

Oct. 11, 1932.

G. W. MULLEN

1,881,855

METHOD FOR PRESERVING

Original Filed May 12, 1926 3 Sheets-Sheet 1

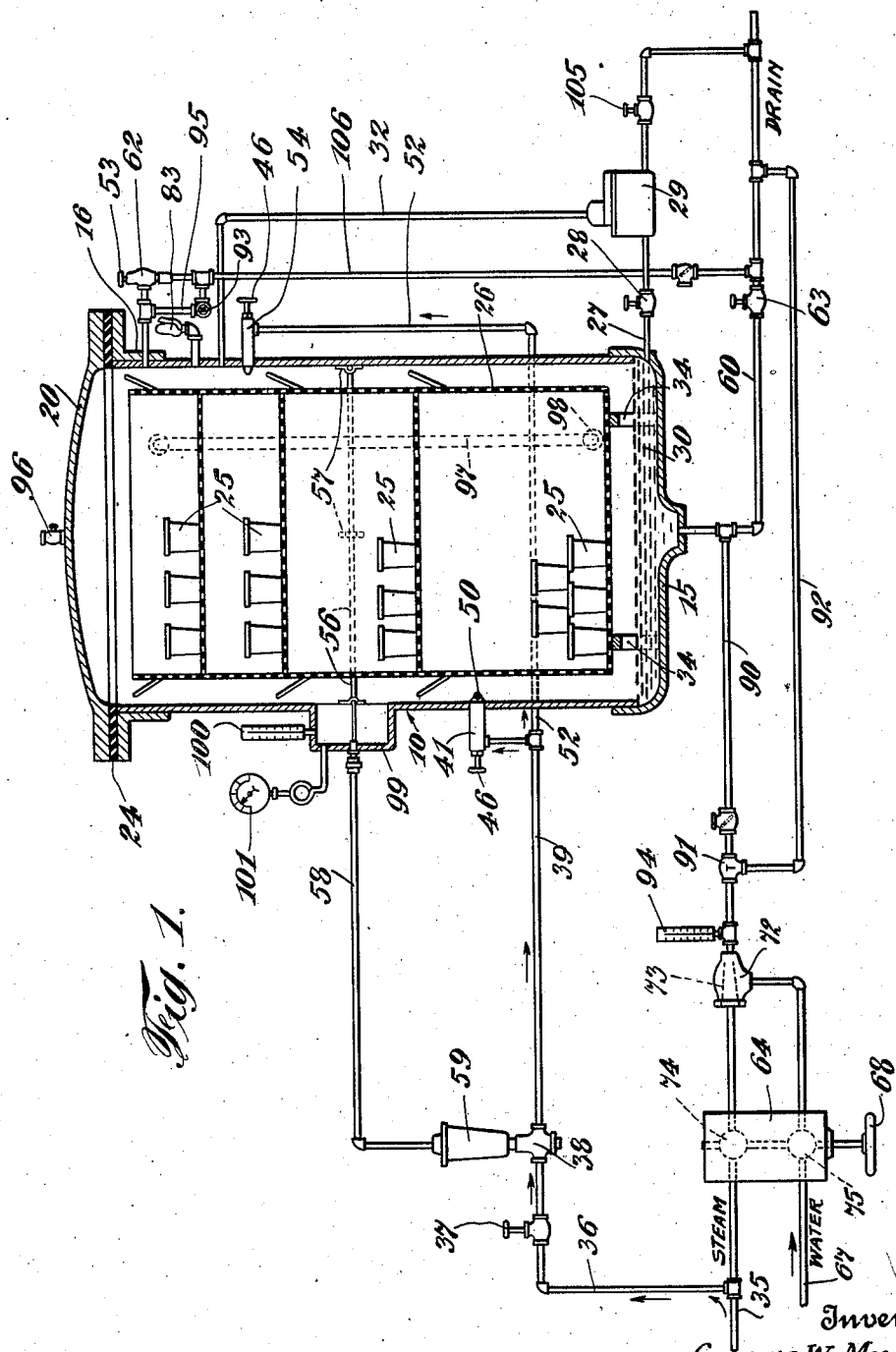


Fig. 1.

