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Buchner et al.

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[54] **APPARATUS FOR THE STERILIZATION OF PACKAGING MATERIAL**

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[52] **U.S. Cl.** **21/91**; 21/58; 134/1; 134/15; 134/64

[51] **Int. Cl.²**.... **A61L 3/00**; B08B 3/12; B08B 3/08; B08B 1/02

[58] **Field of Search** 21/91, 58; 134/1, 9, 15, 134/42, 122, 64; 53/167

[56] **References Cited**

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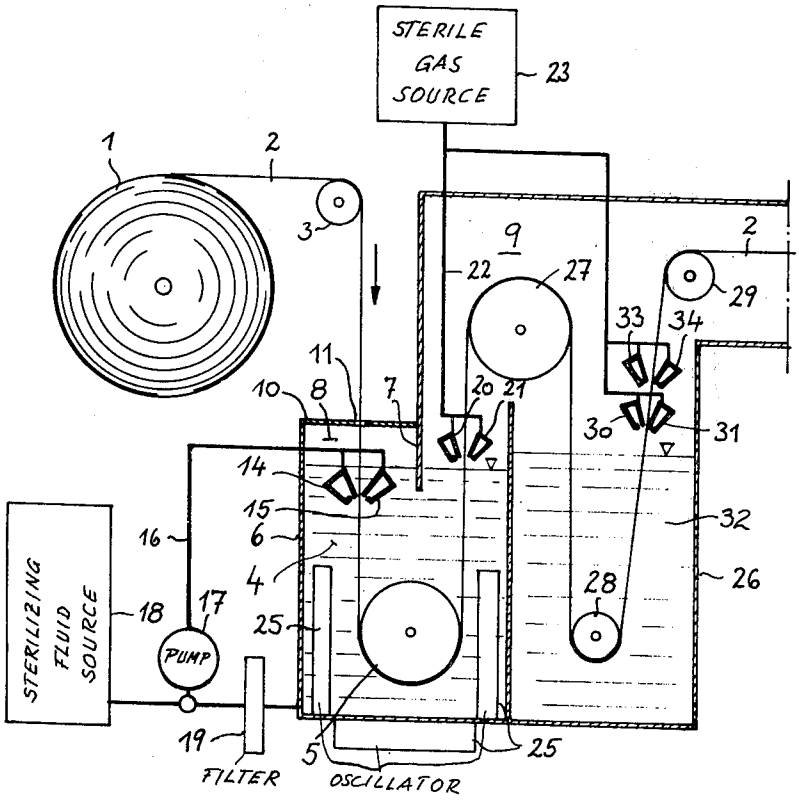
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[57] **ABSTRACT**

An apparatus for sterilizing a web of packaging material by passage through a sterilizing liquid and subsequent passage through a neutralizing liquid. Prior to or during the passage through the sterilizing bath, the material is exposed to a high-velocity stream of sterilizing liquid emanating from liquid scouring nozzles and after passage through the sterilizing bath, as well as after passage through the neutralizing bath, the packaging material is exposed to a high-velocity stream of a sterile gas emanating from gas scouring nozzles.

