats of sterilizing a product, sterilizing a can and also a cover and introducing the treated product into the can and sealing the product in the can, provision is made for handling the sterilized product and can parts in an enclosed chamber or chambers the interiors of which are maintained under a pressure greater than the atmospheric pressure outside of the chambers so that contamination of the interior walls of the chamber as well as contamination of can or product passing therethrough will be prevented even though there may exist leaks in the apparatus.

In the present invention provision is made for utilizing an interior treating chamber pressure less than normal or outside atmospheric pressure and insuring at all times an additional controlled surrounding atmosphere just exterior to the chamber. This controlled atmosphere is at less pressure than any pressure existing within the treating chamber. With this condition prevailing at all times should there be leaks in the apparatus, bacteria or other types of contamination could not enter the treating chamber as any exchange of pressure would always be outward, that is, from the interior of the treating chamber to the surrounding confined atmosphere and therefore the outside normal atmosphere will not be involved.

This provision in addition to overcoming any evils which might occur by leaky chamber walls permits much more latitude of treatment within the chambers themselves. In other words, the present invention contemplates a treating chamber, which may be subjected to a high vacuum instead of pressure, as in my patent referred to above, and when cans and product are brought into or discharged from the vacuum chamber there is no danger of entrance of bacterial contamination.

Treatment of a product is often desirable in a chamber having a sub-atmosphere, i. e., one having an absolute pressure below atmospheric pressure. Steam heat treatment of sterilized food products, for example, can be carried out without high temperatures where the treatment takes place in a chamber having a sub-atmosphere. The effective value of heat at any reduced temperature, under such conditions, will depend upon the absolute pressure of the chamber pressure. This makes it possible to heat treat a product by steam at a temperature lower than 212° F. which is the temperature of saturated steam at normal atmospheric pressure. Some products will retain their taste, color or other characteristics much better at the lower temperatures of steam made possible by the reduced chamber pressure.

An object of the present invention is the provision of a method of treating a product under sterile conditions by introducing it into an inner sealed chamber wherein there is maintained a chamber atmosphere of desired absolute pressure less than normal atmospheric pressure, there also being provided a surrounding confined and controlled atmosphere of less pressure so that possible contamination of the product while within the inner chamber is entirely eliminated.

A further object is the provision of a method of treating a sterile product which includes control of a created atmosphere exterior to a treating chamber so that if there are any leaks in the treating chamber walls no contamination from the outside will enter through the leaks because gases, vapors, etc., will only pass through the leaks outwardly from the treating chamber.

Another object of the invention is the provision of such a method wherein contamination from the outside is prevented in a manner which permits a continuous stream or flow of the product through the chamber.

Still another object is the provision of a method of evaporating a liquid within a vacuum chamber, the chamber being protected against contamination by a surrounding protecting confined chamber or jacket which is at all times held under a absolute pressure less than that obtaining in the vacuum chamber.

Yet another object is the provision of a method of sterilizing and canning a product by sterilizing the product, then filling it into a can either before or after complete sterilization, then transporting the partially or fully sterilized product while within a can through a sealed chamber and hermetically sealing the can while still within the chamber which is protected against contamination by enclosure of the chamber, the chamber being entirely confined within a jacket main-

tained at an absolute pressure less than the pressure existing within the chamber.

Another object is the provision of a method of handling a food product after its sterilization and after its cooling when sterilized by heat, which includes a treating chamber adapted to receive the sterilized and cooled product, the chamber being surrounded by a protecting chamber or jacket held under an absolute pressure less than that of the treating chamber so that any tendency to equalize pressures as through wall leaks, entrance or discharge openings will result in an outward flow from the treating chamber and never an inward flow into the chamber thus preventing any entrance of contaminating elements.

A further object is the provision of a method of canning a discrete particle product by heat sterilizing and cooling the product, sterilizing a can to receive the product, sterilizing a can cover, filling the product into the can and hermetically sealing by uniting can and cover, the filling of the product into the sterilized can and its sealing being carried out within one or more treating chambers maintained at less than normal atmospheric pressure, the treating chambers being surrounded by a protecting jacket which is at all times held under an absolute pressure less than the pressure within the treating chambers to prevent contamination of the product at any stage of its treatment while within the chambers.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a schematic view illustrating a series of interconnected mechanisms for performing various steps in the treatment of a product which in one case is of liquiform nature or as in another case of the discrete particle type and illustrating the manner of protecting the treating chambers by surrounding jackets confining a space which is maintained under vacuum;

Fig. 2 is an enlarged sectional view taken substantially along the line 2—2 in Fig. 1 parts being broken away;

Fig. 3 is a fanciful sectional view taken substantially along the line 3—3 in Fig. 1 and illustrating the means of protecting one of the valve openings associated with the can sterilizer; and

Fig. 4 is a transverse sectional view of the discharge valve of the apparatus illustrating the protection of the valve surfaces against contamination, this view being taken substantially along the line 4—4 in Fig. 1.