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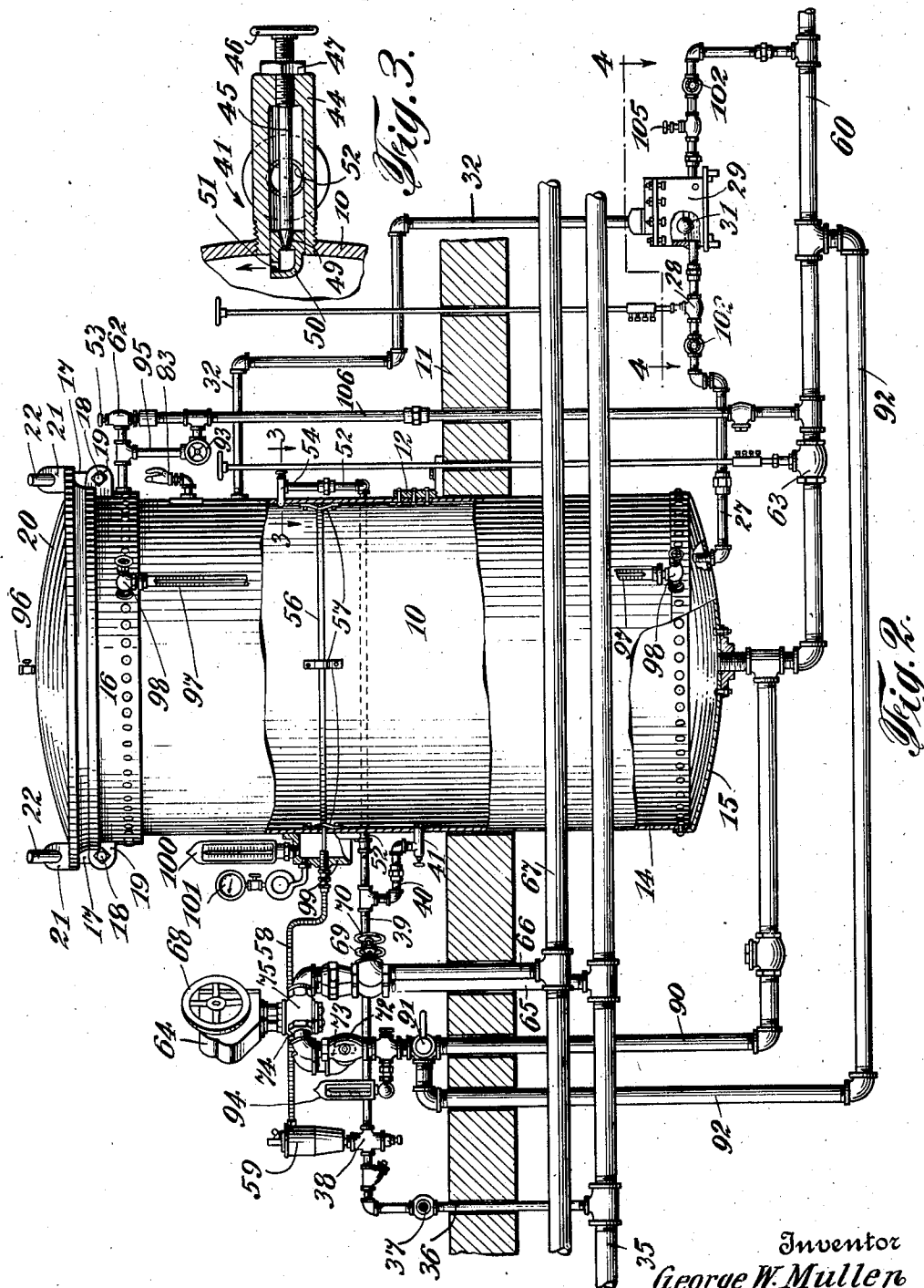
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Original Filed May 12, 1926 3 Sheets-Sheet 3

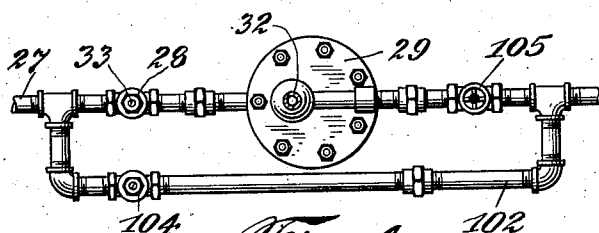


Fig. 4.

