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**(54) FILLING APPARATUS FOR FILLING CONTAINERS IN ASEPTIC CONDITIONS AND METHOD FOR STERILIZING SUCH APPARATUS**

FÜLLVORRICHTUNG ZUM FÜLLEN VON BEHÄLTERN UNTER ASEPTISCHEN BEDINGUNGEN  
UND VERFAHREN ZUM STERILISIEREN SOLCH EINER VORRICHTUNG

APPAREIL DE REMPLISSAGE POUR REMPLIR DES RÉCIPIENTS DANS DES CONDITIONS  
ASEPTIQUES ET PROCÉDÉ DE STÉRILISATION D'UN TEL APPAREIL

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**EP 3 755 652 B1**

## Description

### Technical field

[0001] The present invention relates to a filling apparatus for filling containers in aseptic conditions and a method for sterilizing such apparatus.

[0002] The term "Sterilization-In-Place" (acronym SIP) is to be intended as a sterilization method or cycle of the internal surfaces of closed systems that avoids the disassembly of the latter.

### Background art

[0003] Within the field of an apparatus for filling containers, sanitization systems are known of the "dummy bottle" type. When the apparatus is in use, the filling fluid (e.g. a beverage or a pharmaceutical product) coming from a supply line is sent to the dispensing nozzles. During filling, the dummy bottles are in a resting position whereby they do not interfere with the corresponding nozzle.

[0004] When a SIP cycle must be carried out, the dummy bottles are positioned below the corresponding nozzles. Water vapour (possibly with the addition of a sterilizing agent) is supplied through the supply line and dispensed by the nozzles to flow into the dummy bottles before being evacuated through specific ducts. The passage of the vapour allows sterilizing the various components.

[0005] Apart from the variants available today, the dummy bottle sanitization systems are structurally complex and bulky in that they envisage a dummy bottle (and relative actuation means) for each nozzle of the filler.

[0006] In addition, the components are heated due to the flow of high-temperature water vapour (up to 120°). For this reason, these systems envisage a cooling step of the components, subsequent to the SIP cycle, which is carried out by sending a cooled fluid (e.g. sterile inert gas or air).

[0007] Furthermore, the use of water vapour requires maintaining an overpressure with respect to the clean chamber in which the filling is performed.

[0008] EP 3 199 488 A1 discloses a filling apparatus in accordance with the preamble of claim 1.

### Disclosure of the invention

[0009] In this context, the technical task underpinning the present invention is to provide a filling apparatus for filling containers in aseptic conditions and a method for sterilizing such apparatus, which obviate the drawbacks of the prior art cited above.

[0010] In particular, an object of the present invention is to provide a filling apparatus for filling containers in aseptic conditions, which is sanitized and also have a simplified and more compact structure with respect to the prior art.

[0011] Another object of the present invention is to propose a filling apparatus for filling containers in aseptic conditions and a method for sterilizing such apparatus, in which there is no need to cool the components after the execution of a SIP cycle.

[0012] The stated technical task and specified objects are substantially achieved by a filling apparatus for filling containers in aseptic conditions, comprising:

- a tank for containing a filling fluid;
- a plurality of dispensing nozzles in fluid communication with the tank, the nozzles being located in a contamination-controlled environment that is isolated from an external environment;
- a VHP or vaporized hydrogen peroxide generator,

characterized in that it comprises at least one first VHP supplying duct that extends from the vaporized hydrogen peroxide generator to the tank.

[0013] Preferably, a valve is operatively active on the first VHP supplying duct in order to establish a selective communication between the vaporized hydrogen peroxide generator and the tank.

[0014] In accordance with one embodiment, the apparatus comprises a second VHP supplying duct which extends from the vaporized hydrogen peroxide generator to the contamination-controlled environment.

[0015] In accordance with one embodiment, the tank is located externally to the contamination-controlled environment.

[0016] In accordance with another embodiment, the tank is placed within the contamination-controlled environment.

[0017] In particular, no dummy bottles are envisaged in the apparatus.

[0018] In accordance with one embodiment, the apparatus comprises a fixed base and a rotary carousel. The tank and the dispensing nozzles are integral to the rotary carousel.

[0019] In accordance with another embodiment, the apparatus is of a linear type.

