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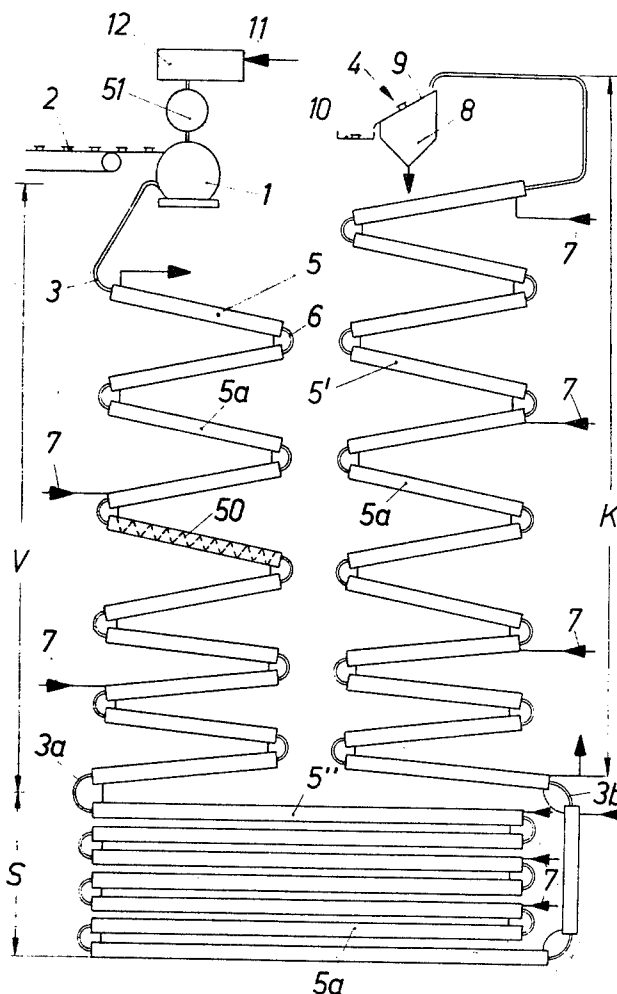
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[33] **Switzerland**
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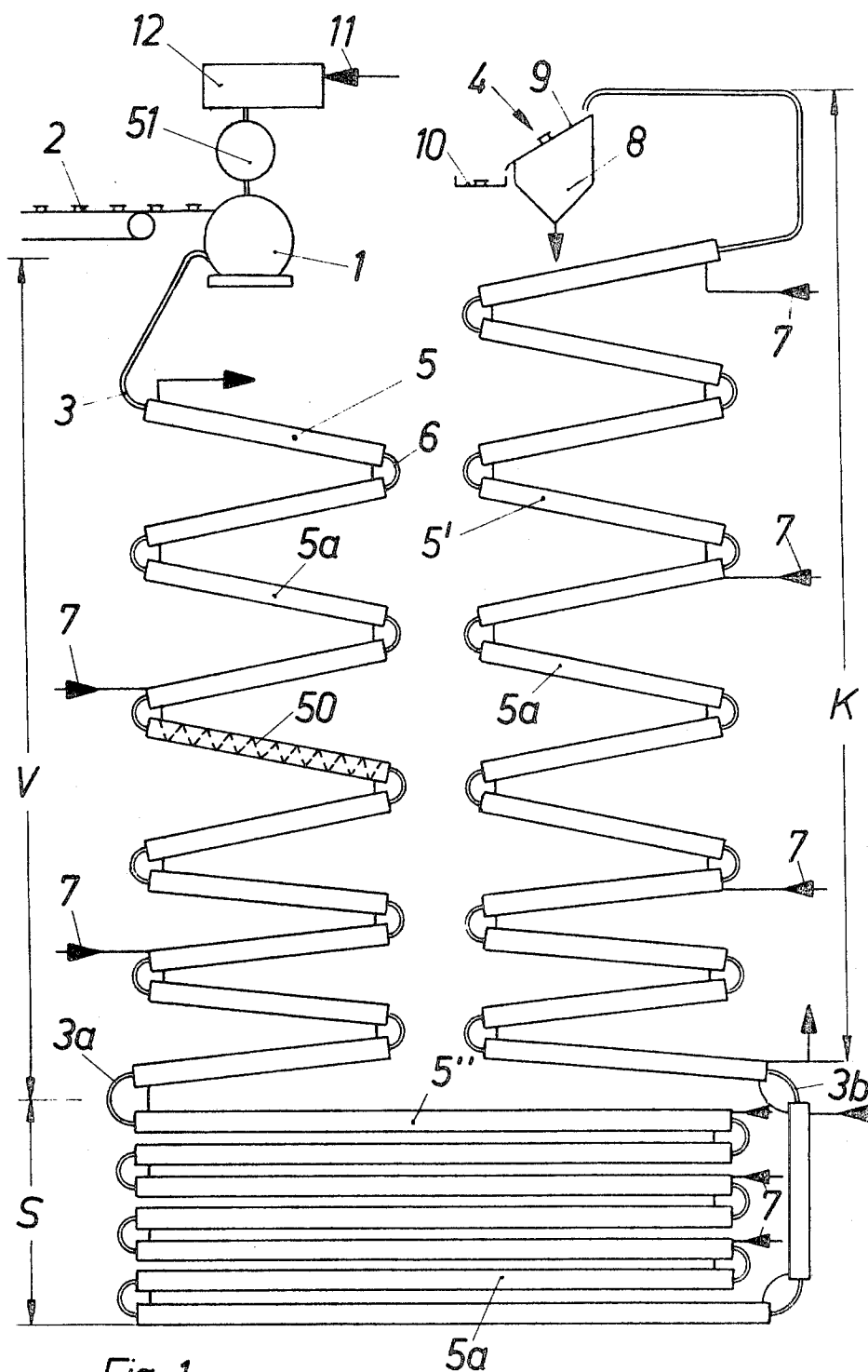
[54] **APPARATUS FOR THE STERILIZATION OF
FILLED PACKAGES HAVING PRESSURE
SENSITIVE CLOSURES AND FILLED WITH
MATERIAL, ESPECIALLY FOODSTUFFS OR
CONDIMENTS OR THE LIKE**
27 Claims, 5 Drawing Figs.