The invention contemplates the passage of a food product or the like through a treating chamber, the drawings illustrating an initial step of sterilization and showing alternate treatments for a product of a liquiform nature and one consisting of discrete particles. When the sterilization of a discrete particle product is taking place some of the mechanism which applies only to liquiform products is closed off from operation and in like manner other mechanism applicable to the discrete particle product is not used when products of a liquiform nature are being treated.

The sterilized product of whatever nature is received into the treating chamber where any desired operation may take place. In the drawings there is disclosed a filling chamber in which cans may receive the product and the filled cans are shown as being hermetically sealed by double seamed covers. The drawings also show, as exemplary of treating steps, the sterilization of the empty cans as well as the covers. The present invention is directed specifically to conditions applying to a treating chamber and therefore it is only incidental whether a can is used during the treatment. If the product is not to be put into a can obviously the treating chamber will be slightly changed to meet whatever conditions obtain.

The connecting passageways between the various chambers or sections of the same chamber provide for a sealed space for treatment of product as desired and provision is made for enclosing the walls of the chamber or chambers with a surrounding jacket. The space within this jacket may be connected with a source of vacuum so that the pressure obtained within the space can be held at all times under a less absolute pressure than the pressure used in the treating chamber or chambers.

The enclosing jacket, as will be hereinafter more definitely shown in detail, is coextensive with any outside wall part of the treating chamber so that entrance of contamination from the outside will be prevented. By maintaining an absolute pressure in the surrounding jacket which is less than the pressure in the treating chamber, any leakage of gases, vapors, etc., through the chamber walls and any leakage through entrance or exit openings will always be outwardly and at no time will there be any tendency for contamination of any kind to enter from the outside.

For the purpose of more clearly illustrating the various steps of the present invention reference should be had to Fig. 1 which represents schematically the principal parts of an apparatus for carrying out these steps. In the description which follows consideration will first be given to the treatment of a product of the discrete particle type.

The product is or may be first introduced into a hopper 21 of a product sterilizing apparatus 22. In this consideration of a discrete product, garden peas will be taken as an example and these are designated by the numeral 23. This product passes from the hopper and through the sterilizing apparatus after which, if the sterilization consists of a heat treatment, the sterilized product moves downwardly from the sterilizing apparatus 22 and enters a cooling device 24. This device 24 discharges a sterilized and cooled product through a passageway 25 which extends from one side of the cooling device. A manually operated gate valve 26 is introduced in the passageway 25 and is used to seal off the passageway when this part of the apparatus is not being used. The passageway 25 leads to a filling chamber 27 where it is introduced into cans preparatory to entering the treating chamber.

The cooling device 24 is surrounded by an outer spaced wall 28 which also extends around the passageway 25 and furthermore encloses the gate valve 26. This spaced wall encloses a protecting jacket 29 and provides an enclosure for the entire cooling operation as well as the passageway 25. Only the operating hand wheel of the gate valve 26 extends outside of the jacket wall 28 and provision is made for packing this joint so that there will never be any means of entrance of contamination into the cooling chamber or into the passageway 25.

The hopper section and the sterilizing device may be provided with live steam and steam pipes 30 are provided for this purpose. The protecting chamber 29 surrounding the cooling device 24, the gate valve 26 and the passageway 25 are adapted to be maintained under a desired vacuum which at all times is less in absolute pressure from that existing inside the cooling chamber and inside the passageway 25. Vacuum pipes 31 may be used for this purpose.

The filling chamber 27 is contained within an inner housing 32, and an outer spaced wall 33 surrounds the chamber in all directions so that a protecting space 34 is provided between the walls 32, 33 and this constitutes a protecting jacket or chamber which is also adapted to be held under a vacuum so that the absolute pressure within the jacket will always be less than that existing in the filling chamber 27. A pipe 35 extends through the outer wall 33, where it is protected by a suitable stuffing box, and into the wall 32. This permits the entrance of steam into the filling chamber.