[0020] The stated technical task and specified objects are substantially achieved by a method for sterilizing the above described filling apparatus for filling containers in aseptic conditions, comprising the following steps:

- generating vaporized hydrogen peroxide or VHP;
- supplying the vaporized hydrogen peroxide to a tank of the filling apparatus;
- distributing the vaporized hydrogen peroxide from the tank to dispensing nozzles of the filling apparatus;
- dispensing the vaporized hydrogen peroxide by means of the dispensing nozzles.

[0021] Preferably, the step of generating the vaporized hydrogen peroxide is carried out externally to the contamination-controlled environment.

**[0022]** Preferably, no other compound is supplied to the tank during the step of supplying the vaporized hydrogen peroxide to the tank.

**[0023]** Preferably, the temperature of the generated vaporized hydrogen peroxide is comprised between 50°C and 100°C.

**[0024]** More preferably, the temperature of such vaporized hydrogen peroxide is comprised between 70°C and 80°C.

**[0025]** Preferably, the pressure of the generated vaporized hydrogen peroxide is comprised between 100 mbar and 1 bar.

**[0026]** More preferably, the pressure of this vaporized hydrogen peroxide is comprised between 200 mbar and 300 mbar.

### **Brief description of drawings**

**[0027]** Further characteristics and advantages of the present invention will more fully emerge from the indicative, and therefore non-limiting, description of a preferred but not exclusive embodiment of a filling apparatus for filling containers in aseptic conditions and a method for sterilizing such apparatus, as illustrated in the accompanying drawings, in which:

- figure 1 schematically illustrates a first embodiment of a filling apparatus for filling containers in aseptic conditions, according to the present invention;
- figure 2 schematically illustrates a second embodiment of the apparatus of figure 1, according to the present invention. The reference number 1 is used to indicate a filling apparatus for filling containers 100 in aseptic conditions.

### **Detailed description of preferred embodiments of the invention**

**[0028]** In particular, the containers 100 are made of a thermoplastic material, for example PET or HDPE.

**[0029]** The filling apparatus 1 comprises:

- a tank 2 for a filling fluid;
- a plurality of dispensing nozzles 3 in fluid communication with the tank 2.

**[0030]** For example, the filling fluid is a beverage or a pharmaceutical compound. In certain cases, the filling fluid could contain solid pieces. For example, these solid pieces can be pieces of fruit or vegetables, or grains, or legumes, or dried fruit.

**[0031]** The dispensing nozzles 3 are located in a contamination-controlled environment 4 that is isolated from an external environment 5.

**[0032]** The contamination-controlled environment 4 is isolated, i.e. physically separated, with respect to the external (contaminated) environment 5 through an isolation device 6. Such isolation device is not the subject matter

of the present invention, therefore it will not be further described. By way of example, an isolation device similar to that described and illustrated in patent EP2246176 can be used.

5 **[0033]** The tank 2 can be located outside of the contamination-controlled environment 4 (see figure 1) or inside such environment (see figure 2).

**[0034]** In the embodiment described herein, the filling apparatus 1 is preferably of the rotary carousel type.

10 **[0035]** Such filling apparatus 1 comprises a fixed base and a rotary carousel. The tank 2 is integral with the rotary carousel and in fluid communication with a rotary distributor from which the supply ducts of the dispensing nozzles 3 depart.

15 **[0036]** In an alternative embodiment (not shown), the filling apparatus 1 is of the linear type.

**[0037]** The filling apparatus 1 comprises a vaporized hydrogen peroxide generator indicated with the number 11.

20 **[0038]** Vaporized hydrogen peroxide is usually denoted by the abbreviation VHP, therefore the generator 11 is briefly indicated in the following description as "VHP generator". The VHP generator is located in the external environment 5.

25 **[0039]** Originally, a first VHP supplying duct 12 (hereinafter briefly indicated as "first duct") puts the VHP generator 11 in fluid communication with the tank 2. At least one valve 13 is operatively active on the first duct 12 in order to establish a selective communication between the VHP generator 11 and the tank 2.

30 **[0040]** Preferably, a second VHP supplying duct 14 (hereinafter briefly indicated as "second duct") starts from the VHP generator 11 and opens into the contamination-controlled environment 4. This second duct 14 thus defines an additional path for the VHP without passing through the tank 2.

35 **[0041]** More preferably, other ducts (not shown) are present that convey the VHP from the VHP generator 11 to the contamination-controlled environment 4.

