

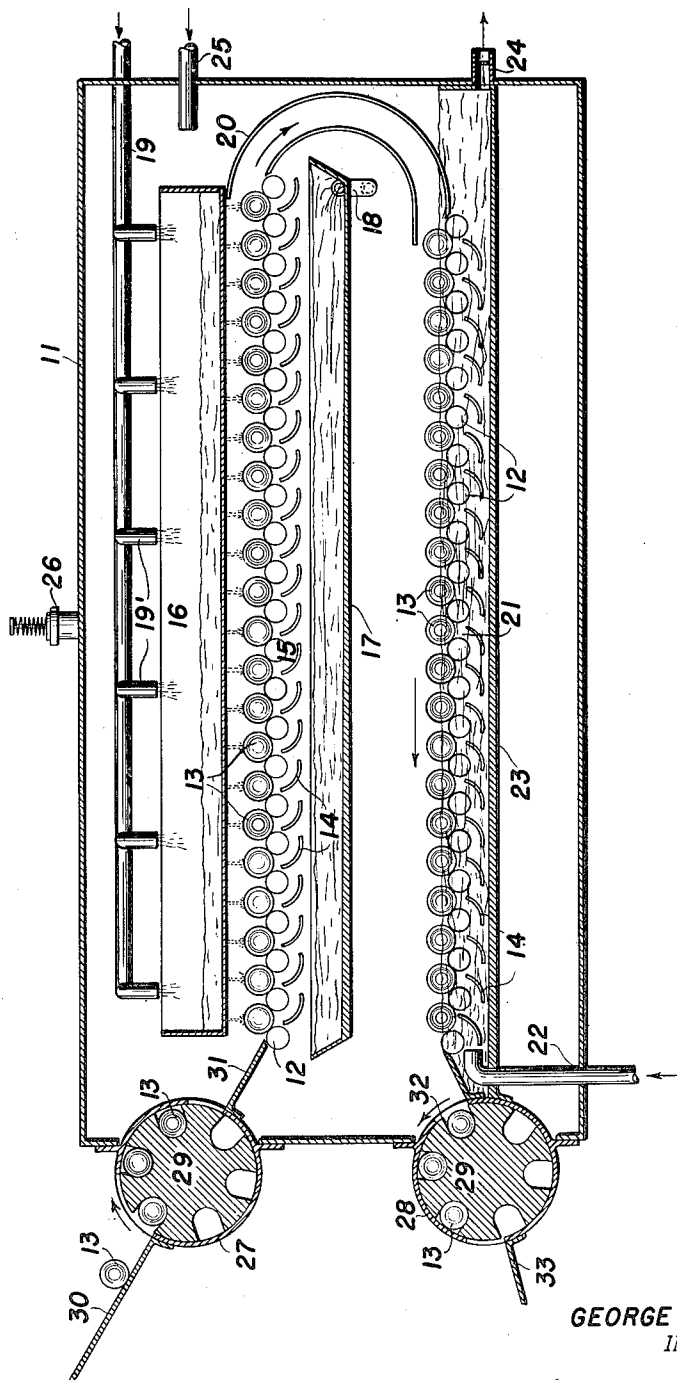
Oct. 2, 1951

G. K. VIALI

2,569,645

PROCESS FOR STERILIZING CANNED FOODS

Filed Nov. 6, 1948



GEORGE K. VIALL
INVENTOR.

BY *George A. Evans*
ATTORNEY

UNITED STATES PATENT OFFICE

2,569,645

PROCESS FOR STERILIZING CANNED FOODS

George K. Viall, Milwaukee, Wis., assignor to
Chain Belt Company, Milwaukee, Wis., a cor-
poration of Wisconsin

Application November 6, 1948, Serial No. 58,672

6 Claims. (Cl. 99-214)

1

This invention relates to an improved process for sterilizing canned foods of the type that are heated considerably above the boiling point of water in order that bacteria may be destroyed.

It is an object of this invention to provide a more economical way of sterilizing the can contents while minimizing the risks of can failures during the heating and cooling operations.

The present invention enables the use of a short heating period, made possible by rapid transfer of heat to the can contents preferably through rotation of the cans in a liquid heating medium. The shorter the heating period, the better is the retention of flavor, vitamins, color and other desirable properties, making the canned product more nearly resemble the fresh food prior to canning.