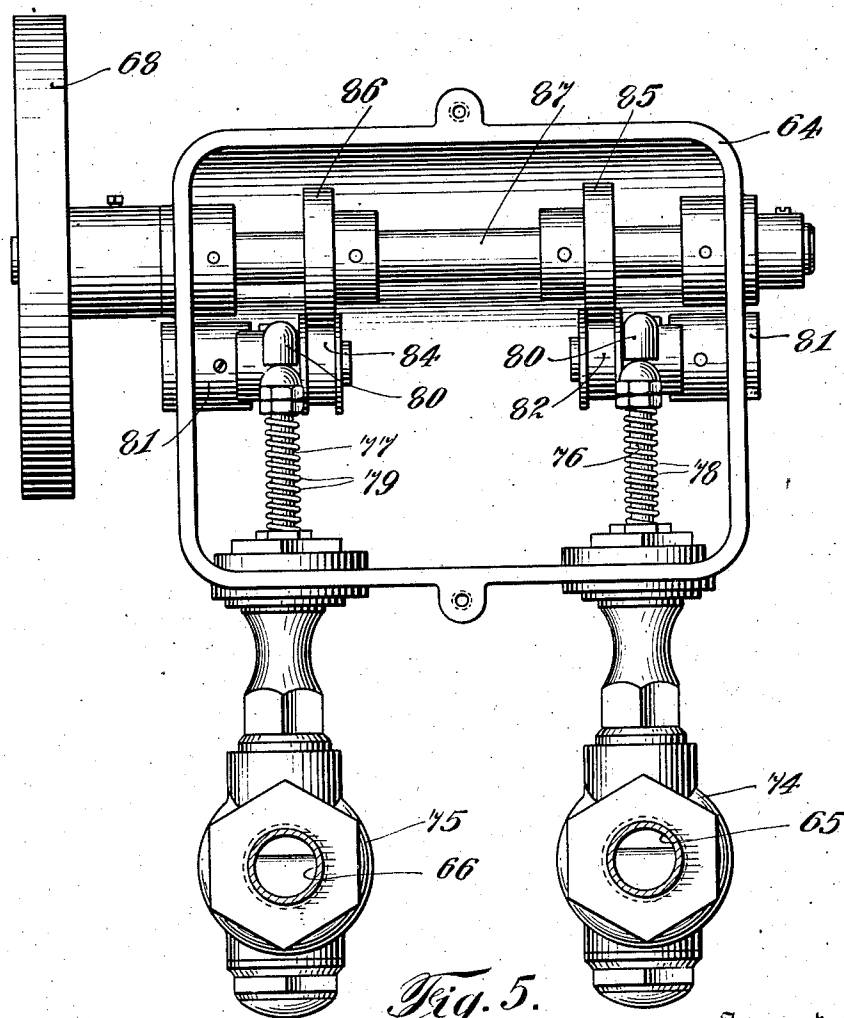


Fig. 5.

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METHOD FOR PRESERVING

Original application filed May 12, 1926, Serial No. 108,497. Divided and this application filed November 5, 1927. Serial No. 231,196.

The present invention relates to cooking and preserving, and more particularly to a method for cooking or preserving material packed in hermetically sealed containers.

5 In processing foods commercially, it is customary first to pack the material in containers and then subject the containers and contents to the proper sterilizing and cooking operations. Since the flavor of the food depends to a considerable extent upon the cooking, great care must be taken to obtain the exact temperature in all parts of the retort for a considerable period of time to prevent insufficient or excessive processing of any of the containers. In doing this, considerable difficulty has been encountered because the containers are usually heated to 240 or 250 degrees Fahrenheit, which is considerably above boiling temperature, and as a result an internal pressure is developed in the containers which is considerably in excess of the external steam pressure. This is particularly true where the air is not exhausted before the containers are sealed. Pressures of 30 pounds or more gage are developed under ordinary operations when the containers are sealed at room temperature (70 degrees Fahrenheit) without exhausting the air therefrom, and this is sufficient, if not counterbalanced, to distort metallic containers and to burst glass containers or to cause leaks in the seals thereof. Where the heating medium is steam, the internal pressure is partially balanced by the pressure of the steam in the retort, which is usually about 10 pounds gage, leaving a differential pressure of upwards of 20 pounds.

