(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 357 081 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.10.2003 Bulletin 2003/44

(51) Int Cl.[7]: **B67C 7/00**

(21) Application number: **02008930.6**

(22) Date of filing: **22.04.2002**

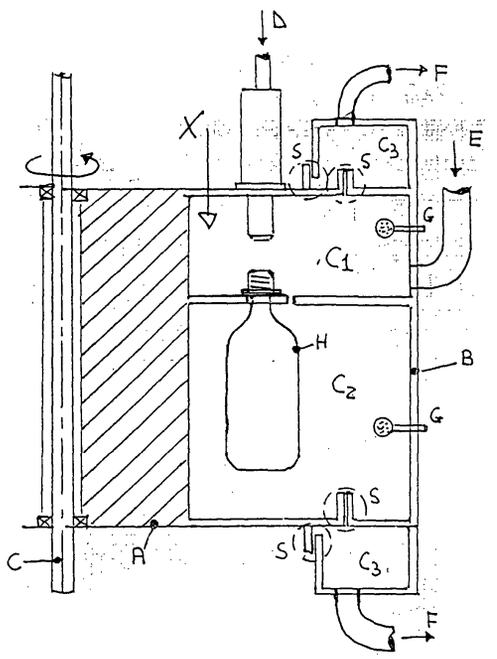
(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

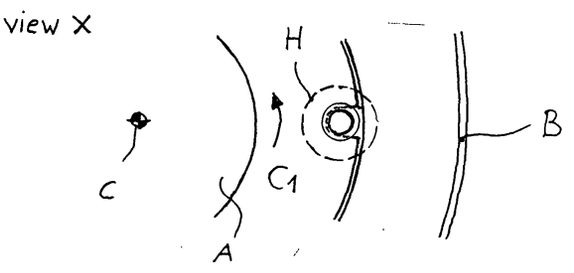
(71) Applicant: **KRONES AG**
93068 Neutraubling (DE)

(72) Inventor: **Tomba, Franco**
37016 Garda (IT)

(54) Aseptic filling machine

(57) The invention described in this paper introduces a new aseptic packing technology for plastic bottles made of PET, PE, PEHD, polypropylene or other hygienically compatible plastics. In order to apply this technology to aseptic product packing lines, a special system configuration of the product packing machine is required: an aseptic room (C1,C2) is to be created inside the machine, where sterile air (E) constantly flows into. Its structure consists of one stationary section (B) and one rotation section (A) whose special configuration create a volume where the bottle filling process takes place.





EP 1 357 081 A1

Description

[0001] This invention introduces a new aseptic filling technology for plastic bottles made of PET, PE, PEHD, polypropylene or other hygienically compatible plastics, which is applied to aseptic product packing machines with a rotary or carousel-based concept.
Aseptic product packing in plastic bottles is a fairly recent technology. It has developed in the last years especially for products like fruit juices, tea, soft drinks, milk and its byproducts, going hand in hand with companies offering their new technological solutions for this field and, of course, with the market's interest for them to be applied.
This kind of packing is a complex technology, which implies several stages and depends on the type, shape and condition of the original bottle, as well as on the product itself. It requires interventions by machine operators to be reduced to the lowest possible degree and to be carried out under the safest conditions in order to preclude the possibility of contamination of the machine, in particular of its internal microclimate and, as a consequence, of the product.
[0002] There are basically two main families of bottles which can serve this packing purpose:

a) bottles produced by means of the blow-extrusion process from virgin resins (polyethylene - polypropylene family);
b) bottles produced by means of the blowing process from a preform produced per injection (PET family).

[0003] Bottles belonging to the first group can be produced aseptically (i.e. completely closed) or else not hermetically (their inner part is open to the surrounding air). PET bottles are produced from preforms that are open to the ambient air, and therefore they are always blown under non-sterile conditions. In both cases, the bottles can be either produced at the product packing factory or bought from a specialized producer, who will deliver them arranged on pallets or in bulk within proper containers. Regardless of their delivery format, however, all bottles destined to aseptic packing undergo one of two different procedures, depending on their production:

Procedure no. 1: non-aseptically produced bottles (all bottles described under "b") and non-hermetic bottles (described under "a"):

[0004]