While the sterilized and cooled peas 23 are passing into the filling chamber open ended cans 36 are conveyed along a runway 37 and pass into one of a plurality of pockets 38 of a rotary valve 39 mounted on a vertical shaft 40. This valve member constitutes a movable element of a can sterilizing apparatus and is surrounded by a hollow casing or series of casings 41. The first casing, that is, the one through which the runway 37 extends, preferably encloses a vacuumizing chamber 42 and connects with a suitable source of vacuum as by means of a pipe 43. As the turret rotates in the direction of the arrow air is withdrawn from the rotary valve pockets 38 and from the empty cans therein as each pocket with its can passes along the chamber.

The casings 41 adjacent that which encloses the vacuum chamber 42 enclose steam chambers 44 receiving live steam through a pipe 45. The steam chambers 42 are preferably interconnected by means of a pipe 46. During the continued rotation of the valve 39 in the direction of the arrow the empty cans are successively subjected to the steam chambers 44 and upon completion of one rotation of the valve the cans carried thereby are sterilized. The chambers 44 may be provided with a drain pipe 47.

The sterilized cans are thence thransferred from the valve pockets of the sterilizer and pass through a passageway 51 which connects with the filling chamber 27 of the filling apparatus. Each can upon reaching the filling chamber is engaged by a starwheel 52 which moves it through the filling chamber, putting it into filling position to receive a charge of the product 23. This filling of the can in the sterile filling chamber takes place under completely aseptic conditions the walls of the chamber completely enclosing the apparatus.

The spaced walls 33 which enclose the filling chamber are extended to the can sterilizer and adjacent the turret 39, these walls spreading out into a rotary turret seat casing 53. The protecting chamber 34 on the inside of the walls thus extends into this turret seat wall 53 and terminates in an annular opening 54 (see also Fig. 3). This opening completely encircles the end of the pasasgeway 51 which is adjacent the turret 39 and thus prevents the entrance of any contamination from the outside into the passageway or into the cans passing therethrough.

The filled and sterilized can with its sterilized product is thence transferred through a passageway 55 (Fig. 1) which opens at one end into the filling chamber 27. At the opposite end the passageway communicates with a chamber 56 in which is located a starwheel 57. The can passing from the passageway 55 is received by one arm of the starwheel 57 and after being swept in a circular path of travel through the chamber 56 is introduced into a closing chamber 58.

The wall 32 which encloses the filling chamber 27 continues as the enclosing wall for the chambers 56 and 58. In like manner the spaced wall 33 extends in spaced relation to completely encircle the chamber 56 and also the chamber 58. The protecting jacket space 34 thus merges into a protecting space 59 for the starwheel chamber 56 and the sealing chamber 58. This jacket space provides for protection against contamination of the chambers 56, 58 and will be hereinafter again discussed.

Steam pipes 60 pass through the outer spaced wall 33 adjacent the starwheel and seaming chambers 56, 58 and provide for the introduction of steam into these chambers. Where these pipes pass through the protecting jacket walls 33 provision is made for suitable stuffing boxes to prevent any contamination from the outside along the surface of the pipes.

While the foregoing operations are taking place can covers 61 are advanced through a runway 62 and positioned successively into a plurality of pockets 63 of a valve member 64 mounted on a vertical shaft 65. This valve constitutes a movable element in a can cover sterilizing apparatus. The valve 64 is continuously rotated in the direction of the arrow and is completely enclosed by a casing or a series of casings 66.

In the casing section through which runway 62 extends there is provided a vacuum chamber 67 and a pipe 68 provides a means for evacuating this chamber. As the cover 61 within the turret pocket 63 passes adjacent the chamber 67 air is removed from the pocket and from the surfaces of the cover.

Adjacent the casing containing the vacuum chamber 67 the casing sections 66 enclose steam chambers 69. Steam at a desired temperature may be circulated through the steam chambers 69 by means of pipes 70 the drawings illustrating two such chambers connected together by a suitable steam pipe connection 70.

By the time the turret 64 has made one complete rotation and the covers resting in the turret pockets have been subjected to the steam within the steam chambers 69 these covers are in a sterile condition. The sterilized covers are thence removed through a passageway 71 and positioned into a chamber enclosed in a cover cooling apparatus 72. The covers pass from the passageway 71 into a pocket of a starwheel 73 mounted on a vertical shaft 74. This starwheel carries the covers through the cooling chamber of the cooling apparatus.