Various methods and apparatus have been devised to eliminate the effects of these pressures. Containers have been provided with small apertures to permit the escape of gases during the cooking and adapted to be readily sealed thereafter. Clamps have also been used to prevent the covers from being blown off. Perhaps the most successful method has been to inject compressed air into the retort to counterbalance the pressure developed in the containers at a given temperature. Elaborate devices have been designed automatically to control the admission of compressed

air to give the desired pressure for different temperatures within the retort and for different pressures in the containers. Such devices are expensive and are frequently out of order requiring the attention of an expert mechanic to keep them in adjustment. Further, the entrance of the compressed air into the container and its contact with steam, causes a sudden increase in pressure which is dangerous, to say the least. To prevent air pockets and variations in temperature in the different parts of the retort due to the injected air it is customary to have one or more apertures in the retort exhausting air and steam continuously to obtain proper circulation, thereby occasioning considerable waste of heat and objectionable noises due to the escaping steam and air.

The present invention eliminates the above difficulties and provides an adequate pressure at all temperatures to counterbalance the internal pressures in the containers. The method may be practiced with an apparatus which is simple in construction and inexpensive in manufacture, and which has a minimum of parts likely to occasion adjustment. Generally these advantages are obtained by entrapping a quantity of air in the retort preferably at atmospheric pressure, and subjecting the air to the same heating medium that the containers are subjected to. The air will increase in pressure in proportion to the change in its absolute temperature and the increase in air pressure outside the containers will counterbalance the pressure in the containers, which is usually above the pressure of saturated steam at a given temperature, and the differential pressure will be substantially constant throughout the processing operation. To maintain the external pressure required as low as possible, the air in the containers is exhausted by sealing the containers while hot or else by sealing them in a vacuum chamber so that the portion of the internal pressure caused by air and other gases will be reduced to a minimum. This not only facilitates and simplifies the processing but also prevents discoloration of the food and prevents decomposition in some instances.

One form of apparatus, by means of which

the method may be practiced, is described herein and comprises a retort adapted to receive a number of containers. The air is entrapped in the retort when it is enclosed for the processing operation so that no compressed air facilities are required. Steam is injected at a predetermined rate until the temperature in the retort reaches the predetermined maximum for the particular food at which time it is automatically controlled by a motor valve responsive to the temperature in the retort. Thorough circulation and uniform temperatures are maintained in all parts of the retort by injecting the steam tangentially of the curved wall of the retort so that a swirling action causes a thorough mixture of the injected steam and the entrapped air. A suitable control device maintains a quantity of water at a definite level in the bottom of the retort so that the steam will always be saturated. Suitable valve mechanisms are provided to facilitate the injection of cooling water after the contents of the containers have been cooked.

25 An object of the invention is to simplify the methods used heretofore in processing foods in hermetically sealed containers.

Another object of the invention is to eliminate air compressors and the complicated automatic controls for the compressed air and steam heretofore required for maintaining the proper external pressure on the sealed containers, by entrapping within the retort a quantity of air or other gas and permitting its pressure to increase under the influence of the temperature medium for the containers so that a variable external pressure is provided which is directly responsive to the temperature within the retort and by minimizing the external pressure required by exhausting the air from containers prior to the sealing operation.

Another object of the invention is to render the gaseous condition in the retort similar to the gaseous condition in the containers so that the pressure in the retort and in the containers will be substantially equalized at all temperatures.

A further object of the invention is to maintain a uniform temperature throughout the retort by injecting steam tangentially at the side thereof to cause a swirling action which thoroughly mixes the gases in the retort.

55 Other and further objects of the invention will be obvious upon an understanding of the illustrated embodiment about to be described, or will be obvious from the accompanying drawings, or indicated in the appended claims, and various advantages secured by the invention other than those herein specifically referred to, will occur to one skilled in the art upon employment of the invention in practice.

65 While the present invention is not limited

to any particular form of apparatus, one embodiment of an apparatus for practicing the process has been chosen for the purpose of illustration and description and is shown in the accompanying drawings, wherein

Fig. 1 is a diagrammatic view of a preferred form of apparatus;

Fig. 2 is a side elevational view of a preferred form of apparatus with portions broken away to show details thereof;

Fig. 3 is a sectional view along the line 3—3 of Fig. 2, illustrating details of the needle valves;

Fig. 4 is a top plan view along the line 4—4 of Fig. 2, and

Fig. 5 is a view of the steam and water control mechanism with the cover removed showing details thereof.