40 **[0042]** The operation of the filling apparatus in aseptic conditions is described here below, as well as the method for sterilizing such an apparatus, in accordance with the present invention.

45 **[0043]** When the filling apparatus 1 is in operation, i.e. it is performing the filling of the containers 100, the latter are located below the dispensing nozzles 3 which receive the filling fluid from the tank 2 through the rotary carousel 9.

50 **[0044]** In this case, the valve 13 is closed, therefore the flow of VHP is interrupted from the VHP generator 11 to the tank 2.

**[0045]** When the tank 2 has been emptied of all the filling fluid, a SIP cycle is generally run. In this case, the valve 13 opens that enables the fluid communication between the VHP generator 11 and the tank 2 through the first duct 12.

**[0046]** The dispensing nozzles 3 are in an open configuration, thus they dispense the VHP coming from the

tank 2.

[0047] Throughout the step wherein the tank 2 is supplied with VHP, no other compound is introduced. In particular, water vapour is not introduced.

[0048] Additional VHP can possibly be introduced directly into the contamination-controlled environment 4 through the second duct 14.

[0049] Once the SIP cycle has ended, the valve 13 is closed again, the tank 2 is supplied again with the filling fluid and the normal operation of the apparatus resumes.

[0050] From the above description, the characteristics of the filling apparatus for filling containers in aseptic conditions and the method for sterilizing such apparatus, according to the present invention, are clear, as are the advantages.

[0051] In particular, the SIP cycles are carried out by introducing only VHP and not water vapour into the tank of the filling apparatus. Since the temperature of the VHP is approximately 70°-80°C, there is no longer a need to cool the components crossed by VHP (as instead occurred in the solutions using water vapour).

[0052] Finally, the pressures involved during SIP cycles with only VHP are very low (about 200-300 mbar), for which the components are less subject to wear and a tank with walls of reduced thickness can be used, with obvious advantages in terms of weight and thermal efficiency.

[0053] The presence of other ducts that supply the VHP to the contamination-controlled environment (without passing through the tank) allow speeding up the SIP cycle.

[0054] Finally, the solution proposed herein does not use dummy bottles, thus its structure is simpler and more compact compared to the known solutions.

## Claims

1. Filling apparatus (1) for filling containers (100) in aseptic conditions, comprising:

a tank (2) for containing a filling fluid;  
a plurality of dispensing nozzles (3) in fluid communication with said tank (2), said nozzles (3) being located in a contamination-controlled environment (4) that is isolated from an external environment (5);  
a VHP or vaporized hydrogen peroxide generator (11),

**characterized in that** it comprises at least one first VHP supplying duct (12) that goes from the VHP generator (11) to said tank (2).

2. Filling apparatus (1) according to claim 1, further comprising a valve (13) that is operatively active on said first VHP supplying duct (12) in order to establish a selective communication between the VHP generator (11) and the tank (2).

3. Filling apparatus (1) according to claim 1 or 2, further comprising a second VHP supplying duct (14) that goes from the VHP generator (11) to said contamination-controlled environment (4).

4. Filling apparatus (1) according to any of the preceding claims, wherein the tank (2) is located externally to said contamination-controlled environment (4).

5. Filling apparatus (1) according to any of the claims 1 to 3, wherein the tank (2) is located within said contamination-controlled environment (4).

6. Filling apparatus (1) according to any of the preceding claims, where no dummy bottles are present.

7. Filling apparatus (1) according to any of the preceding claims, comprising a fixed base and a rotary carousel, said tank (2) and said dispensing nozzles (3) being integral to the rotary carousel.

8. Filling apparatus (1) according to any of the claims 1 to 6, **characterized in that** it is of the linear type.

9. Method for sterilizing a filling apparatus (1) for filling containers (100) in aseptic conditions according to any of the preceding claims, comprising the steps of:

generating vaporized hydrogen peroxide or VHP;  
supplying the VHP to the tank (2) of the filling apparatus (1);  
distributing the VHP from the tank (2) to the dispensing nozzles (3);  
dispensing the VHP by means of said dispensing nozzles (3).

10. Method according to claim 9, wherein the step of generating VHP is carried out externally to the contamination-controlled environment (4).

11. Method according to claim 9 or 10, wherein no other compound is supplied to the tank (2) during the step of supplying the VHP to said tank (2).

12. Method according to any of the claims 9 to 11, wherein the temperature of the generated VHP is comprised between 50°C and 100°C.

