Aug. 18, 1936. M. H. RANEY 2,051,391

METHOD AND APPARATUS FOR PROCESSING

Filed Dec. 9, 1932 2 Sheets-Sheet 1

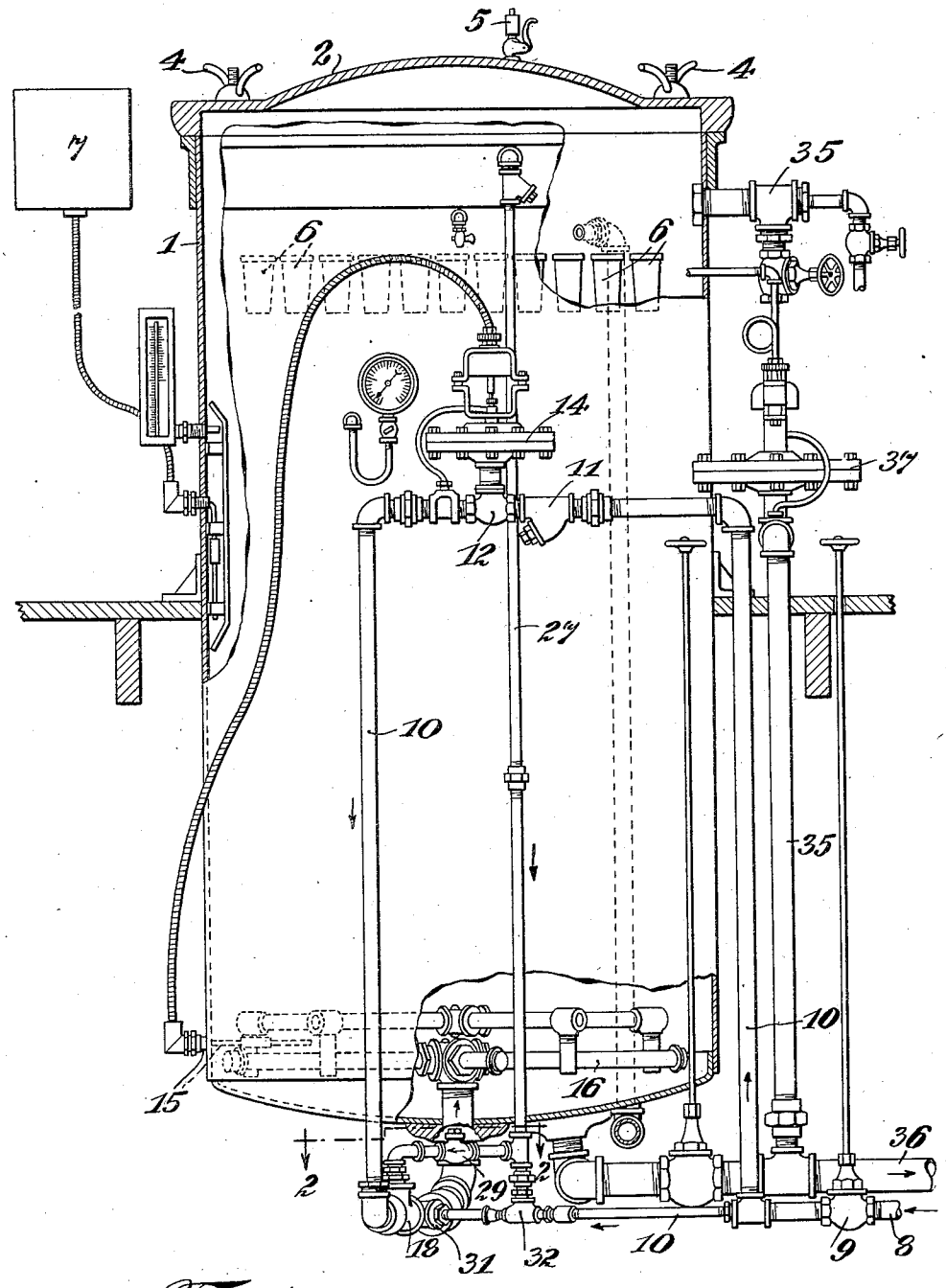


Fig. 1.