Referring to the drawings, there is shown a retort 10, mounted and held in a foundation 11 of cement or other material by means of the brackets 12. Preferably the retort extends through the foundation with its lower end projecting a substantial distance to permit suitable pipings to be attached thereto. The space below the foundation furnishes a convenient location for the various pipes associated with the apparatus.

The retort preferably comprises a cylindrical body portion 14, having a lower head 15 riveted thereto and an upper circular rim 16 riveted in position, with a pair of lugs 17 hinged thereto by means of bolts 18 passing through the bifurcated extensions 19 on the rim. A cover 20 is adapted to be seated on the rim and has suitable recesses in its periphery adapted to receive the lugs 17, when they are raised about their pivots into engagement with the cover. The nuts 21 may be rotated by means of the arms 22 to apply the pressure required to maintain the cover in position when there is steam pressure in the retort. A suitable gasket 24 may be utilized to seal the retort and to prevent escape of air or steam between the cover and the rim.

Containers 25 are placed one upon another to fill the perforated baskets 26 which are stacked one upon another in the retort. This facilitates rapid removal of the containers and also permits the stacking of the containers to be done outside of the retort so that the time during which the retort is idle is reduced to a minimum. The pipe 27, with a valve 28 therein, leads from the bottom of the retort to a steam trap 29 which is adapted to maintain a constant level of water 30 so that the steam in the retort will always be saturated. In the event the steam trap becomes ineffective, or out of order at any time, a bypass 102 is shown in Fig. 4 with a valve 104 therein so that the excess water may be bypassed around the steam trap by closing the valves 28 and 105 and opening valve 104. The bottom basket is mounted upon a sup-

port 34 to maintain the containers above the level of the water at all times during the sterilizing operation.

The steam trap 29 may be of any form but it is here shown having a float-controlled valve, that is, having a valve within the steam trap controlling the flow therefrom which is opened when the float 31 reaches a predetermined lower level. A pipe 32 leads from the steam trap to some portion of the retort above the water level to prevent the steam trap from becoming air-bound, by maintaining the same pressure in the steam trap as exists in the retort so that the water will flow freely to and from the steam trap. After the baskets 26 filled with containers have been placed in the retort and the cover 20 fixed rigidly in position, steam is admitted from the main supply pipe 35 through pipe 36, hand valve 37, automatic valve 38, pipes 39 and 40, and needle valve 41 into the retort.

The needle valve 41 is preferably formed as shown in Fig. 3, wherein a tube 44 is threaded into the retort 10 with a needle 45 seated in its closed end controlled by the knob 46 and locked in position by the nut 47. The end of the needle is conical to cooperate with a conical seat 49 fitted into the end of the tube 44. A deflector 50 is formed over the seat 49 with a small aperture 51 in the side thereof to direct a jet of steam tangentially of the wall of the retort thereby causing a swirling action which mixes thoroughly the gases in the retort.

Other needle valves similar to 41 may be mounted at various positions by extending the pipe 39 about the retort as shown at 52 and connecting the needle valves thereto as shown at 54. One or more of the needle valves are adjusted by means of the knobs 46 and lock nuts 47 to admit sufficient steam to bring the retort and its contents up to a desired constant temperature in a definite period of time. After the needle valves have been adjusted in one instance, it is merely necessary in subsequent runs to turn the steam on at valve 37.

When the steam reaches a predetermined temperature inside the retort, the gas in the tube 56, which extends around the retort substantially at its center portion being held in position by the brackets 57, expands and operates through the flexible tube 58 the motor valve 59, which controls the automatic valve 38 in the usual manner. The needle valves furnish steam at a slightly greater rate than it is absorbed by the food in the sterilizing operation and as a result, the motor valve operates from time to time to shut off the steam or to decrease its flow so that the temperature remains constant at its upper limit. The condensed steam falls to the bottom and enters the drain pipe 60 by means of the pipe 27 and steam trap 29. If the pressure in the retort increases beyond a predeter-

mined maximum the relief valve 62, which may be set by means of the member 53 for any pressure, operates to prevent an excessive pressure on the containers. As a further precaution, there is provided a safety valve 83, preferably set several pounds higher than the setting of the relief valve, to take care of excess pressure in the event the relief valve fails to function properly.

