METHOD AND DEVICE FOR STERILISING OF CONTAINERS

Inventor: Alfred Grafingholt, Hamburg, Germany
Assignee: Lever Brothers Company, New York, N.Y.

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ABSTRACT

A method of sterilising stackable containers by the effects of a sterilising gas before they are filled and closed in which the containers to be sterilised are stacked one inside the other, are exposed to the effects of sterilising gas in a sterilisation chamber and are subjected to strong fluctuations in pressure of the gas at successive intervals, after which the containers are filled and sealed under sterile conditions.

4 Claims, 3 Drawing Figures
METHOD AND DEVICE FOR STERILISING OF CONTAINERS

This is a continuation of application Ser. No. 52,208, filed July 6, 1970, and now abandoned.

The invention relates to a method of sterilising prefabricated, stackable packaging containers before they are filled and closed, sterilisation being effected by means of a sterilising gas. The invention also relates to devices for carrying out this method.

It is known to pass flat packaging material through a sterilising bath before it is formed into a tube from which bag-like containers are formed after filling, and to keep it in a protective gas atmosphere until the packs have been sealed. It has also been proposed to sterilise cylindrical cans with high-pressure steam before they are filled, the cans being conveyed separately in a straight-like conveyor device through a processing chamber bounded by two rotating gates. In the case of containers of deep-drawn plastic films, attempts have also been made to sterilise these, for example by radiation. Due to the short duration of the treatment and because processing by means of deep-drawing moulds cannot be kept sterile, it is not, however, possible to achieve adequate sterilisation.

The known devices are not suitable for sterilising packaging containers such as tubs or trays adequately in the quantities which can be filled and closed by a fast-running packaging machine. In the case of the plastic packaging containers common today, it must also be noted that at least in some cases they consist of material which cannot be heated excessively without undergoing undesirable deformation. It is therefore often impossible to sterilise them by means of super-heated steam.

Packaging sensitive liquids or paste-like products, such as fruit juice, oil, mayonnaise, milk, ice cream and processed cheese for example, in prefabricated containers requires sterilisation not only of these products but also of the packaging material in order to extend their storage period. The object of the invention is therefore to sterilise prefabricated packaging containers by treating them with a germicidal gas for an adequate time and, if necessary, repeating the treatment with this gas.

The method discovered for solving this problem, which is also suitable for the substantial number of containers required by a fast-running packaging machine, consists in that the containers to be sterilised, stacked one inside the other, are exposed to the effects of the sterilising gas in sterilisation chambers, the stacks of containers being exposed to repeated, fairly strong fluctuations in pressure within the sterilisation chambers. The sterilising gas is then removed from the sterilisation chamber and the containers are passed into a packaging machine in which they are filled and closed in a sterile atmosphere in a manner known per se. The lids required for the closure are sterilised in the same way as the containers and conveyed to the packaging machine. According to the invention the fluctuations in pressure in the sterilisation chambers are at least 1/3 and preferably more than 9/10 of the maximum pressure. It was found preferable to allow the pressure of the processing gas to fluctuate several times between approximately 1 atm. and 1 to 10 mm. mercury column. Before the processing gas is first introduced the sterilisation chamber is evacuated in order to remove most of the air brought in with the containers. Before the containers are discharged to the packaging machine the sterilising gas is likewise removed by evacuation before the sterilisation chamber is filled with the sterile atmosphere used in the packaging machine.

Thanks to the method according to the invention not only is an adequate sterilisation period obtained but as a result of treating the containers and lids in stacks an economic ratio is also achieved between the effective capacity of the containers and the amount of gas required. Even greater economy can be achieved by using the gas several times.

The device provided for putting the method into effect consists of a number of tubular chambers to take the stacks of containers. These chambers can be arranged parallel to one another and mounted rotatably about a common shaft. It is also possible, however, to arrange them in the path of the feed line of the packaging containers, the chambers then being in series.

The device and the method to be carried out with it are described in detail below with the aid of the embodiments illustrated in diagram form in the attached drawings:

FIG. 1 shows a cross-section through a device with chambers rotating about a shaft.

FIG. 2 shows a cross-section through chambers arranged in series, and

FIG. 3 shows the chambers arranged according to FIG. 2 in the path of the feed line of the containers to the packaging machine.

In the device according to FIG. 1 several tubular chambers 1 are arranged in a type of rotating platform 16. The cross-section of the chambers 1 is slightly larger than the largest diameter of the containers in the stack of containers 15. The chambers 1 have at their upper end an inlet opening, the cross-section of which is as large as that of the chambers. This inlet opening can be hermetically sealed by a sealing organ 2, for example in the form of a retractable slide plate. The lower end of the chambers 1 is constructed in the same way and is hermetically sealed by a similar sealing organ 3. Each of the chambers has at least one pipe connection 5 for vacuum and/or gas. The height of the chambers is approximately the same as the height of a stack of containers which can be filled by the packaging machine coupled to the outlet side in a period that depends on the number of chambers and the duration of the sterilisation treatment. The chambers 1 arranged in the rotating platform 16 or suitable supporting arms can be rotated about the shaft 6 so that the chambers 1 can be connected in one position of the rotating platform 16 with the feed pipe 12 for the tubs and in another position with the discharge pipe 13 for the sterilised tubs. The rotating platform 16 rotates intermittently so that there is sufficient time for the tubs to be introduced and discharged. On the shaft 6 there is a distributor to provide a link between the connections 5 on the chambers 1 and the feed pipes 11 for vacuum, sterilising gas and protective gas. This distributor consists of a perforated disc 8 rotating with the rotating platform 16, from which feed pipes 10 branch off to the connections 5, and a fixed perforated disc 9 to which the pipes 11, through which the gases are introduced or discharged, lead via the control mechanisms 7.