[52] U.S. Cl. **99/361,**
99/368
[51] Int. Cl. **A23I 3/02**
[50] Field of Search **99/359-**
-363, 367-368

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ABSTRACT: There is disclosed an apparatus for the sterilization of filled packages equipped with pressure-sensitive closures and filled with materials, especially foodstuffs and semiluxurious products such as condiments or the like, which comprises feed channel means provided with infeed or inlet means and discharge means. The feed channel means pass through a preheating zone, a sterilization zone and a cooling zone. A fluid medium serves as the energy transfer agent for conveying the packages through the feed channel means. The infeed means and discharge means are situated at a greater height than said sterilization zone of the feed channel means. According to an important aspect of the invention, the preheating zone and cooling zone are also situated at a greater height than the sterilization zone, with said feed channel means at said preheating zone and cooling zone possessing a greater slope than at said sterilization zone. Further, energy transmission means are provided at the feed channel means at least along the greatest portion of such feed channel means. The feed channel means at the lowest region of the preheating zone and cooling zone, respectively, merging with the sterilization zone. Moreover, the system operates such that the pressure of the fluid medium in the feed channel means at least from the infeed means up to the region of the cooling zone corresponding to the infeed temperature is greater than the internal pressure of the package.





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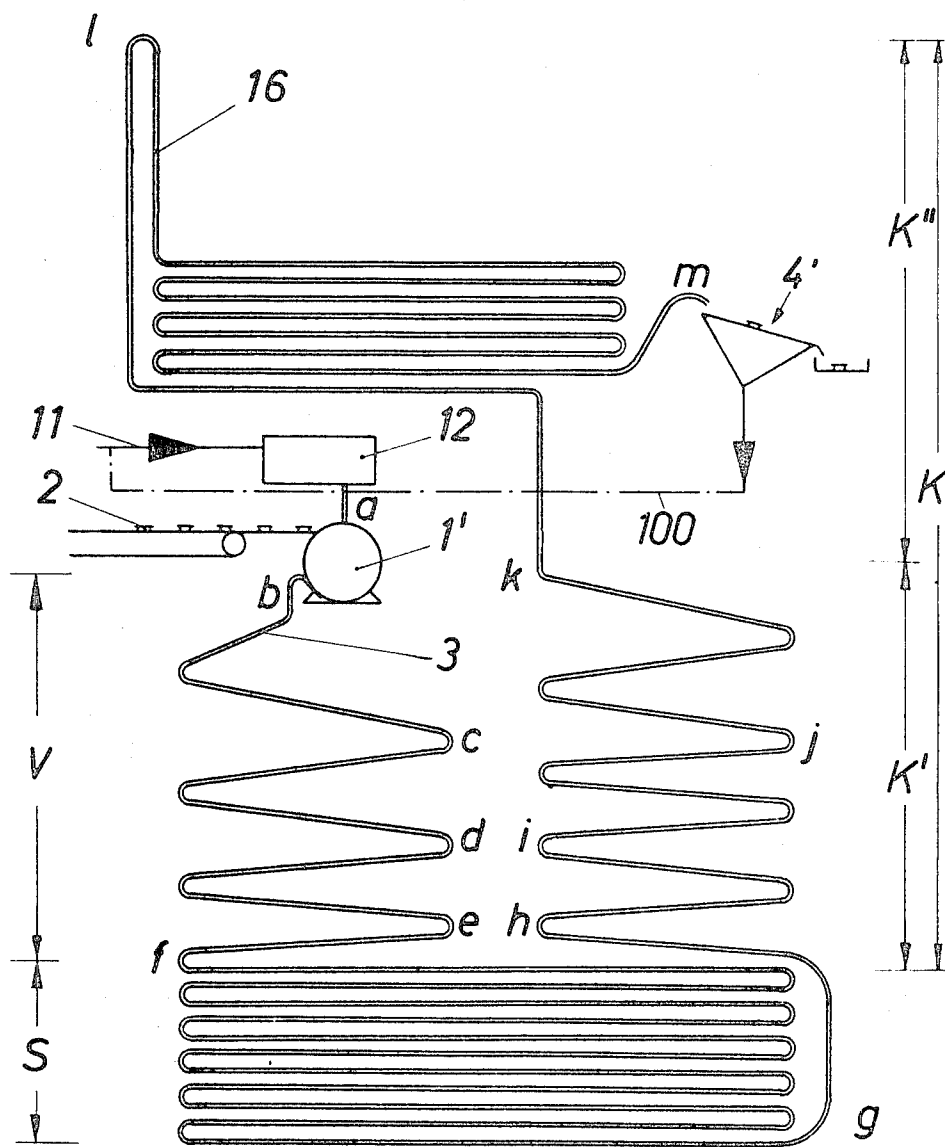
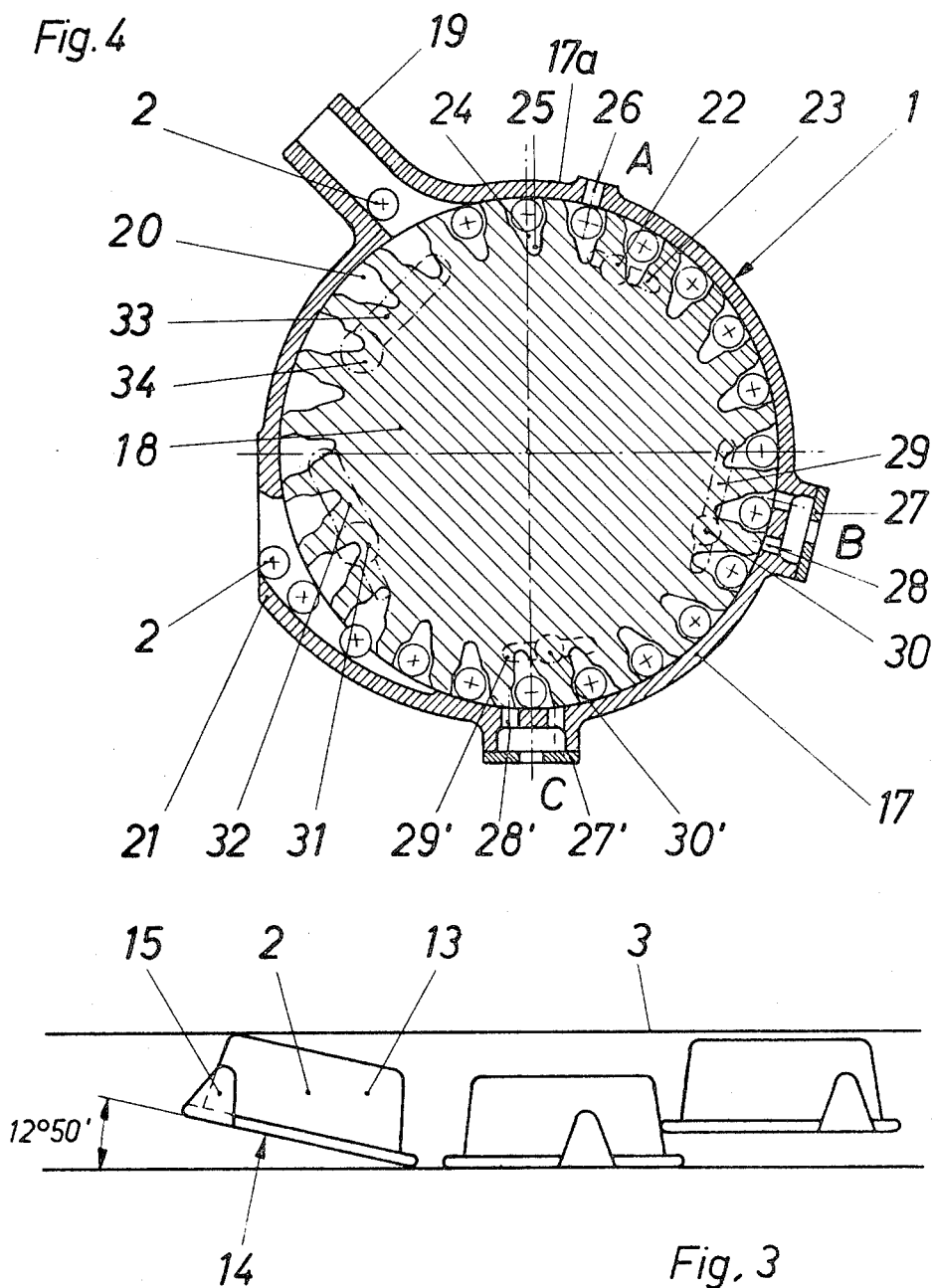