After the sterilizing or cooking operation has been completed, it becomes necessary to cool the containers. This requires considerable time when the containers are glass because of its being a relatively poor conductor of heat and also because of its tendency to break if its temperature is changed too suddenly. There is provided in the present apparatus a mixing valve enclosed by a housing 64, shown in detail in Fig. 5 with the cover of the housing removed, wherein the valves in the pipes 65 and 66, leading from the steam pipe 35 and water pipe 67, respectively, are controlled simultaneously by means of the hand wheel 68. The two pipes 65 and 66 have hand operated valves 69 and 70. At 72 the water pipe joins the steam pipe, supplying its water about the conical portion 73, as shown in dotted lines in Fig. 1, so that the steam may aid in forcing water into the container and, if necessary, inject it therein. In the pipes 65 and 66 adjacent their junction, there are a pair of valves 74 and 75, having valve stems 76 and 77 extending upwardly into the housing 64 with the springs 78 and 79 maintaining the valves in their closed position. The upper ends of the valve stems engage the arms 80 pivoted at 81 to support the cam riders 82 and 84, engaging cams 85 and 86 on shaft 87. The shape of the cams 85 and 86 is such that when the wheel 68 is turned a predetermined amount in one direction the valves 74 and 75 are opened sufficiently to give an attenuated supply of water at a definite temperature, usually 190 degrees, which may be supplied to the retort without fear of breaking the containers therein.

In the event that it is desired to determine the exact temperature of the water prior to its entry through the pipe 90 into the retort, the three-way valve 91 may be turned so that the water will pass through the pipe 92 into drain pipe 60 and its temperature will be registered by the thermometer 94 attached adjacent the three-way valve 91. When the flow through the pipes 65 and 66 have been regulated to give the temperature desired, the three-way valve may be turned to direct water into the retort. This furnishes an easy and ready means for quickly supplying water for the cooling of the vessels. As the level of the water rises in the retorts, the air pressure increases until it operates the relief valve 62. If desired, or if the relief valve does not respond quickly, the valve 93 in

the by-pass 95 may be manually operated to maintain the pressure at the desired degree during the cooling operation. A suitable glass tube 97 extends from the upper
5 to the lower end of the retort so that the level of the water during the cooling operation may be readily observed. Suitable valves 98 are provided at its respective ends for shutting off the water in the event of
10 breakage or the like.

During the cooling operation, the steam trap 29 is shut off by means of the valve 105. The valve 62 maintains the required pressure in the retort and opens automatically
15 to conduct the warmest water through pipe 106 from the upper part of the retort into the drain while colder water is being injected at the bottom. The by-pass 95 and valve 93 can be used in conjunction with, or instead
20 of the relief valve for running the water into the drain. When the contents of the containers have cooled sufficiently not to require external pressure the valve 93 may be completely opened. The pet cock 96 may be
25 opened to permit the escape of the air entrapped above the retort valve connection so that the retort will fill completely. To facilitate the attachment of a thermometer 100 and a pressure gage 101 there is provided a
30 boxlike construction 99 on the side of the retort.

In practicing the method by means of the apparatus shown, the containers 25 are placed in the retort which is sealed by means
35 of a cover 20, thereby entrapping a quantity of air about the containers which is not permitted to escape. The needle valves 41 and 54 are then adjusted, if not already in adjustment, and steam admitted through the
40 pipes 36 and 39 and valves 37 and 38 to bring the contents of the retort to the desired temperature by injecting the steam tangentially of the side wall of the retort by means of the
45 deflectors 50 attached to the needle valves which cause thorough circulation and mixing of the air and steam throughout the heating operation. When the retort reaches the proper cooking or sterilizing temperature the gas in the thermostat tube 56 operates
50 the motor valve 59 to close the automatic valve 38 or to decrease the opening thereof so that the steam entering the retort is stopped or the amount decreased considerably to open the valve 59 again. The radiation
55 of the retort and the absorption of the heat by the food causes steam to be required almost constantly and as a result, the needle valves inject sufficient steam to cause thorough circulation at all times, thereby preventing
60 air pockets and the dangers of explosions due to quantities of air contacting suddenly with steam at a higher temperature, also preventing breakage of containers due to sudden local changes in temperature. The entrapped
65 air, as its temperature is increased,

being unable to expand increases in pressure and this furnishes a fluid pressure in the retort in addition to the steam pressure which increases with the temperature of the containers and the differential between the pressure in the containers and the pressure outside of them may be maintained substantially constant throughout the sterilizing operation by entrapping the proper quantity of
70 air when the top is sealed on the retort. If there is a slight excess of air pressure when the maximum temperature is reached, it is relieved automatically by the relief valve 62. This completely eliminates the necessity of
75 a source of compressed air for maintaining the proper pressure within the retort at the different temperatures and also completely eliminates the highly complicated automatic devices heretofore used for this purpose.