1. The bottles are fed into the packing machine on a pneumatic or chain conveyance system.
2. The bottles enter the first section, where their inner and outer surfaces undergo chemical sterilization by use of chemical agents like hydrogen peroxide (peroxide), combinations of media based on peracetic acid and peroxide (oxonia) or similar media.
3. The bottles are introduced into the bottle drying section: here all traces of chemical agents are removed by a sterile water stream (or sterile air only, if the sterilization has been carried out using only peroxide).
4. After their treatment and sterilization, the bottles enter the aseptic filling section:
here they are filled with a preset quantity of product through special dosing nozzles. In order to control this process, a volumetric or a weight-measuring system is used, i.e. by flow-meters, pre-calibrated chambers or weighting cells.
5. The bottles enter the closing section and are closed with pre-sterilized plastic caps or sterilized pre-cut aluminium foils.
6. Now the bottles leave the aseptic product packing machine and enter the packaging and post-packaging sections on conveyors: when the labelling and final packaging processes are over, they are palletized.

Procedure no. 2) aseptically produced bottles (described under "a") by means of the aseptic extrusion process:

[0005] In this case there is no need for sterilization. The extrusion process guarantees that the bottles' inner surfaces are already sterile. As a consequence the cycle is different.

1. The bottles are fed into a section where only their external surface is washed and sterilized.
2. The bottles enter a cutting section: here the plastic part which preserved their closed condition (and at the same time their above mentioned sterility) is cut away.
3. The bottles enter the aseptic filling section: here they are filled with a preset quantity of product through special dosing nozzles. In order to control this process, a volumetric or a weight-measuring system is used, i.e. by flow-meters, pre-calibrated chambers or weighting cells.
4. The bottles enter the closing section and are closed with pre-sterilized plastic caps or sterilized pre-cut aluminium foils
5. Now the bottles leave the aseptic product packing machine and enter the packaging and post-packaging sections on conveyors: when the labelling and final packaging processes are over, they are palletized.

[0006] In both cases it is necessary to preserve the aseptic condition in the whole inner part of the product packing machine: if the microclimate is not perfectly sterile, the bottle and/or its content might be con-

tamined. It is also to be considered that a machine cannot always work optimally and that bottles do not always comply with perfect standards. As a consequence, sometimes it happens that a stuck bottle blocks the operating cycle of the machine. It is therefore necessary for the machine operator to intervene and remove the stuck bottle and/or the machine's block: in order to do so, the machine operator has to work within the machine's microlimate and, consequently, there is a risk of contamination from the outside environment.

When an intervention is needed, traditional technology offers two solutions, the one deriving actually from the other.

[0007] First solution - The whole machine is positioned inside a cleanroom, where sterile air (filtered in Class 1000 or Class 100) flows into; a slight overpressure is to be found in this environment. The machine operator wearing a sterilized overall, facial mask, gloves and all pre-sterilized accessories controls the machine functioning from inside the cleanroom and directly intervenes to solve the problem. The machine operator is part of the microclimate and integrates the operational cycle of the machine.

[0008] Second solution - Proper laminar flows are generated in order to protect each machine's section (mini-cleanrooms in each section) enclosed by an upper wall (purposely built to support the filters), a lower wall (machine base) and a rigid side wall (sheet steel and/or glass) or alternatively a flexible side wall (transparent plastic material for the food industry). In this case the machine operator can intervene from outside, working on the machine through openings dislocated in strategically optimal positions in the side walls, his arms covered by long flexible gloves ("sleeves"): they are fixed to the openings and thus always inside the aseptic environment, therefore a part of the internal microclimate. Although they cannot be contaminated from outside, they restrict intervention possibilities for the machine operator.

[0009] In both solutions it is therefore assumed that a condition of laminar flow and air sterility is maintained inside the machine as a whole, also in the event of an interruption or stop of the production process. Both sterility and microclimate have to be continuosly preserved all round the clock, with no interruption - otherwise it will be necessary to sterilize the whole environment once again, a complex procedure requiring a long treating time (even 48-60 hours) before all surfaces and filters are brought back to their safety conditions.

[0010] Situations of this kind occur anyway in the event of major maintenance works on the machine, when the use of the "sleeves" is not sufficient to carry out the operation, in the event of a sudden break with leaking of product and/or oil or other fluids due to a mistake made by the operator.

[0011] It should be highlighted that the most critical sections in the machine are the dosing and cap application sections, where both the bottle and the product are most exposed to possible environmental contamination. In the sterilization section, instead, the chemical agents' vapours protect the microclimate against bacteria possibly coming from outside. The first two sections are also more frequently subject to intervention by the machine operator, for instance in case of wrong measuring up of the product, loss of closures or aluminium caps, stuck bottles and caps and so on. A wrong intervention in this area determines severe problems and may make it necessary to carry out a new sanitization cycle of the whole machine.