Fig. 2

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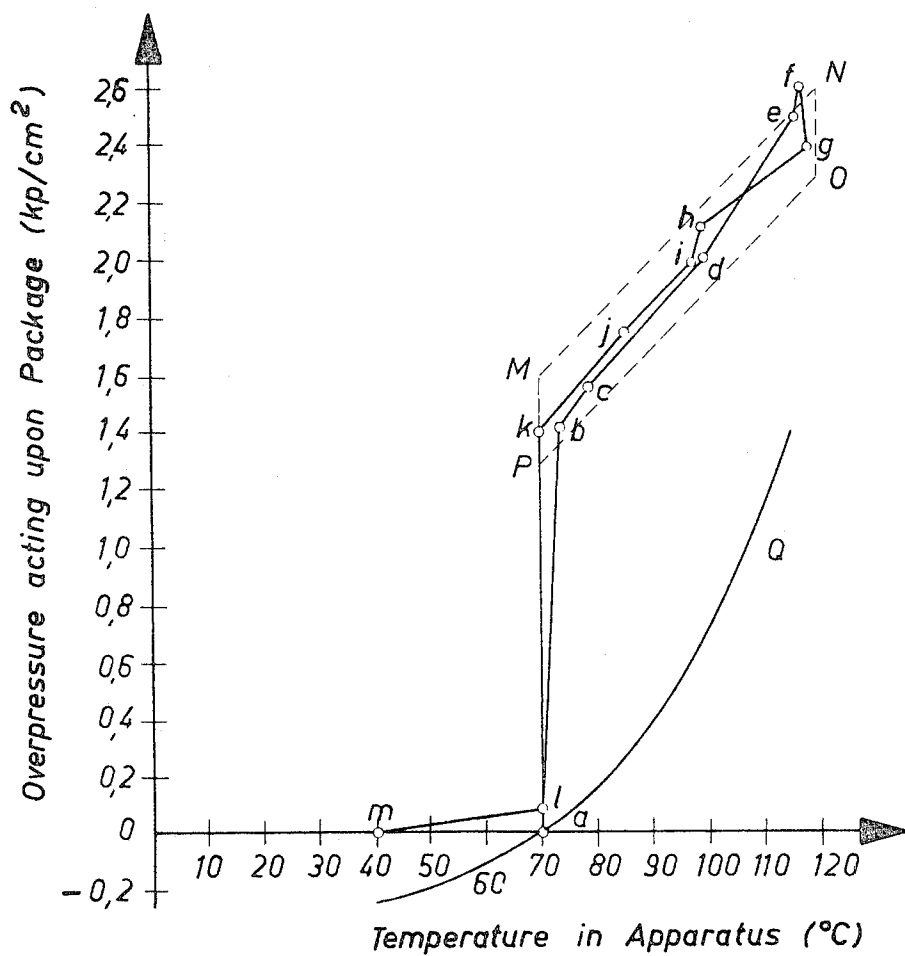


Fig. 5

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APPARATUS FOR THE STERILIZATION OF FILLED PACKAGES HAVING PRESSURE SENSITIVE CLOSURES AND FILLED WITH MATERIAL, ESPECIALLY FOODSTUFFS OR CONDIMENTS OR THE LIKE

BACKGROUND OF THE INVENTION

The present invention relates to an improved apparatus for the sterilization of filled packages possessing pressure-sensitive closure means and filled with materials, especially foodstuffs or semiluxurious products, such as condiments or the like. The inventive apparatus is generally of the type incorporating a feed channel means possessing an inlet means and an outlet means, the feed channel means passing through a preheating zone, a sterilization zone and a cooling zone, the packages being conveyed by means of a throughflowing fluid medium serving as energy transfer means, with the inlet means and outlet means disposed higher than the sterilization zone of the feed channel means.