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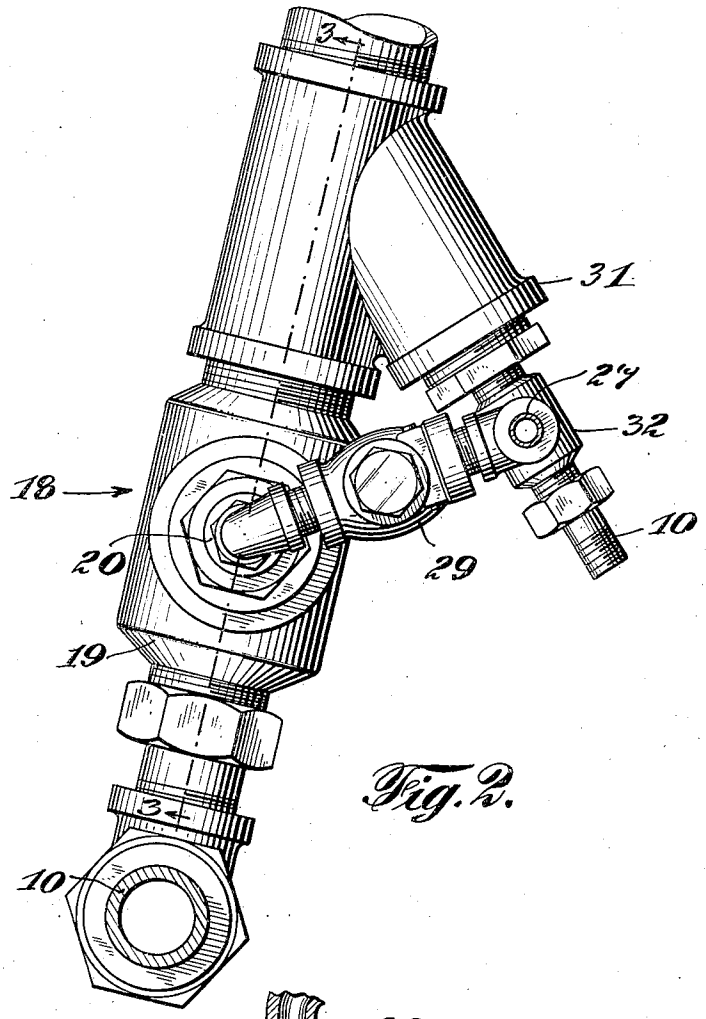


Fig. 2.

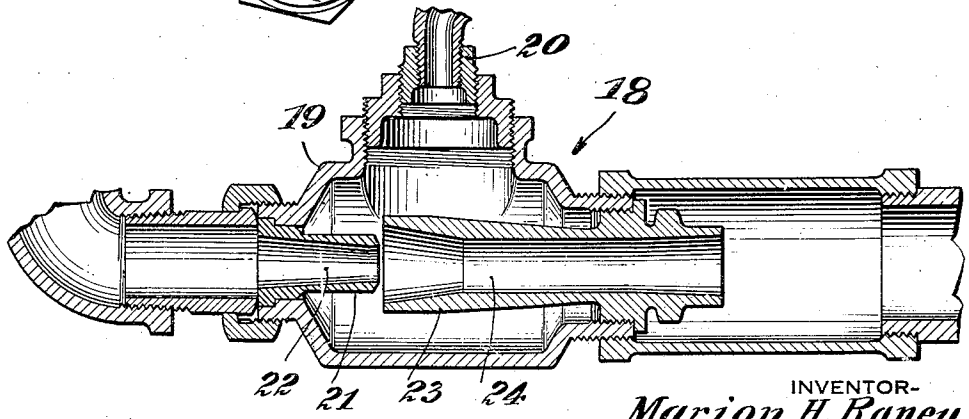


Fig. 3.

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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR PROCESSING

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Application December 9, 1932, Serial No. 646,435

17 Claims. (Cl. 53—19)

The present invention relates to pressure processing equipment, and more particularly to a method and apparatus for maintaining uniform temperatures throughout the retort and for eliminating or minimizing the noise instant to the operations thereof. The invention is particularly applicable to the system described and illustrated in the patent granted to George W. Mullen, No. 1,927,043, although it will be understood that the invention has broader aspects and is applicable to other systems and to other equipment, generally.