After the retort has been maintained at a
85 predetermined sterilizing or cooking temperature for the desired period of time, the steam supply is cut off and the hand wheel 68 operated to open the valves in the water and steam pipes to inject attemperated
90 water into the retort and this water for convenience, may be diverted into the drain until the exact temperature desired has been obtained. As the retort continues to fill, the excess air is released automatically through
95 the relief valve 62 or through the manually operated valve 93, and when the retort becomes filled, the water runs automatically from the upper level through the relief valve 62 and pipe 106 into the drain. As the cooling
100 proceeds, the hand wheel 68 may be turned further and further to reduce the temperature of the water until the packages are completely cooled. The supply of cooling fluid is then cut off and the water removed from the retort by opening valve 63
105 in the drain pipe.

It will be seen that a method has been provided which eliminates effectively the use of highly complicated, automatic devices for
110 maintaining pressures within the retort in excess of the pressure of saturated steam at that temperature. The entrapped air increases in pressure to maintain a substantially constant differential pressure between
115 the interior and exterior of the respective containers.

This prevents the formation of leaks and deformation of closure caps. Thorough circulation is maintained at all times to prevent local variations in temperature and the
120 resulting breakage of containers. Further the method is simple and can be practiced without complicated apparatus, hence skilled labor can be eliminated. Existing processing systems may be readily adapted to the practice of the present method.

As various changes may be made in the above embodiment without departing from the spirit of the invention, it is to be under-
125 130

stood that all matter herein set forth is to be taken as illustrative and not in a limiting sense. The present method may be practiced with various forms of apparatus, and therefore is not limited to the apparatus described herein.

The present application is a division of a prior application for method and apparatus for preserving, filed May 12, 1926, S. N. 108,497, and which has eventuated into Patent No. 1,709,481.

Having thus described my invention, I claim:

1. The method of preserving food, which comprises packing the food in a container, substantially removing the air from the container and sealing it, introducing a heating fluid for subjecting the sealed container to sterilizing heat in a retort, and entrapping a predetermined quantity of air in said retort at a pressure greater than the normal pressure within the containers to provide external fluid pressure upon the container in excess of the pressure within the container without increasing the quantity of air in said retort.

2. The method of preserving food, which comprises packing food in a container, substantially removing the air from the container and sealing it, subjecting the sealed container to sterilizing heat in a retort by bringing a heating fluid into contact with the container, and entrapping a predetermined quantity of air in said retort and maintaining the quantity of air substantially constant to permit the air pressure within the retort to increase as the temperature increases, thereby to provide an external fluid pressure upon the container that is in excess of the pressure within the container at all temperatures during the sterilizing operation, cooling the containers, and maintaining during the cooling operation an external pressure greater than the internal pressure of the containers.

3. The method of preserving food, which comprises packing the food in a container, exhausting the air from the container and sealing same, entrapping a quantity of air about said container at a pressure higher than the air pressure within the containers and subjecting it to a sterilizing heat by introducing a heating fluid therein, whereby the pressure about said container increases as the temperature increases, thereby providing an external pressure upon the container in excess of the internal fluid pressure at all times without increasing the quantity of air.

4. The method of preserving food, which comprises packing the food in a container, exhausting the air from said container and sealing same, entrapping a quantity of air about said container, maintaining said quantity of air substantially constant and subjecting said air and said container to steam

under pressure externally of the container, whereby the air pressure increases in a definite relation to increases in steam temperature.

5. The method of controlling the external pressure on a container during sterilization to maintain an external pressure on the container greater than the internal pressure thereof, which comprises reducing the normal pressure within the containers below atmospheric pressure, entrapping a quantity of gas about the container at atmospheric pressure and maintaining the temperature of the gas at the temperature of the container by the introduction of a heating fluid therein whereby the external pressure on the container will increase in a definite relation to the increase in the temperature of the container to maintain an external pressure on the container greater than the internal pressure thereof without introducing additional air during the sterilizing operation.