There are already known to the art an entire series of apparatuses for the sterilization of packages filled with materials, especially foodstuffs. In particular, one such type apparatus is a pressure cooker or digester in which the material is conveyed by a chain conveyor means or arrangement along the feed or conveying path through a preheating region or zone, a sterilization zone and a cooling zone. A pressure is exerted upon the packages which varies along the conveying path as a function of the progression or course of the temperature of the packages. In so doing, the conveyed material at the preheating zone is conveyed along a vertically directed surge tank at zones of higher hydrostatic pressure and at the lower end is fed into a vapor compartment or chamber defining the sterilization zone. Passing through the surge tank in counter-current flow is hot water. After the vapor compartment, the chain conveyor means, together with the packages, again enters into a vertically directed surge tank where the packages are cooled. With progressive cooling, the packages arrive at a region of lower hydrostatic pressure. The surge tank of the cooling zone has cold water moving therethrough in counter-current flow. The pressure in the vapor compartment is determined by the water column of both surge tanks of the preheating and cooling zones.

A major disadvantage of such known pressure digester construction is that, in the surge tanks, the course or progression of the temperature and pressure of the cooling and hot water along the conveying path cannot be sufficiently exactly accommodated to the course or progression of the temperature and pressure of the package contents. An increase of the conveying path through the surge tanks is not readily possible, or, at the very best, only possible with expenditures which are not economically feasible. The same is also true with respect to accommodation of the energy content of the cooling or hot water through a given region or zone. Additionally, there must be taken into account that at the transition locations between the surge tanks and the vapor compartment there always occurs a temperature gradient which, likewise, can adversely act upon packages having pressure-sensitive closures.

On the other hand, pressure digesters are known to the art in which packages to be treated are guided in feed channels and conveyed by means of a water current. In this context, the water current simultaneously serves as energy carrier for heating the packages. The water can be heated along the conveying path by infed vapor or steam. At the inlet and/or outlet side of the pressure digester the guide channel is constructed as an ascending pipe or conduit. The height of the water level in this channel determines the pressure in the pressure digester. The ascending conduits are constructed as straight channel members and do not possess any energy transfer for transmission devices for heating or cooling the water. What is likewise disadvantageous with this known pressure digester is the fact that there is not contemplated, and also it is not possible to provide, an accommodation of the temperature and pressure variations or progression along the conveying path to

the progression of the pressure and temperature of the package contents.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide an improved apparatus which effectively overcomes the aforementioned drawbacks of the prior art constructions.

Another, more specific object of the present invention, is to provide an improved apparatus for the sterilization of packages having pressure-sensitive closures and filled with materials, especially foodstuffs or semiluxurious products, such as condiments, or the like, and wherein there is rendered possible a really good accommodation of the course of the temperature and pressure of the fluid medium along the conveying path to the course of the pressure and temperature of the package contents.

Now, in order to implement these and still further objects of the invention, it should be recognized that the inventive apparatus of the aforementioned type is generally manifested by the features:

a that also the preheating zone and the cooling zone are situated at a greater height than the sterilization zone, whereby the feed channel means of the preheating zone and the cooling zone possess a greater slope or gradient than that of the sterilization zone and at least along the greatest portion of the feed channel means such are equipped with energy transmission devices and at their lowest situating ends merge with the sterilization zone, the entire arrangement being such that the fluid medium pressure in the feed channel means at least from the inlet means up to the region of the cooling zone corresponding to the inlet temperature is greater than the internal pressure of the packages; and further,

b wherein this apparatus can be used for the sterilization of so-called controlled serving portion packages filled with appropriate materials, particularly foodstuffs or semiluxurious products, such as condiments or the like.

The apparatus of the invention renders it possible to match or accommodate the course of the pressure and temperature of the fluid medium, preferably water, along the feed or conveying path in optimum manner to the course of the pressure and temperature of the package contents. Consequently, it is now possible for the first time to also faultlessly sterilize pressure-sensitive hard foil packages.

The apparatus is advantageously constructed in such a fashion that the fluid medium pressure along the entire feed channel means is greater than the internal pressure of the packages.

Advantageously, the inventive apparatus possesses a lock or sluice mechanism serving as inlet means, the sluice mechanism incorporating a housing closed in fluid-type fashion to both sides. A suitable pocket wheel is rotatably arranged in the housing and receives in pockets thereof the packages. Furthermore, an inlet stud and an outlet stud for the packages is provided at the housing. The lock or sluice mechanism is preferably constructed such that the pocket wheel, along the conveying or feed path from the inlet stud to the outlet stud, passes through regions of increasing fluid medium pressure and, if desired, increasing fluid medium temperature. The individual regions of differing pressure are preferably determined by means of a fluid medium infed arrangement, preferably located at the jacket or casings of the housing and which at least spans the region of one pocket, and further by means of a fluid medium discharge arrangement which at least spans the region of one pocket.