13. Method according to claim 12, wherein the temperature of the generated VHP is comprised between 70°C and 80°C.

14. Method according to any of the claims 9 to 13, wherein the pressure of the generated VHP is comprised between 100 mbar and 1 bar.

15. Method according to claim 14, wherein the pressure

of the generated VHP is comprised between 200 mbar and 300 mbar.

## Patentansprüche

1. Füllvorrichtung (1) zum Füllen von Behältern (100) unter aseptischen Bedingungen, umfassend:

einen Tank (2) zum Aufnehmen einer Füllflüssigkeit;  
eine Vielzahl von Abgabedüsen (3) in Fluidkommunikation mit dem Tank (2), wobei die Düsen (3) in einer kontaminationskontrollierten Umgebung (4) angeordnet sind, die von einer äußeren Umgebung (5) isoliert ist;  
einen VHP- oder verdampften Wasserstoffperoxidgenerator (11),  
**dadurch gekennzeichnet, dass** sie mindestens eine erste VHP-Zuführleitung (12) umfasst, die vom VHP-Generator (11) zum Tank (2) verläuft.

2. Füllvorrichtung (1) nach Anspruch 1, ferner umfassend ein Ventil (13), das an der ersten VHP-Zuführleitung (12) betriebswirksam aktiv ist, um eine selektive Verbindung zwischen dem VHP-Generator (11) und dem Tank (2) herzustellen.

3. Füllvorrichtung (1) nach Anspruch 1 oder 2, ferner umfassend eine zweite VHP-Zuführleitung (14), die vom VHP-Generator (11) zur kontaminationskontrollierten Umgebung (4) verläuft.

4. Füllvorrichtung (1) nach einem der vorhergehenden Ansprüche, wobei sich der Tank (2) außerhalb der kontaminationskontrollierten Umgebung (4) befindet.

5. Füllvorrichtung (1) nach einem der Ansprüche 1 bis 3, wobei sich der Tank (2) innerhalb der kontaminationskontrollierten Umgebung (4) befindet.

6. Füllvorrichtung (1) nach einem der vorhergehenden Ansprüche, wobei keine Dummy-Flaschen vorhanden sind.

7. Füllvorrichtung (1) nach einem der vorhergehenden Ansprüche, umfassend eine feste Basis und ein Drehkarussell, wobei der Tank (2) und die Abgabedüsen (3) einstückig mit dem Drehkarussell sind.

8. Füllvorrichtung (1) nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** sie vom linearen Typ ist.

9. Verfahren zum Sterilisieren einer Füllvorrichtung (1) zum Füllen von Behältern (100) unter aseptischen

Bedingungen nach einem der vorhergehenden Ansprüche, umfassend die Schritte:

Erzeugen von verdampftem Wasserstoffperoxid oder VHP;  
Zuführen des VHP zum Tank (2) der Füllvorrichtung (1);  
Verteilen des VHP aus dem Tank (2) zu den Abgabedüsen (3);  
Abgeben des VHP mittels der Abgabedüsen (3).

10. Verfahren nach Anspruch 9, wobei der Schritt zum Erzeugen von VHP außerhalb der kontaminationskontrollierten Umgebung (4) ausgeführt wird.

11. Verfahren nach Anspruch 9 oder 10, wobei dem Tank (2) während des Schritts zum Zuführen des VHP zum Tank (2) keine andere Verbindung zugeführt wird.

12. Verfahren nach einem der Ansprüche 9 bis 11, wobei die Temperatur des erzeugten VHP zwischen 50 °C und 100 °C liegt.

13. Verfahren nach Anspruch 12, wobei die Temperatur des erzeugten VHP zwischen 70 °C und 80 °C liegt.

14. Verfahren nach einem der Ansprüche 9 bis 13, wobei der Druck des erzeugten VHP zwischen 100 mbar und 1 bar liegt.

15. Verfahren nach Anspruch 14, wobei der Druck des erzeugten VHP zwischen 200 mbar und 300 mbar liegt.

## Revendications

1. Appareil de remplissage (1) pour remplir des récipients (100) dans des conditions aseptiques, comprenant :

un réservoir (2) servant à contenir un fluide de remplissage ;  
une pluralité de buses de distribution (3) en communication fluide avec ledit réservoir (2), lesdites buses (3) étant situées dans un environnement à contamination contrôlée (4) étant isolé d'un environnement extérieur (5) ;  
un générateur (11) de PHV ou peroxyde d'hydrogène vaporisé,  
**caractérisé en ce qu'il** comprend au moins un premier conduit d'alimentation (12) en PHV allant du générateur (11) de PHV audit réservoir (2).