To effect rapid heat transfer, a heated liquid having a boiling point considerably above the boiling point of water and also above the sterilizing temperature is employed, so that by contact with this liquid as referred to above, the cans be brought to the desired sterilizing temperature.

The use of a heating medium which is liquid at the temperatures employed has considerable advantage over the use of steam as a heating medium because of the simplicity of apparatus that may be employed in handling the canned product in a continuous manner and causing rotation of the cans during the heating period. It has a disadvantage however, if the processing is done at atmospheric pressure, that the cans themselves are subjected to considerable stress on account of internal pressures created within the can during heating, requiring either that the cans be of sturdier construction than is now normally provided or else of special construction allowing for the expansion that occurs.

By the present invention, an artificial pressure is created within the heating chamber, which balances to a certain extent the internal pressure developed within the cans, but which is considerably less than the corresponding pressure of steam when the same sterilizing temperatures are employed. As a result, it is possible to simplify the construction of the pressure chamber and also the construction of the air locks admitting the cans to and withdrawing them from the heating chamber as compared with the conventional, continuous, steam type pressure cookers now commonly used.

The apparatus for supporting and advancing the cans during the sterilizing process may be

2

housed in the same chamber with the apparatus for effecting cooling of the cans, and the same pressure maintained in both portions of the chamber. Thus as the cans are cooled and the internal pressure within the cans is reduced, the pressure differential between the inside and the outside of the cans may shift from an excess internal pressure to an excess external pressure, but by maintaining within the chamber an intermediate pressure somewhat above that of the atmosphere, the pressure differential may at all times be kept within limits which the structure of the cans may safely withstand.

Apparatus suitable for carrying out the present invention is illustrated in the accompanying drawing, although it will be realized that other types of apparatus could be substituted for that shown in carrying out the process.

The apparatus to be employed may very well be of the type illustrated in U. S. Patent No. 2,348,440 issued May 9, 1944 on an application of Horace L. Smith, entitled Apparatus for Treating Canned Material. The accompanying drawing is intended to illustrate such apparatus more or less diagrammatically with such modifications as adapt it to the present invention.

The chamber 11 is arranged to accommodate two decks of transversely extending, parallel rolls 12 between which the cans 13 may rest as they are rotated about their longitudinal axes. Transverse members 14 are arranged to lift the cans periodically from the valleys between adjacent rolls, to advance them to the next valley, in which they are again rotated, and therefore to progress the row of cans across the bed of rolls. The upper deck, generally designated 15, which may also be termed the heating deck, is of sufficient length so that by the time the cans have progressed from one end of the bed of rolls to the other while subjected to the heating medium, their contents will become sterilized on account of the rapid heat transfer effected by rotation of the cans.

Heating in the upper deck 15 is accomplished by dripping a heating medium from the perforated drip pan 16 directly onto the cans beneath it. The liquid that falls from the bottom of the cans is collected in a pan 17 arranged beneath the upper bed of rolls. The liquid may be conducted through the pipe 18 and may be cleaned, reheated and reintroduced through the pipe 19 that supplies the liquid to the perforated pan 16 by the headers 19'.

Various heating media liquid at the temperatures employed and having a boiling point higher

3

than water may be employed, such as propylene glycol or a heating oil that does not break down over an extended period of use. The temperature of the liquid heating medium when introduced into the chamber will vary with the temperature which must be obtained in order to produce the desired sterility of the product. Normally the selected sterilizing temperature will depend upon the length of time the cans are subjected to the hot liquid, but it is desirable to sterilize as rapidly as possible, and hence a high temperature of the order of 260° F. or greater is preferably employed since the thermal death rate of the bacteria increases rapidly with increase in temperature.

After the can contents have been brought to the desired sterilizing temperature and held at that temperature long enough to kill the bacteria present, the cans are passed from the heating deck by the guides 20 to the cooling deck 21 where similar apparatus is employed to cause the cans to rotate and to progress along the lower bed of rolls. The cooling liquid for cooling the cans may be dripped onto the cans, as in the heating deck, or the lower portions of the cans may be immersed in the liquid to effect heat transfer, as illustrated in the drawing. In the latter instance the cooling liquid enters through a pipe 22 into a pan 23 arranged below the rolls, the inlet pipe 22 being at the cold end of the deck adjacent the can exit. Liquid flows across the pan 23 parallel and countercurrent to the movement of the cans, and the spent, heated liquid leaves through a pipe 24 adjacent the guides 20.