It is particularly advantageous to utilize as the energy transmission devices suitable jackets or casings for the regions of the feed channel, the appropriate heat transfer agent, namely a suitable heating or cooling agent, flowing through such jackets. As heating agent, there is preferably employed steam. Moreover, for the energy transmission devices of the preheating region or zone, and if desired, the sterilization zone, there

can, if desired, also be used appropriate electrical heating means surrounding the feed channel region. A particularly advantageous construction of inventive apparatus is obtained if the transmission devices are preferably controllable in regions or zones. This can be achieved, for instance, through the regional or zonal admixing of heating or cooling agents into the jackets or casings of the energy transmission devices.

Likewise, it is especially advantageous if the feed velocity of the fluid medium in the apparatus can be varied. With such constructed apparatus for the sterilization of packages, it is possible to optimally accommodate the course or progression of the fluid medium pressure and the temperature of such fluid medium along the conveying path to the progression of the pressure and temperature of the package contents. Thus, it is possible to also treat packages having very pressure-sensitive closures.

As the energy transfer means and the conveying means for the packages there can be preferably employed water which, in order to change its boiling point, can, if desired, contain conventional additives. Yet, other types of fluids are also possible within the scope of the invention, thus, for instance, oil.

The present invention therefore renders it possible, for the first time, to sterilize so-called "portion packages," such as sealed hard foil packages, with or without an opening expedient or aid, and containing for instance, evaporated milk or cream. Such packages, for economical reasons, can only be manufactured from very light material, for instance, from thin sheet metal foil, and must be capable of being easily opened by hand. Portion packages of this type are, above all, in consideration of their closure, naturally very pressure sensitive, especially sensitive to internal pressure and, thus, could not be treated with the previously known pressure digesters or similar equipment.

The pressure invention is especially suitable for the sterilization of these so-called controlled serving portion packages containing foodstuffs and semiluxurious products, such as condiments or the like. More precisely, these portion packages can, for instance contain the following products:

- milk,
- cream with different fat content stages,
- aromatic dessert creams,
- concentrated milk products in different concentration stages, such as, for instance, evaporated milk or unsugared condensed milk, and
- milk or cream substitute products.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood, and objects other than those set forth above, will become apparent, when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 is a schematic representation of a first embodiment of inventive apparatus for the sterilization of packages equipped with pressure-sensitive closures, wherein the inlet means and the outlet means are situated at approximately the same height;

FIG. 2 is a schematic representation of a further embodiment of inventive apparatus for the sterilization of pressure-sensitive packages, in which the inlet means is located lower than the outlet means;

FIG. 3 is a longitudinal sectional view approximately to scale of a rectangular feed or conveyor channel means in which there are located the so-called controlled serving portion packages;

FIG. 4 is a sectional view through the central plane of an inlet lock or sluice mechanism;

FIG. 5 is a graph showing the course or progression of the temperature and pressure of the fluid medium along the conveying or feed path.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, the exemplary illustrated embodiment of inventive sterilization apparatus shown in FIG. 1 incorporates an infeed means defined by an inlet lock or sluice mechanism 1 in which packages 2 are charged into the feed or conveyor channel means 3. After the inlet lock or charging device 1, the conveyor or feed channel means 3 passes through a preheating region or zone V, then to a sterilization zone or region S. After the sterilization zone S, the feed channel means 3 passes through a cooling zone K at the upper end of which there is disposed the discharge or outlet means 4.

The inlet means formed by the lock or sluice mechanism 1, together with the preheating zone V of the feed channel means 3 as well as also the outlet means 4 with the cooling zone K of the feed channel means 3 are situated elevationally higher than the sterilization zone or region S. The feed channel means 3 of both the preheating zone V and the cooling zone K are wound in serpentine or snakelike fashion, as shown, and exhibit a greater slope or gradient than that of the sterilization zone S. Furthermore, the feed channel means 3 is equipped at least along the greatest portion of its feed or conveying path with energy transmission devices 5, 5'. Additionally, it will be recognized that, in each instance, at the lowest situated ends 3a and 3b of the feed channel means 3 of the preheating zone V and cooling zone K, respectively, the feed channel means 3 merge with the sterilization zone S. Also, the section of the feed channel means 3 passing through this sterilization zone S is surrounded or equipped with energy transmission devices 5". If desired, the system may be equipped with a suitable mechanism, such as a pump 51, for controlling the feed velocity of the fluid medium.

In the instant embodiment, there are provided for the energy or thermal transmission devices 5, 5', 5", suitable jackets or casings 5a which are throughpassed by a suitable heat transfer agent, typically a suitable heating or cooling agent, and, if desired, in countercurrent flow. It is, however, possible to have the jackets of the preheating zone V and, if desired, those of the sterilization zone S, provided with conventional electrical heater means, as schematically shown by reference numeral 50 in FIG. 1. Although it is readily possible for the jacket means 5a to be continuous at least along the greatest portion of the feed channel means 3, it is advantageous in the instant case, for technical reasons, to recess or otherwise interrupt such jacket means at the bends or turning portions 6 of the feed channel means 3. Water vapor preferably serves as the heating agent. The jackets or casings 5a of the sterilization zone S and the preheating zone V are arranged in rows behind one another or in series, as shown. In order to be able to regulate the temperature of the heating agent in these zones along the feed channel means 3 to the desired value, the jackets or casings 5a thereof are periodically equipped at intervals, as shown, with connection locations or ports 7, by means of which a heating agent of different energy content can be introduced into the heating agent of the jacket means 5a. If warm water heating is used, then, for instance, warm water of a different temperature can be admixed. On the other hand, it is, however, also possible to condition the warm water in the jackets or casings 5a through the introduction of fresh vapor or steam.

The jackets or casings 5a of the cooling zone K of the feed channel means 3 are constructed in analogous manner to the jacket means 5a of the preheating zone V and passed by a suitable cooling agent. Also, in this instance, there are provided connection locations 7, by means of which further cooling agent can be admixed, for the purpose of conditioning the cooling agent already located in such jacket means of the cooling zone. Cold water can be advantageously used as the cooling agent. In contrast to the illustrated embodiment, it is possible that the jacket means for the energy transmission device are not arranged in rows behind one another, rather are divided into individual energy transmission regions. These in-

dividual regions can then be either always furnished with separate heating or cooling agent streams or they can be coupled with one another via conditioning devices.