2. Appareil de remplissage (1) selon la revendication 1, comprenant de plus une valve (13) étant active

- de manière fonctionnelle sur ledit premier conduit d'alimentation (12) en PHV afin d'établir une communication sélective entre le générateur (11) de PHV et le réservoir (2).
3. Appareil de remplissage (1) selon la revendication 1 ou 2, comprenant de plus un second conduit d'alimentation (14) en PHV allant du générateur (11) de PHV audit environnement à contamination contrôlée (4).
  4. Appareil de remplissage (1) selon l'une quelconque des revendications précédentes, dans lequel le réservoir (2) est situé à l'extérieur dudit environnement à contamination contrôlée (4).
  5. Appareil de remplissage (1) selon l'une quelconque des revendications 1 à 3, dans lequel le réservoir (2) est situé à l'intérieur dudit environnement à contamination contrôlée (4).
  6. Appareil de remplissage (1) selon l'une quelconque des revendications précédentes, où aucune fausse bouteille n'est présente.
  7. Appareil de remplissage (1) selon l'une quelconque des revendications précédentes, comprenant une base fixe et un carrousel rotatif, ledit réservoir (2) et lesdites buses de distribution (3) étant solidaires du carrousel rotatif.
  8. Appareil de remplissage (1) selon l'une quelconque des revendications 1 à 6, **caractérisé en ce qu'il est de type linéaire.**
  9. Procédé de stérilisation d'un appareil de remplissage (1) pour remplir des récipients (100) dans des conditions aseptiques selon l'une quelconque des revendications précédentes, comprenant les étapes de :
    - générer du peroxyde d'hydrogène vaporisé ou PHV ;
    - fournir le PHV au réservoir (2) de l'appareil de remplissage (1) ;
    - distribuer le PHV du réservoir (2) aux buses de distribution (3) ;
    - distribuer le PHV au moyen desdites buses de distribution (3).
  10. Procédé selon la revendication 9, dans lequel l'étape de génération de PHV est exécutée à l'extérieur de l'environnement à contamination contrôlée (4).
  11. Procédé selon la revendication 9 ou 10, dans lequel aucun autre composé n'est fourni au réservoir (2) pendant l'étape de fourniture du PHV audit réservoir (2).
  12. Procédé selon l'une quelconque des revendications 9 à 11, dans lequel la température du PHV généré est comprise entre 50 et 100 °C.
  13. Procédé selon la revendication 12, dans lequel la température du PHV généré est comprise entre 70 et 80 °C.
  14. Procédé selon l'une quelconque des revendications 9 à 13, dans lequel la pression du PHV généré est comprise entre 100 mbar et 1 bar.
  15. Procédé selon la revendication 14, dans lequel la pression du PHV généré est comprise entre 200 mbar et 300 mbar.