Food products are packed in glass or tin containers in large quantities for preservation. To prevent the contents of these packages from spoiling, it is customary, with many types of products, to process the packages, that is, to heat them up to a temperature sufficient to sterilize or pasteurize the contents to kill any germs or spores therein. In some instances, the products are cooked or partially cooked, after being sealed in the containers. The temperatures required in the processing are usually in excess of 220° Fahrenheit, generally in the neighborhood of 240°, and these temperatures may be maintained for a considerable period of time. If the temperature is not uniform throughout the retort, some of the packages are overcooked and others undercooked. It has been found that a difference of as much as one or two degrees during the period of processing makes a material difference in the results obtained. Very elaborate equipment has been devised to maintain the required temperature, without obtaining the desired results. Another serious objection to the present types of processing equipment is the noise which they make, particularly in being brought up to the required temperature. Because of the quantities of packages processed, it is necessary to have large retorts and these retorts are usually filled with relatively cool water, and steam is injected to raise the temperature to the desired degree. The steam creates a water hammer and makes a deafening noise, which is quite objectionable.

The present invention aims to overcome the above objections by eliminating or minimizing the noise incident to the heating of the fluid and by maintaining a constant temperature at all times throughout the retort and, in addition, aims to achieve these results with a simple construction and at a minimum cost.

An object of the present invention is to maintain uniform temperatures throughout the retort at all times.

A further object of the invention is to create a constant circulation of the fluid to maintain a uniform temperature throughout the retort.

Another object of the invention is to prevent or minimize the noise incident to the injection of steam into the retort for heating purposes.

A further object of the invention is to achieve the above results of uniform temperature and elimination of noise by a minimum number of changes in the construction and at a low cost.

A further object of the invention is to provide a device which will accomplish the above objects and which is readily applicable to existing equipment.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawings, forming a part of the specification, wherein

Fig. 1 is a side elevational view of a retort, partly in section, illustrating a preferred embodiment of the present invention applied thereto;

Fig. 2 is a sectional view, along the lines 2—2 of Fig. 1, with parts broken away to illustrate details thereof; and

Fig. 3 is a detailed sectional view on the line 3—3 of Fig. 2, illustrating details of the preferred embodiment of the ejector.

Referring again to the drawings, there is shown a retort 1 having a cover 2 secured thereto in the usual manner by wing nuts 4. A safety valve 5 vents the retort if an excessive pressure should accumulate therein. The retort may be filled with containers 6, which are usually deposited in wire baskets and lowered into the retort. Thereafter, liquid may be supplied to the retort to immerse the containers, but a space should be left above the liquid so that a quantity of air will be entrapped in the retort when the cover 2 is applied. It is well known that containers, when heated, develop an internal pressure which is substantially greater than the steam pressure within the retort. The air within the sealed packages increases in volume and will blow off or damage the packages unless it is counterbalanced by a corresponding air pressure within the retort. This may be achieved by entrapping a quantity of air in the retort, which will increase

in pressure and temperature as the pressure and temperature of the package is increased.

After the retort is closed with sufficient liquid to cook the contents of the packages, and the proper amount of air is entrapped in the retort, the contents have to be heated rapidly to a required temperature and maintained at that temperature for a definite period and thereafter cooled sufficiently to be removed from the retort. An accurate record of the performance of the retort may be made by a recording thermometer 7. Naturally, if the recording thermometer shows particularly bad results, the contents of the retort may have to be thrown out. It is customary to utilize steam for heating up and maintaining the temperature of a retort, and a steam conduit 8 is shown herein controlled by a hand valve 9. This conduit has a branch 10 extending upwardly, with a strainer 11 therein. An automatic control valve 12 controls the amount of steam delivered through the branch pipe 10 and is operated by an automatic temperature regulator 14 having a thermostat 15 positioned directly adjacent to the point of delivery of the steam to the retort. The branch conduit 10 continues downwardly and passes through the bottom of the retort and connects with an outlet-cross 16 for supplying steam to the bottom of the retort. The thermostat 15 actuates the control valve 12 and when the valve 9, controlling the inlet of the steam, is opened, supplies steam to the retort as long as the temperature in the retort is below the desired amount. The thermostat 15 and regulator 14 automatically operate to shut off the supply of steam when the temperature reaches the desired amount. As the steam enters the retort, it does not condense immediately, but forms large pockets which suddenly contract when the steam condenses, creating a hammerlike noise which is undesirable. In addition, the steam in the branch steam pipes 10 condenses between the retort and the regulator. When the control valve operates to deliver steam, the condensate in the conduit acts as a water hammer, making a disturbing noise.