The passageway 71 and the cooling chamber 72 are enclosed within suitable walls which may be a part of or connected with the chamber walls 32. This wall as illustrated in the drawings where it encloses the passageway 71 extends into one of the casing sections 66 of the can cover sterilizing apparatus.

The spaced wall 33 also extends in spaced relation throughout the full extent of the inner wall 32 and encloses a protecting space which is an extension of the space 59. This protecting space or jacket completely encircles the cooling appa-

ratus 72, the passageway 71 and extends into the casing 66 of the can cover sterilizer. An annular opening 75 joins with the end of the jacket space 59 within the casing section 66 (as best illustrated in Figs. 1 and 3) and this annular space 75 completely surrounds the entrance opening to the passageway 71 adjacent the face of the turret 64.

A suitable cooling medium may be circulated through the cooling chamber of the cooling apparatus 72 as by means of pipes 76 which extend also through the wall 33 where they are suitably packed against contamination from the outside.

The step of cooling a can cover after sterilizing may in some cases be dispensed with but where a plastic sealing compound is used in the covers as a gasket for forming a hermetic seal between cover and can it may be desirable that the can cover be cooled prior to its introduction into the sealing chamber. It is the heat of the steam used in the sterilizer that is extracted in this manner.

The sterilized and cooled covers 61, in passing from the cooling apparatus 72, travel through a passageway 77 which is formed inside of the chamber walls 32 and which connects the cover cooling apparatus with the chamber 56. This permits introduction of the can covers into the starwheel 57 which loosely places a cover upon each can fed into the chamber 56 through passageway 55. It will be understood that the starwheel 57 may be of double construction so that the lower section of the starwheel will provide for transfer of the can from the passageway 55 into the chamber 56 and the upper part of the starwheel will correspondingly handle the can cover.

The filled cans with their loosely applied covers upon leaving the starwheel chamber 56 pass into the can closing and sealing chamber 58. The numeral 78 designates a suitable closing machine, the seaming head or other part of this machine being fully enclosed within the sealing chamber 58. The protecting chamber 59 also extends around the closing chamber 58 and around the sealing mechanism 78 so that at no time will there be any opportunity for contamination to enter into the sealing chamber. Suitable pipes 79 extending into the outer shell 33 of the protecting jacket 59 or its corresponding jacket 34 may provide for vacuumizing this protecting jacket at all times.

The filled and sterilized can with its superimposed sterilized cover upon passing into the sealing mechanism 78 within the sealing chamber 58 is hermetically sealed. The hermetically sealed can is thence removed from the sealing chamber by a discharge valve 80 operating in an enclosing housing 81 which joins with the walls 32, 33. The valve 80 comprises a multiple pocket turret 82 mounted on a vertical shaft 83 (see also Fig. 4) the hermetically sealed can passing into one of the pockets and being conveyed by the valve into a discharge chamber.

It will be observed by reference to Figs. 1 and 4 that the discharge end of the sealing chamber 58, where it contacts the turret valve 82, is completely encircled with the protecting chamber 59 and the shaft 83 where it extends through the chamber walls is suitably provided with stuffing boxes or other means of protection against contamination from the outside.

The casing wall 81 extends into an elongated housing 85 which encloses the discharge chamber designated by the numeral 86 through which the cans pass from the valve 82 onto a discharge plunger 87. The chamber 86 is filled with live steam or other sterilizing medium which constantly sweeps out the chamber by escaping through a suitable discharge opening formed in the housing 85. The discharge chamber 86 thus prevents entrance of air or other bacteria carrying medium into the discharge valve 82 and thus maintains a sterile condition in the apparatus.

Steam when it is used as a protecting medium is introduced into the discharge chamber 86 through a steam pipe 88 and through pipes 89 leading into both sides of the housing 85. The cans upon being brought successively to the plunger 87 are discharged by it from the chamber 86 in any suitable manner.

Consideration will now be given to the alternate phase of treatment of liquiform products and the sterilization and evaporation of milk will be given by way of example. The sterilized and evaporated milk after this treatment will be brought into the filling chamber 27 and following its receipt the further treatment of the milk will parallel the handling of the garden peas as has already been fully described as exemplary of a product of the discrete particle type. Description of this latter or further treatment of milk will therefore not be repeated.