In the embodiment shown in FIG. 1 the inlet sluice or lock mechanism 1 and the outlet or discharge means 4 are arranged at approximately the same height, so that at the inlet side as well as the outlet side there prevails approximately the same hydrostatic pressure. The water emanating from the discharge or outlet side is conducted to a sieve-covered collecting basin 8, wherein the water can penetrate through the sieve member 9 whereas the packages 2 are held back by such sieve. This sieve 9 is preferably arranged at an inclination in such a way that the packages 2 automatically slide down the sieve 9 and onto a conveyor band 10, thereby conveyed away to a suitable packaging apparatus.

The water collected in the collecting basin 8 can either run off and not be used any further, or it can be recycled back into the apparatus, as schematically indicated by reference numeral 100 in FIG. 2. If the water serving as the conveying means and energy transfer agent is only used once, there is provided the advantage that the fresh packages are always delivered by fresh preheated water to the apparatus, pass therethrough and are commonly sterilized. The water therefore, as a practical matter, comes into contact only one time with a package. This is of distinct advantage in terms of keeping the conveying means and the energy transfer agent free of germs. On the other hand, the closed cycle circulation of the water is to be recommended when the available fresh water has a great deal of calcium, so that it first must be either freed of such calcium deposits, otherwise the danger exists of calcification of the apparatus.

The fresh water 11 delivered to the inlet arrangement or lock 1 mechanism or the close cycled water from the collecting basin 8 is initially brought to the required starting temperature in a suitable heater 12.

The inlet lock or sluice mechanism 1 is capable of introducing the packages into the apparatus in a practically overpressureless condition and the overpressure can then be built up along the feed or conveying path. However, it is, as will be explained in further detail hereinafter advantageous to construct the lock or sluice mechanism as a pressure lock, and already therein to place the packages, preferably stepwise, under a predetermined pressure. Such type operating inlet lock or sluice arrangement is shown in FIG. 4 and will be discussed in greater detail shortly.

The feed or conveyor channel means 3, for instance, of the type shown in FIG. 3, can possess a substantially rectangular cross section. If it is desired to treat, in the sterilization apparatus, for instance, flat, round packages 2, then, as best seen by referring to FIG. 3, the height of the cross section of such feed channel means should advantageously be dimensioned such that the packages 2 in the lengthwise direction of such feed or conveying channel means can tilt through an angle of 11° to 14° , preferably through an angle of $12^\circ 50'$. In this instance, the danger is slightest that the packages 2 will mutually contact one another and tend to become clamped or wedged in the feed channel means 3.

With the arrangement and construction of apparatus shown in FIG. 1 for the sterilization of packages, it is now possible, in a most unique and novel manner, to match or accommodate the feed velocity and the course of the temperature in each portion of the apparatus with respect to one another such that the course or changes in the pressure and temperature of the water along the feed path can be exactly accommodated to the course of the pressure and temperature of the package contents. In so doing, it is possible to regulate the variations or changes in pressure such that the overpressure, brought about by the water column, and, if desired, an additional overpressure at each location of the feed channel means, is greater than the internal overpressure of the package. This pressure relationship can, if desired, be maintained along the entire feed or conveying path. If the relationship between the overpressure in the package and overpressure in the apparatus first

then becomes critical at a predetermined temperature, then it is possible to also construct the apparatus in such a way and to regulate it such that, the pressure relationship is first maintained at and up to this predetermined temperature.

FIG. 2 schematically depicts a further embodiment of inventive sterilization apparatus which, preferably, is suitable for the sterilization of the so-called controlled serving portion packages containing cream, especially coffee cream. Such a package 2 possesses the form shown in cross section in FIG. 3 and is of circular configuration. The package 2 itself consists of a container 13 formed of thin sheet metal or plastic and covered by a suitable foil 14, this foil 14 advantageously possessing a flap or tear portion 15 for ripping open the aforementioned serving portion package 2. These packages 2 are advantageously conveyed in a rectangular-shaped feed or conveyor channel 3 of the above-mentioned type and best illustrated in FIG. 3.

The portion package 2 is filled and sealed, the filling and sealing temperature amounts to, for instance, 60°C . The apparatus depicted in FIG. 2 practically corresponds to the apparatus of FIG. 1, with the exception that the cooling zone K is subdivided into a cooling region K' situated lower than the lock or sluice mechanism 1' and further cooling region K'' situated higher than such lock or sluice mechanism 1'. The cooling region K'' moreover possesses a tower 16 serving to increase the hydrostatic overpressure in the apparatus or system.

The inlet means determined by the infeed lock or sluice mechanism 1' is already subjected to a hydrostatic overpressure, to which there is further added the overpressure brought about by the feed of the water. This construction of apparatus has proven itself to be especially suitable for the sterilization of controlled serving portion packages of the above-mentioned type.

In order to charge the packages there is advantageously employed a lock or sluice mechanism 1 of the type shown in FIG. 4. Such renders possible a step-wise pressure increase during the charging operation. As best seen by referring to FIG. 4, it will be recognized that this charging lock or sluice mechanism 1 possesses a housing 17 which is sealed so as to be fluidtight to both sides thereof. Within the confines of the housing 17 there is rotatably mounted a suitable pocket wheel arrangement 18. The packages 2 arrive in dry condition into the lock mechanism 1 through the agency of an inlet stud or connection 19. These packages 2 are then engaged by the pockets 20 distributed about the periphery of pocket wheel 18 and extending radially toward the outside of such pocket wheel, as shown. The thus engaged packages 2 are then conveyed towards the outlet or discharge stud or connection 21. Between the inlet stud 19 and the outlet stud 21, the pocket wheel arrangement 18 passes through the regions or zones A, B, and C of increasing overpressure. While at the inlet connection or stud 19 the packages 2 are subjected to the surrounding pressure, at region A they are subjected to an overpressure of 0.5 to 0.8 kp/cm^2 , at region B, to an overpressure of 0.8 to 1.2 kp/cm^2 , and at region C to an overpressure of 1.2 to 1.4 kp/cm^2 , and at the outlet stud 20 to an overpressure of 1.6 kp/cm^2 .