To eliminate these difficulties, the present invention contemplates the insertion of an ejector 18 in the branch steam line 10. Any suitable type of ejector may be utilized, but as shown herein (Fig. 3), the ejector 18 may comprise a hollow member 19 threaded at its respective ends for attachment to the steam pipe line. An extension 20 may be attached to the air pipe 27 to connect it to the interior of the ejector. On the inside of the ejector, a nozzle 21, inserted into one end of the member 19, has a bore 22 converging in size toward its inner end and terminating at the mouth of a Venturi tube 23 having a reduced throat 24. The steam passing through the member 21 into the venturi 23 draws air from the top of the retort through the pipe 27 and delivers it to the bottom of the retort with the steam.

A check valve 29 prevents return of the air and the passage of steam to the upper part of the retort. As the steam is delivered by the automatic valve 12, it passes through the ejector 18, as described above, and withdraws air from the upper part of the retort and delivers it with the steam into the lower part of the retort. The advantage of this construction is two-fold. First, the air withdrawn from the top of the retort is not condensible, and hence, when the pockets are formed, the air does not condense as the steam does so that the contraction of the pocket is cushioned and the hammering noise is eliminated. In addition, as the pockets of air and steam contract, the air bubbles up through the liquid to the upper part of the retort. This circulation of air through the liquid agitates the liquid and maintains uniform temperatures throughout the retort.

While the retort is being brought up to temperature, the automatic valve 12 is open at all times, and steam is supplied constantly to the retort. After the retort reaches the desired temperature, the valve 12 is cut in and out at intervals by the thermostat 15, as the temperature of the retort changes within predetermined limits. To further improve the operation of the retort, the present invention contemplates connecting the steam conduit 8 to the horizontal part of the branch 10 at 31, through the intermediation of a second ejector 32, which may be similar to the ejector 18 but, preferably, of smaller size. The quantity of steam delivered through ejector 32 is preferably slightly less than the amount of steam required for compensating for the heat radiated from the retort, so that the steam may flow continuously without heating up the retort. The ejector 32 is connected, also, to the air circulating pipe 27 so that the continuous supply of steam through the ejector 32 causes a constant withdrawal of air from the upper part of the retort, and delivery of the air and steam to the lower part of the retort so that air is continuously bubbling up through the liquid in the retort to agitate it. As described above, the air delivered with the steam eliminates the noise incident to the injection of steam through the steam conduit 8 and ejector 32. In addition, this auxiliary supply of steam maintains the branch pipe 10, on the retort side of the automatic valve 12, filled at all times with steam and prevents the liquid from the retort entering the same, and also prevents condensation and the resulting water hammer incident to the delivery of steam through pipe 10.

Various other devices may be utilized in connection with the retort. For example, an overflow line 35 may be provided, leading to a drain 36 connected to the lower part of the retort. The overflow line may have an automatic relief valve 37 to relieve the pressure in the retort when it exceeds a predetermined amount, and likewise to prevent the liquid in the container from exceeding a predetermined level.

In the operation of the device, the baskets of containers are placed in the retort, liquid is run into the proper level, and the retort closed to entrap a quantity of air in it; or the retort may be closed first and the liquid forced into the retort, permitting the overflow pipe 35 to exhaust the excess pressure. Thereafter the steam conduit 8 is opened by means of the hand valve 9, and the automatic control valve 12 injects the steam through the branch pipe 10 into the bottom of the retort. The ejector 18, through which the steam passes, is operatively connected with the upper part of the retort through the air circulating pipe 27 and draws air from the upper part of the retort and injects it into the bottom part thereof, cushioning the action of the steam and water as it is delivered to the retort and, in addition passes through the liquid to the top of the retort, thereby agitating the liquid and maintaining uniform temperatures throughout the retort. A steam pipe 8 is also connected to the bottom of the retort through an ejector 32, likewise con-

nected to the air circulating pipe 27. This connection delivers a constant amount of steam continuously to the retort from the time the hand valve is opened, so that air is withdrawn from the top of the retort and injected into the bottom thereof throughout the run. This eliminates noise and constantly circulates the liquid within the retort. By withdrawing the air from the top of the retort, the pressure conditions within the retort are not disturbed but are maintained in direct relation to the pressure conditions within the package, since the quantity of air in the packages is substantially constant, and likewise the quantity of air in the retort is substantially constant.