Preparatory to sterilizing and evaporating milk in the apparatus the gate valve 26 (Fig. 1) will be fully closed and this shuts off from use the various mechanisms specifically relating to discrete particle products that have already been previously described.

As best illustrated in Fig. 2 the milk may be pumped through a sterilizer 91 where the milk is sterilized as it is forced therethrough. The milk is first introduced into the apparatus through a pipe 92 which passes it into a liquid pump 93 which may be of the rotary type. This pump forces the milk through a pipe 94 and into the sterilizer.

A form of sterilizer suitable for sterilization of the milk is herein shown as consisting of a series of circulating heating coils each coil comprising two concentric spaced pipe elements 95 located within a sealed housing 96 the milk being caused to traverse a sinuous path between each pair of concentric pipes. The pipe walls constitute in this instance heated surfaces. Header members are associated with the ends of the pipes 95 to insure proper transfer of the milk from one set of pipes to the other. The milk is finally delivered at the top of the housing 96 through a pipe 97.

During the passage of milk through the pipes it is heated to a high temperature receiving its heat through the walls of the concentric pipes. These wall surfaces are preferably heated by steam which is introduced into the housing 96 and which circulates around the exterior of the outer pipe elements and also passes through the inside of the inner pipe of each pair of pipes. A pipe 98 leading into the top of the housing may be used for introducing the steam at the proper pressure and temperature to effect the required transfer of heat to the milk.

Since the milk is in a thin film-like form by reason of the close space between the concentric pipes, i. e., the pipe surfaces between which the milk passes, it picks up or rapidly absorbs the heat. The housing 96 is also provided with a drain pipe 99 from which condensate may be withdrawn. A vent 101 may also be mounted in

the housing preferably near the top for venting the space surrounding the heating coils.

The heated milk is thus fully sterilized and is then passed through the pipe 97 into a vacuum pan 105. A manually controlled valve 106 may be located in the line 97 to control the amount of milk passing through the discharge pipe 97.

If desired the milk in its passage through the pipe 97 can be cooled to approximately its evaporation temperature before entering the vacuum pan.

The vacuum pan 105 comprises a cylindrical housing 107 which is fitted with a dome-shaped top section 108 and a cylindrical bowl-like bottom 109. A baffle plate 111 may be secured to the inner wall of the vacuum pan and is preferably curved to extend over the outlet of the pipe 97. The milk flowing through the pipe and entering the vacuum pan strikes against the baffle plate and is caused to discharge properly into the vacuum pan. It will be understood that the milk entering the pan is subjected to the vacuum within and cooling and condensation take place.

The evaporated milk which collects in the vacuum pan 105 is designated by the numeral 112. Heat is applied continuously to the body of milk while in the pan to maintain the temperature of the milk at a point where efficient evaporation takes place. A heating coil 113 is provided for this purpose which is submerged in the body of the milk on the inside of the vacuum pan, its terminal ends 114, 115 extending outside of the pan. Steam at suitable temperature and pressure may be circulated through the heating coil and thus impart the required heat to the body of milk in the vacuum pan.

The dome top 108 of the vacuum pan is connected to a header pipe 121 which leads into a suitable condenser 122. Any suitable means of evacuating the condenser may be used as by a low vacuum pump 123 which connects with and operates through the condenser. By means of this pump a desired degree of vacuum may be maintained at all times in the condenser and by its connection with the vacuum pan the desired degree of vacuum will be maintained in the pan.

The evaporated milk is adapted to be withdrawn from the vacuum pan through a discahrge pipe 125 which connects into a pump 126 by means of which the milk is forced into a filling pipe 127 (see also Fig. 1) which conveys the milk into the filling chamber 27. A hand operated valve 128 is located in the pipe 127 and this controls the amount of milk passing through the pipe.

During the treatment of a discrete particle product being run through the apparatus, the valve 128 would be closed. This valve thus provides the means for shutting off any connection between the filling chamber and the vacuum pan when this part of the apparatus is not in use.

From the time the milk leaves the sterilizer 91 through the pipe 97 and until it passes into the filling chamber 27 as evaporated milk all of the passageways are protected by a surrounding controlled and confined atmosphere. Thus provision is made for preventing any contamination of the product and any contaminating action to the interior of the pipes, vacuum pan, etc., which might be caused by leakage of the apparatus. To insure against such contamination the various pipes and vacuum pan condenser, etc., are enclosed within sealed jackets which may be maintained at an absolute pressure at all times less than the absolute pressure existing in any of the product conveying parts of the apparatus now under consideration.