FIG. 1

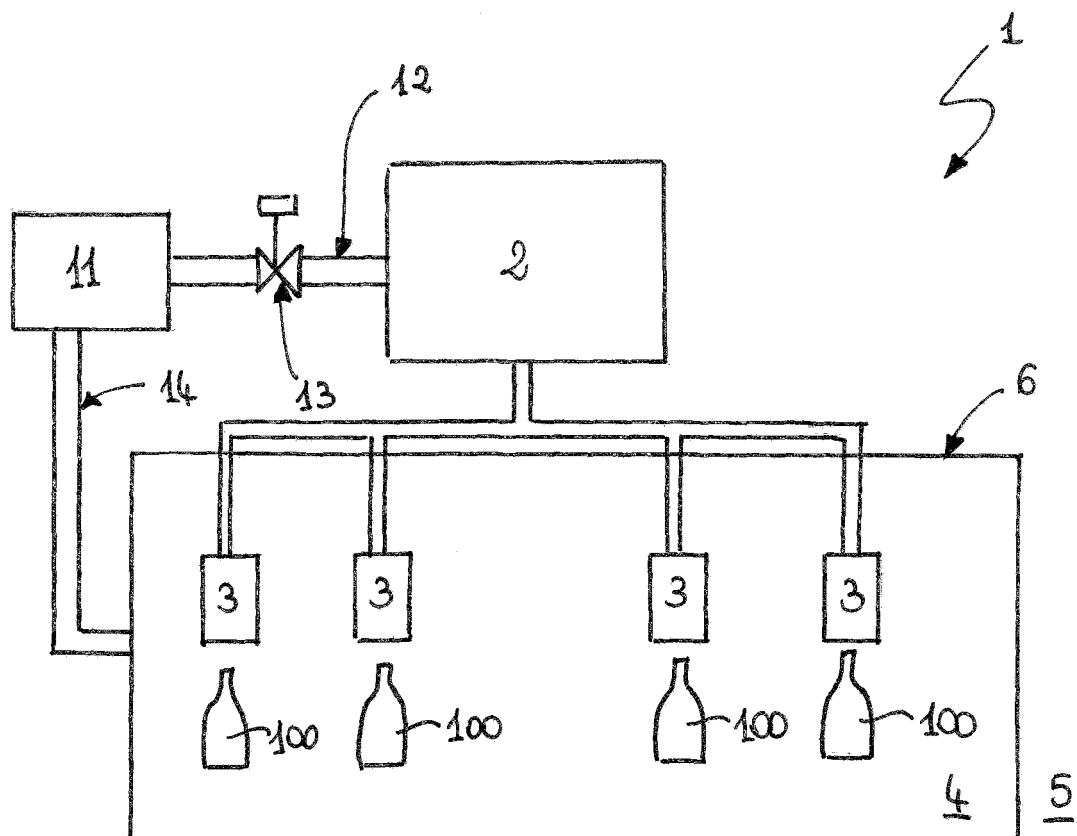
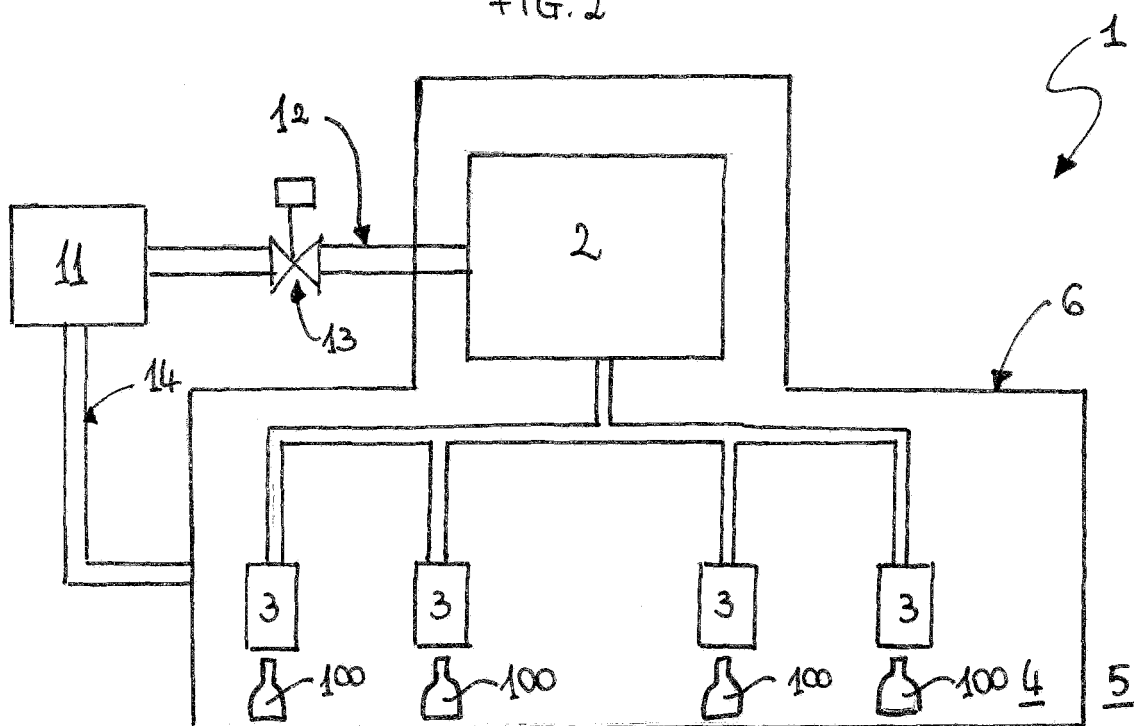


FIG. 2



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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