It will be seen that the present method and apparatus are simple in construction and readily applicable to existing processing equipment. In applying it to such systems, few changes are necessary and the cost thereof is slight. The constant delivery of steam to the retort and the utilization of the steam for withdrawing air from the top of the retort and circulating it through the liquid, minimizes variation in temperature throughout the retort, and, in addition, eliminates noise. Likewise, the ejector through the branch steam line and through the control temperature regulator distributes the additional heat supplied to the bottom of the retort to the remainder thereof and, in addition, the air supplied with the steam eliminates the noise incident to the injection of the steam into the water.

As various changes may be made in the form, construction and arrangement of the parts herein without departing from the spirit and scope of the invention and without eliminating any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. The method of processing in a closed retort, which method comprises utilizing a liquid for supplying heat to the products to be sterilized, injecting steam into the liquid to heat the same, maintaining a substantially constant volume of air above the liquid and supplying the injected steam with air drawn from above the liquid to minimize noise, and to agitate the liquid in the retort to assure uniform temperature throughout.

2. The method of processing food products and the like in a closed retort, which method comprises supplying liquid to the retort entrapping air above the liquid, delivering steam into the retort below the liquid level thereof, and withdrawing air from the space above the liquid level and delivering said air into the retort mixed with the steam to eliminate noise due to the condensing of the liquid and to agitate the liquid to obtain uniform temperatures and maintaining the air pressure substantially constant without increasing the quantity of air.

3. The method of processing food products in a retort, which method comprises partially filling the retort with a liquid, entrapping a substantially constant quantity of air in the space above the liquid, supplying steam to the retort below the liquid level thereof, and utilizing the steam to withdraw the air from the top of the retort and to inject it into the retort with the steam.

4. The method of processing food products and the like in a closed retort, which method comprises partially filling the retort with a liquid, closing the retort to entrap a quantity of air above the liquid, delivering steam to the retort at the lower part thereof to heat the liquid, and utilizing the energy of the steam to withdraw air from the upper part of the retort and to inject it into the retort with the steam.

5. The method of processing food products and the like, which method comprises enclosing the products in a retort, partially filling the retort with a liquid delivering steam to the retort to heat the contents thereof to a predetermined temperature, independently delivering steam continuously at a substantially lower rate, and utilizing the steam for withdrawing air from the upper part of the retort and delivering it to the lower part thereof to obtain a constant circulation of air throughout the retort.

6. The method of processing food products and the like, which method comprises utilizing a liquid in a closed retort to immerse the products, entrapping a quantity of air above the liquid to maintain the desired pressure in the retort, delivering steam into the retort constantly to partially compensate for heat radiation, and utilizing the energy of the steam to withdraw air from the upper part of the retort and to inject it into the lower part thereof with the steam, and independently and periodically supplying steam at an increased rate to control the temperature of the retort.

7. The method of processing food products and the like, which method comprises utilizing a liquid in a closed retort to immerse the products, entrapping a quantity of air above the liquid to maintain the desired pressure in the retort, delivering steam into the retort constantly to partially compensate for heat radiation, and utilizing the energy of the steam to withdraw air from the upper part of the retort and to inject it into the lower part thereof with the steam, independently increasing the supply of steam to control the temperature of the retort, and utilizing said increased supply of steam to withdraw more air from the upper part of the retort and to inject it into the lower part with the increased supply of steam.

8. The method of processing food products and the like, which method comprises providing a retort, supplying a quantity of liquid to the retort and immersing the contents thereof, entrapping a quantity of air in the upper part of the retort for maintaining the required air pressure, automatically supplying, periodically, steam to said retort to control the temperature thereof, and continually supplying steam to said retort to maintain the inlets in a heated condition, and to continuously agitate the liquid in the retort to maintain uniform temperatures throughout.

9. In a device of the class described, the combination of a retort, a steam conduit leading to the lower part of said retort, automatic means responsive to the temperature within the retort for supplying steam at intervals to the retort, a second conduit connected to said steam conduit adapted to supply steam continuously thereto and to the retort to maintain said steam conduit in heated condition and substantially free from liquid.