6. The method of preserving food, which comprises packing the food in a container, entrapping a quantity of air about the container in a retort at a pressure greater than the air pressure within the container, injecting steam into the retort tangentially of the side thereof to cause a swirling action in a single direction about the retort and a thorough mixture of the steam and air whereby an adequate external fluid pressure is maintained about said container which is caused by increase in temperature of said entrapped air while maintaining the quantity of air substantially constant.

7. The method of preserving food, which comprises packing the food in a container, entrapping a sufficient quantity of air about the container in a retort to produce a normal external pressure greater than the normal internal pressure of the container, maintaining the quantity of air in said retort substantially constant, injecting steam into the retort, and utilizing the kinetic energy of the steam to cause circulation and a thorough mixture of the steam and air whereby an external fluid pressure is maintained about said container, without substantially increasing the quantity of the air, which is greater than the pressure of the steam, and the amount the external pressure exceeds the pressure of the steam increases with the temperature of the steam.

8. The method of preserving food, which comprises packing the food in a container, substantially exhausting the air from said container and sealing same, entrapping a quantity of air about the container in a retort, injecting steam into the retort having a normal pressure greater than the normal pressure within the container tangentially of the side thereof to cause a swirling action and a thorough mixture of the steam and air whereby an external fluid pressure is main-

tained about said container which is greater than the pressure of the steam.

9. The method of preserving food, which comprises packing the food in a container, sealing the container, entrapping a predetermined quantity of air in a retort, injecting jets of steam into said retort in a single direction thereabout to furnish a sterilizing heat, and to mix thoroughly the air and steam to prevent pockets.

10. The method of preserving food in a sealed container, which comprises entrapping a predetermined quantity of gas in a retort about the container, injecting steam into said retort to furnish sterilizing heat, and directing the jets of steam in the same direction about the retort to mix thoroughly the gas and steam to prevent pockets by causing a swirling action, whereby the gas pressure in said retort increases with the temperature to provide an external fluid pressure greater than the pressure of saturated steam at the given temperature.

11. The method of controlling the external pressure on a container during sterilization by heat, which comprises entrapping a quantity of air in a retort greater than the amount required for maintaining the desired external pressure about the container during the sterilizing operation, permitting its pressure to increase as its temperature increases without increasing the quantity thereof, and maintaining its pressure below a predetermined maximum by releasing air from the retort when said maximum pressure is reached.

12. The method of providing a uniform temperature throughout the interior of a retort which comprises injecting a plurality of jets of a heating medium in a single direction only about the circumference of the retort whereby the jets co-operate with each other to cause a swirling action thoroughly to mix the air and the heating medium therein.

13. The method of providing a uniform temperature throughout the interior of a sterilizing retort, which comprises injecting steam into the retort in substantially a single direction only circumferentially thereof to cause a swirling action and thereby utilize the kinetic energy of the steam for circulation within the retort to provide uniform temperature and to prevent pockets therein.

14. The method of preserving food, which comprises packing the food in a container and sealing same, subjecting the sealed container to contact with a heating fluid in a retort and entrapping a predetermined quantity of air in the retort at a pressure greater than the pressure within the container, and maintaining said quantity of air substantially constant to permit the air pressure within the retort to increase as the temperature increases, thereby to provide an external fluid pressure upon the container at all temperatures in

excess of the pressure of the heating fluid.

15. The method of controlling the external pressure on a container during sterilization, which comprises entrapping a quantity of air about the container and maintaining it at the temperature of the container, whereby the external pressure on the container will increase as the temperature of the container increases without increasing said quantity of air to balance the pressure within the container, cooling the containers and maintaining during the cooling operation a pressure externally of the containers greater than the internal pressure by reducing the volume of the air in the retort.

16. The method of controlling the external pressure on a container during sterilization to maintain pressure externally of the containers greater than the pressure internally thereof, which method comprises entrapping a quantity of air at atmospheric pressure about the container, and introducing a heating fluid thereto for increasing the temperature of the air and the temperature of the container, whereby the pressure of said quantity of air and the external pressure on the container will increase as the temperature increases to provide adequate external pressure in addition to the fluid pressure without increasing the quantity of air, cooling the container and maintaining during the cooling operation an external pressure on the container greater than the internal pressure thereof by reducing the volume of the air, thereby to increase its pressure.

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