The cooling liquid may be the same material as the heating liquid, and the spent liquid may be cleaned, refrigerated and re-used. Employing the same liquid in the heating and cooling decks avoids the necessity of providing a partition and a can lock between the decks, which might be required if different liquids were employed and the vapors of one had a detrimental, contaminating influence on the other. In some instances cold water may be used in the cooling deck provided there is not excessive vaporizing of the water in contact with the hot cans to cause the chamber to become filled with steam.

In order to maintain an external pressure on the cans during the heating and cooling steps, a compressible gas is introduced into the chamber by the pipe 25, and a constant pressure is maintained in the chamber by venting through the relief valve 26 any gas in excess of that which is required.

Some care must be exercised if compressed air is the medium introduced into the chamber and a liquid such as propylene glycol is the heating liquid used. It is possible that vapors from the glycol may form an inflammable mixture with the oxygen in the air and the oxygen may attack the heating medium detrimentally. The danger may be minimized by using an inert gas, for instance nitrogen, or a liquid heating medium having a higher flash point.

In order to hold the desired pressure in the chamber 11 and to introduce the cans 13 to the chamber and to remove them therefrom, feeding locks 27 and 28 are provided, each consisting of pocketed wheels 29. The wheel 29 rotating in the entrance lock is arranged to feed the cans from the chute 30 outside of the chamber and to deposit them via the chute 31 onto the entrance end of the heating deck. The pockets in the exit wheel 32 are arranged to receive the cans from the exit end of the lower deck 21 and

4

upon rotation of the wheel, to deposit the cans in the receiving chute 33 external to the chamber. The construction of these locks is generally well known and needs no detailed description.

The pressure to be maintained within the chamber varies depending upon the product being canned and the sterilizing temperatures employed. It will also depend, to a certain extent, upon the temperature to which the cans are cooled at the time they leave the pressure chamber. The following example may be helpful in illustrating desirable pressure ranges.

In the processing of canned peas, it is desirable to process the cans at 260° F. Canned peas in normal size cans are processed at this temperature in about 3 to 4 minutes if the cans are rotated at a rate of about 60 R. P. M. with the apparatus referred to above. Since the cans are substantially filled with product plus a brine, there is considerable internal pressure developed, due to liquid expansion and the creation of water vapor and gases, when the product is heated to these temperatures. The internal pressure is considerably in excess of the vapor pressure of saturated steam at 260° F., the latter being roughly 20 pounds per square inch gauge. Cans presently used for canned peas will not withstand this pressure, which is in excess of 20 pounds per square inch.

In this instance the desirable pressure to maintain in the chamber is of the order of about 10 to 15 pounds gauge, which is accomplished by the introduction of a fixed gas in the chamber to reduce by approximately one-half the difference between the internal and external pressure on the cans. In this illustration, if the cans are cooled in the lower deck to the point where the internal pressure is restored to approximately atmospheric pressure (by cooling them say to 100° F.), there will then be an external pressure of about 10 to 15 pounds per square inch on the can, but in either case, the can may be designed without too great expense to withstand these pressure differences.

There may be other instances where it is desirable to process at lower temperatures for longer periods of time, or cases where on account of the nature of the product or manner in which it is filled, the internal pressures created within the cans is not so great. In such instances a lower gas pressure may be maintained within the chamber without danger of cans bursting or buckling. Vacuum packing is also a factor to consider in establishing the selected intermediate pressure.

Instead of performing the entire heating and/or cooling within the pressure chamber, the cans may be preheated and/or after-cooled outside the chamber. For instance if preheating is employed, the preheating step may involve similar apparatus and similar application of a high boiling point, liquid heating medium. In this instance, preheating may be done at atmospheric pressure provided the final preheating temperature is such that the can may safely withstand the internal pressure developed at that temperature without the use of an external pressure-balancing medium. Cans so preheated may then be introduced into the pressure chamber, where, by the application of an external pressure, the cans may be heated to a higher temperature without imposing any additional strain on the cans.

So also in cooling, the final cooling temperature in the pressure chamber may be such that the internal and external pressure on the cans

5

6

at this temperature is approximately balanced, but the internal pressure is low enough so that upon passing the cans into the atmosphere, they will not buckle due to the pressure differential that may then exist. Final cooling may there-
after be performed in an atmospheric cooler, preferably employing rotation of the cans in a suitable cooling medium, as previously set forth.