For a processing period of approximately 15 minutes in the sterilisation device 16, chambers 1, say, are provided in the rotating platform, each of the chambers 1
being able to take a stack of containers which can be handled by the packaging machine in approximately one minute. The individual chambers in this device are moved to the next position about once a minute. The duration of the individual processing operations may be longer or shorter than the time a chamber remains in each position. By operating the control mechanisms it is possible to carry out several operations with the chamber in a single position or to extend a processing operation over several positions of a chamber.

Thus, after a new stack of tubs has been supplied relatively quickly through the feed pipe 12, it is possible to close this chamber by means of the sealing organ 2, then substantially to remove the air by means of a vacuum pump and to introduce sterilising gas into this chamber while it is still in the same position. In another position repeated fluctuations of pressure between a maximum of one atm. and less than 10 mm. mercury column can be induced. These fluctuations in the pressure of the sterilising gas can naturally be extended to several successive positions of the chambers. Before the sterilised tubs pass from the chamber 1 into the discharge pipe 13, which takes the tubs to the packaging machine, by the sealing organ 3 being opened, the chamber 1 is first evacuated and then filled with the protective gas under which the tubs are handled in the packaging machine. Evacuation of the chamber 1 with the sterilised tubs and filling it with protective gas can, if necessary, be repeated several times in order to remove all traces of the sterilising gas.

The device according to the invention and the method to be carried out with it enable the tubs or similar packaging containers to be treated for a sufficient length of time. At the same time the device only requires a relatively small amount of space, as the containers are treated in stacks. The fluctuations of pressure according to the invention enable the stack of containers to be adequately sterilised. Surprisingly they ensure that even the parts of the containers in the interior of the stack are sufficiently exposed to the sterilising gas.

In the embodiments illustrated in FIGS. 2 and 3 the chambers 1 are in a line. In this case the chambers can be arranged horizontally, vertically or obliquely. There is a sealing organ 4 between every two chambers. By opening this sealing organ 4 a connection is provided between two consecutive chambers. If at the same time a difference in pressure or a flow of gas is produced between these chambers, the stack of tubs can be conveyed from one chamber to the next, even when they are arranged horizontally.

It is nowadays customary to unpack packing materials in a separate room at a higher level and to convey them to the packing machine by exploiting the force of gravity. In this way the sterilisation chambers according to the invention can be arranged in a particularly advantageous way, as shown in FIG. 3. The stacks of tubs 15 pass from a magazine 14, into which the prefabricated tubs are inserted in stacks and from which they are pushed into the first of the chambers 1 in a known way, through further chambers 1, in which they are treated in the manner described above, the packaging machine 17.

It has been found advantageous to make the chambers 1 from glass tubes. These glass tubes are corrosion-proof and gastight and it is easy to see any breakdown in them. The internal cross-section of the chambers 1 is only slightly larger than the largest cross-section of the stack of containers. The quantity of gas required for sterilisation is kept small by this means.

The chambers to be arranged in series in a line according to FIGS. 2 and 3 make it possible to sterilise the prefabricated containers without additional space being needed for this process if the container feed pipes previously used are replaced by the chambers. The chambers also provide a buffer space for the packaging material.

Sterilisation can be carried out at a normal temperature without heating the containers which preferably consist of thermoplastics, by means of gases or mixtures of gases, for example HCl, ethylene oxide, formalin and the like; however, the device is naturally also suitable for treating containers with steam if the material of the containers with steam if the material of the containers permits of such treatment.

What is claimed is:

1. A method of sterilizing rigid preformed stackable containers by the effects of a sterilizing gas before they are filled and closed in which the containers to be sterilized are stacked one inside the other in a nested relationship comprising the steps of:

a. introducing the containers in a stacked nested configuration to a sterilization chamber, the chamber having a substantially cylindrical interior with an internal diameter slightly larger than the external diameter of the container and a height approximately that of the height of the stack of containers;

b. substantially evacuating the sterilization chamber of air brought in with the containers;

c. introducing a sterilization gas into the sterilization chamber;

d. maintaining the sterilization gas in the sterilization chamber for a period of time sufficient to sterilize the containers;

e. evacuating the chamber of sterilizing gas;

f. introducing a protective gas to the sterilization chamber, and;

g. removing the sterilized containers from the sterilizing chamber.

2. A method as in claim 1 wherein the sterilization gas is selected from the group consisting of hydrogen chloride, ethylene oxide, steam and formalin.

3. A method as in claim 1 wherein the sterilization gas is hydrogen chloride.

4. A method as in claim 1 wherein the pressure in the sterilization chamber is fluctuated between a maximum of 1 atmosphere and a minimum of 1 mm. mercury column when the sterilization gas is in the sterilization chamber.