8 Claims, 3 Drawing Figures



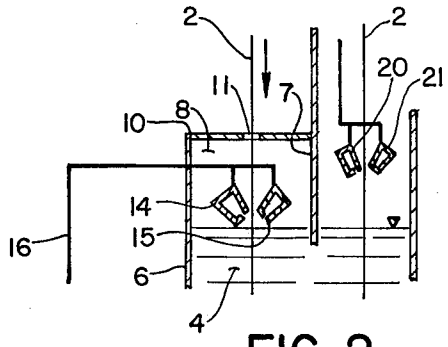


FIG. 2

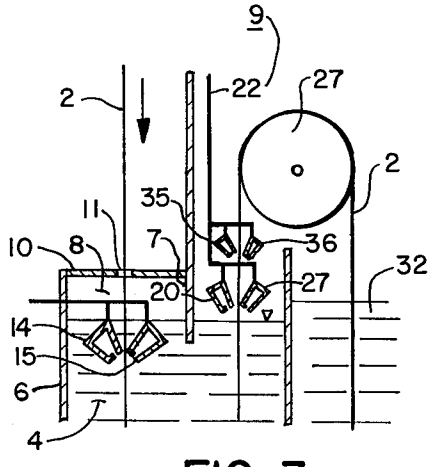


FIG. 3

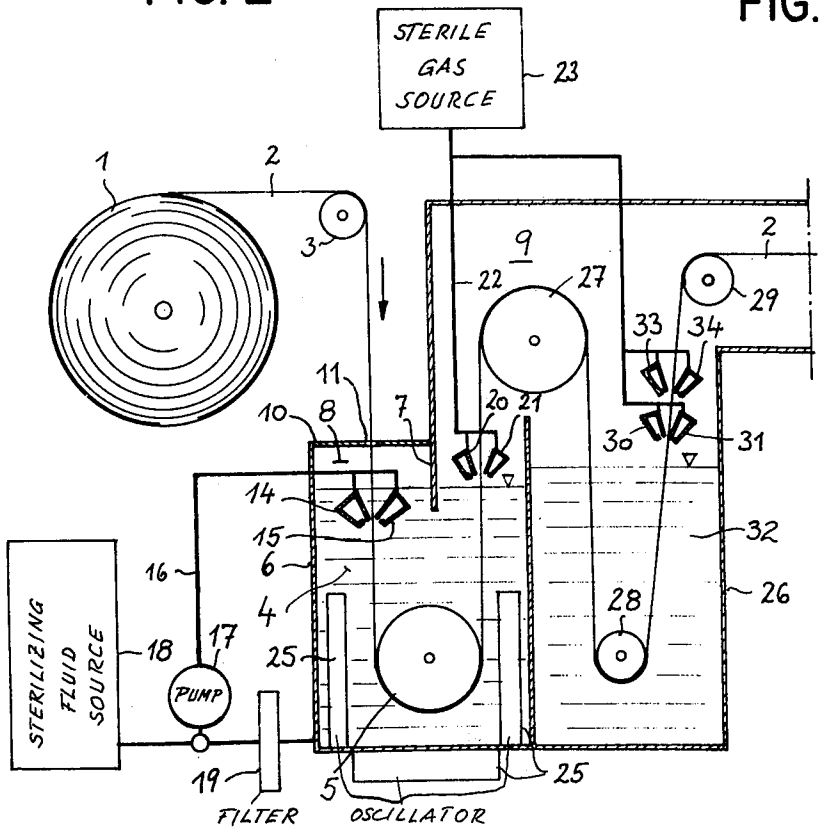


FIG. 1

APPARATUS FOR THE STERILIZATION OF PACKAGING MATERIAL

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to an apparatus for sterilization of a web of packaging material, and more particularly to an apparatus for sterilization of a web of packaging material including a bath containing sterilizing liquid through which the web of packaging material is guided, a loosening installation for the loosening of contaminants from the web of packaging material and a drying installation disposed subsequent to the bath for drying the web of packaging material.

2. Description of the Prior Art

In an apparatus of this type, as is disclosed for example in Swiss Patent Specification No. 361,636, a web of packaging material is pulled through a bath of hydrogen peroxide for sterilization and, prior to its entry into a packaging machine, the web is subjected to a heat treatment which has a sterilizing and drying effect. In that apparatus, contaminants and air bubbles adhering to the web of packaging material and containing germs are only partially loosened so that some germs resist the chemical action of the sterilizing liquid and the effect of the heat due to their being protected by the contaminants and air bubbles. In order to loosen the contaminants and air bubbles from the web of packaging material more thoroughly, it has been suggested to add a wetting agent to the sterilizing fluid. In addition to the fact that a wetting agent would be foreign matter inadmissible in the packaging of foodstuffs, a wetting agent cannot loosen all contaminants from the packaging material.

A further known sterilizing apparatus is disclosed in German OS No. 1,492,482 (laid open application) in which the web of packaging material is pulled over brushes in the sterilizing bath and is exposed to the pressure effects of a liquid pad of a sterilizing medium. Because the brushes do not touch the packaging material web at all parts of the surface, it can happen that microbiological contaminants are not removed from the web and are also unaffected by the liquid pressure pad. Such contaminants form the foci for the growth of residual germs which finally spoil the foodstuffs.

OBJECTS OF THE INVENTION

It is an object of the invention to render packaging materials, especially webs of packaging material, germ free with such a certainty that they are suitable for the aseptic packaging of foodstuff. The sterilization of the packaging material is such that as large a part of the microbiological contaminants as possible is removed from the surface of the packaging material and as small a part as possible remains for the actual sterilization by chemical means.

SUMMARY OF THE INVENTION

This and other objects of the invention are attained in that the apparatus for the loosening of the contaminants comprises a sterilizing bath, a liquid scouring device including at least one nozzle disposed at the entrance of the packaging material into the sterilizing bath through which a stream of sterilizing liquid is sprayed with high velocity so as to hit the packaging material over its entire width, and a drying installation including a gas scouring device disposed at the exit of the packaging material from the bath, the gas scouring device having at least one nozzle through which a curtain of a sterile gas streams obliquely downward onto the packaging material at high velocity.