The packages 2 are entrained at the region of the inlet stud or connection 19 by the dry pocket 20 of the pocket wheel arrangement 18. At the region A, water, which is at an overpressure and increased temperature, is introduced via a delivery conduit 22, into an arcuate-shaped groove 23 provided at the side portion of the housing 17. Groove 23 preferably spans the region of two to three pockets 20. This water is delivered into the pockets 20 through the agency of bores 24, running parallel to the axis of the pocket wheel 18, and the therewith communicating radially outwardly extending bores 25. Consequently, the pockets 20 are filled with water. The expelled air and excess water can escape into a nonillustrated conduit by means of the opening or port 26 provided at the casing of jacket 17a of the housing 17.

At the regions B and C, there are also provided connections or conduits 27 and 27', respectively, at the jacket or casing 17a of the housing 17 and serve for the further introduction of water which is at an overpressure and increased temperature. In so doing, the water, in each instance, is introduced into the pockets 20 through the agency of one or a number of peripherally spaced, radially directed bores 28 and 28', respectively. The water flows through the pockets 20 and via the bores 25 and 24 enters into an arcuate-shaped groove 29 and 29', respectively from which then it can flow via an opening 30 and 30', respectively, into a nonillustrated withdrawal conduit.

For ejecting the packages at the outlet or discharge connection or stud 21, there is likewise advantageously introduced water, also under an overpressure and at increased temperature, into an arcuate-shaped groove 32 through the agency of an opening or port 31. The water then flows via the bores 24, 25 into the bottom of the pockets 20 and thus flushes the packages out of the pockets into the discharge stud 21. The escaping water thus simultaneously serves as the conveying and energy transmission means in the pressure digester.

Continuing, it will be seen that between the discharge stud 21 and the inlet stud 19 there is likewise provided and arcuate-shaped groove 33, by means of which, via the bores 24 and 25, the water which is still located in the pockets 20 can be sucked away into a suction opening 34. Between the individual regions A, B, and C, and the inlet stud and the outlet stud, the pocket wheel 18 together with its pockets 20 is guided at least approximately in fluid-type fashion.

According to an advantageous embodiment of the invention, the apparatus structure shown in FIG. 2 can be operated with the following data: The packages filled and sealed at the surrounding or ambient pressure and in the temperature range from the freezing point to the boiling point, preferably from 60° C. to 80° C., are introduced via the inlet stud or connection 19 into the lock or sluice arrangement 1. The latter charges the packages, during gradually increasing water pressure, as explained above, into the feed channel means 3. At the outlet connection or stud 21 of the lock or sluice mechanism 1 the water preferably exhibits an overpressure of 1.3 to 1.8 kp/cm.² and a temperature corresponding to the filling temperature of the package. Along the preheating zone V, the packages are further heated during increasing pressure until at the sterilization zone S there is achieved a temperature of 100° C. to 130° C., preferably from 110° C. to 120° C. and an overpressure of 2.3 to 2.7 kp/cm.², preferably from 2.4 to 2.6 kp/cm.². At the cooling zone, the packages are again gradually cooled. The discharge region finally possesses a temperature of 30° C. to 50° C., preferably about 40° C. and the overpressure is reduced to zero or null.

The graph depicted in FIG. 5 illustrates the progression or course of the temperature and overpressure, points (a) to (m) along the feed path, of an apparatus of the type shown in FIG. 2, for the sterilization of serving portion packages. Experiments have shown that such temperature and overpressure course for the given packages must fluctuate within the broken-line region MNOP. The curve Q shows, in comparison thereto, the theoretically determined saturation pressure of the vapor in such a serving portion package, starting with a sealing or closure temperature of 70° C.

According to the arrangement of FIG. 2, the water is heated in the conveying or feed channel means 3 by the heating apparatus 12, so that at the inlet lock or sluice mechanism 1', it possesses approximately the same temperature as the introduced serving portion packages. At the inlet lock or sluice mechanism 1' (point (b) of the graph), the conveying water therefore preferably possesses a temperature of approximately 70° C. and a hydrostatic overpressure of approximately 1.4 kp/cm.². In the preheating zone or region V, the conveying or feed water and the portion packages are heated to such an extent that at point (e), they enter into the sterilization zone S at a temperature of 115° C. At this location, the hydrostatic overpressure of the conveying or feed water is approximately

2.5 kp/cm.². The portion package passes through the sterilization zone S at a temperature, for instance, of approximately 115° C. and an overpressure of 2.5 to 2.6 kp/cm.². Thereafter, the portion package is depressurized in the cooling zone K up to the outlet or discharge means 4' (point m) to the surrounding pressure and cooled to a temperature of approximately 40° C. Since the overpressure and temperature course up to the filling temperature is critical, it is necessary that cooling to this temperature, in other words up to point (k), and the external pressure corresponding to the internal pressure in the package, must be carefully undertaken. Accordingly, the sterilization device is constructed in such a way that the course of the overpressure and temperature in the cooling zone K' is preferably proportional to the course of the pressure and temperature of the serving portion package 2. Since the remaining portion of the cooling from point (k) to point (m) can be carried out under an optional pressure, this region K'' of the cooling zone K can be constructed according to structural and technical requirements. However, the system must be designed such that at the outlet there prevails the surrounding or ambient pressure and the temperature of the feed water and the portion package has been adjusted to approximately 40° C.

It is still here to be mentioned that the course or progression of the temperature and overpressure which can be actually used is extensively dependent upon the properties of the package to be treated and its contents; water content of the product and its temperature during sealing. The manner of sealing and the material properties of the package can considerably influence the required magnitudes.