The vacuum pan 105 is surrounded by a casing 131 (Fig. 2) the walls of which are spaced from the outer walls of the vacuum pan members 107, 108, 109 and an enclosing housing 132 is also provided around the pipe 97 adjacent the vacuum pan. This housing 132 is connected with the housing 131 and provides for intercommunication with a protecting space 135 which surrounds the vacuum pan and with an auxiliary space 136 which surrounds the pipe 97. The manipulating handle of the valve 106 is extended through the wall of the housing 132 and the stem of the handle is properly packed in a sealed joint to prevent any leakage around the valve stem.

A tubular housing 137 is also provided to surround the header pipe 121 leading to the condenser 122 and this housing is bolted to the vacuum pan housing 131. A protecting housing 138 is also provided for surrounding the condenser 122 and this housing is hermetically secured to the end of the housing 137. This provides a jacket space 141 surrounding the pipe 121 and communicating on one side with the vacuum pan space 135 and at the condenser end with a protecting space 142 which is confined within the housing 138 and in communication with the jacket space 141. The condenser housing 138 also encloses the pump 123 as well as a high vacuum pump 145 which is located alongside of the pump 123 and which communicates with the interior of this jacket space.

At the lower end of the vacuum pan the enclosing jacket casing 131 is connected with an outer spaced housing 146 which encloses the discharge pipe 125 and also the pump 126 and this housing provides a confined space 147 surrounding these parts and which communicates with the jacket space 135 of the vacuum pan.

In like manner an enclosing tubular housing 148 is connected with the housing 146 and surrounds the pipe 127. Housing 148 at its inner end is directly connected with the spaced jacket wall 33 surrounding the filling chamber 27. The housing 148 encloses a confined jacket space 149 which communicates with the jacket space 147 at one end and with the protecting space 34 of the filling chamber at the other end.

Where the heating coil 113 passes into the vacuum chamber of the vacuum pan, the pipes 114, 115 are suitably packed and this also applies where they extend through the casing 131 surrounding the vacuum pan. In a similar manner the operating shaft of the pump 126, which is designated by the numeral 151, is suitably packed where it extends through the wall 146 of the enclosing housing.

The pump shaft 151 may carry a drive pulley 152 to which operating power may be applied in suitable manner as by a drive belt 153. The hand wheel of the valve 128 is located exterior of the housing 148 and where the valve stem extends through the housing wall a suitable packed joint is provided.

By reason of the intercommunication of the jacket chambers 135, 136, 141, 142, 147 and 149, the entire space surrounding the various units of the evaporating apparatus are confined and may be maintained at a suitable diminished absolute pressure. This creation and maintenance of an artificially controlled atmosphere is effected by the vacuum pump 145 which withdraws the air directly from the space 142 and

indirectly from all of the other surrounding jacket spaces.

The amount of absolute pressure maintained in these jacket spaces is always less than that existing on the inside of the vacuum pan 105 or in the pipes or chambers connected therewith. Thus bacterial contamination is prevented from entering into the product or into the interior of the working parts of the apparatus concerned with heating or sterilization, with evaporation or condensation of the milk. This example of a treatment of milk, which requires a treating chamber at a reduced or sub-atmospheric pressure, emphasizes the advantages of having a confined and controlled protecting casing surrounding the treating chamber.

It will be evident from the foregoing, that irrespective of whether a discrete particle product is being handled through the apparatus such as peas filled into sterile cans, or whether condensed milk or other liquiform products are being sterilized, evaporated or otherwise treated, that the entire process of any particular stage is such as to fully protect the product against outside contamination. From a mechanical standpoint where it is necessary for some part to extend through a surrounding jacket wall of a protecting chamber, it will be seen that provision is also made for preventing entrance of bacterial contamination at such a point.

It will also be evident that in order to insure the maintenance of aseptic operating conditions in the various chambers, passageways, etc., these chambers and other parts will be rendered completely sterile before operation begins. This may be done by treating the chambers with saturated steam under pressure. As an extreme safety measure, the surrounding jackets may also be sterilized before operation begins, although this is not an essential part of the procedure.