In the apparatus according to the invention, the air bubbles and even such organic or inorganic contaminants as do not merely lie loosely on the web are flushed from the surface so that the sterilizing liquid may act on the entire surface of the web of packaging material during its passage through the sterilizing bath. Any contaminants which are not removed by the action of the liquid scouring device and by the sterilizing bath are softened during the passage through the bath and, together with any sterilizing liquid adhering to the surface of the packaging material, are stripped off by the sterile gas curtain emanating from the gas scouring device and striking the surface of the packaging material with high velocity. The gas scouring device dries the packaging materials so thoroughly that only a very small quantity of liquid remains on the surface of the packaging material. A particularly high drying effect is achieved by the disposition of several sequential gas scouring devices.

In the preferred embodiment of the invention, the bath containing the sterilizing liquid is equipped with an ultrasonic oscillator. By this means, the surface of the packaging material is subjected to a strong, intensive cleaning process which aids in the removal of microbiological surface contaminants.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 shows a simplified schematic side view of a sterilizing apparatus for a web of packaging material.

FIG. 2 shows the liquid scouring nozzles in an alternative position relative to the surface of the sterilizing bath.

FIG. 3 shows an alternative embodiment of the gas scouring nozzles according to which sequentially disposed series of nozzles are provided.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A supply roll **1** continuously supplies a web of packaging material **2**, out of which a packaging machine, which is not shown, eventually forms packages and fills them with perishable foodstuffs under aseptic conditions. The web is led around a guide roller **3** and into a sterilizing bath. Within this bath, the web **2** travels at first downwardly, around another guide roller **5** and then back toward the top to another guide roller, for example, guide roller **27**. The sterilizing bath consists of a container **6** filled with a sterilizing liquid **4**, for example, hydrogen peroxide, up to a predetermined level. A separating wall **7** extends downwardly into the container **6** below the level of the liquid **4**. The separating wall **7** divides the air space above the liquid **4** into a volume **8** which communicates with the atmosphere at the entry end of the web **2** and a sterile volume **9** at the exit end of the web **2**, the volume **9** extending to the packaging machine (not shown). At the entry end, the volume **8** is covered with a plate **10** in which a slot **11** is provided for the passage of the web **2**. On both sides of the vertical path of the entering web **2**, scouring nozzles **14** and **15** are disposed within the container **6**. The length of the nozzles **14** and **15**, that is, the transverse dimension in the width direction of the web **2**, corresponds at least to the width of the web **2**. The stream direction of the scouring nozzles **14**, **15** is di-

rected obliquely downward against the surface of the incoming web **2**. Preferably, the scouring nozzles **14, 15** are disposed at a small distance beneath the level of the sterilizing liquid **4**. However, they can be disposed slightly above the level of the sterilizing liquid **4** (FIG. **2**). The scouring nozzles **14, 15** communicate through a conduit **16** with a pump **17** which pumps sterilizing liquid from a supply **18** or from the container **6** through a filter **19** and delivers it at high pressure to the scouring nozzles **14, 15**. The pumped sterilizing liquid is ejected by the scouring nozzles **14** and **15** at high velocity and in the form of a thin but closed jet or curtain against the surface of the moving web **2**. Due to the impact force of the jet, the air bubbles and contaminants adhering to the surface of the web are loosened and flushed away and their microbiological constituents are killed by the sterilizing liquid of the bath. During the traverse of the web **2** through the sterilizing bath **4**, any germs which may still remain on the surface of the web are exposed to the chemical action of the sterilizing liquid **4**.

A short distance above the level of the sterilizing liquid in the container **6** and within the sterile volume **9**, air scouring nozzles **20** and **21** are disposed on both sides of the web **2** as it leaves the bath. The stream direction of these nozzles is directed obliquely downward against the surface of the web **2**. These air scouring nozzles **20, 21** communicate through a conduit **22** with a sterile air source **23**. From the sterile air source **23**, sterile air or other sterile gas flows through the scouring nozzles **20** and **21** in a form of a broad, closed stream of high velocity and impinges against the web **2** as it leaves the bath. During this process, the liquid carried along with the web and any possibly still adhering but now softened contaminants are removed from web **2** and are blown away. In order to intensify the removal of contaminants adhering to the web **2**, ultrasonic oscillators **25** are assigned to the sterilizing bath **4**. These oscillators **25** are preferably located within the container **6**, but they may also be attached to its outside wall.