It should be apparent from the foregoing detailed description, that the objects set forth at the outset to this specification have been successfully achieved.

What we claim is:

1. Apparatus for the sterilization of filled packages equipped with pressure-sensitive closures and filled with materials, especially foodstuffs or condiments or the like, comprising feed channel means provided with inlet means and discharge means, said feed channel means passing through a preheating zone, a sterilization zone and a cooling zone, a fluid medium serving as energy transfer means for conveying said packages through said feed channel means, said inlet means and said discharge means being disposed at a greater height than said sterilization zone of said feed channel means, said preheating zone and said cooling zone being situated at a greater height than said sterilization zone, said feed channel means at said preheating zone and at said cooling zone possessing a greater slope than at said sterilization zone, and energy transmission means provided for said feed channel means at least along the greatest portion of said feed channel means, said feed channel means at the lowest region of said preheating zone and cooling zone, respectively, merging with said sterilization zone, the pressure of said fluid medium in said feed channel means at least from said inlet means up to the region of said cooling zone corresponding to the inlet temperature being greater than the internal pressure of the packages.

2. Apparatus as defined in claim 1, wherein the pressure of said fluid medium along the entire feed channel means is greater than the internal pressure of the packages.

3. Apparatus as defined in claim 1, wherein said inlet means comprises a lock mechanism incorporating a housing sealed in fluidtight fashion to both sides, a pocket wheel having pockets rotatably mounted in said housing and capable of receiving said packages to be processed, an inlet stud and an outlet stud for said packages provided at said housing, and means defining a feed path from said inlet stud to said outlet stud incorporating regions of increasing fluid medium pressure, said pocket wheel moving along said feed path from said inlet stud to said outlet stud and passing through said regions of increasing pressure.

4. Apparatus as defined in claim 3, wherein said means defining said regions of increasing pressure also defines regions of increasing fluid medium temperature.

5. Apparatus as defined in claim 3, wherein said means defining regions of increasing pressure further defines regions of varying pressure, said last-mentioned means incorporating fluid medium delivery means cooperating with said housing and spanning at least the region of one pocket of said pocket wheel and fluid medium withdrawal means spanning at least the region of one pocket of said pocket wheel.

6. Apparatus as defined in claim 1, wherein said energy transmission means comprises jacket means provided for said feed channel means, a heat-exchange fluid medium agent flowing through said jacket means.

7. Apparatus as defined in claim 6, wherein said heat-exchange fluid medium agent flows in counterflow relationship through said jacket means.

8. Apparatus as defined in claim 1, wherein said energy transmission means for said preheating zone and sterilization zone comprise electrical heating means surrounding regions of said feed channel means.

9. Apparatus as defined in claim 6, further including means for controlling said energy transmission means in predetermined zones.

10. Apparatus as defined in claim 9, wherein said controlling means includes connection location means provided for said jacket means along the conveying path for the controlled admixture of a heat-exchange fluid medium containing an energy content which deviates from the energy content of said heat-exchange fluid medium agent flowing through said jacket means.

11. Apparatus as defined in claim 1, further including means for varying the feed velocity of said fluid medium.

12. Apparatus as defined in claim 1, further including means enabling said fluid medium to pass through the apparatus in a closed cycle.

13. Apparatus as defined in claim 1, wherein said inlet means is located lower than said discharge means.

14. Apparatus as defined in claim 1, wherein said feed channel means possesses a substantially rectangular cross-sectional configuration.

15. Apparatus as defined in claim 14, wherein the height of said cross section of said feed channel means is dimensioned such that fresh packages located in said feed channel means can tilt in lengthwise direction through an angle in the range of about 11° to 14°.

16. Apparatus as defined in claim 15, wherein said angle of tilt is preferably about 12°50'.

17. Apparatus as defined in claim 1, wherein the packages which are treated are controlled serving portion packages.

18. Apparatus as defined in claim 17, wherein said inlet

means possesses a temperature in the range of about 50° C. to 90° C.

19. Apparatus as defined in claim 18, wherein said temperature range is preferably between 60° C. to 80° C.

20. Apparatus as defined in claim 17, wherein said inlet means operated with an overpressure of said fluid medium in the range of about 1.3 to 1.8 kp/cm.².

21. Apparatus as defined in claim 3, wherein said lock mechanism is provided between said inlet stud and said outlet stud with a first region having a fluid medium overpressure in the range of about 0.5 to 0.8 kp/cm.², a second region wherein the fluid medium overpressure is in a range of about 0.8 to 1.2 kp/cm.², and a third region wherein the fluid medium overpressure is in a range of about 1.2 to 1.4 kp/cm.².

22. Apparatus as defined in claim 17, wherein said sterilization zone operates at a temperature in the range of about 100° C. to 130° C. and with a fluid medium overpressure which is in the range of about 2.3 to 2.7 kp/cm.².

23. Apparatus as defined in claim 22, wherein said temperature range is preferably between about 110° C. and 120° C. and said fluid medium overpressure is preferably in the range of about 2.4 to 2.6 kp/cm.².

24. Apparatus as defined in claim 17, wherein said discharge means operates in a temperature range of about 30° to 50° C.

25. Apparatus as defined in claim 24, wherein said operating temperature of said discharge means is preferably about 40° C.

26. Apparatus as defined in claim 24, wherein said discharge means is situated at a greater elevation than said in-feed means.

27. Apparatus for the sterilization of filled packages having pressure-sensitive closures and filled with materials, comprising feed channel means provided with inlet means and discharge means, said feed channel means having predetermined regions defining and passing through a preheating zone, a sterilization zone and a cooling zone, a fluid medium for conveying said packages through said feed channel means, said inlet means and discharge means being situated at a greater height than said sterilization zone of said feed channel means, said preheating zone and said cooling zone being situated at a greater height than said sterilization zone, and energy transmission means provided for said feed channel means at least along the greatest portion of said feed channel means, said feed channel means at the lowest region of said preheating zone and cooling zone, respectively, merging with said sterilization zone.

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