With a created, confined and regulated surrounding and protecting atmosphere, any pressure desired in any treating chamber may be used irrespective of the normal outside atmosphere. In other words there are no limiting circumstances relating to a desired treatment which cannot be successfully adjusted and used where a protecting zone of controlled atmosphere is available according to the teachings of the present invention.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the steps of the process described and their order of accomplishment without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the process hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. A method of canning which comprises passing a sterilized product to be canned into a sealed chamber for treating and sterilizing cans, maintaining about the product and in said chamber a sterile atmosphere having an absolute pressure not greater than that of the natural atmosphere outside of the apparatus, and surrounding said chamber with a confined controlled atmosphere of less absolute pressure than the pressure within said chamber.

2. A method of canning which comprises passing a product to be canned into a sterilizing chamber, sterilizing the product, passing the sterilized product into a can filling chamber, maintaining about the product and the can parts in said filling chamber a sterile atmosphere having absolute pressure not greater than that of the natural atmosphere outside of the apparatus, and surrounding said filling chamber with a confined atmosphere of less absolute pressure than that of said filling chamber during said product treatment.

3. A method of canning which comprises passing a sterile product to be canned into a sterile filling chamber, passing a sterile can into said filling chamber, filling the product into the can while in said filling chamber, transferring the filled can into a sterile can closing chamber, hermetically sealing the filled can, and surrounding said closing and filling chambers and the intercommunication therebetween with a confined sterile atmosphere of less absolute pressure than that in any of said chambers during said product treatment.

4. A method of canning which comprises passing a product to be canned into a heat treating chamber, passing said product into a cooling chamber, passing a can through a sterilizing chamber to sterilize the can, passing a can cover through a sterilizing chamber to sterilize the cover, transferring the sterilized can into a sterile filling chamber, transferring the cooled product into said filling chamber, filling the product into the can while in said filling chamber, transferring the filled can into a sterile can closing chamber, transferring the sterilized can cover into said closing chamber and hermetically uniting the sterilized cover with the filled sterilized can, maintaining about the product and the can parts in said sterile closing and filling chambers a sterile atmosphere having absolute pressure not greater than that of the natural atmosphere outside of the apparatus, and surrounding said cooling, filling and closing chambers and the inter-communication therebetween with an atmosphere of less absolute pressure than that in any of said chambers during said product treatment.

5. A method of canning which comprises passing a product to be canned into a sterilizing chamber, sterilizing said product therein, passing a can into a vacuumizing chamber and thence into a sterilizing chamber, sterilizing the can while in said chamber, passing a can cover into a vacuumizing chamber and thence into a sterilizing chamber, sterilizing said cover, transferring the sterilized can into a sterile filling chamber, transferring the sterilized product into said filling chamber, filling the product into the can while in said filling chamber, transferring the filled can into a sterile can closing chamber, transferring the sterilized can cover into said closing chamber and hermetically uniting the sterilized cover with the filled sterilized can, maintaining a sterile chamber atmosphere at a predetermined absolute pressure in said closing and filling chambers to which the product and can parts are subjected, the while surrounding said closing and filling chambers and the intercommunication therebetween with a confined atmosphere of less absolute pressure than that in any of said chambers.

6. The method of treating liquiform products which comprises sterilizing the product, passing the product into a vacuum pan while cooling it, maintaining a vacuum in the pan through the medium of a condenser, withdrawing the sterile and cool liquid from the vacuum pan, and pro-

tecting the liquid against contamination by surrounding said vacuum pan and said condenser with a confined atmosphere of less absolute pressure than that obtaining within said elements.

7. The method of treating liquiform products which comprises sterilizing the product, passing the product into a vacuum pan, maintaining a vacuum in the pan, withdrawing the sterile liquid from the vacuum pan, and protecting the liquid against contamination by surrounding the vacuum pan with a confined high vacuum which is in excess of the vacuum within the said pan.

8. The method of treating liquiform products which comprises sterilizing the product, passing the product into a vacuum pan, maintaining a vacuum in the pan through the medium of a vacuum pump and a condenser thereby cooling the liquid, supplying heat to the cooled liquid in the said vacuum pan to cause evaporation of water which passes into said condenser thereby condensing said liquid, withdrawing the sterile, cooled and condenser liquid from the vacuum pan, and protecting the liquid against contamination by surrounding said vacuum pan and said condenser with a confined atmosphere of less absolute pressure than that obtaining within said elements.

CHARLES O. BALL.