Alternatively, two pairs of scouring nozzles **20, 21** and **35, 36** can be provided sequentially as shown in FIG. **3** thereby affecting a particularly high drying effect for the web **2**.

In order to remove or neutralize any sterilizing liquid possibly still remaining on the web **2**, the web is subsequently drawn through a bath containing a rinsing or neutralizing liquid, for example, sterilized water. For this purpose there is disposed, adjacent to container **6** a first container, a second container **26** which is filled with sterilized water up to a certain level to form a bath **32**. Through this bath **32**, whose upper surface lies within the sterile volume **9**, the web **2** is guided in a loop over guide rollers **27, 28** and **29**. Any liquid carried along by the web **2** is removed by the sterile air streams emanating from air scouring nozzles **30, 31** in the way described above. The air scouring nozzles **30, 31** are disposed at some small distance above the level of the water bath in container **26** and the air streams emanating from them are directed obliquely downward against the outgoing web **2**. The nozzles communicate through a line **32** with the source of sterile air **23**. In order to achieve complete drying of the web **2**, it is advantageous to dispose one or several pairs of air scouring nozzles **33, 34** subsequent to the air scouring nozzles **30, 31**.

It is to be noted that the apparatus according to the invention can treat not only webs of packaging material, but also sheets of packaging material and preformed package containers if suitable conveyor means are provided.

In a preferred embodiment of the invention the liquid scouring nozzles **14, 15** are disposed 50 mm beneath the liquid level of the sterilizing bath **4**. Their liquid jet impinges on the web **2** at an acute angle of from about 5° to 10°. The liquid is fed to the nozzles **14, 15** with a pressure of about 30 psi. The air scouring nozzles **20, 21** and **30, 31** are disposed 80 mm above the liquid level at an angle in the range of 5°–10° with respect to the web **2**.

The web **2** is drawn between the nozzles **14, 15; 20, 21** and **30, 31** and through the sterilizing bath **4** and the rinsing bath with a velocity of about 25 to 30 ft./min. The web of packaging material consists of a thermoplastic film such as polyvinylchloride or of paper coated on both sides with a thermoplastic film such as polyethylene.

That which is claimed is:

1. In an apparatus for the sterilization of packaging material of the type including a container containing sterilizing liquid constituting a sterilizing bath through which the packaging material is drawn and guided, said container defining an entry portion and an exit portion, guide means for guiding the packaging material through the bath, said guide means including at least two elements which engage the packaging material while it is being drawn through the bath, one of the elements being disposed within the bath and the other of the elements being disposed outside of the bath, said other of the elements serving to guide the packaging material into the bath, a device for loosening any contaminants adhering to the packaging material and a drying installation disposed subsequent to the sterilizing bath, the improvement comprising:

a. liquid scouring means serving as said loosening device including at least one nozzle, adjacent to the packaging material adjacent to the entry portion of the container and located to spray a high velocity stream of sterilizing liquid at said packaging material during the passage thereof between said one of and the other of said elements so as to hit the packaging material over its entire width, for loosening the contaminants; and

b. gas scouring means serving as said drying installation including at least one nozzle disposed at a location adjacent the exit portion of the container through which a curtain of a sterile gas streams obliquely downward onto the packaging material at high velocity, for drying the packaging material.

2. An apparatus as defined in claim **1**, wherein said liquid scouring means is disposed at a small distance beneath the liquid level of said sterilizing bath.

3. An apparatus as defined in claim **1**, wherein said liquid scouring means is disposed at a small distance above the liquid level of said sterilizing bath.

4. An apparatus as defined in claim **1**, wherein said liquid scouring means includes a pair of nozzles disposed relative to each other so that their respective streams of sterilizing liquid intersect.

5. An apparatus as defined in claim **1**, further comprising ultrasonic oscillator means connected to said sterilizing bath.

6. An apparatus as defined in claim **1**, wherein said gas scouring means includes a plurality of pairs of noz-

zles, sequentially disposed adjacent the exit portion of the container.

7. An apparatus as defined in claim **1,** further comprising a second container containing a neutralizing liquid constituting a neutralizing bath, wherein said container containing said sterilizing liquid constitutes a first container, and wherein said second container is disposed with respect to said first container so that the packaging material passes through said neutralizing bath sequentially after said sterilizing bath.

8. An apparatus as defined in claim **7,** wherein said gas scouring means includes a plurality of nozzles disposed adjacent the exit portion of the first container, and a plurality of further nozzles disposed adjacent the exit portion of the second container.

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