[0012] This invention aims at creating a protection room for the dosing and cap application area that facilitates interventions by the machine operator, ensuring highest sterility and aseptic conditions at the same time, and reducing the need for intervention from outside - but above all also making it possible to clean and sterilize the machine in its dosing and cap application sections with chemical cleaning and sterilization solutions every time that the machine is to be prepared for production. In other words, the filling and closing room is regularly sterilized by means of traditional methods every time that the cleaning and sterilization phases of the main dosing unit and of the dosing nozzles are started. This ensures that the most critical environment is completely sanitized at every production start.

As a second benefit, this invention enables the operator to have direct access to stuck bottles through passages purposely planned in the room: wearing only a protective glove, he will be able to extract the bottle/cap without contaminating the environment.

A third benefit given by this invention is the stationary part of the room, that makes it possible to create a safe and rigid connection between the room and the sterile air generation system, as well as the cleaning solution infeed and recovery systems. This concept makes the room independent of the other sections of the machine as a whole.

Description of the invention

[0013] The invention is the special configuration of the enclosing room containing the dosing and cap application sections, wich can be applied to any machine with a rotary or carousel-based concept for bottling products destined to the food industry and/or to the chemical and pharmaceutical industry. It is made of two sections and a series of accessories: the room contains two smaller rooms, the first protecting the filling and cap application area, the second enclosing the bottle's body. This concept may include two additional rooms to enable sterile air to be taken in.

[0014] Please see the drawing.

Explanation of the room's main parts:

[0015]

A) Rotating part of the room (supporting the bottle, dosing devices and closers)
B) Stationary part of the room (supporting the infeed of the utilities)
C) Axis of rotation
D) Product dosing device or closer (depending on the section in which it is positioned)
E) Infeed of sterile air under pression into the room
F) Extraction of sterile air from the room
G) Spray balls and sanitizer infeed
H) PE or PET bottle with neck-handling
S) Sliding sealing surfaces and/or labyrinth seals

Room's sections:

[0016]

C1: Packing and closing area
C2: Bottle's body enclosing area
C3: Sterile air intake area

Description of the sections:

[0017]

C1: upper room, consisting of

1. one section (built on the rotating part) obtained on the moving part of the filler and consisting of:

- an upper side, i.e. a plate thick enough to support the dosing system, comprising a certain number of dosing nozzles and the sealing/closing heads;
- a vertical side as an enclosure for the room and its microclimate:
- a lower side where the neck-handling clamp devices are to be found. The space left between each clamp device can be closed using sheet steel or plastic material.

2. one stationary section closing the room by means of proper sliding surfaces (S), and a second horizontal surface closing the room at the same level with the clamp devices supporting the bottles, in order to guarantee the maintenance of the inner overpression; the inner volume is kept to a minimum, just enabling the upper part of the bottle's neck to pass.

C2: lower room, consisting of:

- an upper side, comprising the (rotating) clamp devices supporting the bottles and the fixed plate at the same level (fixed);
- a vertical side (rotating, obtained on the moving part of the closer) as an enclosure for the room and its microclimate;
- a lower side consisting of one rotating surface and one stationary surface, built in order to support a sliding surface or a labyrinth surface for sterile air containment;

and equipped with suitable openings (closed by doors or similar closure devices) for making it possible to reach stuck bottles and/or wrongly positioned closures and caps.

C3: compensation rooms:
rooms for the intake of sterile air consisting of a room created between the stationary part and the rotating part by means of two sliding surfaces; they enable the sterile air to be taken in from the main rooms C1 and C2 and to better control the pressure level in the sections.

[0018] While the upper room (C1) is absolutely essential, the lower room (C2) and the other rooms (C3) are useful but not strictly necessary, as the internal microclimate is maintained by the internal room with proper overpressure.

[0019] Accessories inside rooms C1 and C2: these are pipe circuits, valves and instruments (letters E, F and G) used for feeding the cleaning and sterilization solutions during the machine's preparation stages and for feeding and maintaining the room under sterile air overpression conditions during all production phases. For reasons of structural and functional simplicity, these circuits are connected to the stationary part.