In order to reduce the size of the chamber 11 to the greatest possible extent, and thereby increase its capacity for processing cans as part of a continuous operation, the final preheat temperature and the initial after-cooling temperature may be such that the internal pressure in both cases is roughly one-half the maximum internal pressure developed during sterilizing. By maintaining a pressure in the chamber which is also about one-half the maximum internal can pressure, the temperature range which the cans pass through within the chamber is held at a minimum.

Naturally atmospheric heaters and coolers are cheaper to produce and operate, and their utilization in conjunction with the pressure chamber of the present invention affords considerable economies in over-all costs.

While the invention has been illustrated by means of cylindrical cans, the expression "cans" or "canned" as used in the claims, is intended to embrace the use of other containers having properties making the invention applicable thereto.

I claim:

1. Process of sterilizing canned foods which comprises, subjecting the cans first to contact with a liquid heated substantially above 212° F. having a boiling point higher than the temperature employed to sterilize the contents of the cans and for a sufficient time to sterilize their contents, and subsequently cooling the cans by contact with a cooling liquid, the aforesaid processing being done while maintaining around the cans a body of non-condensable gas at a pressure above atmospheric pressure but below that which is developed within the cans at the maximum sterilizing temperature employed.

2. Process of sterilizing canned foods which comprises, during agitation of the cans subjecting them first to contact with a liquid heated substantially in excess of 212° F. and having a boiling point higher than the temperature employed to sterilize the contents of the cans, and after sterilizing the can contents, subsequently cooling the cans by contact with a cooling liquid, the aforesaid processing being done while maintaining an external pressure on the cans above atmospheric pressure but below that corresponding to the vapor pressure of water at the maximum sterilizing temperature employed, the external pressure being created by a non-condensable gas which is relatively inert to the heating liquid used.

3. Process of sterilizing canned foods which comprises first preheating the cans at atmospheric pressure, then subjecting them to contact with a liquid heated substantially in excess of

212° F. having a boiling point higher than the temperature employed to sterilize the contents of the cans and for a time sufficient to sterilize their contents, and subsequently cooling the cans by contact with a cooling liquid, the aforesaid sterilizing and cooling steps being performed while maintaining an external pressure on the cans above atmospheric pressure but below that corresponding to the vapor pressure of water at the maximum sterilizing temperature employed.

4. Continuous process of sterilizing canned foods which comprises first preheating the cans at atmospheric pressure, then subjecting them to contact with a liquid heated substantially above 212° F. having a boiling point higher than the temperature employed to sterilize the contents of the cans and for a time sufficient to sterilize their contents, and subsequently cooling the cans by contact with a cooling liquid, the aforesaid sterilizing and cooling steps being performed while maintaining an external pressure on the cans above atmospheric pressure and of the order of the internal pressure developed within the can during the preheating step.

5. Process of sterilizing canned foods which comprises, subjecting the canned food to contact with a liquid heated substantially above 212° F. having a boiling point higher than the temperature employed to sterilize the contents of the cans, and after sterilizing the can contents, cooling the cans in two steps by contact with a cooling liquid, the sterilizing step and the first cooling step being performed while maintaining an external pressure on the cans above atmospheric pressure and of the order of the internal pressure in the cans at the conclusion of the first cooling step.

6. Process for sterilizing canned foods which comprises introducing cans of food into a chamber divided into communicating zones, subjecting the cans in a first zone to contact with a liquid heated substantially in excess of 212° F. having a boiling point higher than the temperature employed to sterilize the contents of the cans, transferring the cans from one zone to the next, cooling the cans in a subsequent zone by contact with a cooling liquid, and maintaining within the chamber a supply of nitrogen at a pressure above atmospheric but below that corresponding to the vapor pressure of water at the sterilizing temperature employed.

GEORGE K. VIALI.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,330,456	Taylor	Feb. 10, 1920
1,485,133	White	Feb. 26, 1924
1,570,235	Fooks	Jan. 19, 1926
1,901,083	Chapman	Mar. 14, 1933
2,141,089	Milton	Dec. 20, 1938
2,415,782	Zademach et al.	Feb. 11, 1947