10. In a device of the class described, the combination of a retort adapted to receive food containers and a liquid for immersing the same, a cover for said retort adapted to entrap a quantity of air therein, a steam conduit leading to the lower part of said retort, means responsive to the temperature within the retort for supplying steam to the retort at intervals, an ejector in said steam conduit and an air circulation con-

duit connected to the upper part of said retort and to said ejector to draw air from the top of the retort and deliver it into the bottom of the retort, a check valve in said air circulation conduit, a second steam conduit connected to the first, and means for supplying steam continuously to said second steam conduit, an ejector in said second steam conduit, said ejector being operatively connected to the upper part of the retort to withdraw air therefrom and deliver it continuously to the lower part of the retort.

11. In a device of the class described, the combination of a retort adapted to receive a liquid, means for closing said retort to entrap a quantity of air therein, an air conduit connected with the upper part of the retort, a steam conduit, means for periodically supplying steam to said steam conduit for maintaining the desired temperature in the retort, an ejector operatively connected to said steam conduit, and said air circulating conduit to withdraw air from the upper part of the retort and deliver it to the lower part thereof, a second conduit connected with the lower part of said retort, and means for supplying steam constantly to said conduit to heat the contents of the retort, and a second ejector operatively connected with said air circulation conduit and with said second steam conduit to utilize the energy of the steam to withdraw the air from the upper part of the retort and deliver it to the lower part thereof.

12. In a device of the class described, the combination of a retort having a quantity of air entrapped therein and having a liquid therein, a conduit leading to the lower part of said retort, automatic means for supplying steam at intervals to said conduit to maintain the proper temperature therein, a second conduit leading from the upper part of said retort, a check valve connected to said second conduit, an ejector operatively connected with said steam conduit and with said check valve connected to said second conduit, whereby said ejector is adapted to utilize the energy of the steam for withdrawing air from the upper part of the retort and injecting it into the lower part thereof, said check valve preventing air from passing back into said retort through said second conduit and preventing the formation of back pressure tending to draw liquid into said ejector.

13. The method of processing sealed containers and the like in a retort, which method comprises partially filling the retort with a liquid, closing the retort to entrap a quantity of a non-condensible fluid therein, continuously supplying a condensible heating fluid to the liquid in the retort utilizing the condensible fluid to withdraw the non-condensible fluid from the retort, and supplying with said heating fluid the withdrawn non-condensible fluid to maintain the temperature of the liquid and the pressure in the retort substantially uniform without injecting additional air.

14. The method of processing food products and the like, which method comprises providing a retort containing a quantity of liquid and food containers immersed therein, supplying steam at intervals to the retort in response to the temperature of the liquid to control the temperature thereof, and independently supplying steam to said retort continuously at a lower rate to continuously agitate the liquid and maintain a uniform temperature throughout the retort.

15. The method of processing food products and the like, which method comprises providing a retort containing a quantity of liquid and food containers immersed therein, entrapping air above the liquid to maintain a desired pressure in the retort, supplying steam at intervals to the retort in response to the temperature of the liquid, independently supplying steam to said retort continuously at a substantially lower rate, utilizing the energy of the steam supplied at a substantially lower rate to continuously withdraw air from the upper part of the retort, and injecting the withdrawn air together with the continuously supplied steam into the liquid in the retort.

16. In a device of the class described, the combination of a retort for containing food containers and the like, adapted to be filled with a liquid, means for closing said retort to entrap a quantity of air therein, a conduit leading to the lower part of said retort and automatic means for supplying steam to said conduit periodically to maintain proper temperature in said retort, and means for independently supplying steam continuously at a substantially lower rate to said conduit to maintain said conduit in heated condition and to continuously agitate the fluid in said retort to provide an even temperature throughout the retort.

17. In a device of the class described, the combination of a retort adapted to receive food containers and the like, and a liquid for immersing the containers, means for closing said retort and retaining a substantially constant quantity of air therein, a steam conduit, a steam line constantly open to the flow of steam and directly connected to a source of steam for supplying steam through said conduit continuously to heat said liquid during the operation of the retort, a second conduit connected with the upper part of the retort above the liquid level thereof, and an injector associated with said steam conduit and said second conduit leading from the upper part of the retort adapted to utilize the energy of the steam delivered to the retort to withdraw air from the upper part of the retort and deliver it to the lower part thereof together with the continuous supply of steam.

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