[0020] This invention aims at obtaining an easier and safer process of aseptic filling for plastic bottles, regardless of their specific material, without using standard traditional cleanrooms or else laminar flows, but by making use of a room enclosing the critical area and consisting of two sections; both sections are purposely developed in order to best serve their functional purpose, minimizing the sterile room's volume, that is to say reducing it to the critical area comprising the bottle's neck and the lower part of the nozzles and of the closer.
This is certainly an innovative solution: besides the advantages presented above, this invention also makes it possible to intervene directly on all mechanical parts of the machine without altering the microclimate in the filling area; thanks to this solution, any intervention becomes simpler and safer. Further benefits come from the new sterile air distribution: sterile air is no more top-down distributed only through the filters, but it is now fed through apposite pipes and circuits, resulting in a better flow distribution and a more accurate control of the positive pressure, and offering better guarantees in terms of functionality.

Claims

1. Aseptic filling machine, especially for plastic bottles, comprising a carousel and an enclosing room apt to protect the product dosing and/or bottles closing, consisting of two main rooms (C1, C2) each of them comprising a stationary part, a rotating part and accessories which make it possible to maintain an aseptic condition in the enclosing room.

2. Invention as in Claim no. 1, where the volume of the upper room (C1) is kept to a minimum, that is to say to the volume existing between the dosing nozzles/closing heads and the bottle's neck.

3. Invention as in Claim no. 1, where the sealing between the stationary and the rotating surfaces is guaranteed by suitable sliding surfaces and/or labyrinth surfaces for sterile use in order to enclose the inner microclimate.

4. Invention as in Claim no. 1, where the upper surface of the main room C1 consists of the plate supporting the dosing nozzles/closing heads, and where the lower surface consists of the plate supporting the bottle neck handling clamp devices and of a sealing surface with suitable sliding points for guaranteeing tightness for the maintenance of the inner pressure.

5. Invention as in Claim no. 1, where the upper surface of the main room C2 consists of the plate supporting the bottle neck handling clamp devices and of a fixed surface, and where the lower surface consists of a stationary plate and of a rotating plate with suitable sliding points for guaranteeing tightness for the maintenance of the inner pressure.

6. Invention as in Claim no. 1., where sterile air is fed into the room through proper pipelines.

7. Invention as in Claim no. 1, where the room can be cleaned and sterilized through proper pipelines, independently of the machine and without any human intervention, using traditional chemical agents.

8. Invention as in Claim no. 1, where suitable nozzles for dosing/vaporizing chemical agents on the room's surfaces can be installed in the inside without any prejudice to the room's sterile conditions.

9. Invention as in Claim no. 1, where the fixed enclosing wall is made of rigid plastic material or, alternatively, of flexible plastic material.

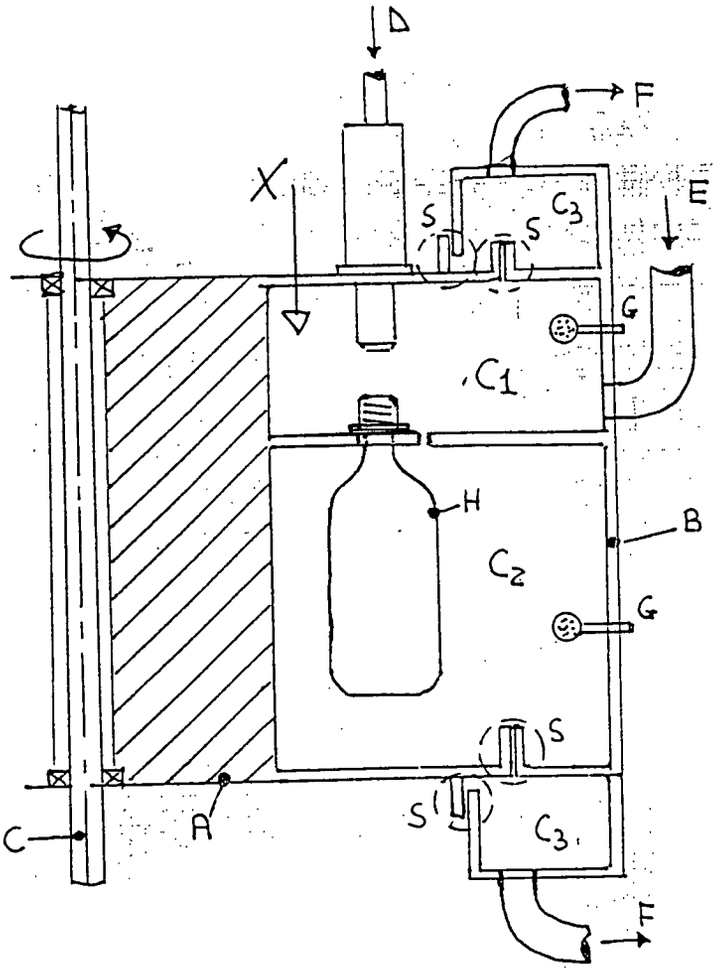
10. Invention as in Claim no. 1, where the described room is used also in the bottles' sterilization and rinsing phases.

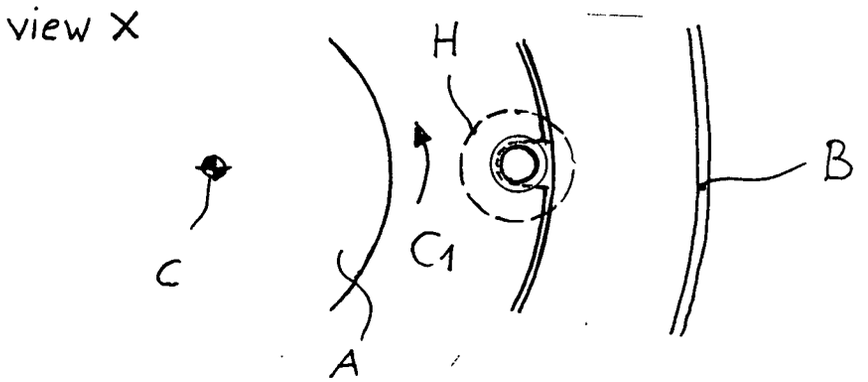
11. Invention as in Claim no. 1, where the concept may not include the rooms defined as C3, as the sterile air pressure and internal microclimate can be maintained also by the main rooms C1 and C2 only.

12. Invention as in Claim no. 1, where the concept may not include the room defined as C2, as the sterile air pressure inside the room C1 can be maintained also without the room C2.

13. Invention as in claim no. 1, comprising at least one room (C3) that save the purpose of intakting the sterile air flow coming out of the main rooms C1 and/or C2.

14. Invention as in claim no. 1, where the two main rooms (C1, C2) comprise accessories to sanitize it using sterilizing agents when the machine undergoes its preparation phases.


D
F
X
E
S
Y
S
C3
G
C1
H
B
C2
G
S
S
C3
C
A
F


view X
H
B
C
C1
A

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 00 8930

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 405 402 A (TOYO SEIKAN KAISHA LTD) 2 January 1991 (1991-01-02) * column 9, line 41 - line 48 * * column 10, line 4 - line 17 * * column 11, line 8 - line 13 * * column 13, line 9 - line 15; figures 1-3 *	1-4,6-14	B67C7/00
X	EP 0 758 624 A (ROSSI & CATELLI SPA) 19 February 1997 (1997-02-19) * column 2, line 33 - line 52; figures 1-4 *	1-3,6,7, 9-14	
X	US 6 026 867 A (KLARL HERMANN) 22 February 2000 (2000-02-22) * column 3, line 25 - line 38 * * column 4, line 47 - line 58; figures 1,2 *	1-3,6,13	
X	CH 101 585 A (NIELSEN NIELS JONAS) 16 October 1923 (1923-10-16) * page 1, left-hand column, line 20 - right-hand column, line 2 * * page 2, right-hand column, line 5 - line 21; figures 1-3 *	1-3,6,7, 11-13	TECHNICAL FIELDS SEARCHED (Int.Cl.7) B67C B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20 September 2002	Wartenhorst, F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 00 8930

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-09-2002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0405402 A	02-01-1991	JP 1931394 C	12-05-1995
		JP 3029702 A	07-02-1991
		JP 6062125 B	17-08-1994
		JP 3029703 A	07-02-1991
		EP 0405402 A2	02-01-1991
		DE 68913705 T2	11-08-1994
EP 0758624 A	19-02-1997	AU 727925 B2	04-01-2001
		IT 1279846 B1	18-12-1997
		JP 10157797 A	16-06-1998
		US 5848515 A	15-12-1998
		AU 7187896 A	28-05-1998
		EP 0758624 A1	19-02-1997
		AT 221855 T	15-08-2002
		DE 69622800 D1	12-09-2002
US 6026867 A	22-02-2000	DE 29713155 U1	10-09-1998
		EP 0893396 A1	27-01-1999
		JP 2918548 B2	12-07-1999
		JP 11091876 A	06-04-1999
CH 101585 A	16-10-1923	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82